INSTRUCTION MANUAL

WESTAMP A641 SERIES

This is a general manual describing a whole series of amplifiers and may be used in conjunction with drawings pertaining to various specific models.

CAUTION

The maintenance procedure described herein should be attempted only by highly skilled technicians using proper test equipment. Read your warranty provisions before starting, to avoid voiding your warranty.

WESTAMP

TABLE OF CONTENTS

FOREWORD:

This manual is a general purpose manual, covering the theory and application of the A641 Series of Pulse Width Modulated Servo Amplifiers.

This manual does not necessarily apply specifically to any individual amplifier. However, the information is presented in a general way so that it may be applied to a specific amplifier in conjunction with its associated drawings.

The A641 Series of Pulse Width Modulated Amplifiers consist of a single chassis which contains the following:

1. A control amplifier board module which contains the control circuits.
2. Output power sections which contain the output Thyristor Bridges.
3. The chassis contains the bias power supply which is plus and minus 15 Volts, the main output power supply, the terminal block with the input and output connections for the power section, protective fuses, a UL listed blower and regulator.

FUSE DATA			
MODEL NO.	FUSE	F901	F801-4
	TYPE	AGC	MDX
A6412-307		2 Amp	3 Amps
A6415-312		2 Amp	3 Amps

SPECIFICATIONS:	A6412	A6415
1. Peak Current	± 100 A	± 200 A
2. Peak Voltage (Typ)	± 165 VDC	± 165 VDC
3. Continuous Current	± 75 A	± 100 A
4. Continuous Voltage (Typ)	± 150 VDC	± 150 VDC
5. Horsepower Rating (Cont)	15 HP	20 HP
6. Input Voltage	120 VAC RMS-3Ø bus power	
7. Form Factor	1.02-Defined at full output current	
8. Switching Frequency	Constant	
9. Frequency Response	350 Hz Min	
10. Dead Band	None	
11. Gain	Adjustable (18 turn pot)	
Input 1	0 to 25000 A/V	
Input 2	0 to 25000 A/V (Min)	
Input 3	0 to 25000 A/V	
12. Signal Input Impedance	20 K Min/Input	
13. Signal Input Voltage		
Typical	± 10 Volts	
Max	± 50 Volts	
14. Drift (Refer to Input)	10 u V/°C	
15. Current Limit	Adjustable (18 turn pot)	
16. Signal Balance	Adjustable (18 turn pot)	
17. Ambient Temp (Operating)	0° - 50° C	
18. Auxiliary Inputs	Gain reduction Limit switch overtravel Remote on-off (electronic) Programmable current limit	
19. Auxiliary Outputs	Output current monitor (See Notes) ± 15 VDC @ 50 MA	
20. System Compensation	Adjustable and built in	
21. Cooling	Blower	
22. Weight	60 lbs *	
23. Mounting	Panel (Vertical/Horizontal)	
24. Power Transformer	Separate.	

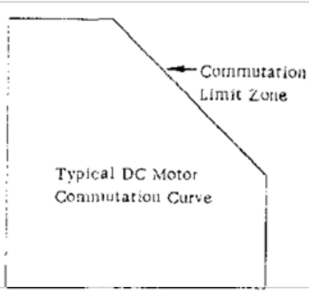
* Unit without transformer or inductor.

25. Protection
    a) Shorts to ground
    b) Shorts across output
    c) RMS overload protection (electronic)
    d) Bias fault protection
    e) Undervoltage bus protection
    f) Current Limit
    g) Bias power fuse
    h) Output circuit breaker

26. Options: Regulator
    Special Compensation
    Tapered current limit-for reduced current at high output voltages (motor commutation capability)

NOTES:

1. Max peak current is for 2 sec.
2. Freq. response is typical of units with no compensation. System compensation in most applications usually reduce the response.
3. Consult the factory concerning applications requiring continuous regeneration.
4. Output voltage is max from 120 VAC RMS bus power.
5. If motor has 2.6 mHy no external inductor is necessary.
6. Output current monitor is capable of driving a zero center 100 micro Ampere meter.
7. If red light is on, this indicates trip of fault logic. Unit will restart if fault has been cleared.



OPTIONAL

← Tapered Current Limit

Amplifier output current can be readjusted to keep motor currents within safe commutation zone.

Model	Series Inductors Min. MHy
A6412	2.6
A6415	2.1

BLOCK DIAGRAM DESCRIPTION

The A641 Series of D.C. Servo Amplifiers are Thyristor pulse width modulated units. The following description and explanation of the Block Diagram of this model is presented so that you may have a better understanding of the operation of this unit: See Figures No. 1 and No. 2. There are three inputs for this unit.

1. Auxiliary Input,
2. Signal Input,
3. Tachometer Input.

Each of the inputs has a potentiometer which is used to adjust the effective gain of that input. The three input signals are summed in the velocity control amplifier which also contains the necessary compensation for achieving servo stability. The output of the velocity control amplifier is directed to the input of the current error amplifier. There is also a current feedback input to the current error amplifier from the current sensor. The current error amplifier amplifies the difference between the current command and current feedback signals. The output of the current amplifier is fed to the modulator where it is summed with the output from the triangle waveform generator. The modulator takes these two signals and converts them to a pulse-width modulated output. The output of the modulator is then fed to the fault gate which permits the modulator output signal to proceed through the commutation logic and the thyristor trigger driver. The thyristor trigger driver output provides the gate signal to the thyristors in thyristor bridges #1 and #2. In the event of a fault (such as low bias voltage, or an overvoltage on the output bus) the fault gate closes and shuts the amplifier off.

A current sensing resistor is in series with the output of the bridge which senses the output current. The current sensor generates an output voltage proportional to the output bridge current. This voltage signal is then fed to the RMS current detector circuit and is also used as a feedback signal for the current error amplifier. In the event that the output current exceeds the rated RMS current of the unit, the output of the velocity control amplifier is clamped to a safe operating level.

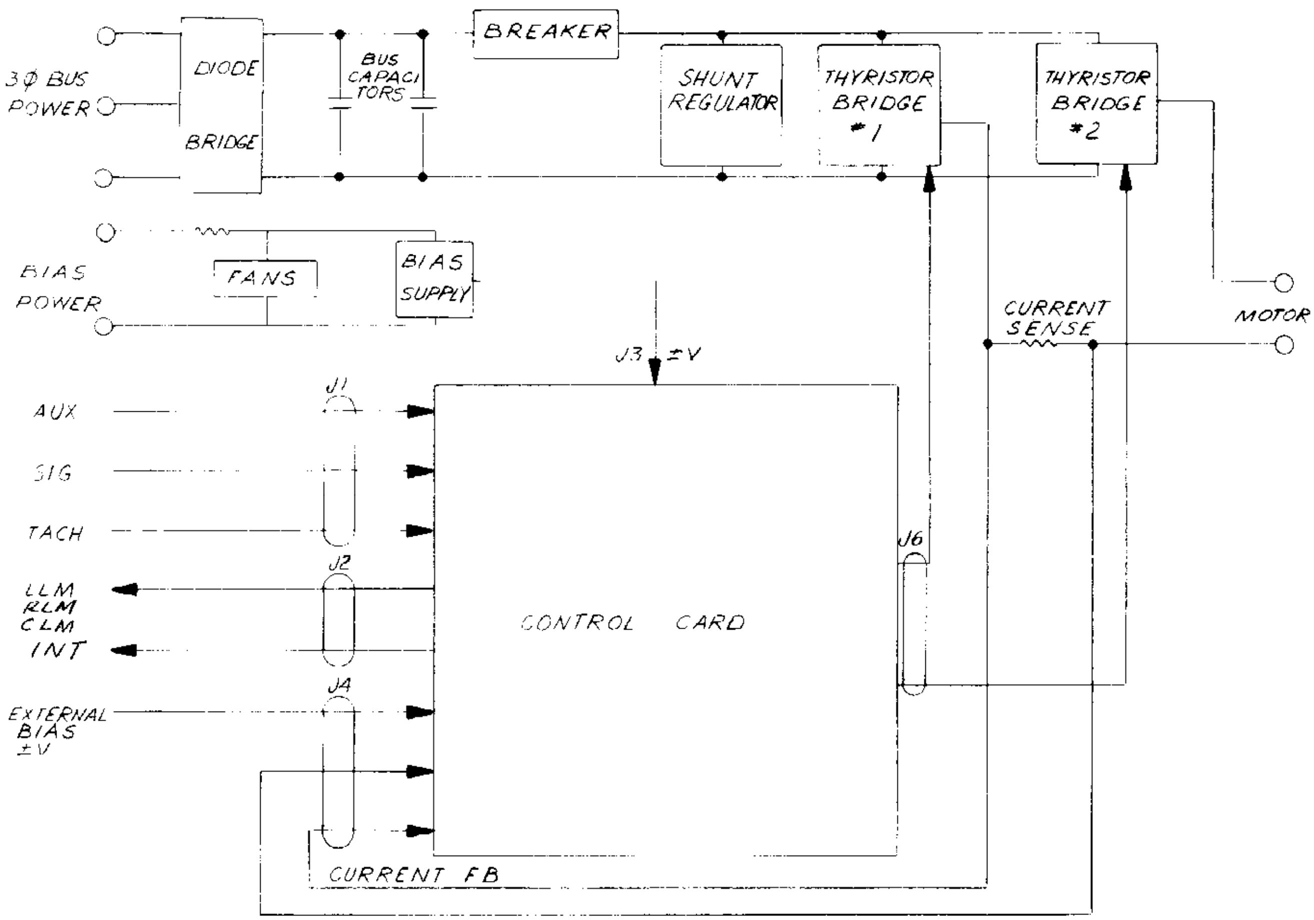


FIGURE 1. BLOCK DIAGRAM OF TITAN DRIVE

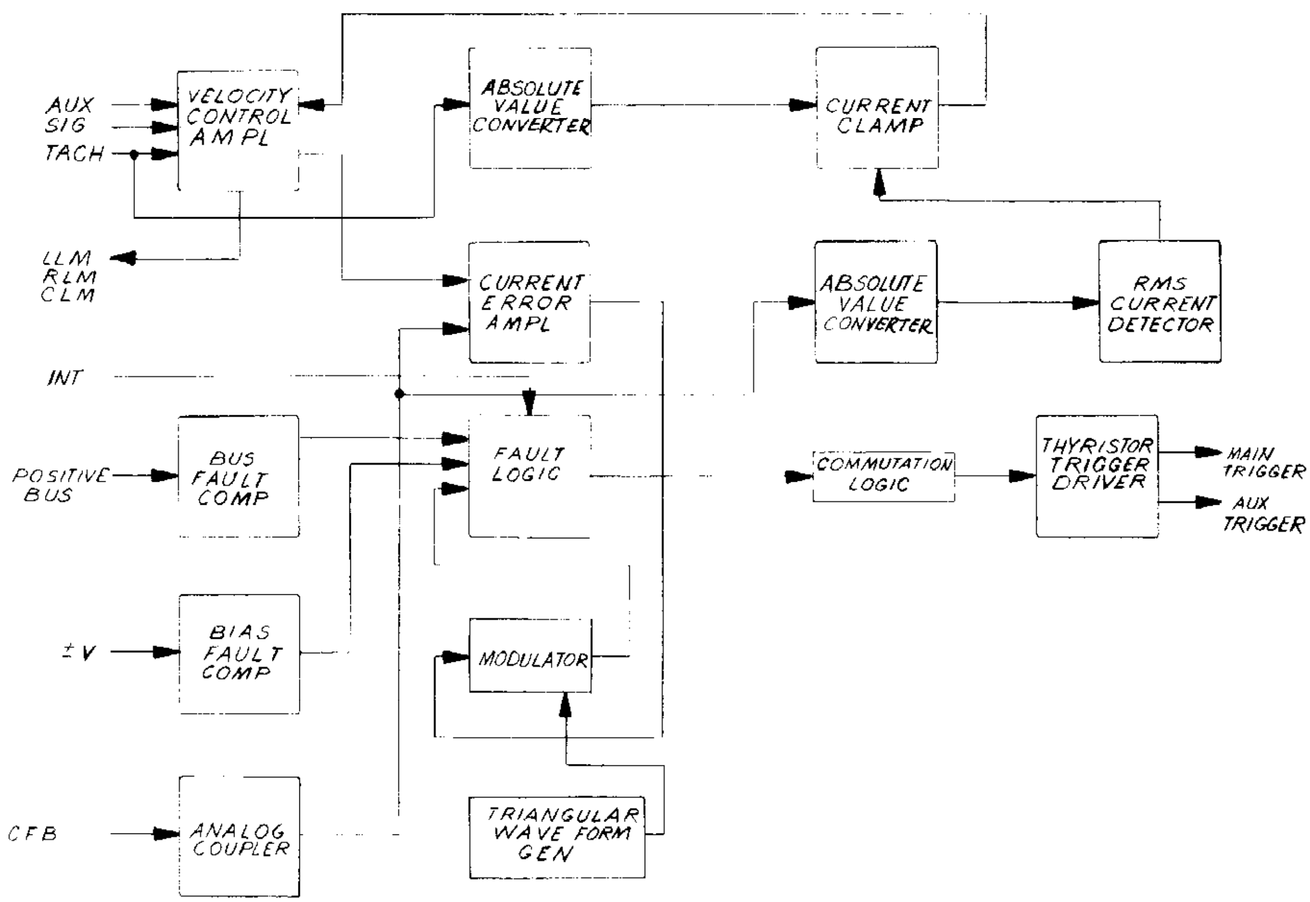


FIGURE 2. BLOCK DIAGRAM OF CONTROL CARD

PROTECTIVE FEATURES:

The A641 unit has the most advanced safety features available today in the marketplace. These safety features help protect personnel, machinery and the amplifier from accidental damage.

A) Amplifier will shut off and turn on red fault light if:

1) Bus voltage becomes too high or low.

2) Internal bias voltage becomes too high or low.

B) Amplifier will not shut off for output drive exceeding rated RMS current.

1) Amplifier will put out reduced power and return automatically to full power so as to keep unit within rating.

OTHER FEATURES: Fig. No. 4

Connector J-1

Pin 1 - Signal Input (Auxiliary)

Pin 2 - Signal Input (Standard)

Pin 3 - Signal Input (Tach)

Pin 4 - Signal Common

Pin 5 - Decoupled Current Sense - The output current of the amplifier is decoupled through a mod/demod circuit. The demodulator output is applied to this pin and is capable of driving a zero center 100 micro amp meter. Proper scaling of this output current is done by installing appropriate resistors in series with the amp meter. Pin 4 or 9 can be used as return.

Pin 6 & 7 - Limit Switch Overtravel:

These circuits are used to prevent the amplifier from producing more than 12% of rated current when grounded to Pin #9 usually used in conjunction with machine limit switches.

Pin 6 Clamps the negative output.

Pin 7 Clamps the positive output.

Outputs are with respect to signal commands.

Pin 8 - Electronic shut down and trip indication -

The bridge is disabled by grounding the interlock line, Pin 8. However, if a fault occurs, the line will fall from + 15 Volts to 0 Volt (50 K Ohm maximum external load).

The point can be used both as an electronic shut down and trip indication, provided proper logic techniques are used.

Pin 9 - Common for Pins 6, 7 & 8.

Pin 10 - + 15 VDC bias power.

50 MA is available for external use.

Pin 11 - Common-bias power.

Pin 12 - - 15 VDC bias power.

50 MA is available for external use.

NOTE: Pins 10, 11, 12 - - - If more than 50 MA is taken from these pins the bias power will sag and the amplifier may turn off. Reference paragraph A under Protective Features.

Connector J-2

Pin 1 and Pin 2 may be connected together to reduce gain around velocity control amplifier. When jumper is installed, gain of amplifier becomes 0 to 8 A/V.

Pin 1 and Pin 3 are used for an external programmable current limit by installing an appropriate resistor for the desired current.

Power Supply Regulator (Shunt Regulator)

During the slowing down or stopping of a D.C. motor, the motor regenerates. This energy is put back into the system. The system absorbs this in the form of pumping up the supply voltage capacitor. If the supply voltage exceeds the set trip level of the overvoltage sensor, the fault sensor trips the unit off and the red light comes on.

In order to keep the voltage on the capacitor within a safe level, it may be necessary to install a regulator.

The regulator is protected against excessive dissipation by means of a fuse.

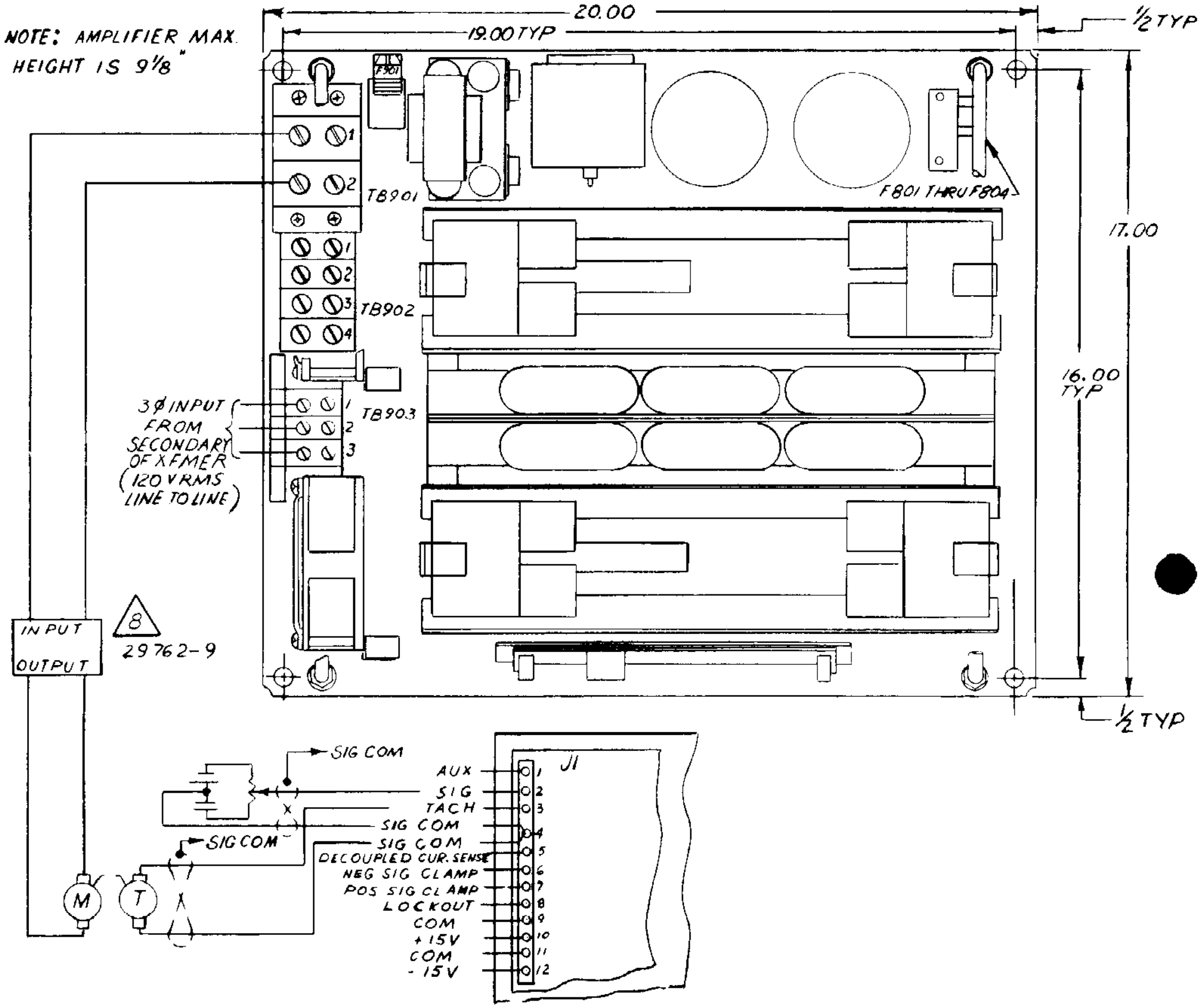
INSTALLATION:

Each amplifier in the A641 Series comes with an individual installation drawing showing where to make the various connections for power input, signal input, tachometer input, and output to the motor. While this manual may show in a general way how to make connections to amplifiers, it is imperative that the specific instructions applicable to your amplifier are followed. Always be certain to apply the correct input power voltage and frequency. The input power transformer for all the amplifiers in the A641 Series are separately mounted. It is possible to use one power transformer for several amplifier units if that transformer is sized properly. These transformers may have dual voltage primaries and in such cases, make certain that the jumpers are on the correct transformer terminals for your input AC power source. On all amplifiers the motor output is taken from separate terminals mounted on TB901.

CAUTION: DO NOT USE GROUNDED TEST EQUIPMENT ON THE OUTPUT CIRCUITS AND DO NOT CONNECT EITHER OF THE OUTPUTS TO GROUND.

The signal input is usually applied directly to Pin 2 of J-1 and the signal common is usually applied to Pin 4 of J-1. The tachometer signal is usually applied to Pin 3 of J-1 and the tachometer return is connected to Pin 4 of J-1. The auxiliary signal is applied to Pin 1 and the auxiliary signal return is applied to Pin 4.

Use shielded wires for signal and tachometer inputs to prevent stray pickup and noise being introduced into the amplifier. The amplifier may have a bandwidth anywhere from 350 Hz (no compensation) to a much lower frequency, depending upon the setting of the TC (time constant) potentiometer and the components in the servo compensation network. Fig. 3 shows a typical installation drawing that could be used to test an amplifier-motor combination. In many cases, a reactor is connected in series with the output of the amplifier and the motor. This reactor is required if the inductance of the motor is below recommended value - See Specification Sheet, Page 3. The amplifiers in this series require up to 2 Amperes of 120 VAC for the fan and power bias which are Terminals 1 and 3 of TB903. In addition, the output voltage from the secondary of the transformer should be 120 Volt RMS in accordance with the maximum output voltage required. The output of the secondary of the 3 ∅ power transformer is connected to Terminals 1, 2 & 3 of TB903. Please be sure that all the connections are proper before applying power to the unit.



INSTALLATION DRAWING

FIGURE No. 3

ADJUSTMENTS:

Figure 4 shows the location of various adjustments on the circuit board. These adjustments are as follows:

Aux Gain - Potentiometer R-2 adjusts the auxiliary gain in the event that this input is used. If this input is not used, the auxiliary potentiometer R-2 should be turned to the fully "CCW" position.

Sig Gain - The signal gain potentiometer R-5 is used to set the signal gain of the system. Turning R-5 in a "CW" direction increases the signal gain.

Tach Gain - The tach gain should be adjusted to set the stability of the tachometer loop, and to adjust the amount of tach feedback in the closed loop system. R-12 is the tach potentiometer. Turning R-12 in a "CW" direction increases the tachometer gain.

Balance - Potentiometer R-23 is the balance control. It may be necessary to adjust the balance for zero output when zero output is applied. This should be done after the tach and signal gains have been adjusted.

TC - The TC (time constant) potentiometer is R-15. The TC potentiometer is used to help stabilize the closed loop system. "CW" rotation increases the bandwidth.

Cur Lim - The current limit potentiometer is R-28. If the current limit potentiometer is at the maximum "CW" position then the unit puts out its maximum rated peak current. If it is desired to decrease the peak output current of the amplifier, turn the Cur Lim potentiometer in a "CCW" direction to reduce the peak output current.

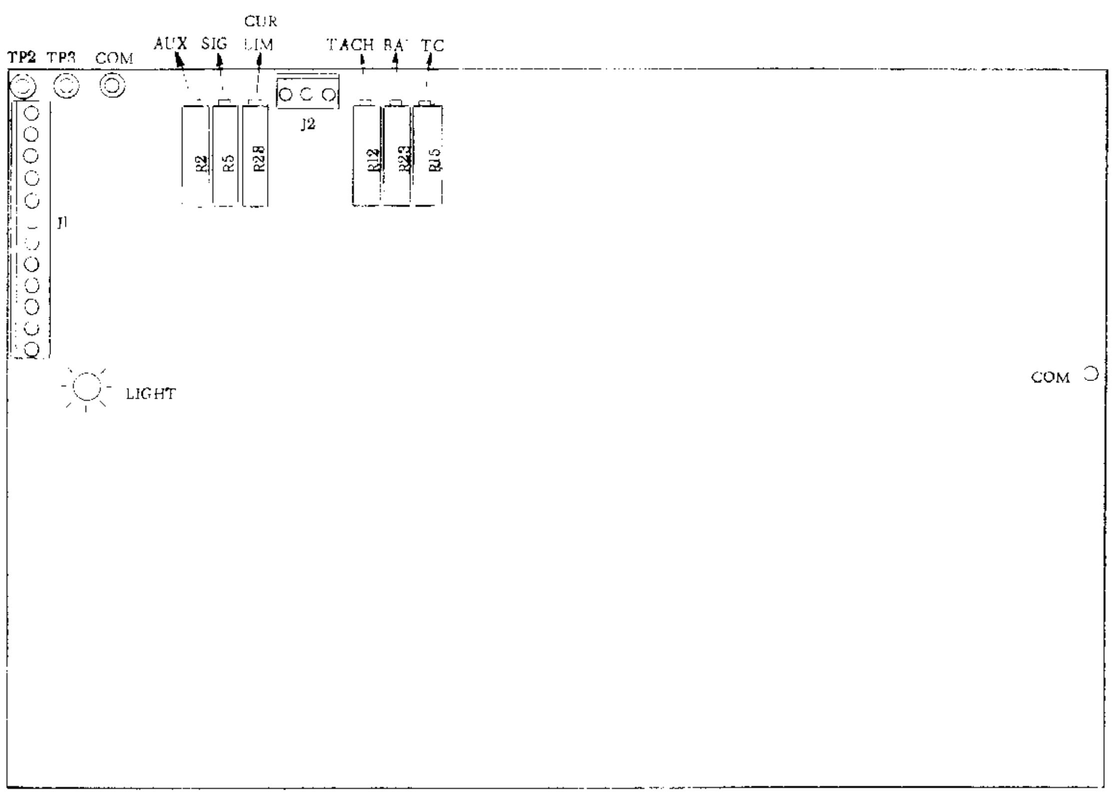


FIGURE No. 4

SERVO SYSTEM COMPENSATION:

It is possible to compensate a servo system empirically without any theoretical evaluation of the system, provided that the specifications are not too stringent. For most applications the procedure as outlined in the Short Form "Set Up Procedure" will result in adequate servo performance. The A641 Series of Servo Amplifiers were designed to operate with "state of the art" characteristics in modern performance oriented systems. Therefore, matching amplifier-motor-tachometer combinations are recommended. However, the A641 Series Amplifiers will provide good performance with many DC motor-tach combinations, accomplished by merely adjusting the TV and the tach gain potentiometers.

SHORT FORM SET UP PROCEDURE

(All PWM Amplifiers)

1. Connect in accordance with proper Installation Drawing.
2. Check input voltage and proper transformer connections.
3. Note: All adjustment pots are 20 turns.
4. Before turning power on, adjust all pots as follows:
    a. Current limit pot - Full CCW position.
    b. "TC" pot - mid-range 10 turns from either end.
    c. Tach pot - turn fully "CCW" then turn "CW" 5 turns.
    d. Signal gain pot - turn approximately mid-range, 10 turns from either end.
5. Apply power but do not apply input signal.
6. To check phasing of the tachometer and motor: Turn current limit pot CW very slowly. If motor starts to run away, remove power and correct phasing of the motor-tach combination.
7. Turn power back on and repeat Item 6. (Do not consider drift). Turn current limit pot to desired current.

    Pot setting produces currents as shown in example.

Example:			
	3 turns CW	=	33% Peak Current
	6 turns CW	=	66% Peak Current
	9 turns CW	=	85% Peak Current
	13 turns CW	=	96% Peak Current

8. If motor rotates slowly or drifts, adjust signal balance pot either way until motor stops moving.
9. Still with no input signal, turn "TC" pot "CW" until motor starts to oscillate high frequency then back off CCW until this oscillation stops.
10. Important - If TC is fully CCW and system is still oscillating at high frequency, see Notes at bottom.
11. Apply a small signal and observe motor shaft.
12. Increase or decrease tach gain pot for desired results.
    A) Increasing tach (Turn pot CW) provides quicker settling time (higher bandwidth).
    B) Decrease tach (Turn pot CCW) provides slower settling time (lower bandwidth).

    Note:

    Settling time is not to be confused with accel or decel time but is the time just before stopping.
13. After you are satisfied with tach response do not change the tach pot anymore.
14. If motor drifts, it may be necessary to re-adjust signal balance pot.
15. Run the motor at some higher speed and watch and listen to it. If it runs smoothly, the system is o.k. A rough sound means either TC is still too far CW or tach is too far CW.
16. Set appropriate speed of the system by turning signal gain pot. CW will make system go faster for same voltage into unit.
17. No further adjustments are necessary. (STOP).

MORE DETAILED SET UP PROCEDURE

If your system requires more accurate tach adjustment,

1) Go through Steps 1 - 10.
2) Then apply a small signal until motor rotates and watch tach signal on an oscilloscope.

   Note: Refer to Helpful Hints section.

3) If tach loop is overdamped, turn tach pot CW until one overshoot appears. The system is now set up for maximum bandwidth in tach loop.
4) If you don't want an overshoot in your tach loop, turn tach pot CCW until the overshoot disappears.

   Note: One overshoot in tach loop does not necessarily mean the position loop will overshoot.

5) Also, if motor drifts, it may be necessary to re-adjust signal balance pot until motor stops.
6) After you have made the above adjustments, you will have to re-calibrate signal gain pot to obtain proper output voltage to input signal.
7) All other adjustments are factory set and do not require any further adjusting.

CAUTION: MAKE SURE POWER IS OFF WHEN SOLDERING ON CIRCUIT BOARDS.

NOTES:

1) Check system for backlash, wind up lost motion, misalignment, bad coupling or any other mechanical problems.

   AFTER YOU MAKE ANY OF THE CHANGES BELOW, REPEAT SET UP PROCEDURE - START WITH STEP 4 ON PAGE 11.

2) High frequency oscillation even though TC pot fully CCW (high frequency oscillation probably motor resonance). Increase C7 to approximately .033 mfd & add C3 = 2 mfd & C5 = .022 mfd.
3) If system requires more DC gain, then increase C6 to approximately .1 mfd & decrease R11 to approximately 2 K. You might have to increase C7 to approximately .033 mfd - Reference Note 2 above.
4) If the system is highly inertial, or a highly inertial motor is used, it may be necessary to change C6 & R11 - Reference Note 3 above.

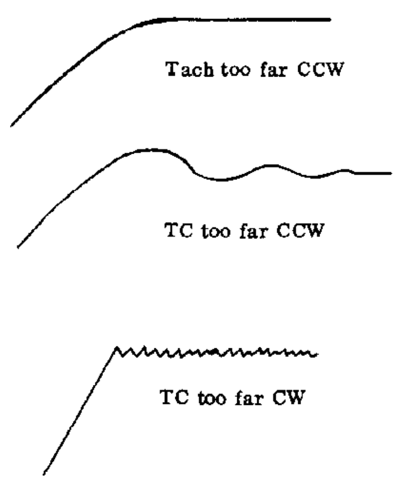
   Then repeat either procedure.

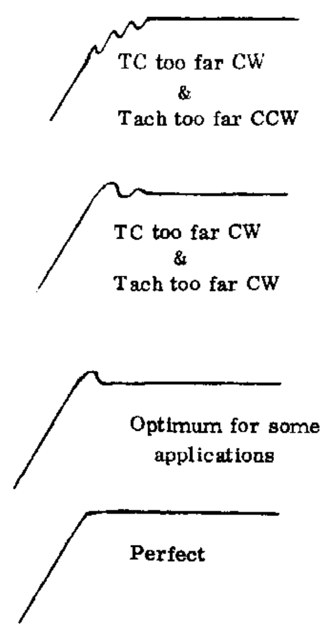
HELPFUL HINTS:

1. Tachometer should be observed on an oscilloscope where sweep speed is set at .1 seconds/centimeter and adjust the vertical attenuator to provide a convenient displacement in response to the signal input.

2. Small step input commands may be provided with a DC simulator (battery box) while observing the tach response on the oscilloscope.

3. Typical pictures you will see on oscilloscope of tach profiles.





Tach Pictures

TROUBLE SHOOTING AIDS: Ref. Fig. No. 1 and 2 and Installation Drawing.

In the event that the unit should fail to operate, it is advisable to follow the following procedure:

1) Examine the unit visually for loose connections, broken wires, and damaged components.

2) Look and see if fault indicator red light is on. Read over Protective Features & Other Feature Sections. Then do some checking to find out reason for trip indication.

OTHER TYPICAL REASONS:

1) Shorts to ground may occur.

   A) Commutators arcing to the frame of a motor during high speed reversals.

   B) Motor armatures shorting to case.

   C) Leads to motor becoming pinched and frayed in the wiring trough and touching ground.

   D) Faulty wiring of connections.

   E) Eventually, during the running of any D.C. motor, brush dust can build up in a motor causing an electrical path from the brushes to the motor case.

2) Check shunt regulator fuse F801 - F804. Fuse could blow due to:

   A) Excessive regeneration time. (Customer may have changed duty cycle).

   B) Blown power transistor (s) in shunt regulator. (Discussed in Other Features section).

3) Check the wiring to the motor tachometer.

4) Check the incoming bias voltage, as well as the main bus power voltage coming from the power transformer.

5) Check control power fuse F901.

6) Connect a D.C. voltmeter to Pin 10 of J-1 with the common lead on Pin 11 of J-1 and check for + 15 Volts.

7) Connect the D.C. voltmeter to Pin 12 of J-1 with the common lead on Pin 11 of J-1 and check for - 15 Volts.

8) Connect the voltmeter across the two terminals on the large capacitor on the chassis to read the bus power supply voltage. This voltage should be 165 VDC.

9) If all the fuses and voltages are proper, it is then advisable to determine if an input signal exists.

   A) If you are putting command signal into (Aux) Input #1, look at R1.

   B) If signal in (Sig) Input #2, look at TP-2.

   C) Use TP4 as common.

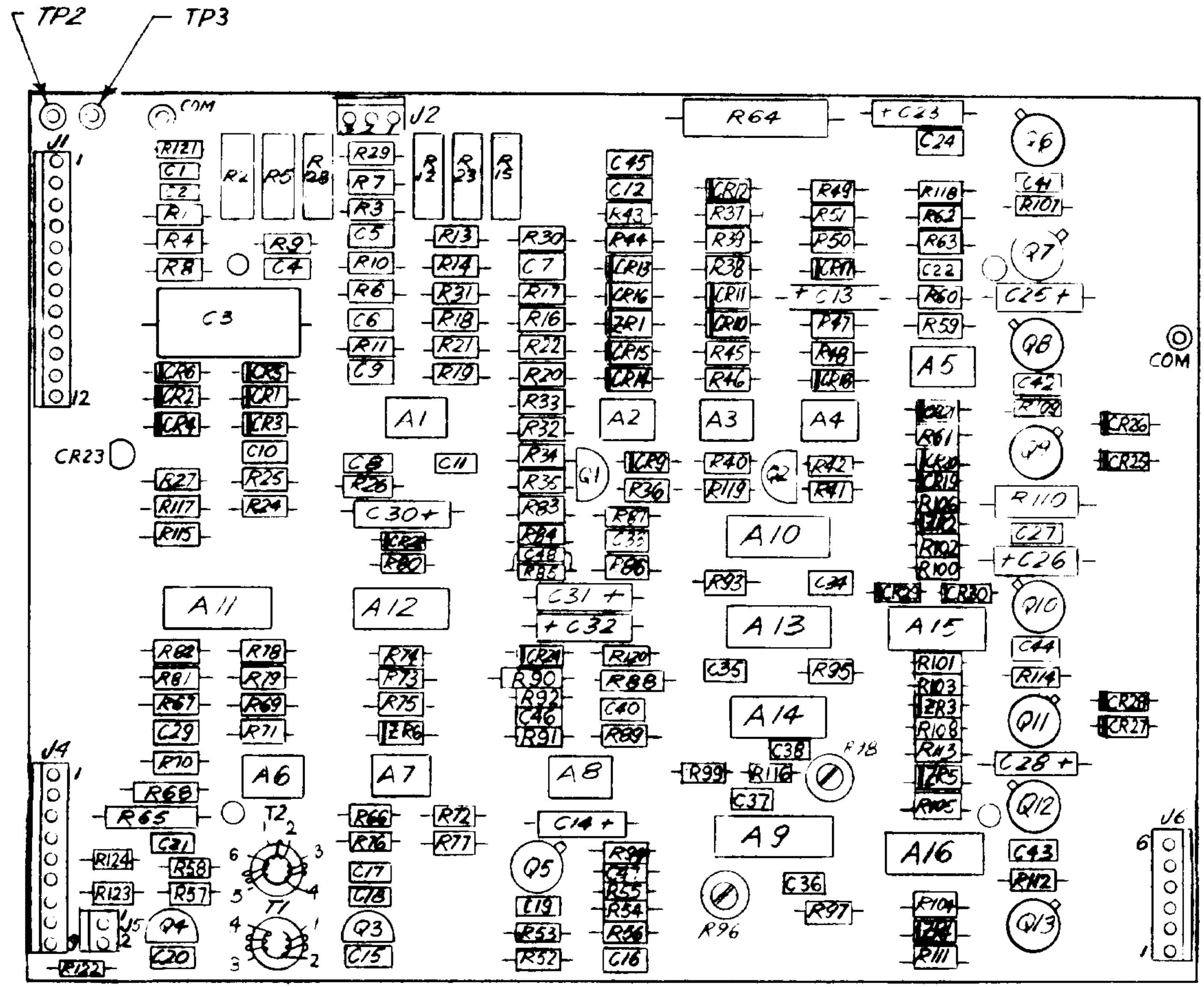
CAUTION: DO NOT USE GROUNDED TEST EQUIPMENT (FLOAT SCOPE)

If there is a signal voltage at R1 or TP-2, check the output of the velocity control amplifier which can be seen at cathode of diode CR-1. Follow the signal flow diagram as shown in Fig. #2 and check the output of each section. If control card is in working order, it is advisable to return this unit to the factory for repair, since sophisticated test equipment, which is usually not available in the field, is required to determine the cause of the failure.

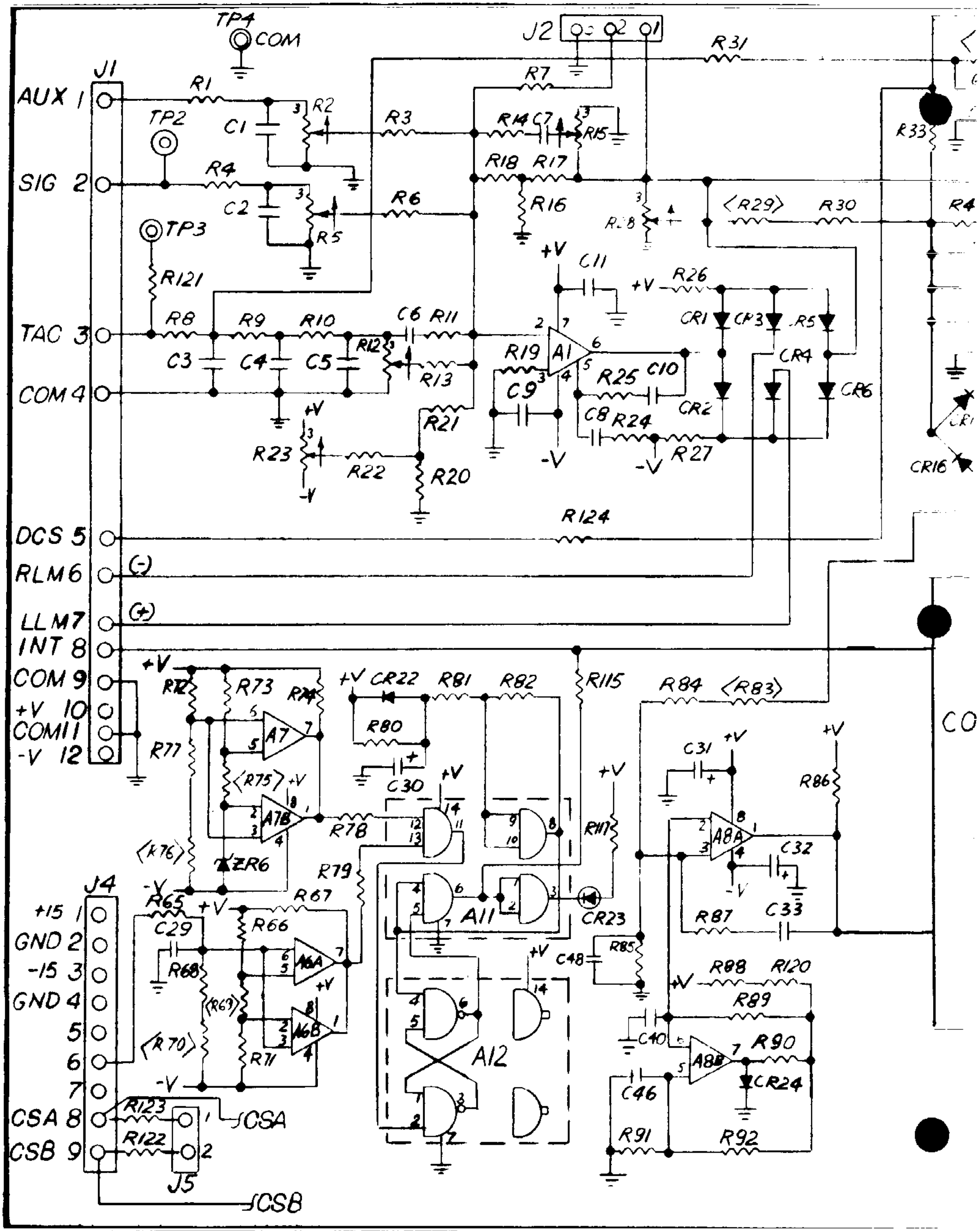
TYPICAL INSTALLATION AND FIELD PROBLEMS - FAULT CONDITIONS ONLY

Westamp A641 Series of Drives

PROBLEM DEFINITION	CAUSE	EFFECT	SOLUTION
High bus voltage	Wrong transformer tap Insufficient bus capacitor or regulator sized incorrectly Regulator fuse (s) blown	Fault trip with indication "	Correct fault condition, re-set drive. " "
Excessive surge currents	Either motor line connected to ground Output leads become shorted together before inductor	Circuit Breaker opens	" " " "
Excessive current at high motor speeds	Exceeded safe commutation zone of motor & motor arcing probably to case of motor	Circuit Breaker opens	Re-set drive and re-select appropriate tapered current limit.
Excessive RMS current	Duty cycle increased Stalled motor - shorted motor Shorted motor lines System oscillation	Drive will shut down and cycle	Correct fault and drive will operate normally.
Low bus voltage	Power line sag Blown line rectifiers	Reduced output voltage, fault trip with indication	Correct fault condition, re-set drive
Incorrect bias power	Overload on bias supplies or Shorted bias supplies	Drive will shut off with no damage to output thyristors	Check reason for overload - correct - then replace bias supply fuse.



PC BOARD LAYOUT


TP4
COM
J2
J1
AUX 1
SIG 2
TAC 3
COM 4
DCS 5
RLM 6
LLM 7
INT 8
COM 9
+V 10
COM 11
-V 12
TP2
TP3
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
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R26
R27
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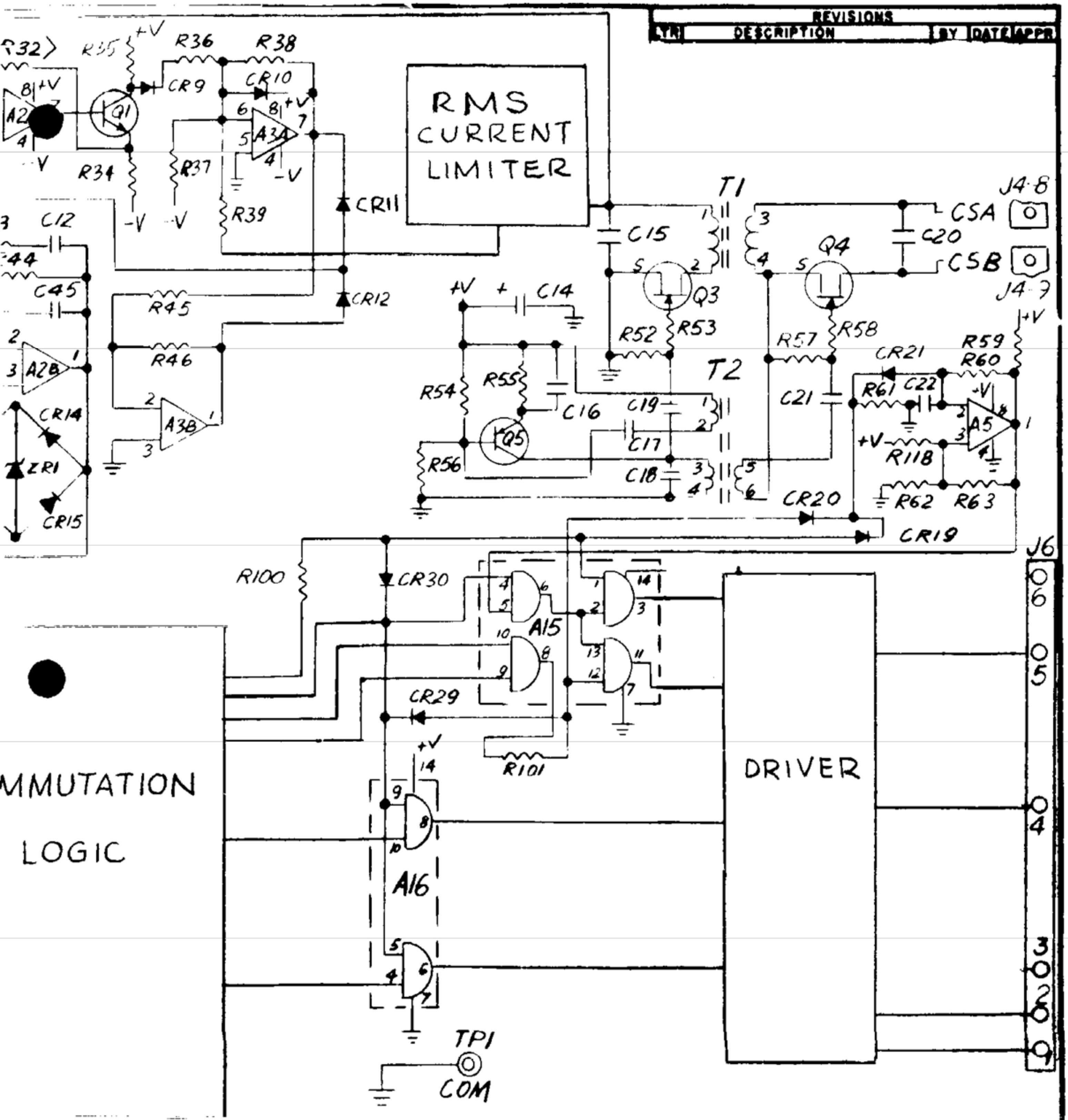
R30
R31
R33
R121
R124
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
A1
+V
-V
CR1
CR2
CR4
CR6
CR16
(-)
(+)
R73
<R75>
<R76>
R77
R78
R79
R80
R81
R82
R84
<R83>
R85
R86
R87
R88
R89
R90
R91
R92
R115
R117
R120
A7
A7B
ZR6
CR22
CR23
CR24
C29
C30
C31
C32
C33
C40
C46
C48
A8A
A8B
A11
A12
J4
+15 1
GND 2
-15 3
GND 4
5
6
7
CSA 8
CSB 9
R65
R66
R67
R68
<R69>
<R70>
R71
A6A
A6B
R122
R123
J5
CSA
CSB
CO

REVISIONS

LTR	DESCRIPTION	BY	DATE	APPR



PART NO.	DESCRIPTION	MATERIAL	ITEM

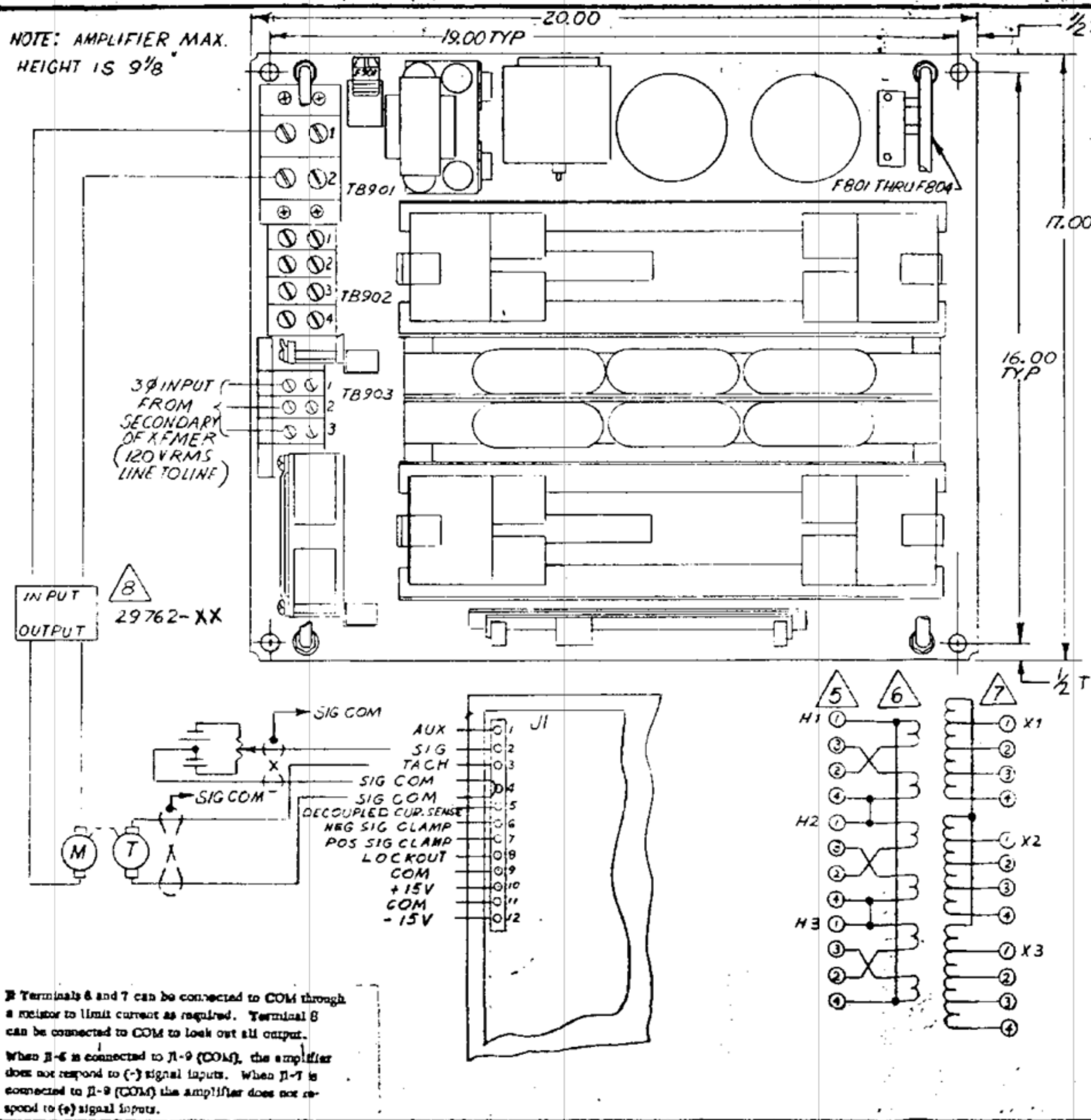
UNLESS OTHERWISE SPECIFIED:
TOLERANCES: FRACTIONS ± 1/64
.XX ± .01 .XXX ± .005 ANGLES ± 2°
BEND RADII
BREAK SHARP EDGES .005-.010
FINISH

SCHEMATIC, CONTROL BOARD SCR – PWM

MODEL A641X

WESTAMP INCORPORATED
1542 15TH STREET
SANTA MONICA, CAL.

DWN RD | CHK RW | APP
DATE 3-8-77 | SCALE | SHEET 2 OF 2 | REV.



FUSE DATA			
Model No.	Fuse	F901	F801 thru F804
	Type	AGC	MDX

NOTES:

1. CAUTION: Outputs at TB901-1 and TB901-2 must be isolated from all other circuits and must not be grounded.
2. Use shielded wire on input leads, connect shield to "shield ground" J1-4.
3. Output at TB901-1 is (+) w.r.t. TB901-2 when J1-2 is (+) w.r.t. J1-4.
4. Motor frame and Amplifier chassis must be connected to System Ground.

5. Primary protection for the Power Transformer must be provided. (Fuse or circuit breaker in each phase). Recommended sizing 30 Amps for 240 VAC. 15 Amps (Slo Blo) for 480 VAC.

6. Power Transformer Primary Connections. 240 VAC Line. Jumper Taps 1 to 3, 2 to 4 of H1, H2 & H3. Apply 240 VAC 50/60 Hz to H1-1, H2-1 & H3-1. 480 VAC Line, Jumper Tap 2 to 3 of H1, H2 & H3. Apply 480 VAC 50/60 Hz to H1-1, H2-1, & H3-1.

7. Power Transformer Secondary Connections, Multiple Secondary Taps are provided to compensate for variations from nominal line voltage.
For Low Line 220/240 VAC use Tap 4 of X1, X2 & X3.
For Nominal Line 240/480 VAC use Tap 3 of X1, X2 & X3.
For High Line 255/510 VAC use Tap 2 of X1, X2 & X3.
Tap 1 of X1, X2 & X3 is used to reduce the max. amplifier output voltage to 90 VDC.

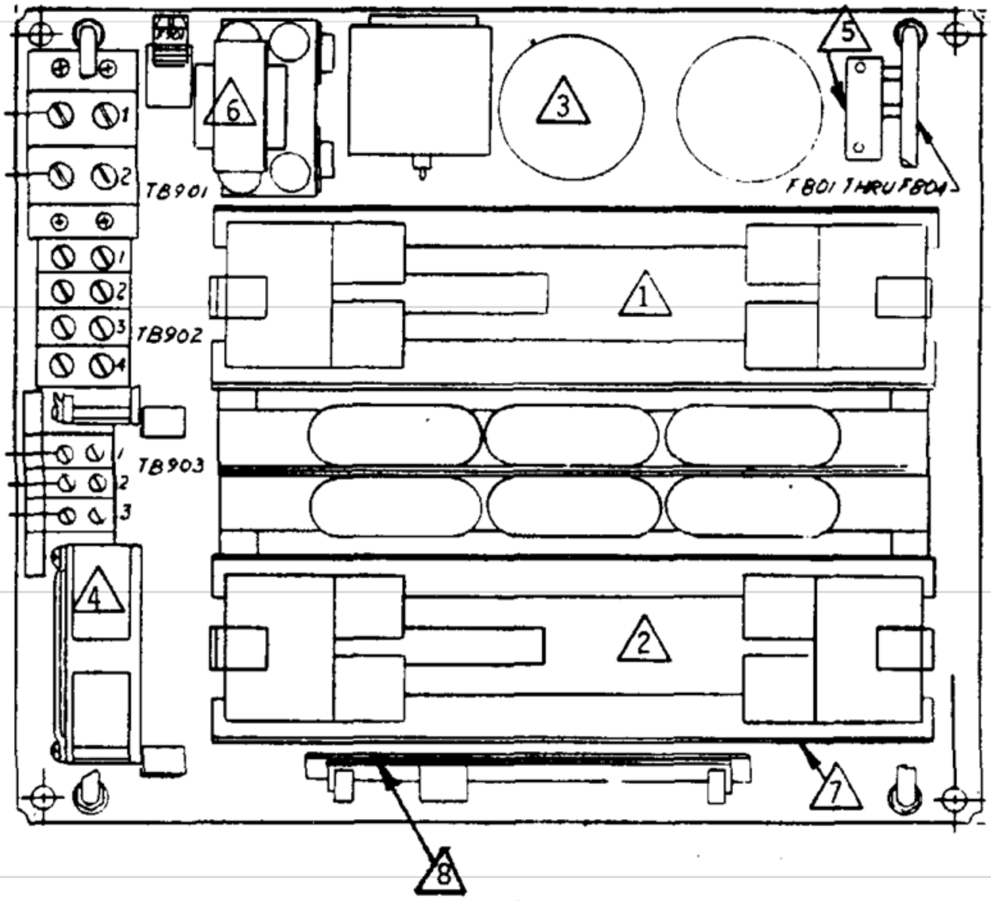
8. 29762-9 or equivalent (approx. 3 MH) must be installed in series with output to prevent damage to amplifier.

Terminals 6 and 7 can be connected to COM through a resistor to limit current as required. Terminal 8 can be connected to COM to lock out all output.
When J1-6 is connected to J1-9 (COM), the amplifier does not respond to (-) signal inputs. When J1-7 is connected to J1-9 (COM) the amplifier does not respond to (+) signal inputs.

REVISIONS			
LTR	DESCRIPTION	BY	DATE APPD

PART NO.	DESCRIPTION	MATERIAL	ITEM
UNLESS OTHERWISE SPECIFIED: TOLERANCES: FRACTIONS ± 1/64 .XX ± .01 .XXX ± .010 ANGLES ± 1/2° BEND RADII ... BREAK SHARP EDGES .005-.015 FINISH	INSTALLATION DRAWING	WESTAMP INCORPORATED 1542 15TH STREET SANTA MONICA, CAL.	
	MODEL A641X	DWG NO. 29600	REV.
	DWN R.R. CHK ... APP ... DATE 7-28-77 SCALE ...	SHEET 2 OF ...	

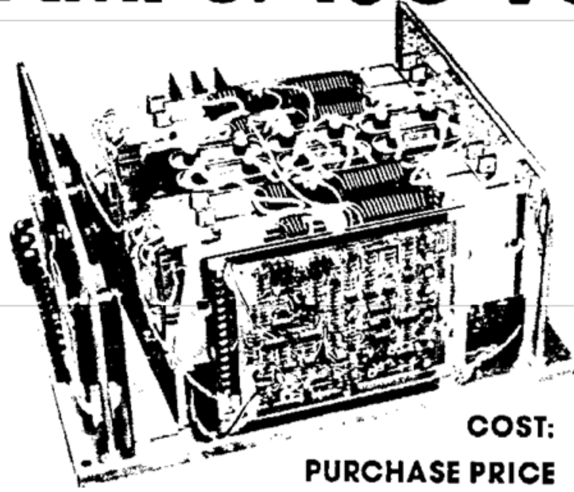
SPARE PARTS LOCATOR
MODEL A6412 (100A) & A6415 (200A)



ITEM	QTY	DESCRIPTION	PART #
1	1	Positive Diode Bridge (located on main chassis)	29536-1
2	1	Negative Diode Bridge (located on main chassis)	29536-3
3	1	Bus Capacitor	FAH 372-200-D3
4	1	Muffin Fan	3-15-3450 (Howard)
5	1	Shunt Regulator	30036-9
6	1	Bias Supply	31550-1
7	1	Thyristor Bridge Assembly	
		(a) 100 Amp	29633-1
		(b) 200 Amp	29633-3
8	1	Control Board	29625-1

WESTAMP® INC.

PWM SERVO AMPLIFIER
A641 SERIES
200 AMPS/160 VOLTS



1 Axis unit shown

PERFORMANCE

RELIABILITY

COST

PERFORMANCE:

Machine productivity can usually be increased by at least a factor of 3 when PWM is compared with an SCR Phase Control.

Better part finish as measured by field results is a direct result of the unique compensation in the unit when compared with the other PWM'S or an SCR Phase Control.

RELIABILITY:

A design is only as good as its protection-think how far you could go if your car did not have any indicators.

The amplifier is protected against the following abnormal conditions:

1) Shorts across output before or after inductor
2) Shorts to ground
3) Loss or low DC Bus power
4) Loss or low DC Bias power
5) Over Voltage
6) Excessive RMS/Peak Current
7) System Oscillation
8) Over Temperature
9) Oil and Grease Resistant

COST:

PURCHASE PRICE

Attractive when compared with phase controls of $ versus performance.

INCREASE MACHINE LIFE

Shock loading from motor torque pulses are considerably reduced as compared with an SCR phase control.

INSTALLATION TIME

Reduce wiring cost because chassis contains amplifier power supplies & (regulator).

SET-UP TIME

Approximate 10 minutes per amplifier results from simplified and adjustable compensation, which is capable of covering a wide range of motors.

FIELD SERVICE

Reduced field service calls due to protective features.

MOTORS

Smaller due to low form factor.

TRANSFORMERS

Smaller due to reactive current flow plus low form factor.

SPECIFICATIONS:	A6412	A6415
1. Peak Current	±100 A	±200 A
2. Peak Voltage (Typ)	±165 VDC	±165 VDC
3. Continuous Current	±75 A	±100 A
4. Continuous Voltage (Typ)	±150 VDC	±160 VDC
5. Horsepower Rating (Cont)	15 HP	20 HP
6. Input Voltage	120 VAC RMS 3 ϕ bus power & 120 VAC RMS 1 ϕ bias power	
7. Form Factor	1.02 – Defined at full output current	
8. Switching Frequency	Constant	
9. Frequency Response	300 Hz Min	
10. Dead Band	None	
11. Gain	Adjustable (22 turn pots)	
Input 1 (Aux)	0 to 25000 A/V (min)	
Input 2 (Signal)	0 to 25000 A/V (min)	
Input 3 (Tach)	0 to 25000 A/V (min)	
12. Signal Input Impedance	20 K Min/Input	
13. Signal Input Voltage		
Typical	±10 Volts	
Max	±50 Volts	
14. Drift (Refer to Input)	10 μ V/°C	
15. Current Limit	Adjustable (22 turn pots)	
16. Signal Balance	Adjustable (22 turn pots)	
17. Ambient Temp (Operating)	0°–50°C	
18. Auxiliary Inputs	Gain reduction Limit switch overtravel Remote on-off (electronic) Programmable current limit	
19. Auxiliary Outputs	Output current monitor (See Note 6) ±15 VDC @ 50 MA	
20. System Compensation	Adjustable and built in	
21. Cooling	Blower	
22. Weight	60 lbs*	
23. Mounting	Panel (Vertical/Horizontal)	
24. Power Transformer	Separate	

25. PROTECTION

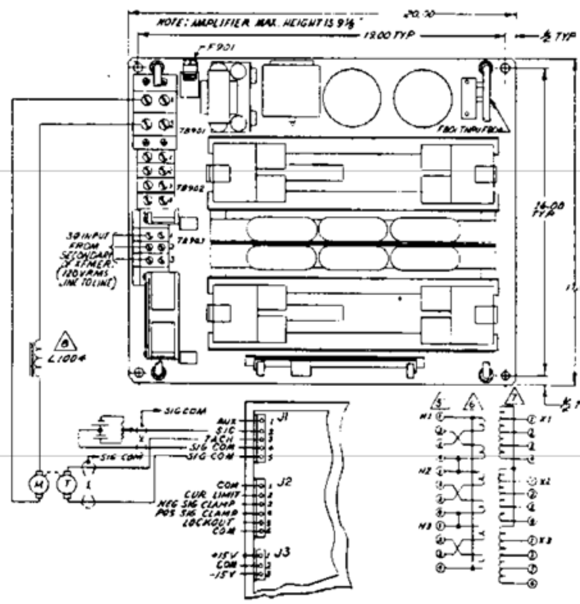
- **a) Shorts to ground**
- **b) Short across output**
- **c) RMS overload protection (electronic)**
- **d) Bias fault protection**
- **e) Undervoltage bus protection**
- **f) Current limit**
- **g) Bias power fuse**
- **h) Circuit breaker**

26. Options:
Special compensation
Tapered current limit – for reduced current at high output voltages (motor commutation capability)

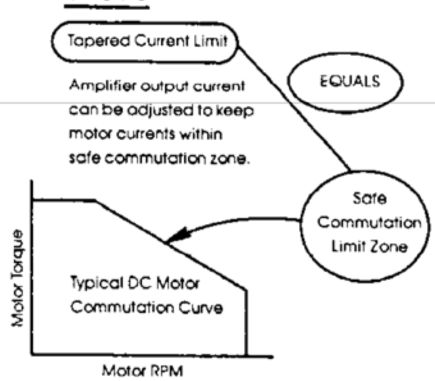
*Unit without transformer or inductor

NOTES:

1. Max peak current is for 2 seconds.
2. Frequency response is typical of units with no compensation. System compensation in most applications usually reduces the response.
3. Consult the factory concerning applications requiring continuous regeneration.
4. Output voltage is max from 120 VAC RMS bus power.
5. If motor has 2.6 mhy no external inductor is necessary.
6. Output current monitor is capable of driving a zero center 100 micro ampere meter.
7. If red light is on, this indicates trip of fault logic. Remove power – wait 10 seconds – reapply power. Unit will restart if fault has cleared.



OPTIONAL



WESTAMP INC.

1542 15th Street, Santa Monica, California 90404 (213) 393-0401

WESTAMP HAS BEEN DESIGNING AND MANUFACTURING SERVO SYSTEMS SINCE 1958

RATE CONTROLLED CURRENT CLAMP

Many motors require reduced currents at high speeds to avoid excessive commutator arcing. Such a clamp circuit requires as an input, the tach voltage and as an output, the current command which can be reduced by means of a clamping action.

Such a circuit, Figure 1, typically consists of (1) a prescaler, (2) an absolute value converter and (3) a double ended clamp. The current command is generated outside of this circuit by the velocity control amplifier with a maximum voltage of ±7 Volts.

An increasing tach voltage reduces the clamp voltage which, in turn, reduces the commanded motor current. Resistors, R1, R2 and R3 are chosen from the V_c (VA) relationship at points 1 and 2 where V_a is V_t, normalized to 10 Volts at maximum motor speed, R1, therefore, is dependent on maximum speed and tach grad. R2 increasing lowers the curve while R3 increasing raises the slope magnitude. Expressions are developed for R1, R2 and R3 as a function of V_a and V_c at points 1 and 2. Expressions for the 3 resistor values are developed as follows:

First a maximum of 1 MA flows through R1. Therefore,

$R_1 = V_{t2}$, $\quad V_{t2}$ -- Volts
R ---- K Ohms

$V_a = V_t$ normalized to 10V maximum
then R2 and R3 = F (V_c, V_a and M)

$$\frac{V_c - .7}{R_3} = \frac{15}{R_2} - \frac{V_A - .7}{10} \qquad R_2 = \frac{15}{\frac{V_A - .7}{10} - \frac{V_c - .7}{10M}}$$

$$M = \frac{V_{c1} - V_{c2}}{V_{A1} - V_{A2}} \qquad R_2 = \frac{150}{V_A - .7 - \frac{V_c - .7}{M}}$$

$$M = -\frac{R_3}{10}$$

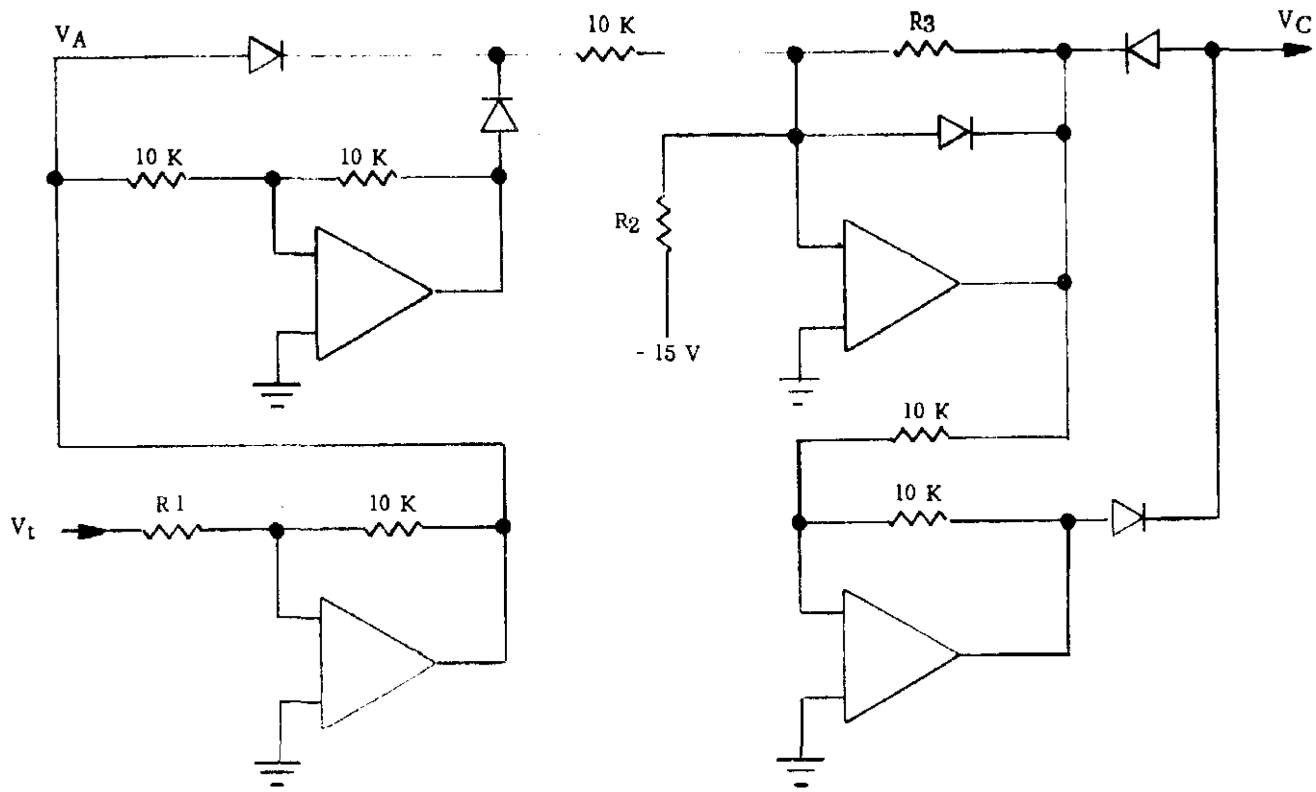
AT POINT 2,

THEREFORE,

$$\frac{V_c - .7}{-10M} = \frac{15}{R_2} - \frac{V_A - .7}{10} \qquad R_2 = \frac{150}{V_{A2} - .7 - \frac{V_{c2} - .7}{M}}$$

$$R_3 = -10M$$

WHERE,
M IS THE SLOPE IN FIG. 1.



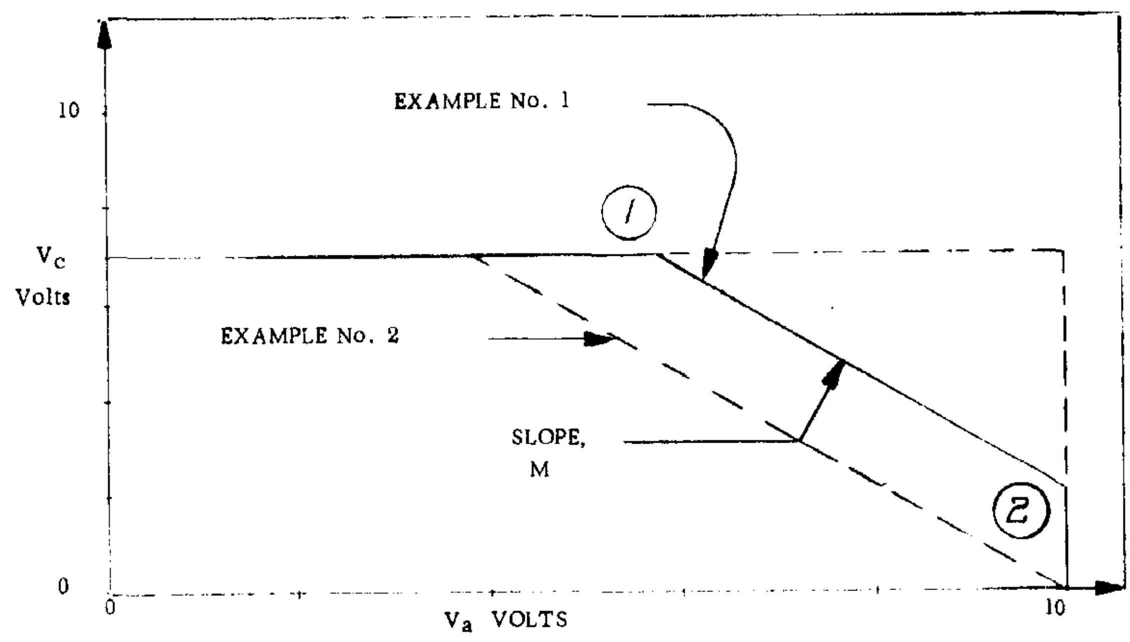


Figure 1. Circuit and DC Transfer Function of Rate Controlled Current Clamp.

Summarizing

$$R_1 = VT2$$

$$R_2 = \frac{150}{Vt2 - .7 - \dfrac{Vc2 - .7}{M}} \quad ; \qquad M = \frac{Vc1 - Vc2}{Va1 - Va2}$$

$$R_3 = -10\,M$$

Where:

V_{t2} = Maximum tach voltage, Volts

R1 = Input scaling resistor, K Ohms

M = Slope magnitude of clamp curve

R_2 = Curve positioning resistor, Ohms

R_3 = Curve sloping resistor, Ohms

A Hewlett Packard - 55 calculator program was then developed to express R2 and R3 as a function of Va1 , Va2 , Vc1 and Vc2 as shown on the following page.*

* Please call our office for this program:

Controlled Motion Products
381-1933