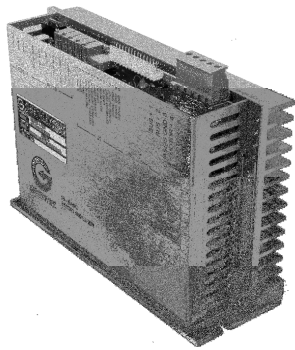


OPERATION & SERVICE MANUAL

SMA5005 & SMA5015

H Bridge Linear Servo Amplifiers



GLENTEK

"Solutions for Motion Control"

*Congratulations, You Cared
Enough to Buy the Very Best!*

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INTRODUCTION

The Glentek SMA5005 and SMA5015 H bridge linear servo amplifiers provide the optimum solution for applications which require high current loop bandwidth, low radiated electrical noise and low crossover distortion. The SMA5015 amplifier incorporates our latest generation ISO-BIAS current sense technology which provide one of the lowest drift linear amplifiers on the market today. These amplifiers are constructed using surface mount technology and incorporate the latest in heat transfer technology which make them one of the most powerful amplifiers for a given form factor.

Typical applications are brushed DC permanent magnet motors and voice coil motors.

The SMA5005 & SMA5015 are configurable and can operate in the following modes:

1. Velocity mode for motors with tachometer feedback.
2. Current mode for torque mode operation
3. Voltage mode (SMA5015 only, special order)

A basic velocity mode servo loop for a brush type motor is shown in figure A. An external controller commands a given velocity (RPM). The velocity loop summing amplifier compares this command with the actual motor velocity, supplied by a DC tachometer on the motor shaft, and produces an error voltage proportional to the difference between the actual and commanded velocity.

The velocity error is used to command motor current in the inner servo-loop. The current loop summing amplifier compares the command current (velocity error) with the actual current in the motor and produces an error voltage proportional to the difference between the actual and commanded current.

Finally, the current error signal is used to produce an output to drive the motor.

The velocity loop may be bypassed, and an external current command fed directly to the current loop. In this case, the external command signal controls the torque of the motor, rather than the velocity. This is known as current-mode operation.

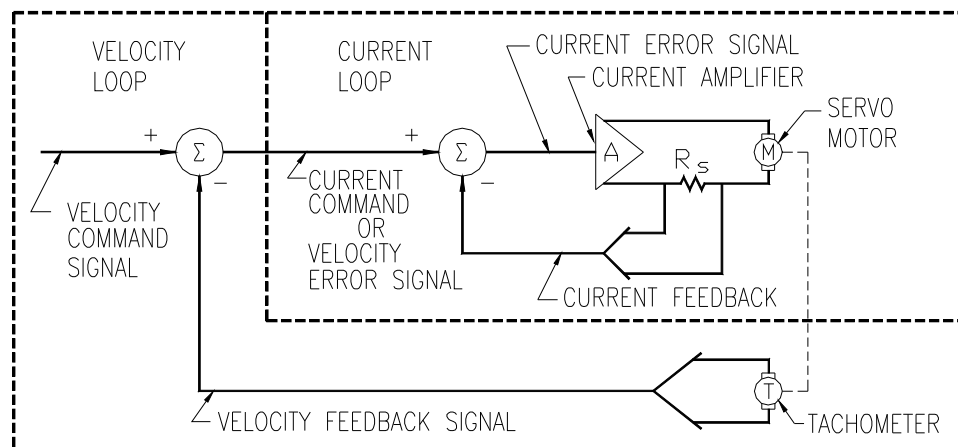


Figure A - Velocity mode servo loop for a brush type motor

FEATURES

- Ergonomic Design Easy access to connections, adjustments and test points.
- SMT construction Provides ultra compact size, cost competitive package and high reliability.
- Bandwidth All servo amplifiers have a nominal 10 kHz current loop bandwidth which varies with the motor inductance.
- Linear output stage Provides high bandwidth, low noise and zero crossover distortion.
- Multimode operation Velocity mode (tachometer feedback), Current mode (torque) and voltage mode (SMA5015 only)
- Operating Voltage Operating input voltage range 17-0-17 to 39-0-39 VAC for standard SMA5015 stand alone (higher voltages available) 24-75 VDC for standard SMA5005 module.
- Basic versions Velocity and current modes (SMA5015 is field configurable).
- Fault protection Short from output to output, short from output to ground, amplifier RMS over current, amplifier under/over voltage (SMA5015 only) and amplifier over temperature.
- Status indicator 7-segment LED display indicates amplifier status on the SMA5015 and LEDs indicate status on the SMA5005.
- Dedicated inputs command signals, +/- limits, inhibit, reset, and fault.
- Dedicated outputs fault out and motor current monitor
- Manual reset A push button reset is available to reset a fault (SMA5015 only).
- Current limit Peak motor current is adjustable.
- Transformer T657TB and T693TB are available for the SMA5015; see drawings in Appendix for more information.
- External fault reset An input is provided to reset the amplifier in the event of a fault.
- CE compliant All servo amplifiers are CE marked.

APPLICATION NOTE

POWER DISSIPATION CONSIDERATIONS AND CALCULATIONS WHEN USING LINEAR DC SERVO AMPLIFIERS:

When selecting a linear amplifier, the following ratings of the amplifier should be known in order to properly size the amplifier to your system requirements:

1– The total wattage, peak current, and voltage rating of all the semiconductors installed on the heat sink of the output power stage of the amplifier.

Output transistor ratings for the SMA5005 series are:

Voltage: 250 Volts

Peak current: 60 A; Continuous current: 30 A (Normally shipped with 12-20A limit)

Total wattage @25 deg C.:1200 Watts

Output transistor ratings for the SMA5015 series are:

Voltage: 200 Volts

Peak current: 240 A; Continuous current: 60 A (Normally shipped with 20-50A limit)

Total wattage @25 deg C.:4480 Watts

The SMA5005 series amplifier is a module style amplifier requiring an external unregulated single polarity DC power supply. Glentek offers various unregulated power supplies for the SMA5005 series amplifiers.

The SMA5005 series amplifier is also available in multi-axis configurations. That is, there are two basic baseplate assemblies namely 2-axis and 4-axis baseplate assemblies that have built-in AC to DC power supplies (un-regulated) and cooling fans. The 2-axis baseplate assembly contains one AC to DC power supply, one fan, and up to two SMA5005 amplifier modules. The 4-axis baseplate assembly contains one AC to DC power supply, two fan, and up to four SMA5005 amplifier modules. For multi-axis applications, it is always recommended to use three phases power transformers for minimizing ripple voltage during high current demand scenarios where all axis motors are running at full load simultaneously. Glentek offers various isolated three phases power transformers.

The SMA5015 series amplifier is a stand-alone style amplifier, meaning that the unregulated dual polarity power supply is mounted within the amplifier enclosure. Glentek offers 1.4KVA and 2.0KVA center tapped power transformers for the SMA5015 series amplifiers.

2– Typical continuous internal rating of the amplifiers running at normal room conditions is:

SMA5005 series; 250 Watts continuous

SMA5015 series; 300 Watts continuous

For most applications, the above heat sinking is adequate. However, if you have a usage mode where the heat sink temperature becomes excessive, please contact Glentek and we can furnish a larger heat sink with greater air flow for your application.

Use the following relationships to calculate amplifier dissipation :

1) **$P_d = I_m \times V_b$ (watts)**

Where: P_d = Total watts delivered from bus

I_m = Motor current

V_b = Bus voltage

2) **$P_m = I_m \times V_m$ (watts)**

Where: P_m = Total power (watts) dissipated in motor

V_m = Motor voltage

3) **$P_a = I_m \times V_b - I_m \times V_m$**

Where: P_a = Total watts dissipated at amplifier

From the above relationship, it can be surmised that the worst case dissipation occurs when the amplifier has to deliver a high continuous current at a low motor speed, i.e., less motor BEMF and more current. For some applications, a power resistor can be added in series with the motor thus shifting some of the power dissipation from the amplifier to the resistor.

TECHNICAL SPECIFICATIONS

Output

- SMA5005: 15A peak, 5A continuous, (forced air cooling required)
Note: Large motor and Small motor versions have different velocity loop compensation.
- SMA5015: 25A peak, 10A continuous, (integral fan cooling)

Input

- SMA5005: 24-75VDC
- SMA5015: 17-0-17VAC to 39-0-39VAC (+/-24 to +/-55VDC Bipolar Input)
- Integral forced air fan cooling (multi-axis SMA5005 and SMA5015 only)
- Analog command signals: differential & single ended, adjustable gain
- Manual reset Pushbutton switch (SMA5015 only)
- Reset: SMA5005: pull up/pull down, active high only;
SMA5015: pull up/pull down, active high, active low
- Inhibit: Same as Reset
- +/- Limits: Same as Reset

Output Connections

- Motor : MTR + & MTR-
- Fault out: SMA5005: Optically isolated can sink up to 50 mA, active high only
SMA5015: Open collector, Pulled Up (+5V), active high or active low

Bandwidth

- 10 kHz maximum and varies with motor inductance

Status Indicator

- SMA5005: Green Run LED, Red Inhibit LED, Red Fault LED
- SMA5015: 7-segment LED display indicates amplifier status and diagnostics

Mechanical

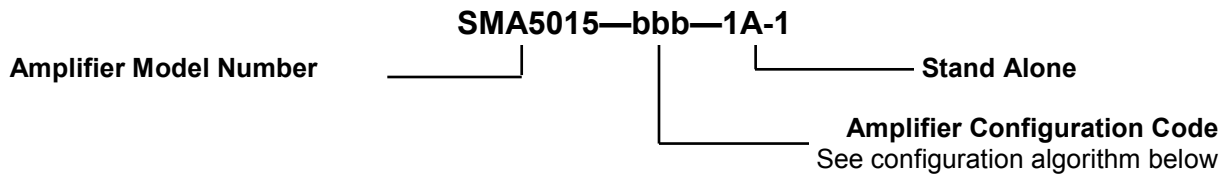
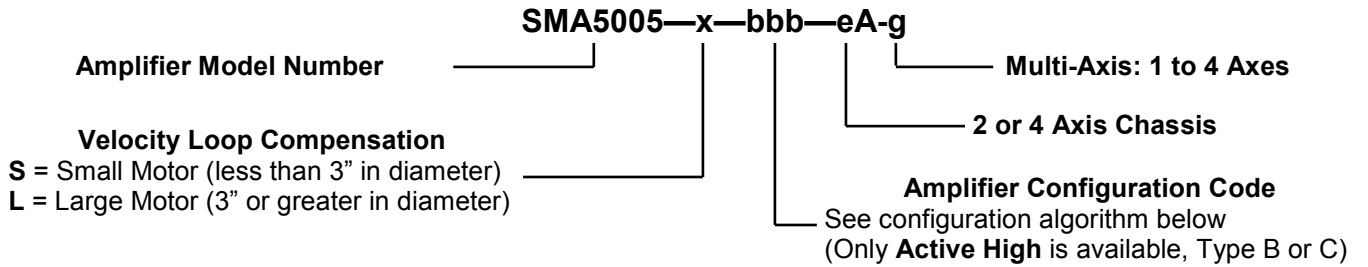
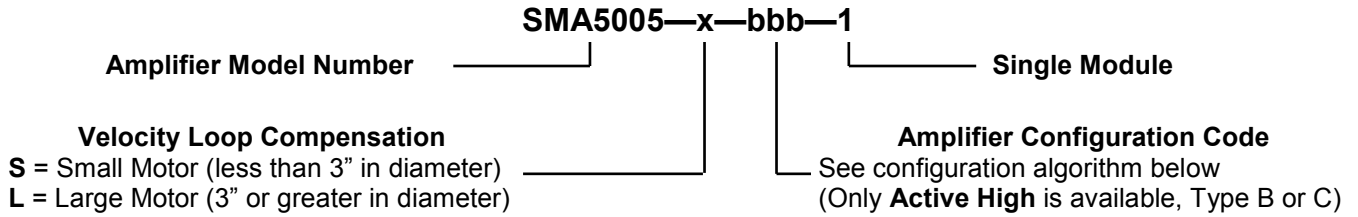
- SMA5005 module: Height: 7.13", Width: 2.23", Depth: 5.69"
- SMA5005 2-Axis: Height: 10.75", Width: 9.75", Depth: 6.93"
- SMA5005 4-Axis: Height: 10.75", Width: 14.90", Depth: 6.93"
- SMA5015 stand-alone: Height: 14.50", Width: 4.25", Depth: 9.00"

Environmental

- Operating temperature 0 to 55°C
- Storage temperature -40 to 80°C
- Humidity 5 – 95% relative (non-condensing)

MODEL NUMBERING

The information below should be used to order your amplifier pre-configured for your application. You may wish to have a Glentek application engineer confirm your configuration because field configuration options are limited.



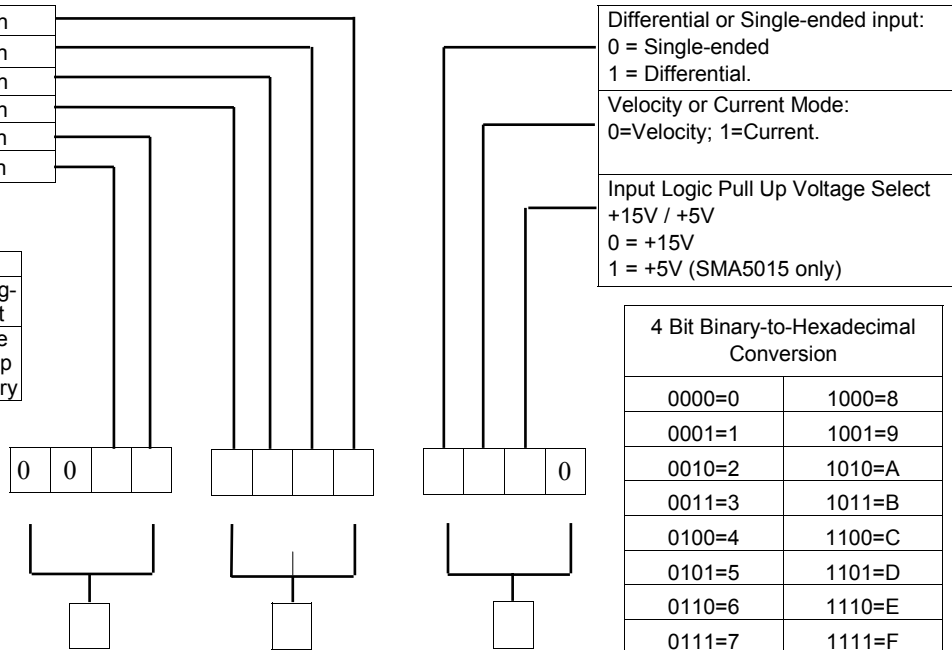
Inhibit, Reset, ±Limit Configuration			
Type	Input is:	Input State:	Binary Code
A	Internally Pulled Up	Active When Low	00
C	Internally Pulled Up	Active When High	01
D	Internally Pulled Down	Active When Low	10
B	Internally Pulled Down	Active When High	11

Logic Input Configuration for Inhibit	
Type	Configuration
Type A	Requires grounding of input to disable the amplifier.
Type B	Requires a positive voltage at input to disable the amplifier.
Type C	Requires grounding of input to enable the amplifier.
Type D	Requires a positive voltage at input to enable the amplifier.

Amplifier Configuration Code

±Limit 0=Active Low, 1= High
±Limit 0=Pulled Up, 1= Down
Inhibit 0=Active Low, 1= High
Inhibit 0=Pulled Up, 1= Down
Reset 0=Active Low, 1= High
Reset 0=Pulled Up, 1= Down

Important Notes:
 SMA5005 is not field configurable except signal input
 SMA5015 logic inputs are hard wired, either pulled up or pulled down at the factory



START UP AND CALIBRATION

This section contains the procedure required for initial start up and amplifier calibration. The SMA5005 and SMA5105 series amplifiers can be configured to run in velocity mode (x.x) and current mode (y.y).

Required Equipment: Oscilloscope, voltmeter & battery box. The battery box serves as a step input voltage command, applying and removing a flashlight battery can also be used for this function. Glentek sells a battery box BB-700 which is ideal for this function.

Refer to the technical specifications page and the drawings in the appendix for the information needed to supply the correct power and to wire the model you are starting up. An isolation transformer is needed for the multi-axis SMA5005 and SMA5015. An isolated power supply (unregulated is OK) providing the necessary voltage is required for the SMA5005 module. Glentek can provide appropriate transformers and power supplies. Consult a Glentek applications engineer or sales person for assistance.

A. Initial Start Up:

When applying power to start up your amplifier system for the first time, we recommend you follow this procedure. If you have already gone through this procedure you can skip to the appropriate calibration procedure.

1. Check for any loose or damaged components.
2. Check that all connections are tight.
3. Be sure that the motor mechanism is clear of obstructions. If the mechanism has limited motion, e.g: a lead-screw, set the mechanism to mid-position.
4. Disconnect the signal and auxiliary inputs.
5. Be sure the Loop-Gain pot(s) are fully CCW (RV6 for SMA5005, and RV4 for SMA5015). This will prevent the motor from running away in velocity mode when power is applied.
6. Check for the correct AC voltage before connecting to SMA5005 multi-axis or SMA5015 amplifiers. The DC Bus (amplifier supply-voltage) will be 1.4 times greater than the AC value. If the voltage is correct, remove power and connect AC source to amplifier inputs. For SMA5005 module amplifier, check for the correct DC voltage before connecting to the amplifier power input.
7. Work on only one amplifier axis at a time for SMA5005 multi-axis amplifiers.

B. Calibration of the Velocity Mode Amplifier (SMA5005 Series):

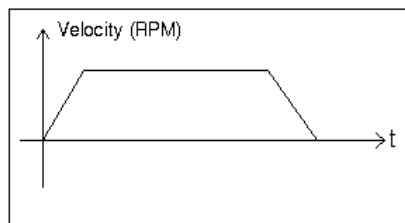
The amplifier, in this configuration, receives an analog, bi-polar input command which is proportional to the motor velocity. The amplifier receives velocity feedback from a tachometer which is usually mounted to the rear of the motor. The following pots will be set during calibration: (Note: RV6 is a single turn pot and RV1-RV5 are 10-turn pots.)

Pots	Name of Pot	Notes
RV1	Signal Gain, SIG	Sets the input voltage to velocity ratio for signal input.
RV4	Tach Gain, TACH	Sets the DC tachometer gain.
RV6	Loop Gain, LOOP GAIN	Used to shut off uncalibrated amplifiers. When the loop gain is fully CCW, no current is delivered to the motor.
RV2	Balance, BAL	Used to null any offset in system.
RV3	Compensation, COMP	Used in conjunction with tach. gain to set the system bandwidth.
RV5	Current Limit, I LIMIT	Sets the maximum motor current. Shipped set CCW (min. current).

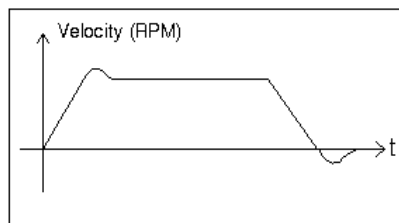
PROCEDURE:

1. Apply main power and fan power. Visually confirm a green LED. Depending on the configuration of the Inhibit, Reset and +/-Limits, it may be necessary to make appropriate connections to those terminals before the amplifier will be enabled and energize the motor.
2. Slowly turn the Loop Gain (RV6) CW fully. Motor should be stopped or turning slowly. If the motor starts running away, remove the power, reverse the tach leads, and retest.
3. Set Balance (RV2) for zero motor rotation.
4. Install a micro-shunt at J3 connector (across J3-1 to J3-2).
Note: For single-ended signal input amplifier, a micro-shunt is permanently installed at J3 connector. On the other hand, the micro-shunt should be removed for differential input amplifier after the calibration process.
5. Connect oscilloscope to J1-7 (MTR I) and battery box to J1-1 (J1-4 is common for both). The voltage on J1-7 is a function of motor current: $1V = 2.0A$. While applying a step input voltage, adjust Current Limit (RV5) for desired peak current.
The purpose of the following procedure is to set the system bandwidth to obtain a critically-damped response or a one hook overshoot response with the maximum possible Tach. Gain. There are many possible settings of Tach. Gain and Compensation which will yield the desired waveform: The optimum setting will occur when Tach Gain is as CW as possible and Compensation is as CCW as possible. However, the servo loop may become unstable (the motor oscillates or hunts) with a very low (near CCW) setting of Compensation. In this case, stability is the limiting factor: At no time should the servo-loop be allowed to be unstable. Amplifiers are normally shipped with the Tach. Gain (RV4) set at 100%. This is a good place to start. If you are unsure of where the Tach. Gain is set, turn the Tach Gain (RV4) fully CW (up to 10 turns).
6. Connect oscilloscope to J1-3 (TACH IN) and J1-4 is common. Set battery box for a DC signal output to obtain approximately 400RPM. The RPM may be set by measuring the tach voltage at J1-3, e.g., 2.8VDC for a 7V/KRPM tach is 400RPM.

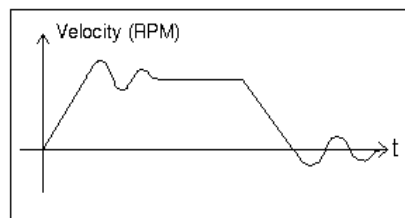
7. Pulse the input and compare the waveform with figure B.



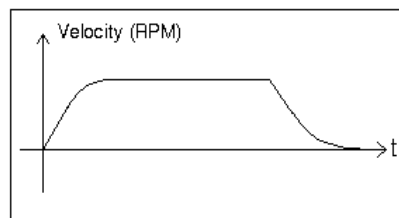
A.) Critically Damped Signal



B.) 1 Hook Overshoot Signal



C.) Under Damped Signal



D.) Over Damped Signal

Figure B - Critically damped, One Hook Overshoot, Under and Over damped

8. Adjust the Compensation pot (RV3) CCW until the waveform is critically damped or one hook overshoot. Then proceed to step 10.
9. If the desired waveform cannot be obtained by adjusting the Compensation pot, back off the Tach Gain pot (CCW) a few turns and repeat step 8.
10. Do not adjust the Tach Gain or Compensation for the rest of the calibration procedure.
11. With battery box still connected at J1-1 and J1-4 for single-ended input (or if your system uses the Differential input, move battery box to J1-1 and J1-2, and remove micro-shunt at J3 connector), set battery box for a known DC voltage. Adjust the Signal Gain pot (RV1) to obtain the desired motor velocity.
12. If the motor is rotating in the wrong direction for a given input polarity, remove the power and reverse both the motor leads and the tach leads.
13. Remove the battery box, and repeat step 3.
14. Calibration complete. Reconnect signal wires.

C. Calibration of the Current Mode Amplifier (SMA5005 Series):

The amplifier in this configuration, receives an analog, bi-polar input command which is proportional to the required motor current (motor torque). The following potentiometers (pots) will be set during calibration: (Note: RV6 is a single turn pot and RV1-RV5 are 10-turn pots.)

Pots	Name of Pot	Notes
RV1	Signal Gain, SIG	Sets the input voltage to velocity ratio for signal input.
RV4	Tach Gain, TACH	Sets the DC tachometer gain.
RV6	Loop Gain, LOOP GAIN	Used to shut off uncalibrated amplifiers. When the loop gain is fully CCW, no current is delivered to the motor.
RV2	Balance, BAL	Used to null any offset in system.
RV3	Compensation, COMP	Used in conjunction with tach. gain to set the system bandwidth.
RV5	Current Limit, I LIMIT	Sets the maximum motor current. Shipped set CCW (min. current).

PROCEDURE:

1. Apply main power and fan power. Visually confirm a green LED. Depending on the configuration of the Inhibit, Reset and +/-Limits, it may be necessary to make appropriate connections to those terminals before the amplifier will be enabled and energize the motor.
2. Slowly turn the Loop Gain (RV6) pot CW fully. The Motor should be stopped or turning slowly. Set the Balance (RV2) for 0V at J2-4 to J2-5.
3. Install a micro-shunt at J3 connector (across J3-1 to J3-2).
Note: For single-ended signal input amplifier, a micro-shunt is permanently installed at J3 connector. On the other hand, the micro-shunt should be removed for differential input amplifier after the calibration process.
4. Connect an oscilloscope to J1-7 (MTR I) and a battery box to J1-1 (J1-4 is common for both). The voltage on J1-7 is a function of motor current: 1V = 2.0A. While applying a step input voltage, adjust the Current Limit (RV5) for the desired peak current. If the desired peak current cannot be achieved with the Current Limit pot full CW, increase the input Signal Gain (RV1) by turning in the CW direction.
5. With the battery box still connected at J1-1 and J1-4 for single-ended input (or if your system uses the Differential input, move battery box to J1-1 and J1-2, and remove micro-shunt at J3 connector), set the battery box for a known DC voltage. Apply \pm input signal pulses and adjust the Signal Gain pot (RV1) to obtain the desired current gain of the amplifier.
6. If the motor is rotating in the wrong direction for a given input polarity, remove the power and reverse the motor leads.
7. Remove the battery box, and repeat step 2.
8. Calibration complete. Reconnect signal wires.

D. Calibration Setup Record (SMA5005 Series):

It is good practice to keep a record of all the pot settings. Doing so will facilitate calibration on future units and repair on this unit. Although not a substitute for the calibration procedure, it will at least get you "in the ballpark." Remove the power and allow all capacitors to discharge before taking measurements. Note: The balance pot should not be measured in this fashion, set per step 3 in the calibration procedure.

Pot/Dip-Switches	AMP1	AMP2	AMP3	AMP4
Signal Gain pot wiper TP2 to common (ohms):				
Tach Gain pot wiper TP3 to common (ohms):				
Compensation pot wiper TP4 to common (ohms):				
Current Limit pot wiper TP5 to common (ohms):				

Note: Tach voltage is measured at J1-3. Common for all measurements is at J1-4.

Date data taken: / /

Serial number S/N: _____

Model number: SMA5005 _____

Note any changes to components or any special features in the space below:

E. Calibration of the Velocity Mode Amplifier (SMA5015 Series):

The amplifier, in this configuration, receives an analog, bi-polar input command which is proportional to the motor velocity. The amplifier receives velocity feedback from a tachometer which is usually mounted to the rear of the motor. The following pots will be set during calibration: (Note: RV7 is a single turn pot and RV1-RV6, RV8-RV10 are 10-turn pots.)

Note: RV9 and RV10 are factory set and should not be adjusted. Adjusting these pots voids warranty.

Pots	Name of Pot	Notes
RV1	Differential Gain, SIG	Sets the input voltage to velocity ratio for differential signal input.
RV4	Tach Gain, TACH	Sets the DC tachometer gain.
RV7	Loop Gain, LOOP GAIN	Used to shut off uncalibrated amplifiers. When the loop gain is fully CCW, no current is delivered to the motor.
RV2	Signal Gain, AUX	Sets the input voltage to velocity ratio for single-ended signal input.
RV3	Balance, BAL	Used to null any offset in system.
RV5	Compensation, COMP	Used in conjunction with tach. gain to set the system bandwidth.
RV6	Current Limit, I LIMIT	Sets the maximum motor current. Shipped set CCW (min. current).

PROCEDURE:

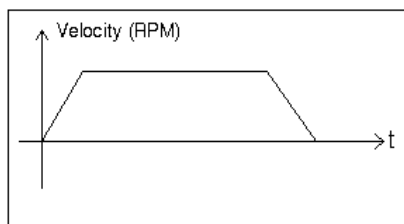
1. Apply main power and fan power. Visually confirm an "O" on the 7-segment display. Depending on the configuration of the Inhibit, Reset and +/-Limits, it may be necessary to make appropriate connections to those terminals before the amplifier will be enabled and energize the motor.
2. Slowly turn the Loop Gain (RV7) CW. Motor should be stopped or turning slowly. If the motor starts running away, remove the power, reverse the tach leads, and retest.
3. Set Balance (RV3) for zero motor rotation.
4. Connect oscilloscope to J1-6 (MTR I) and battery box to J1-3 (J1-4 is common for both). The voltage on J1-6 is a function of motor current: 1V = 10A. While applying a step input voltage, adjust Current Limit (RV6) for desired peak current.

The purpose of the following procedure is to set the system bandwidth to obtain a critically-damped response or a one hook overshoot response with the maximum possible Tach. Gain. There are many possible settings of Tach. Gain and Compensation which will yield the desired waveform: The optimum setting will occur when Tach Gain is as CW as possible and Compensation is as CCW as possible. However, the servo loop may become unstable (the motor oscillates or hunts) with a very low (near CCW) setting of Compensation. In this case, stability is the limiting factor: At no time should the servo-loop be allowed to be unstable.

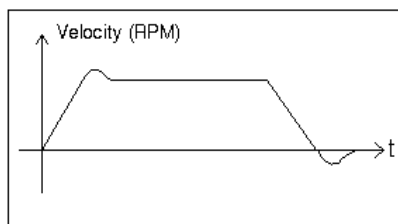
Amplifiers are normally shipped with the Tach. Gain (RV4) set at 100%. This is a good place to start. If you are unsure of where the Tach. Gain is set, turn the Tach Gain (RV4) fully CW (up to 10 turns).

5. Connect oscilloscope to J1-5 (TACH IN) and J1-4 is common. Set battery box for a DC signal output to obtain approximately 400RPM. The RPM may be set by measuring the tach voltage at J1-5, e.g., 2.8VDC for a 7V/KRPM tach is 400RPM.

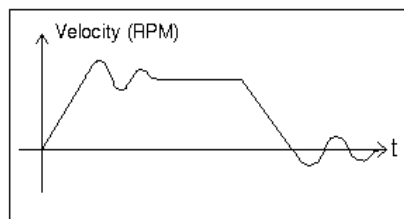
6. Pulse the input and compare the waveform with figure C.



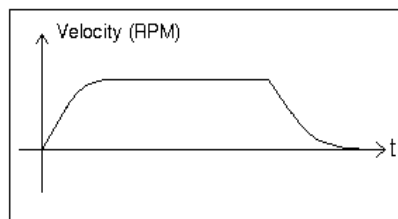
A.) Critically Damped Signal



B.) 1 Hook Overshoot Signal



C.) Under Damped Signal



D.) Over Damped Signal

Figure C - Critically damped, One Hook Overshoot, Under and Over damped

7. Adjust the Compensation pot (RV5) CCW until the waveform is critically damped or one hook overshoot. Then proceed to step 9.
8. If the desired waveform cannot be obtained by adjusting the Compensation pot, back off the Tach Gain pot (CCW) a few turns and repeat step 7.
9. Do not adjust the Tach Gain or Compensation for the rest of the calibration procedure.
10. With battery box still connected at J1-3 and J1-4 for single-ended input (or if your system uses the Differential input, move battery box to J1-1 and J1-2), set battery box for a known DC voltage. Adjust the Aux Gain pot (RV2) or (RV1 for differential input) to obtain the desired motor velocity.
11. If the motor is rotating in the wrong direction for a given input polarity, remove the power and reverse both the motor leads and the tach leads.
12. Remove the battery box, and repeat step 3.
13. Calibration complete. Reconnect signal wires.

F. Calibration of the Current Mode Amplifier (SMA5015 Series):

The amplifier in this configuration, receives an analog, bi-polar input command which is proportional to the required motor current (motor torque). The following potentiometers (pots) will be set during calibration: (Note: RV7 is a single turn pot and RV1-RV6, RV8-RV10 are 10-turn pots.)

Pots	Name of Pot	Notes
RV1	Differential Gain, SIG	Sets the input voltage to velocity ratio for differential signal input.
RV4	Tach Gain, TACH	Sets the DC tachometer gain.
RV7	Loop Gain, LOOP GAIN	Used to shut off uncalibrated amplifiers. When the loop gain is fully CCW, no current is delivered to the motor.
RV2	Signal Gain, AUX	Sets the input voltage to velocity ratio for single-ended signal input.
RV3	Balance, BAL	Used to null any offset in system.
RV5	Compensation, COMP	Used in conjunction with tach. gain to set the system bandwidth.
RV6	Current Limit, I LIMIT	Sets the maximum motor current. Shipped set CCW (min. current).

Note: RV9 and RV10 are factory set and should not be adjusted. Adjusting these pots voids warranty.

PROCEDURE:

1. Apply the main power and fan power. Visually confirm an "O" on the display. Depending on the configuration of the Inhibit, Reset and +/-Limits, it may be necessary to make appropriate connections to those terminals before the amplifier will be enabled and energize the motor.
2. Slowly turn the Loop Gain (RV7) pot CW. The Motor should be stopped or turning slowly. Set the Balance (RV3) for 0V at J1-6 (MTR I).
3. Connect an oscilloscope to J1-6 (MTR I) and a battery box to J1-3 (J1-4 is common for both). The voltage on J1-6 is a function of motor current: 1V = 10A. While applying a step input voltage, adjust the Current Limit (RV6) for the desired peak current. If the desired peak current cannot be achieved with the Current Limit pot full CW, increase either the input signal, Aux Gain (RV2) for single-ended input or Differential Gain (RV1) for differential input.
4. With the battery box still connected at J1-3 and J1-4 for single-ended input (or if your system uses the Differential input, move battery box to J1-1 and J1-2), set the battery box for a known DC voltage. Apply \pm input signal pulses and adjust the AUX (signal gain) (RV2) pot or (RV1 for differential input) to obtain the desired current gain of the amplifier.
5. If the motor is rotating in the wrong direction for a given input polarity, remove the power and reverse the motor leads.
6. Remove the battery box, and repeat step 2.
7. Calibration complete. Reconnect signal wires.

G. Calibration Setup Record (SMA5015 Series):

It is good practice to keep a record of all the pot settings. Doing so will facilitate calibration on future units and repair on this unit. Although not a substitute for the calibration procedure, it will at least get you "in the ballpark." Remove the power and allow all capacitors to discharge before taking measurements. Note: The balance pot should not be measured in this fashion, set per step 3 in the calibration procedure.

Pot/Dip-Switches	Amplifier
Differential Gain pot wiper TP1 to common (ohms):	
Signal Gain pot wiper TP2 to common (ohms):	
Tach Gain pot wiper TP4 to common (ohms):	
Compensation pot wiper TP5 to common (ohms):	
Current Limit pot wiper TP6 to common (ohms):	

Note: Tach voltage is measured at J1-5. Common for all measurements is at J1-4.

Date data taken: / /

Serial number S/N: _____

Model number: SMA5015 _____

Note any changes to components or any special features in the space below:

APPENDIX

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REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3416	5/JAN11	M. TAGUPA	C.V.
-	B	UPDATED TO REFLECT CHANGES IN SPECIFICATIONS	3427	28DEC11	N'HALLA	J.M.

Specifications and Features

Supply Voltage	17-0-17 to 39-0-39 VAC
Low Voltage Supply	±15 VDC
Heatsink Thermal Switch Peak Current	65 °C
Input Command Signals	25 Amps (Adjustable)
	Differential, +/-10Vdc Typ., Adj.
	Single Ended, ± 10Vdc Typ., Adj.
Fault Out	TTL and 24V compatible.
Current Monitor Out	10 AV
Low Speed Electronic Circuit Breaker (LS/ECB)	Trip Level: 10 A Trip Time: 3 Sec.
Bus Over Voltage	Trips nominally at ±62 VDC.
Bus Under Voltage	Trips nominally at +/- 21 VDC.
Amplifier Over temperature	Amplifier faults and is inhibited if the heatsink temp. reaches 65 °C
Fault Out	Open collector goes low when fault occurs. May also be pulled low to inhibit amplifier.
Operating Temperature	0 °C to +55 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Dimension (L x H x W - inches)	14.50 x 9.00 x 4.25

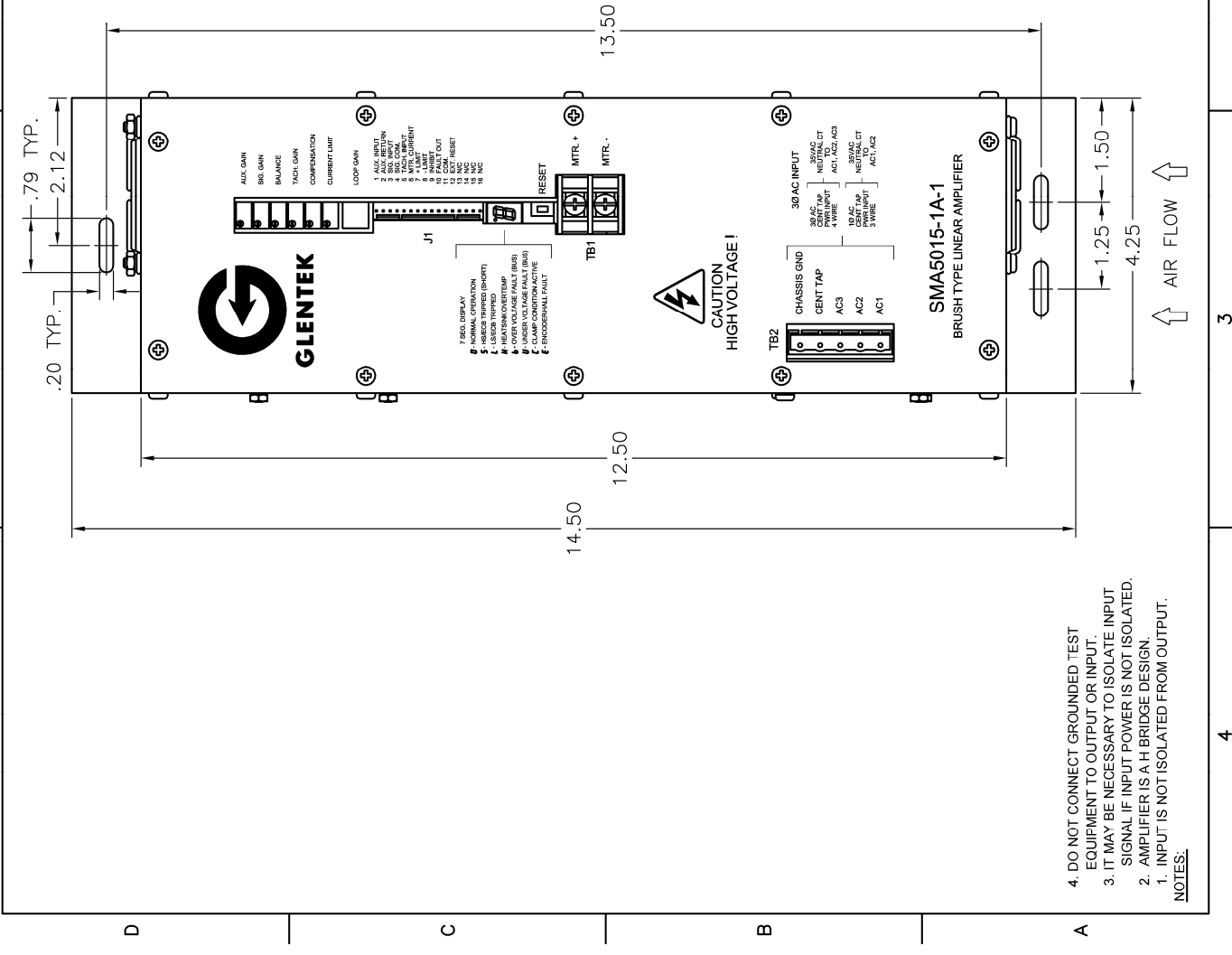
Mating Connectors

J1: Connector	Glentek P/N: EJ381F16; Molex P/N: 22-01-3167
J1: Crimp Terminals	Glentek P/N: EH042260; Molex P/N:08-55-0102

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES		APPROVAL	DATE
DECIMAL: XX = +0.01	XX = +0.05	OWN BY: M. TAGUPA	5/JAN11
ANGULAR: < = +0.5°	> = MAXIMUM	CHK BY: C.V.	5/JAN11
FINISH: 12 = MAXIMUM		APP BY: J.M.	5/JAN11

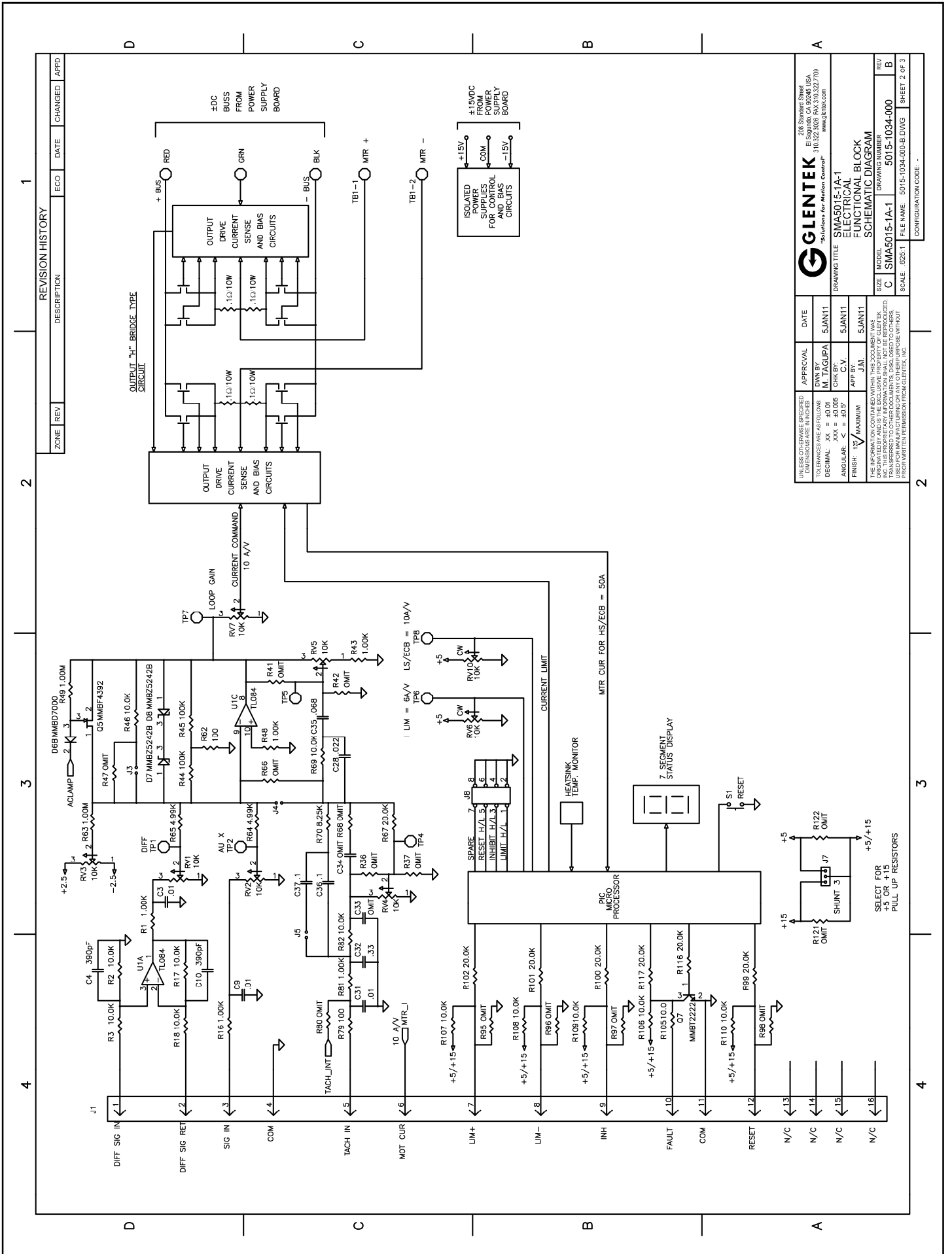
MODEL	DRAWING NUMBER
C SMA5015-1A-1	5015-1034-000

SCALE: 875:1 FILE NAME: 5015-1034-000-B.DWG SHEET 1 OF 3



HEIGHT: 9.0 IN.

- NOTES:**
- DO NOT CONNECT GROUNDED TEST EQUIPMENT TO OUTPUT OR INPUT.
 - IT MAY BE NECESSARY TO ISOLATE INPUT SIGNAL IF INPUT POWER IS NOT ISOLATED.
 - AMPLIFIER IS A H BRIDGE DESIGN.
 - INPUT IS NOT ISOLATED FROM OUTPUT.



ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
1						
2						

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
3						
4						

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
1						
2						

REVISION HISTORY

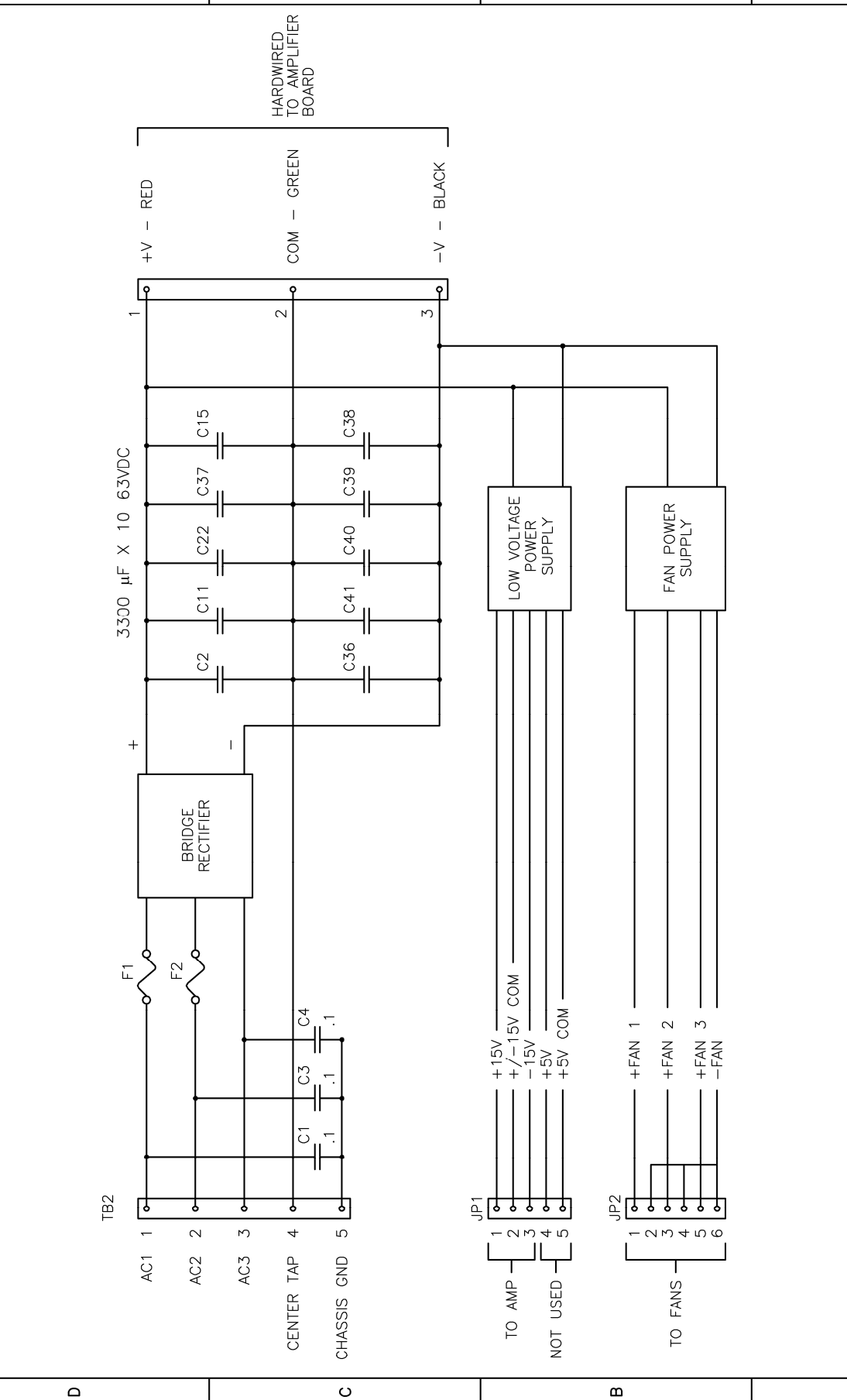
APPROVAL	DATE	APPROVAL	DATE
OWN BY: M. TAGUPA	5/JAN11	OWN BY: M. TAGUPA	5/JAN11
CHK BY: C.V.	5/JAN11	CHK BY: C.V.	5/JAN11
APP BY: M.	5/JAN11	APP BY: M.	5/JAN11

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AS FOLLOWS:
 DECIMAL: XX = ±0.01, XXX = ±0.005
 ANGULAR: < = ±0.5°
 FINISH: 15 / MAXIMUM

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		208 Standard Street El Segundo, CA 90245 USA (310) 322-3026 FAX 310.322.7788 www.glenitek.com	
DRAWING TITLE		SMA5015-1A-1	
FUNCTIONAL BLOCK		ELECTRICAL	
SCHEMATIC DIAGRAM			
SIZE	C	DRAWING NUMBER	5015-1034-000
MODEL	SMA5015-1A-1	REV	B
SCALE	625:1	FILE NAME	5015-1034-000-B.DWG
CONFIGURATION CODE		SHEET 2 OF 3	

1		2		3		4	
REVISION HISTORY				DESCRIPTION			
ZONE	REV	ECC	DATE	CHANGED	APPD		



HARDWIRED TO AMPLIFIER BOARD

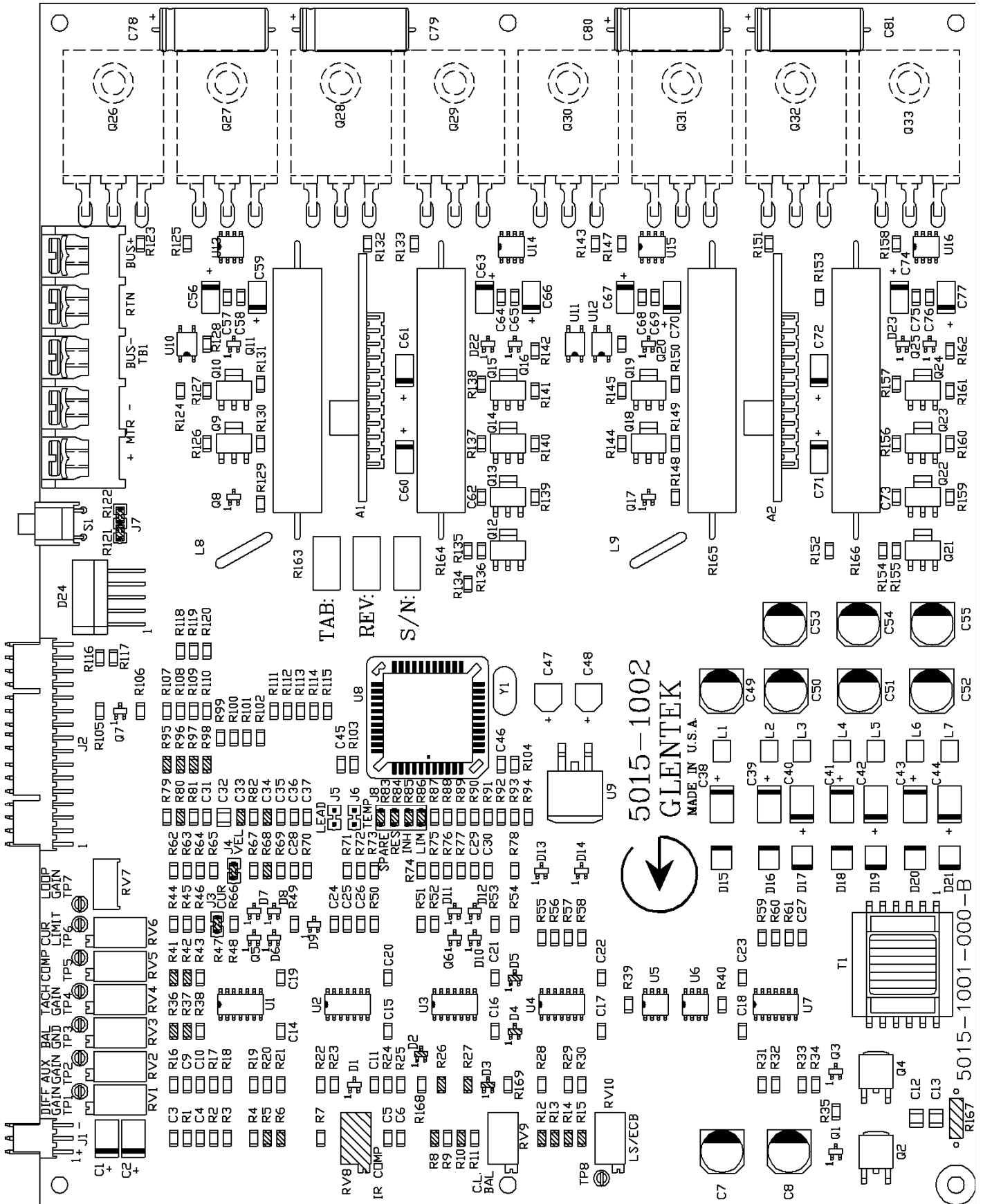
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
DECIMAL: .XX = ±0.01	DRAWN BY: M. TAGUPA	5/JAN/11
ANGULAR: < = ±0.5°	CHK BY: C.V.	5/JAN/11
FINISH: 1/32" MAXIMUM	APP BY: J.M.	5/JAN/11

3. STANDARD TRANSFORMER T657TB CONNECTS TO AC1, AC2 AND CENTER TAP.
 2. F1 AND F2: 15A, 250VAC MDL TYPE FUSES.
 1. DO NOT OPERATE POWER SUPPLY IF JP1 OR JP2 IS DISCONNECTED.

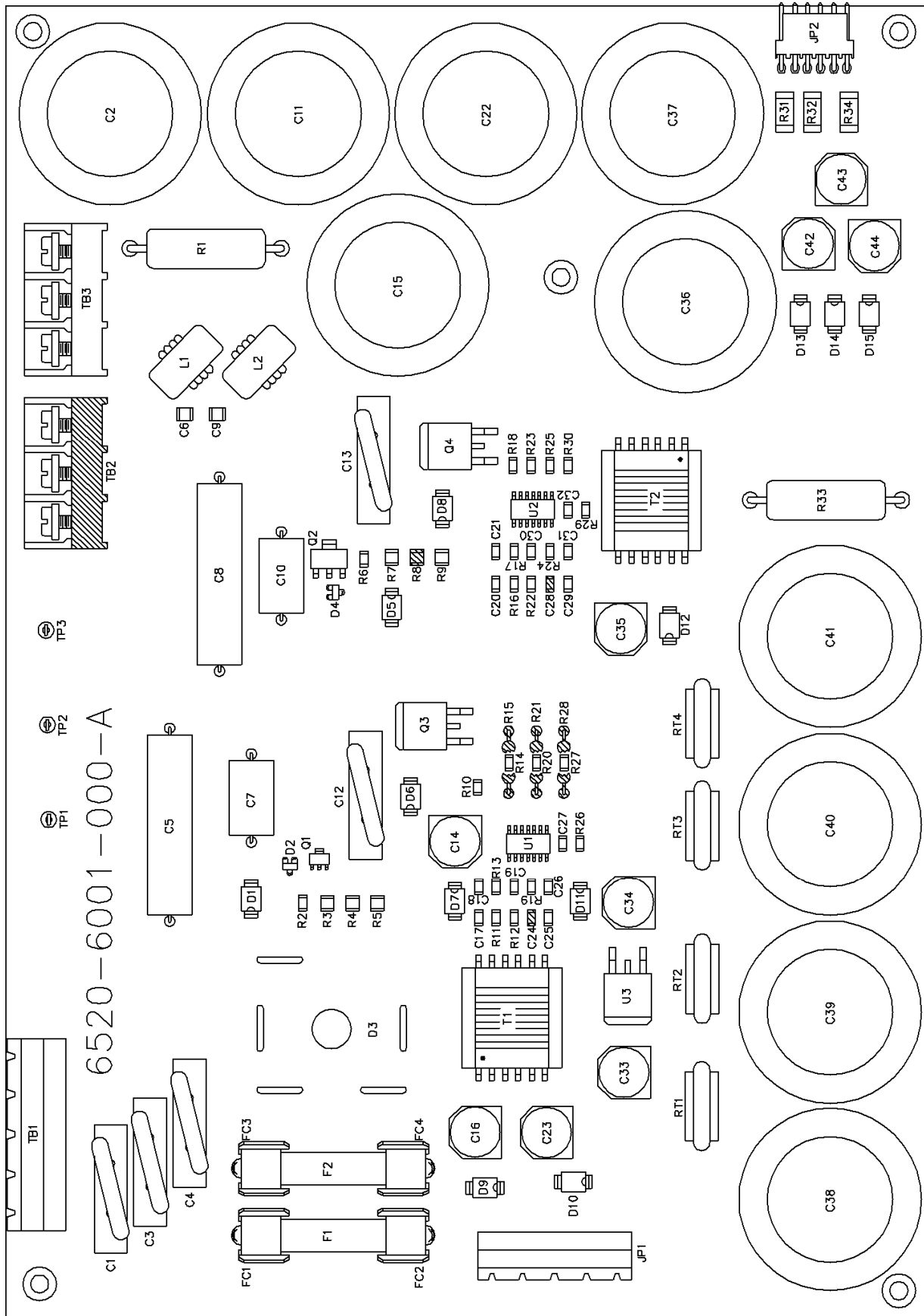
NOTES:

DRAWING TITLE		DRAWING NUMBER	
SMA5015-1A-1 SCHEMATIC		5015-1034-000	
SIZE	MODEL	FILE NAME	SHEET 3 OF 3
C	SMA5015-1A-1	5015-1034-000-B.DWG	

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SMA5015 AMPLIFIER CIRCUIT BOARD ASSEMBLY



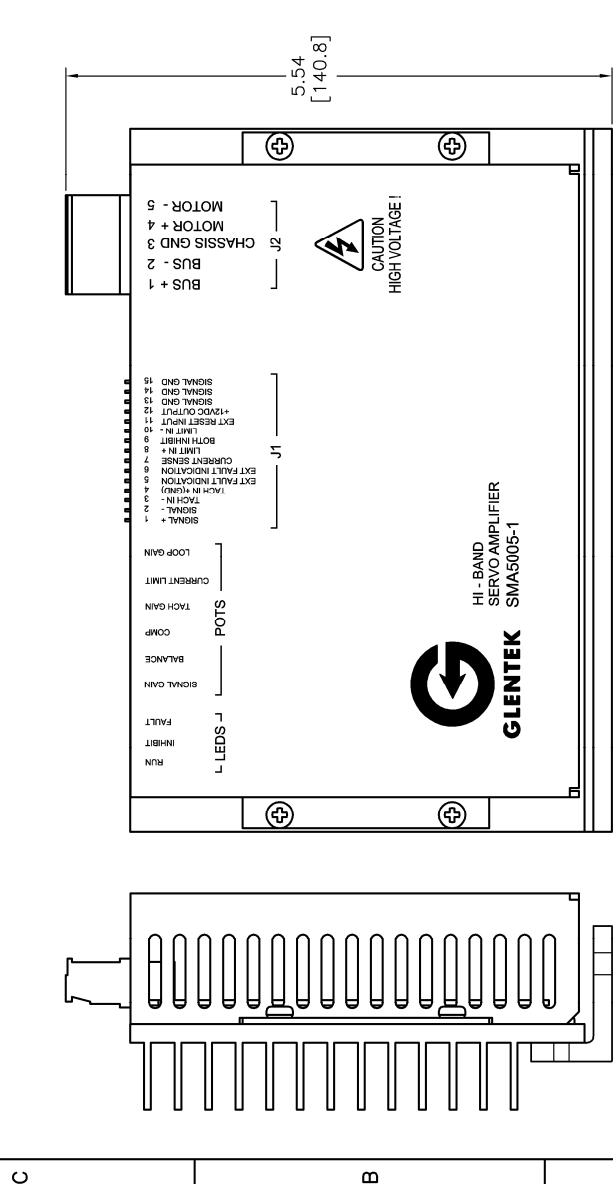
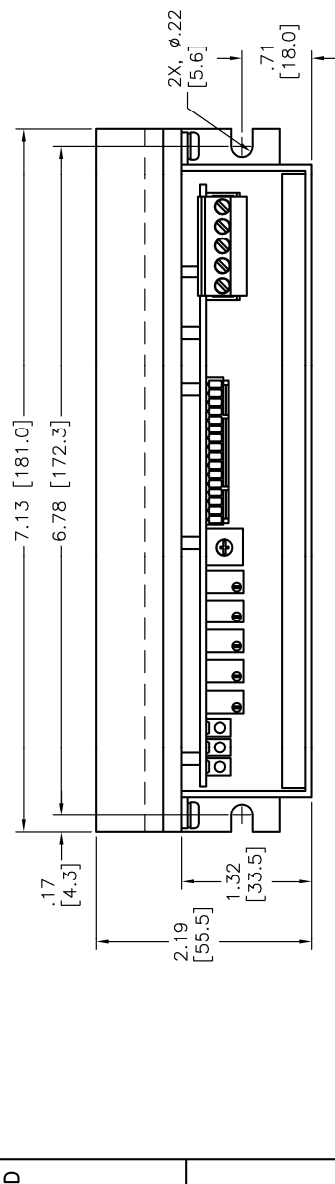
SMA5015 POWER SUPPLY CIRCUIT BOARD ASSEMBLY

REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3416	1FEB11	M.T.	C.V.
-	B	UPDATED TO REFLECT CHANGES IN SUB-ASSEMBLY	3427	28DEC11	N'HALLA	J.M.

Specifications and Features	
DC BUS Input Voltage	24-75VDC max.
Peak Output Current	15 A @ 25°C Ambient (with forced air cooling)
Continuous Output Current	5.0 A @ 25°C Ambient (with forced air cooling)
Input Command Signal	±10 VDC (Max.), Single Ended/ Diff. (field configurable)
Input Command Signal Gain	Adjustable
Low Speed Electronic Circuit Breaker (LSECB)	Latches when current exceeds ±5.0 A for 2 seconds
Amplifier Over temperature	Amplifier faults and is inhibited if the heat sink temperature reaches 75 °C
Green Run LED	Amplifier enabled, normal operating condition
Red Inhibit LED	Amplifier disabled, non-latched condition (External inhibited)
Red Fault LED	Amplifier over temperature or LSECB (Latched condition)
Operating Temperature	0 °C to +55 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing

Mating Connectors	
Motor and DC Input Connector (J2)	Glentek P/N: E1741V05; Phoenix P/N: 17 92 78 6
Signal Connector (J1)	Glentek P/N: EJ041M15; Molex P/N: 22-12-2154-7478

Fuse Table	
10A FAST, Glentek P/N: EF080010; Bussman P/N: BK-AGC-10	DC Input BUS Fuse (F1)
1A FAST, Glentek P/N: EF080001; Bussman P/N: BK-AGC-1	Ground Fuse (F2)

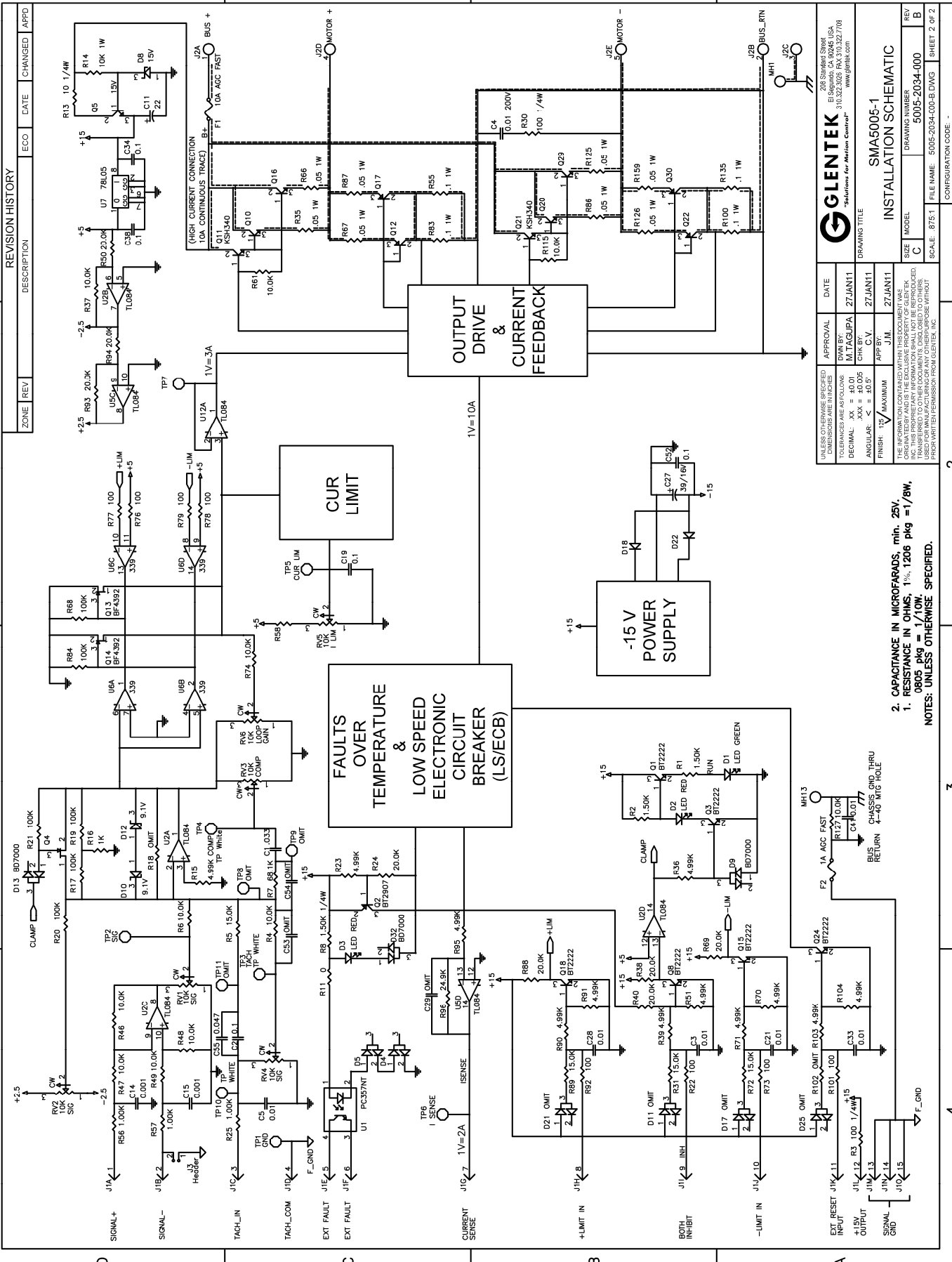


APPROVAL		DATE	
DRAWN BY	M. TAGUJA	DATE	27JAN11
CHECKED BY	C.V.	DATE	27JAN11
APPROVED BY	B.A.	DATE	27JAN11

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SIZE	MODEL	DRAWING NUMBER	REV
C	SMA5005-1	5005-2034-000	B

SCALE: 1:125:1 FILE NAME: 5005-2034-000-B.DWG SHEET 1 OF 2
 CONFIGURATION CODE:

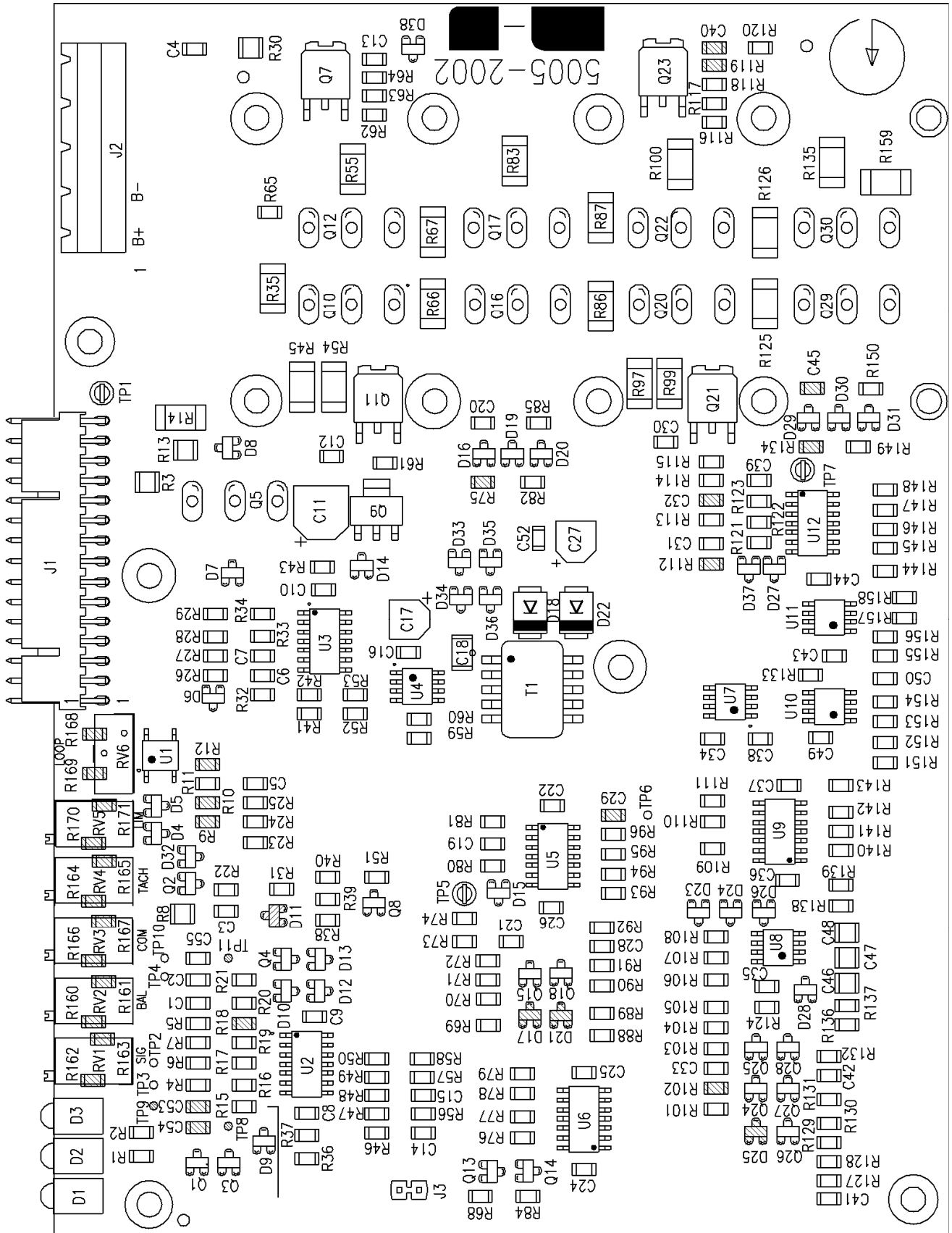


ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
1						
2						
3						
4						

		208 Standard Street El Segundo, CA 90245 (310) 322-3026 FAX 310-322-2708 www.glenetek.com	
DRAWING TITLE		SMA5005-1	
DRAWING NUMBER		5005-2034-000	
SIZE		MODEL	
SCALE		875:1	
FILE NAME		5005-2034-000-B.DWG	
SHEET		2 OF 2	
CONFIGURATION CODE			

UNLESS OTHERWISE SPECIFIED:	APPROVAL	DATE
RESISTANCE: 1% TOLERANCE	DESIGNED BY	27JAN11
CAPACITANCE: 5% TOLERANCE	CHK BY	27JAN11
DECIMAL: .XXX = 40.005	APP BY	27JAN11
ANGULAR: < = 40.5		
FINISH: 15° MAXIMUM		

2. CAPACITANCE IN MICROFARADS, min. 25V.
 1. RESISTANCE IN OHMS, 1%, 1206 pkg = 1/RW,
 0805 pkg = 1/10W.
 NOTES: UNLESS OTHERWISE SPECIFIED.

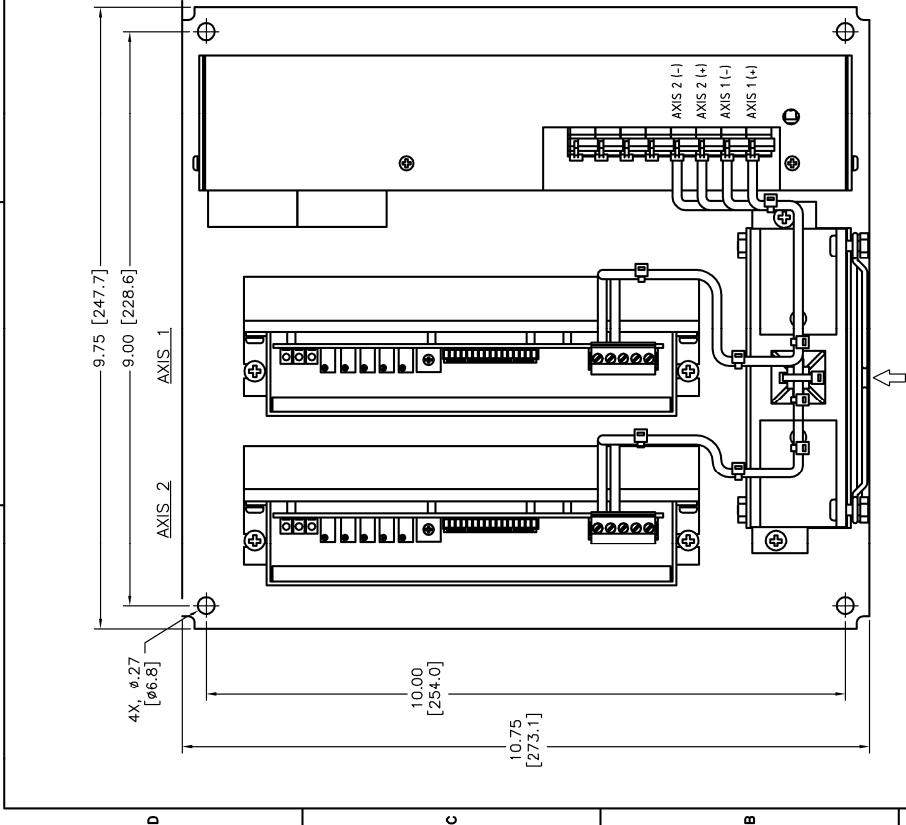
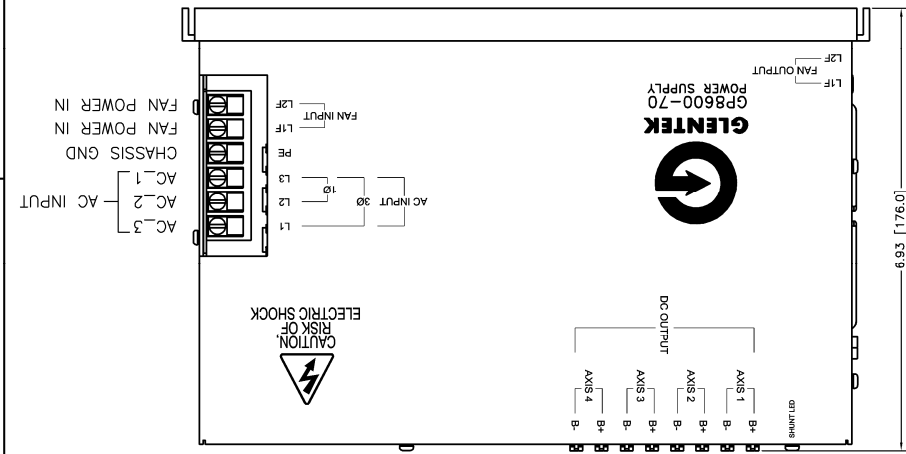


SMA5005 CIRCUIT BOARD ASSEMBLY

SMA5005 & SMA5015 MANUAL

REVISION HISTORY					
ZONE	REV.	DESCRIPTION	ECO	DATE	CHANGED BY
A	1	INITIAL RELEASE	3427	2/28/01	STHALLA J.M.

Specifications and Features	
AC Input Voltage	17-55 VAC, Single or Three Phases
Fan Input Voltage	110-130 VAC, Single Phase, 50/60 Hz
Derived DC BUS Voltage	Unregulated 70 VDC max. @ 50 VAC Input
Continuous Output Current	5.0 A @ 25°C ambient (with forced air cooling) per amplifier
Amplifier Includes	SMA5005-1 (OTY-2)
Mating Connectors	
Motor and DC Input Connector	Shenhai P/N: ELM4105S, Phoenix P/N: 17 82 78 8
Signal Connector	Shenhai P/N: ELM41MS, Molex P/N: 22-12-2154-47H



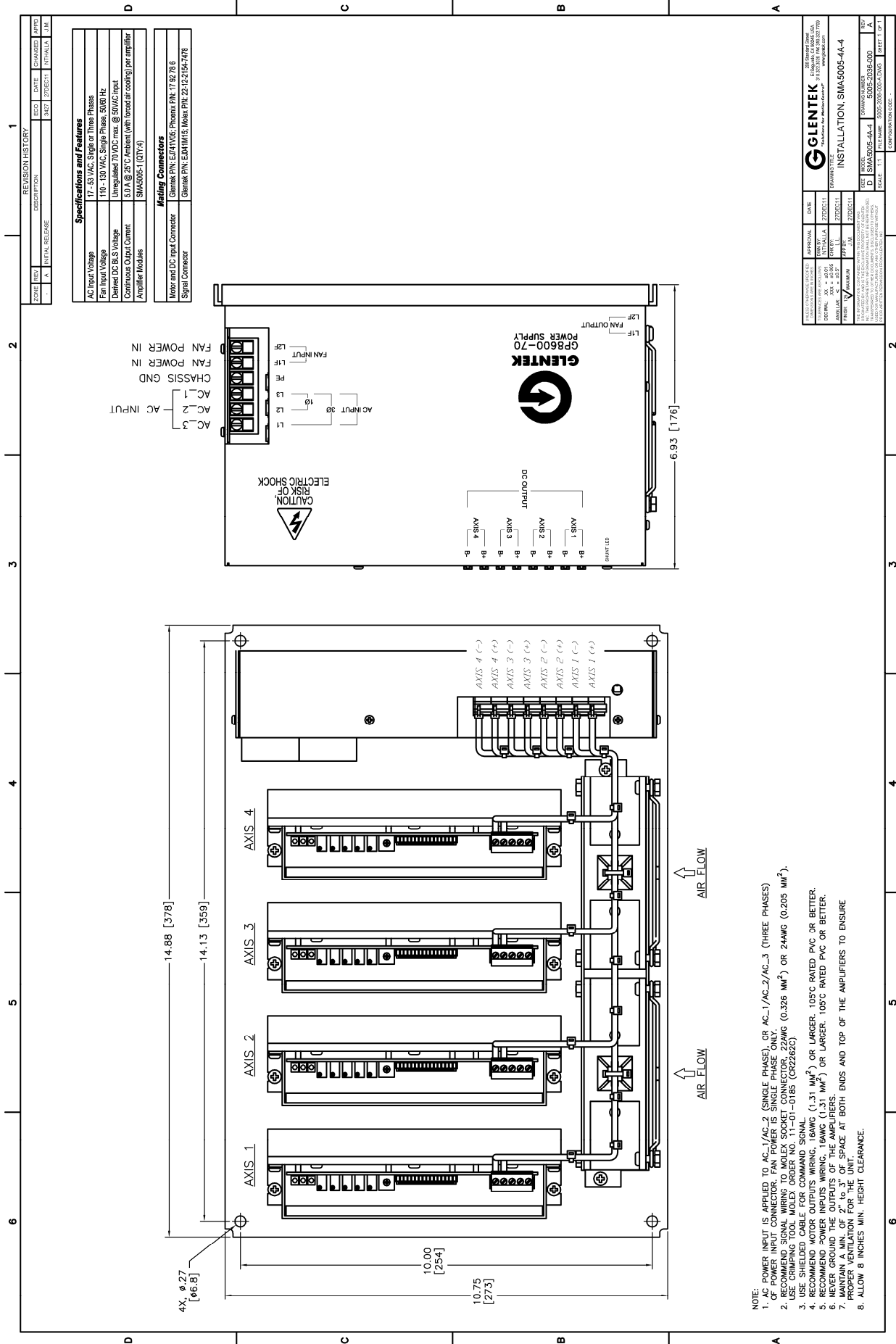
- NOTE:
- AC POWER INPUT IS APPLIED TO AC_1/AC_2 (SINGLE PHASE) OR AC_1/AC_2/AC_3 (THREE PHASES) AND FAN INPUT IS APPLIED TO FAN_1 AND FAN_2.
 - RECOMMEND SIGNAL WIRES TO MOLEX SOCKET CONNECTOR 22AWG (0.326 mm²) OR 24AWG (0.205 mm²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).
 - USE SHIELDED CABLE FOR COMMAND SIGNAL.
 - RECOMMEND MOTOR OUTPUTS WIRING, 16AWG (1.31 mm²) OR LARGER, 105°C RATED PVC OR BETTER.
 - RECOMMEND POWER INPUTS WIRING, 16AWG (1.31 mm²) OR LARGER, 105°C RATED PVC OR BETTER.
 - MAINTAIN A MIN. OF 2" TO 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIERS TO ENSURE PROPER VENTILATION FOR THE UNIT.
 - ALLOW 8 INCHES MIN. HEIGHT CLEARANCE.

GLENTEK	
DATE	2/28/01
DESIGNER	STHALLA
DATE	2/28/01
DESIGNER	STHALLA
DATE	2/28/01
DESIGNER	STHALLA
DATE	2/28/01
DESIGNER	STHALLA

208 Standard Street
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Fax: (310) 322-3027
www.glenetek.com

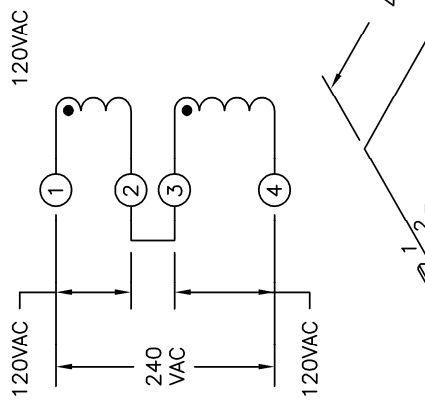
INSTALLATION, SMA5005-2A-2

REV. MODEL: 5005-2035-00D
SMA5005-2A-2
SCALE: 1:1
SHEET: 1 OF 1

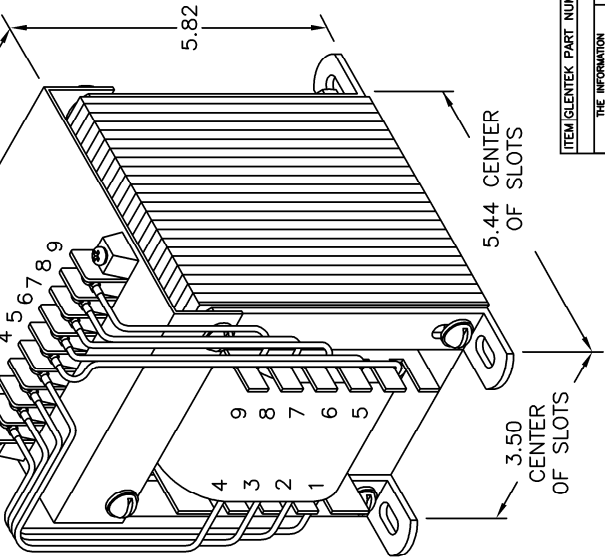
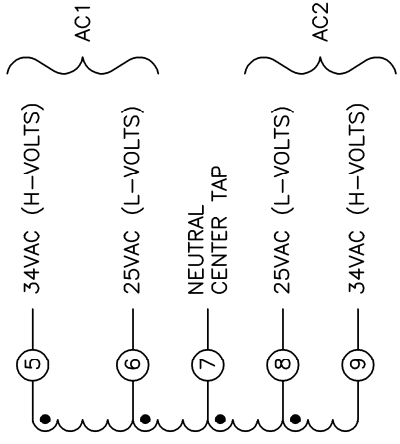


REV	DESCRIPTION	ECO	DATE	CHK BY	APPD BY
B	CHANGED 64 HERTZ TO 50-60 HERTZ ON TITLE BLOCK	-	12/24/92	T.P.	C.V.

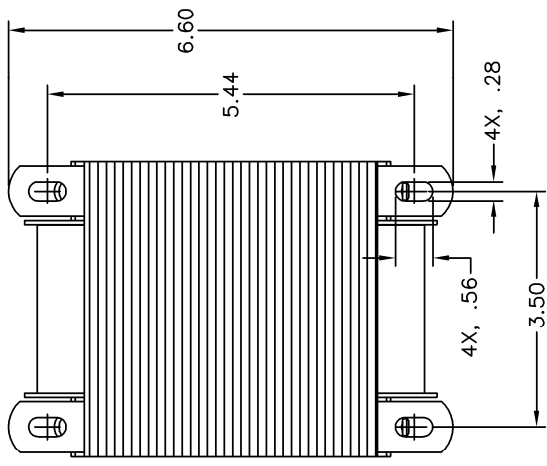
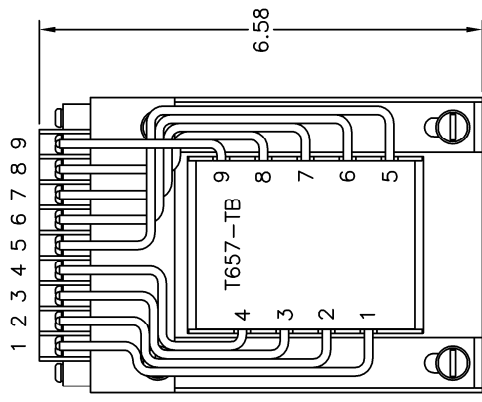
PRIMARY CONNECTIONS



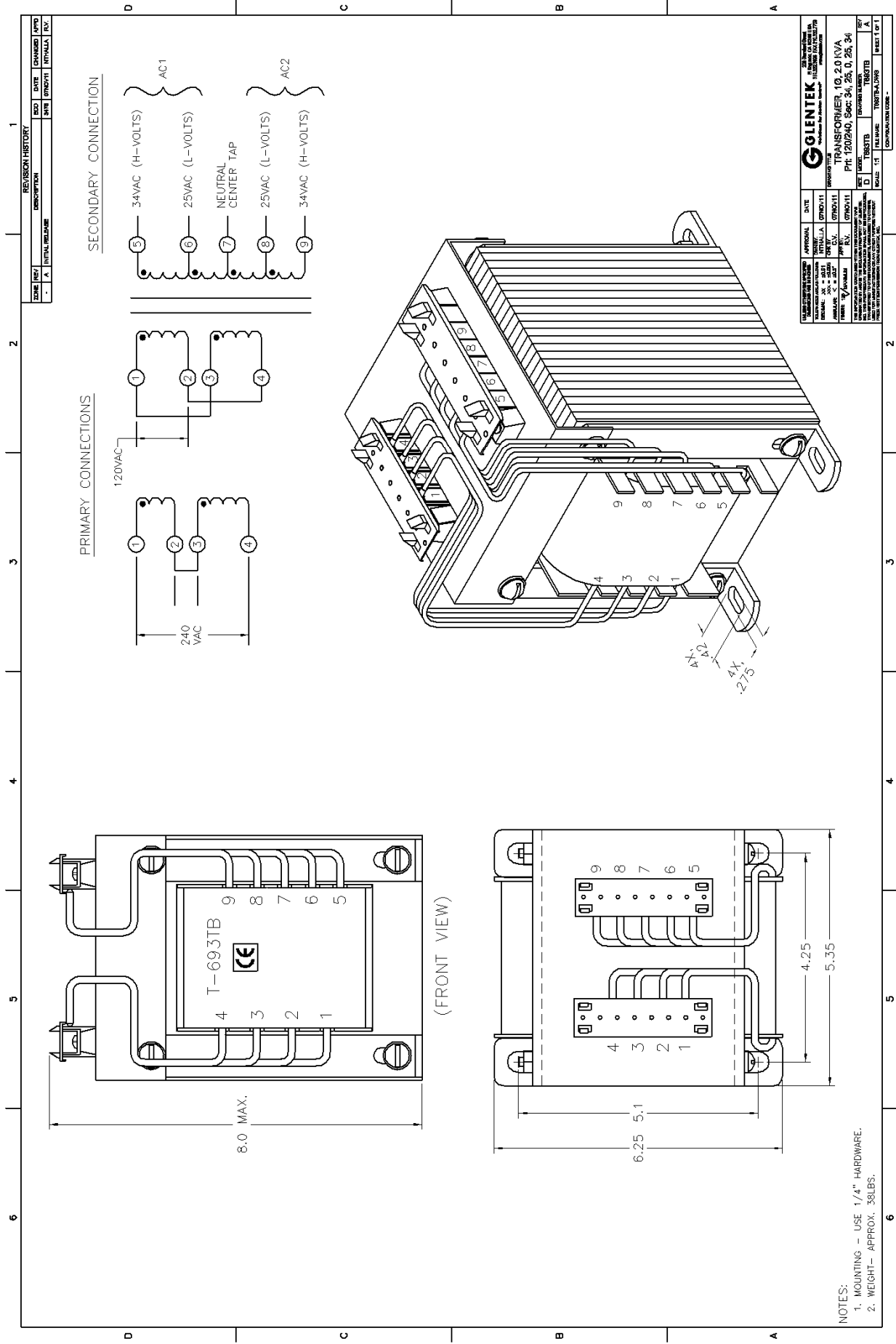
SECONDARY CONNECTION



ENG. NOTES:
 * POWER SUPPLY TRANSFORMER FOR SMA5015
 * LINEAR STANDALONE AMPLIFIER
 * WEIGHT: APPROX. 27 LBS



ITEM/GLENTEK PART NUMBER	MATERIAL DESCRIPTION	UNIT	QUANTITY
LIST OF MATERIALS OR PARTS LIST			
UNLESS OTHERWISE SPECIFIED:	MODEL: T657-TB		
BREAK ALL SHARP EDGES	DRAWN BY: T.P.		
SURFACE FINISHES	T.P. 18SEP01		
TO CLEARANCES	APPROVED BY: R.V.		
DECIMALS TO CLEARANCES	R.V. 1.0 KVA, 50-60Hz		
ANGULAR	POWER TRANS.		
± 0.1°	SIZE DRAWING NUMBER: T657TB		
± .005	FILE: T657TB-B.DWG		
± .015	SCALE: 2		
± .030			
± .045			
± .060			
± .075			
± .090			
± .105			
± .120			
± .135			
± .150			
± .165			
± .180			
± .195			
± .210			
± .225			
± .240			
± .255			
± .270			
± .285			
± .300			
± .315			
± .330			
± .345			
± .360			
± .375			
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± .675			
± .690			
± .705			
± .720			
± .735			
± .750			
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± .825			
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± .855			
± .870			
± .885			
± .900			
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± 1.725			
± 1.740			
± 1.755			
± 1.770			
± 1.785			
± 1.800			
± 1.815			
± 1.830			
± 1.845			
± 1.860			
± 1.875			
± 1.890			
± 1.905			
± 1.920			
± 1.935			
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± 1.995			
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± 2.595			
± 2.610			
± 2.625			
± 2.640			
± 2.655			
± 2.670			
± 2.685			
± 2.700			
± 2.715			
± 2.730			
± 2.745			
± 2.760			
± 2.775			
± 2.790			
± 2.805			
± 2.820			
± 2.835			
± 2.850			
± 2.865			
± 2.880			
± 2.895			
± 2.910			
± 2.925			
± 2.940			
± 2.955			
± 2.970			
± 2.985			
± 3.000			



Digital PWM Brushless Servo Amplifiers

- PWM (Pulse-Width-Modulated) Brushless servo amplifiers to 20KW

Analog Brush Type Servo Amplifiers

- Linear Brush type servo amplifiers to 2.6KW
- PWM (Pulse-Width-Modulated) Brush type servo amplifiers to 28KW

Analog Brushless Servo Amplifiers

- Linear Brushless servo amplifiers to 3.5KW
- PWM (Pulse-Width-Modulated) Brushless servo amplifiers to 51KW

Permanent Magnet DC Brush Type Servo Motors

- Continuous Torques to 335 in. lb.
- Peak Torques to 2100 in. lb.

Permanent Magnet DC Brushless Servo Motors

- Continuous Torques to 1100 in. lb.
- Peak Torques to 2200 in. lb.



GLENTEK

"Solutions for Motion Control"

MANUAL#: 5005-2040-000
REVISION: (D)
DATE: 07 NOV 2013

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