OPERATION
&
SERVICE MANUAL

SMA5005 & SMA5015

H Bridge Linear Servo Drives

GLENTEK

"Solutions for Motion Control"

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INTRODUCTION

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

*High performance models only support current mode

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 Drive 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 Drive 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.

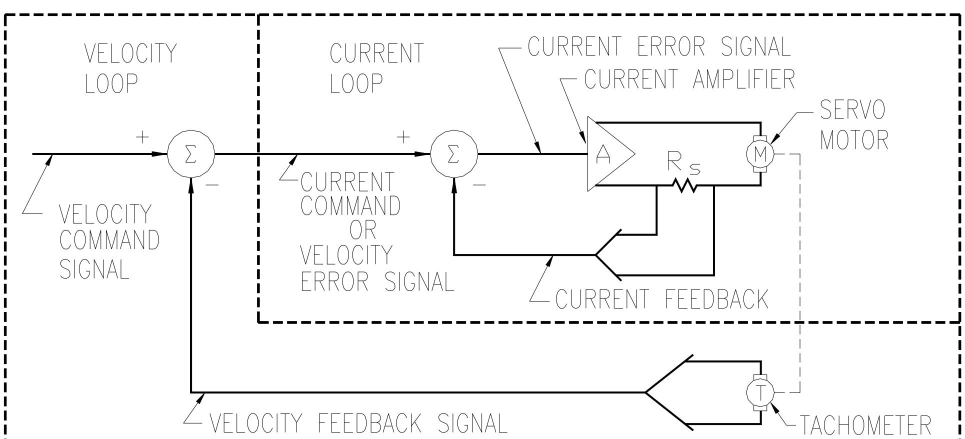


Figure A - Velocity mode servo loop for a brush type motor

FEATURES

• Ergonomic Design	Easy access to connections, adjustments and test points.
• SMT construction	Provides ultra compact size, cost competitive package and high reliability.
• Bandwidth	Standard performance models have a nominal 10 kHz current loop bandwidth which varies with the motor inductance.
	High performance models (SMA5005-4) have a nominal 15 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).
	High performance models (SMA5005-4) operate in current mode only
• Fault protection	Short from output to output, short from output to ground, Drive RMS over current, Drive under/over voltage (SMA5015 only) and Drive over temperature.
• Status indicator	7-segment LED display indicates Drive status on the SMA5015 and LEDs indicate status on the SMA5005.
• Dedicated inputs	command signals, +/- limits, inhibit, reset, and fault. (Note: high performance SMA5005-4 models only have reset and inhibit digital inputs and the logic type and pull-up voltage is fixed. See model numbering)
• 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 the Appendix for more information.
• External fault reset	An input is provided to reset the Drive in the event of a fault.
• CE compliant	All servo Drives are CE marked.

APPLICATION NOTE

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

When selecting a linear Drive, the following ratings of the Drive should be known in order to properly size the Drive 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 Drive.

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 Drive is a module requiring an external unregulated single polarity DC power supply. Glentek offers various unregulated power supplies for the SMA5005 series Drives.

The SMA5005 series Drive 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 Drive modules. The 4-axis baseplate assembly contains one AC to DC power supply, two fans, and up to four SMA5005 Drive 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 is a stand-alone style Drive, meaning that the unregulated dual polarity power supply is mounted within the Drive enclosure. Glentek offers 1.4KVA and 2.0KVA center tapped power transformers for the SMA5015 series Drives.

2– Typical continuous internal power dissipation rating of the Drives running at normal room conditions is:
SMA5005-xLB series (L-bracket heatsink); 100 Watts continuous
SMA5005-xSF series (short fin heatsink); 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 Drive dissipation:

1) **Pd = Im x Vb (watts)**
   Where: Pd = Total watts delivered from bus
   Im = Motor current
   Vb = Bus voltage
2) **Pm = Im x Vm (watts)**
   Where: Pm = Total power (watts) dissipated in motor
   Vm = Motor voltage
3) **Pa = Im x Vb - Im x Vm**
   Where: Pa = Total watts dissipated at Drive

From the above relationship, it can be surmised that the worst case dissipation occurs when the Drive 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 Drive 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)

Rated Internal Power Dissipation
- SMA5005-xLB series (L-bracket heatsink); 100 Watts continuous
- SMA5005-xSF series (short fin heatsink); 250 Watts continuous
- SMA5015 series; 300 Watts continuous

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, active low
  SMA5015: pull up/pull down, active high, active low
- Inhibit: Same as Reset
- +/- Limits: Same as Reset

Refer to Drive Configuration Code on page 11 for more information on signals input options

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 for standard performance models
- 15 kHz maximum and varies with motor inductance for high performance models

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

Mechanical
- SMA5005-xLB module: Height: 4.87”, Width: 1.20”, Depth: 7.13”
- SMA5005-xSF module: Height: 4.87”, Width: 1.88”, Depth: 7.13”
- SMA5005 2-Axis: Height: 6.93”, Width: 9.75”, Depth: 10.75”
- SMA5005 4-Axis: Height: 6.93”, Width: 14.88”, Depth: 10.75”
- SMA5015 stand-alone: Height: 9.00”, Width: 4.25”, Depth: 14.50”

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 Drive pre-configured for your application. You may wish to have a Glentek application engineer confirm your configuration because field configuration options are limited.

Standard Performance Drive Model Numbering:

SMA5005—xx—bbb—1

Drive Model Number

Single Module

Velocity Loop Compensation
Leave blank for standard performance current mode drives
S = Small Motor (less than 3” in diameter)
L = Large Motor (3” or greater in diameter)

Drive Configuration Code
See configuration algorithm on page 11

Internal Heat Dissipation
LB = 100 W (L-bracket heatsink)
SF =250 W (Short fin heatsink)

SMA5005—xx—bbb—eA-g

Drive Model Number

Multi-Axis: 1 to 4 Axes

2 or 4 Axis Chassis

Velocity Loop Compensation
Leave blank for standard performance current mode drives
S = Small Motor (less than 3” in diameter)
L = Large Motor (3” or greater in diameter)

Drive Configuration Code
See configuration algorithm on page 11

Internal Heat Dissipation
LB = 100 W (L-bracket heatsink)
SF =250 W (Short fin heatsink)

SMA5015—bbb—1A-1

Drive Model Number

Stand Alone

Drive Configuration Code
See configuration algorithm on page 11

Standard performance servo drives have a nominal 10 kHz current loop bandwidth which varies with the motor inductance.

High Performance Drive Model Numbering:

SMA5005—4x—34C—1

Drive Model Number

Single Module

Internal Heat Dissipation
LB = 100 W (L-bracket heatsink)
SF =250 W (Short fin heatsink)

Drive Configuration Code
Hardwired: see configuration algorithm on next page

SMA5005—4x—34C—eA-g

Drive Model Number

Multi-Axis: 1 to 4 Axes

2 or 4 Axis Chassis

Internal Heat Dissipation
LB = 100 W (L-bracket heatsink)
SF =250 W (Short fin heatsink)

Drive Configuration Code
Hardwired: see configuration algorithm on next page

High performance servo drives have a nominal 15 kHz current loop bandwidth which varies with the motor inductance.

Standalone model only available as a standard performance servo drive

Note that high performance models have **34C** fixed configuration code.

Reset is pulled down active high, inhibit is pulled up active high, and there are no +/- limits. Signal input is set for differential, but can be configured for single ended input by externally grounding one of the two signal input lines.

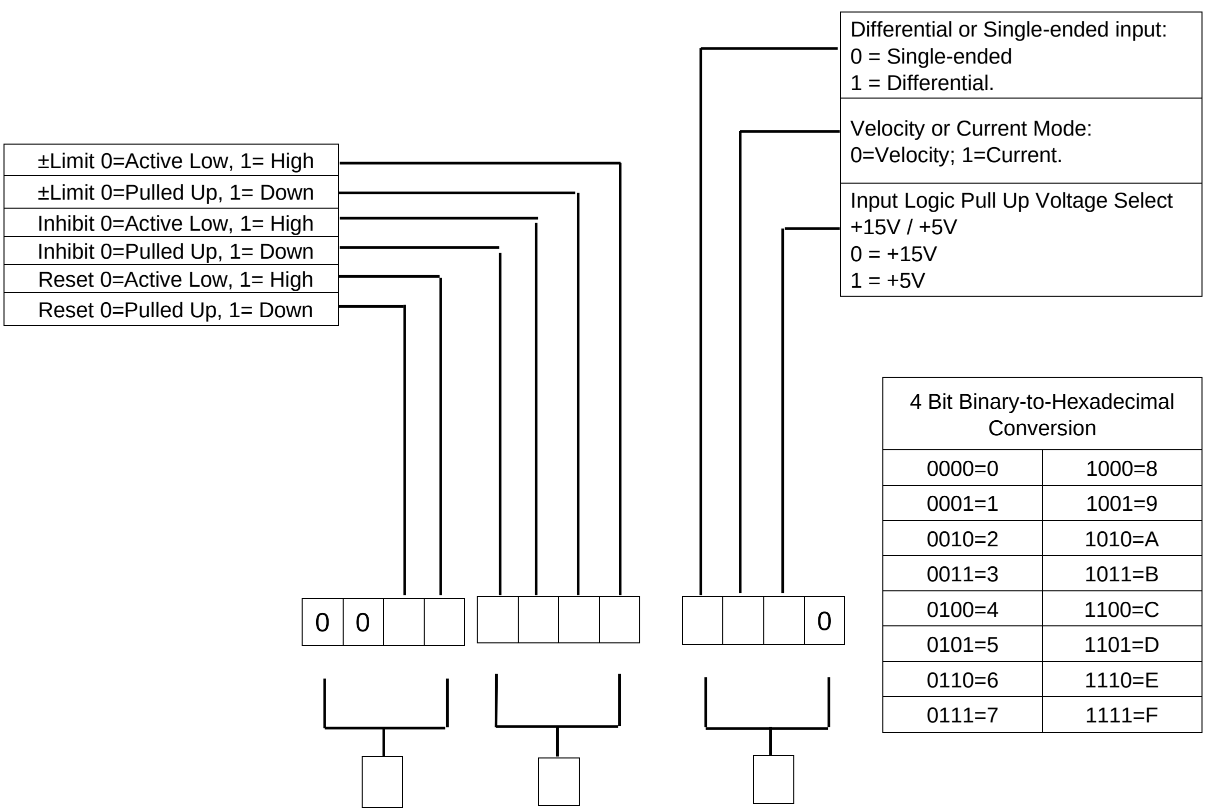
Due to the high performance and high current loop bandwidth, voice coil/motor parameters, operating voltage, and desired current loop bandwidth are required upon ordering.

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

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
High performance SMA5005 has configuration code **34C**: Reset is Pulled down, Active high Inhibit is Pulled up, Active high ±Limit is Pulled up, Active high Differential input Current mode +15V Input logic pull up voltage select

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

Drive Configuration Code



4 Bit Binary-to-Hexadecimal Conversion	
0000=0	1000=8
0001=1	1001=9
0010=2	1010=A
0011=3	1011=B
0100=4	1100=C
0101=5	1101=D
0110=6	1110=E
0111=7	1111=F

Insert 3 digit hexadecimal code into “Drive Configuration Code” section of model numbering (bbb).

START UP AND CALIBRATION

This section contains the procedure required for initial start up and Drive calibration. The standard performance SMA5005 and SMA5015 series Drives can be configured to run in velocity mode and current mode. The high performance SMA5005 Drives can only run in current mode.

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 Drive 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 (RV7 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 Drives. The DC Bus (Drive supply-voltage) will be 1.4 times greater than the AC value. If the voltage is correct, remove power and connect AC source to Drive inputs. For SMA5005 module Drive, check for the correct DC voltage before connecting to the Drive power input.
7. Work on only one Drive axis at a time for SMA5005 multi-axis Drives.

B. Calibration of the Velocity Mode of a Standard Performance Drive (SMA5005 Series)

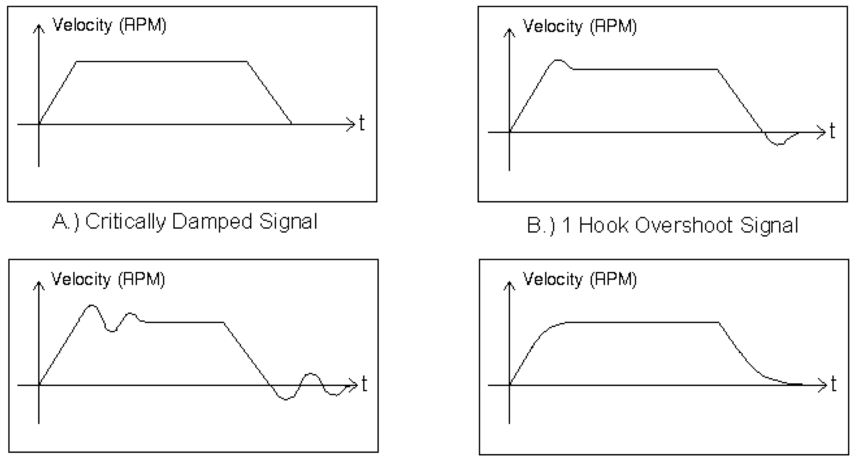
The Drive, in this configuration, receives an analog, bi-polar input command, which is proportional to the motor velocity. The Drive receives velocity feedback from a tachometer, which is usually mounted to the rear of the motor. The following pots will be set during calibration: (Note: RV7 is a single turn pot and RV1-RV5 are 20-turn pots.)

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

PROCEDURE:

1. Connect motor cables to DC Input/Motor Output pin 4 (MOTOR+) and DC Input/Motor Output pin 5 (MOTOR-). Connect the motor ground to the chassis ground (or PE).
2. Connect the Tach. wires to Controller I/O pin 3 (TACH IN-) and Controller I/O pin 4 (TACH IN+ ‘GND’).
3. 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 Drive will be enabled and energize the motor.
4. Slowly turn the Loop Gain (RV7) CW fully. Motor should be stopped or turning slowly. If the motor starts running away, remove the power, reverse the Tach. leads, and apply power.
5. Set Balance (RV2) for zero motor rotation.
6. Connect oscilloscope probe to Controller I/O pin 7 (CURRENT SENSE) and oscilloscope ground to Controller I/O pin 13, 14 or 15 (SIGNAL GND). Connect battery box to Controller I/O pin 1 (SIGNAL+) and Controller I/O pin 2 (SIGNAL-). The voltage on Controller I/O pin 7 is a function of motor current: 1V = 2.0A. While applying a step input voltage, adjust the Current Limit (RV5) for desired peak current.
7. The purpose of the following procedure is to set the system bandwidth to obtain a critically-damped response (see figure B) 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 needed. However, the velocity loop may become unstable (the motor oscillates or hums) as the Compensation is tuned CCW (increasing the BW). In this case, stability is the limiting factor: At no time should the velocity loop be allowed to be unstable. Drives 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 20 turns).
8. Connect oscilloscope probe to Controller I/O pin 3 (TACH IN-) and oscilloscope ground to Controller I/O pin 13, 14 or 15. Set battery box for a DC signal output to obtain approximately 400RPM. The RPM may be set by measuring the Tach. voltage at Controller I/O pin 3, e.g., 2.8VDC for a 7V/KRPM Tach. is 400RPM.

9. 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 waveforms

10. Adjust the Compensation pot (RV3) CCW until the waveform is critically damped or one hook overshoot. If the desired waveform cannot be obtained by adjusting the Compensation pot before the motor becomes unstable, back off the Tach. Gain pot (CCW) a few turns.
11. Do not adjust the Tach. Gain or Compensation for the rest of the calibration procedure.
12. Set battery box for a known DC voltage (+/-10V). Adjust the Signal Gain pot (RV1) and set the ratio based on the desired motor velocity.
13. Calibration complete.
14. Now connect the computer control (CNC). If the motor is rotating in the wrong direction for a given input polarity, power down. Reverse both the motor and Tach. leads.

C. Calibration of the Current Mode of a Standard Performance Drive (SMA5005 Series)

The Drive 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-RV5 are 20-turn pots.)

Pots	**Name of Pot**	Notes
RV1	Signal Gain, **SIG**	Sets the input voltage to current ratio.
RV2	Balance, **BAL**	Used to null any offset in the system.
RV3	Compensation, **COMP**	Used in conjunction with Tach. Gain to set the system bandwidth.
RV4	Tach. Gain, **TACH**	Sets the DC tachometer gain.
RV5	Current Limit, **I LIMIT**	Sets the maximum motor current. Shipped set CW (max).
RV7	Loop Gain, **LOOP GAIN**	Used to shut off uncalibrated Drives. When the loop gain is fully CCW, no current is delivered to the motor.

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 Drive will be enabled and energize the motor.
2. Slowly turn the Loop Gain (RV7) pot CW fully. The Motor should be stopped or turning slowly. Set the Balance (RV2) for 0V across DC Input/Motor Output pin 4 to DC Input/Motor Output pin 5.
3. Connect oscilloscope probe to Controller I/O pin 7 (CURRENT SENSE) and oscilloscope ground to Controller I/O pin 13, 14 or 15 (SIGNAL GND). Connect battery box to Controller I/O pin 1 (SIGNAL+) and Controller I/O pin 2 (SIGNAL-). The voltage on Controller I/O pin 7 is a function of motor current: 1V = 2.0A.
4. To set the current limit at some value less than the maximum, apply a large step command and observe peak above desired peak current. Turn current limit pot CCW until peak current is reduced to desired value.
5. Apply a step command of 3-4 volts. Observe commanded motor (scale is 10A/V) and set the desired signal to current ratio. For example, 3A/V.
6. If the motor is rotating in the wrong direction for a given input polarity, power down and reverse the motor leads.
7. Calibration complete.

D. Calibration of the Current Mode of a High Performance Drive (SMA5005-4 Series)

The Drive in this configuration receives an analog, bi-polar input command, which is proportional to the required motor current (motor torque). The following potentiometer (pot) will be set during calibration: (Note: Balance Pot is a 20-turn pot.)

Name of Pot	Notes
BALANCE POT	Used to null any offset in the system.

Calibration is minimal compared to standard performance Drives. The Drive will be custom tuned at the factory for the specific application. Therefore, voice coil/motor parameters, operating voltage, and desired current loop bandwidth are required upon ordering. The only user tunable parameter is balance/current offset.

PROCEDURE:

1. Apply main power and fan power. Visually confirm a green LED. Depending on the configuration of the Inhibit and Reset pins, it may be necessary to make appropriate connections to those terminals before the Drive will be enabled and energize the motor.
2. The Motor should be stopped or turning slowly. Set the Balance Pot for 0V across DC Input/Motor Output pin 4 to DC Input/Motor Output pin 5.
3. If the motor is rotating in the wrong direction for a given input polarity, power down and reverse the motor leads.
4. Calibration complete.

E. 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 Controller I/O pin 3. Common for all measurements is at Controller I/O pin 4.

Date data taken: / /
Serial number S/N: ______________________________
Model number: SMA5005_______________________

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

F. Calibration of the Velocity Mode Drive (SMA5015 Series)

The Drive, in this configuration, receives an analog, bi-polar input command, which is proportional to the motor velocity. The Drive 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 20-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, **AUX**	Sets the input voltage to velocity ratio for differential signal input.
RV2	Signal Gain, **SIG**	Sets the input voltage to velocity ratio for single-ended signal input.
RV3	Balance, **BAL**	Used to null any offset in the system.
RV4	Tach. Gain, **TACH**	Sets the DC tachometer gain.
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 CW (max).
RV7	Loop Gain, **LOOP GAIN**	Used to shut off uncalibrated Drives. When the loop gain is fully CCW, no current is delivered to the motor.

PROCEDURE:

1. Connect motor cables to TB1 MTR+ and MTR-. Connect the motor ground to chassis ground.
2. Connect the Tach. wires to J1-5 (TACH. INPUT) and J1-11 (COMMON).
3. 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 Drive will be enabled and energize the motor.
4. 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 apply power.
5. Set Balance (RV3) for zero motor rotation.
6. Set the desired peak current limit by adjusting RV6 while measuring voltage at TP6. The ratio is 1V=6A.
7. The purpose of the following procedure is to set the system bandwidth to obtain a critically-damped response (see figure C) 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 needed. However, the velocity loop may become unstable (the motor oscillates or hums) as the Compensation is tuned CCW (increasing the BW). In this case, stability is the limiting factor: At no time should the velocity loop be allowed to be unstable. Drives 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 20 turns).

8. Connect oscilloscope probe to J1-5 (TACH INPUT) and oscilloscope ground to J1-11 (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.
9. Pulse the input and compare the waveform with figure C.

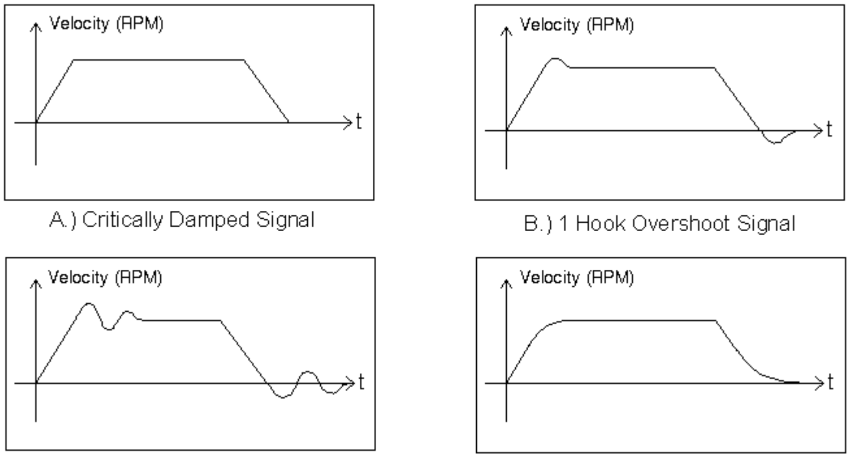


Figure C - Critically damped, One Hook Overshoot, Under and Over damped waveforms

10. Adjust the Compensation pot (RV5) CCW until the waveform is critically damped or one hook overshoot. If the desired waveform cannot be obtained by adjusting the Compensation pot before the motor becomes unstable, back off the Tach. Gain pot (CCW) a few turns.
11. Do not adjust the Tach. Gain or Compensation for the rest of the calibration procedure.
12. Set battery box for a known DC voltage (+/-10V). Adjust the AUX. Gain (RV1) pot for differential Gain or SIG. Gain (RV2) for single-ended input to set the ratio based on the desired motor velocity.
13. Calibration complete.
14. Now connect the computer control (CNC). If the motor is rotating in the wrong direction for a given input polarity, power down. Reverse both the motor and Tach. leads.

G. Calibration of the Current Mode Drive (SMA5015 Series)

The Drive 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 20-turn pots.)

Pots	**Name of Pot**	Notes
RV1	Differential Gain, **AUX**	Sets the input voltage to current ratio for differential signal input.
RV2	Signal Gain, **SIG**	Sets the input voltage to current ratio for single-ended signal input.
RV3	Balance, **BAL**	Used to null any offset in the system.
RV4	Tach. Gain, **TACH**	Sets the DC tachometer gain.
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 CW (max).
RV7	Loop Gain, **LOOP GAIN**	Used to shut off uncalibrated Drives. When the loop gain is fully CCW, no current is delivered to the motor.

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 Drive 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 across TB1 MTR.+ to TB1 MTR.-.
3. Set the desired peak current limit by adjusting RV6 while measuring voltage at TP6. The ratio is 1V = 6A. Battery box does not have to be connected to the Drive.
4. If AUX. Gain is desired, monitor voltage across J1-1 (AUX. INPUT) to J1-2 (AUX. RETURN). If SIG. Gain is desired, monitor voltage across J1-3 (SIG. INPUT) to J1-4 (SIG. COM.). To set the desired signal to current ratio for AUX. Gain adjust the RV1 (differential signal) pot and for SIG. Gain adjust the RV2 (single-ended signal) pot. Apply a step command of 3-4 volts. Observe commanded motor (scale is 10A/V) and set the desired signal to current ratio. For example, 3A/V (max is 30A/10V).
5. If the motor is rotating in the wrong direction for a given input polarity, power down and reverse the motor leads.
6. Calibration complete.

H. 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	Drive
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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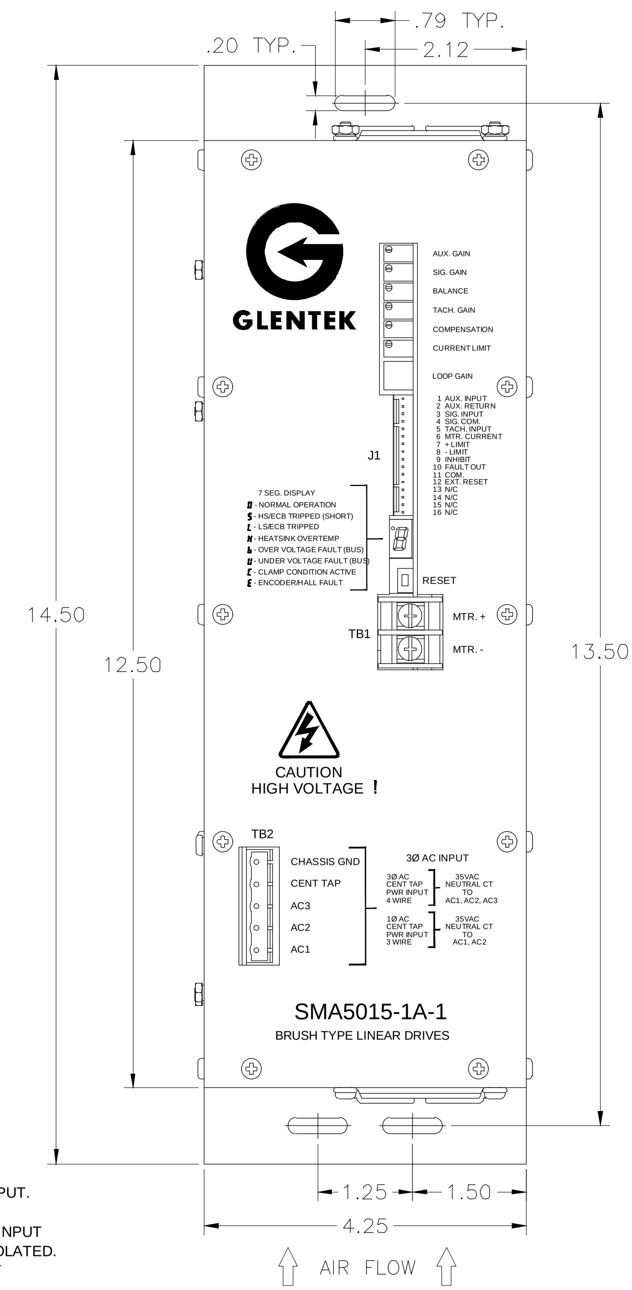


REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3416	5JAN11	M. TAGUPA	C.V.
-	B	UPDATED TO REFLECT CHANGES IN SPECIFICATIONS	3927	28DEC11	NTHALLA	J.M.
A3,A4	C	ADDED WIRIND DIAGRAM IN PAGE 3	4219	10OCT16	NTHALLA	L.P.

Specifications and Features

Supply Voltage	17-0-17 to 39-0-39 VAC
Low Voltage Supply	±15 VDC
Heatsink Thermal Switch	65 °C
Peak Current	25 Amps (Adjustable)
Input Command Signals	Differential, +/-10Vdc Typ., Adj. Single Ended,± 10Vdc Typ., Adj.
Fault Out	TTL and 24V compatible.
Current Monitor Out	10 A/V
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.
Drive Over temperature	Drive 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 drive.
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		Provided
J1: Connector	Glentek P/N: EJ381F16; Molex P/N: 22-01-3167	Yes
J1: Crimp Terminals	Glentek P/N: EH042260; Molex P/N:08-55-0102	Yes

NOTES:

1. INPUT IS NOT ISOLATED FROM OUTPUT.
2. DRIVE IS A H BRIDGE DESIGN.
3. IT MAY BE NECESSARY TO ISOLATE INPUT SIGNAL IF INPUT POWER IS NOT ISOLATED.
4. DO NOT CONNECT GROUNDED TEST EQUIPMENT TO OUTPUT OR INPUT.

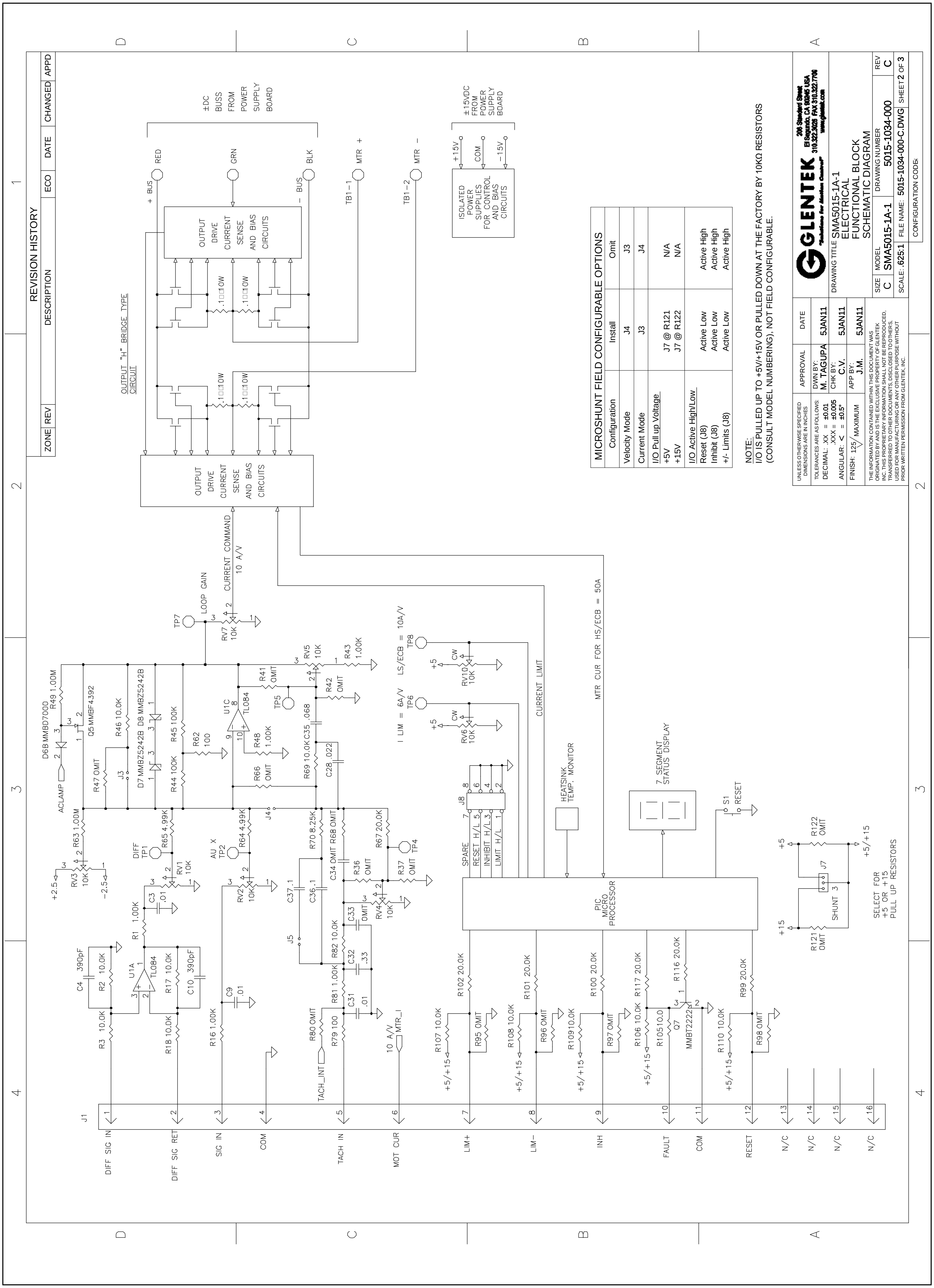
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005	DWN BY: M. TAGUPA	5JAN11
ANGULAR: < = ±0.5°	CHK BY: C.V.	5JAN11
FINISH: 125 MAXIMUM	APP BY: J.M.	5JAN11

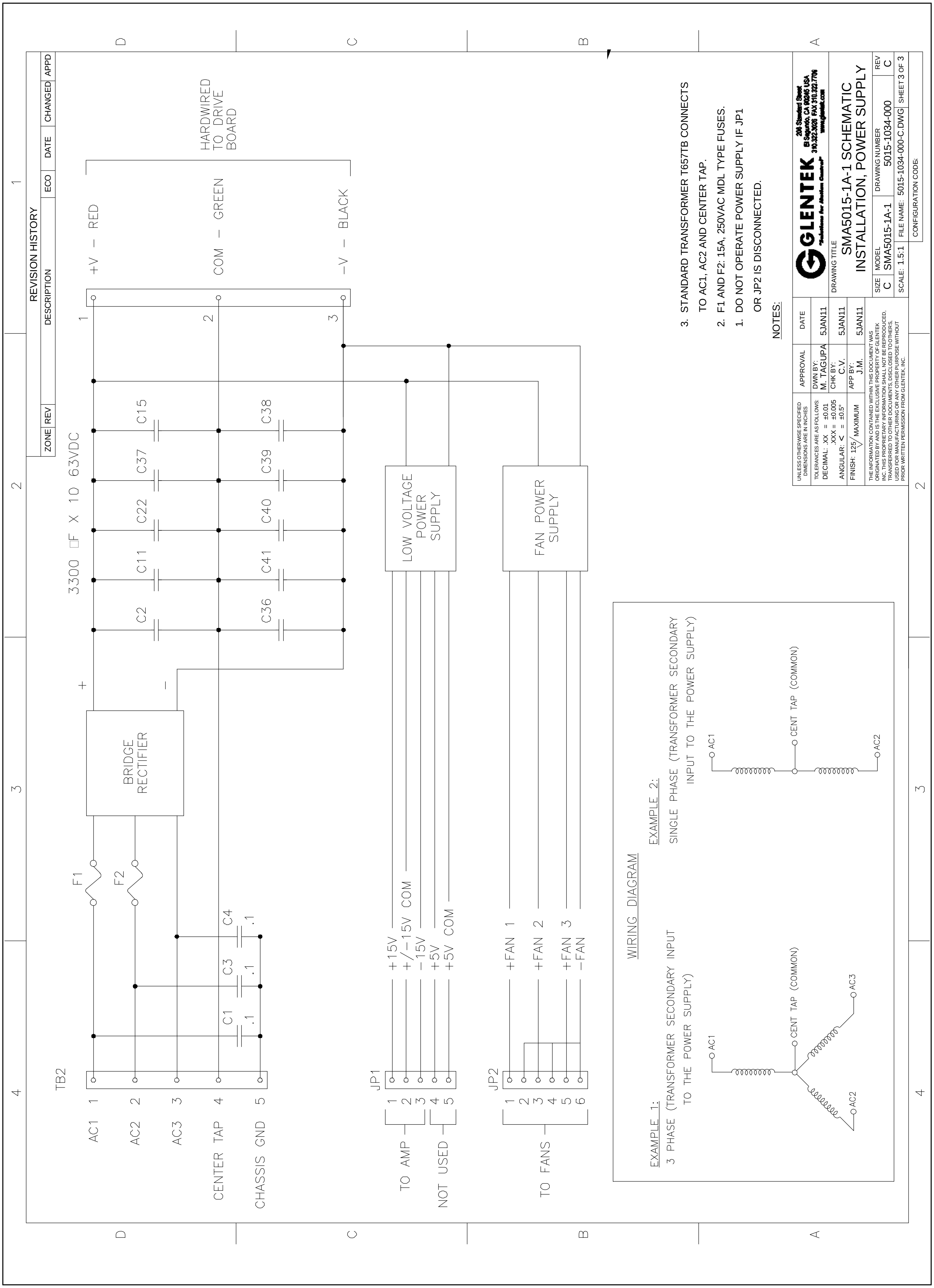
GLENTEK "Solutions for Motion Control"
208 Standard Street
El Segundo, CA 90245 USA
310.322.3026 FAX 310.322.7709
www.glentek.com

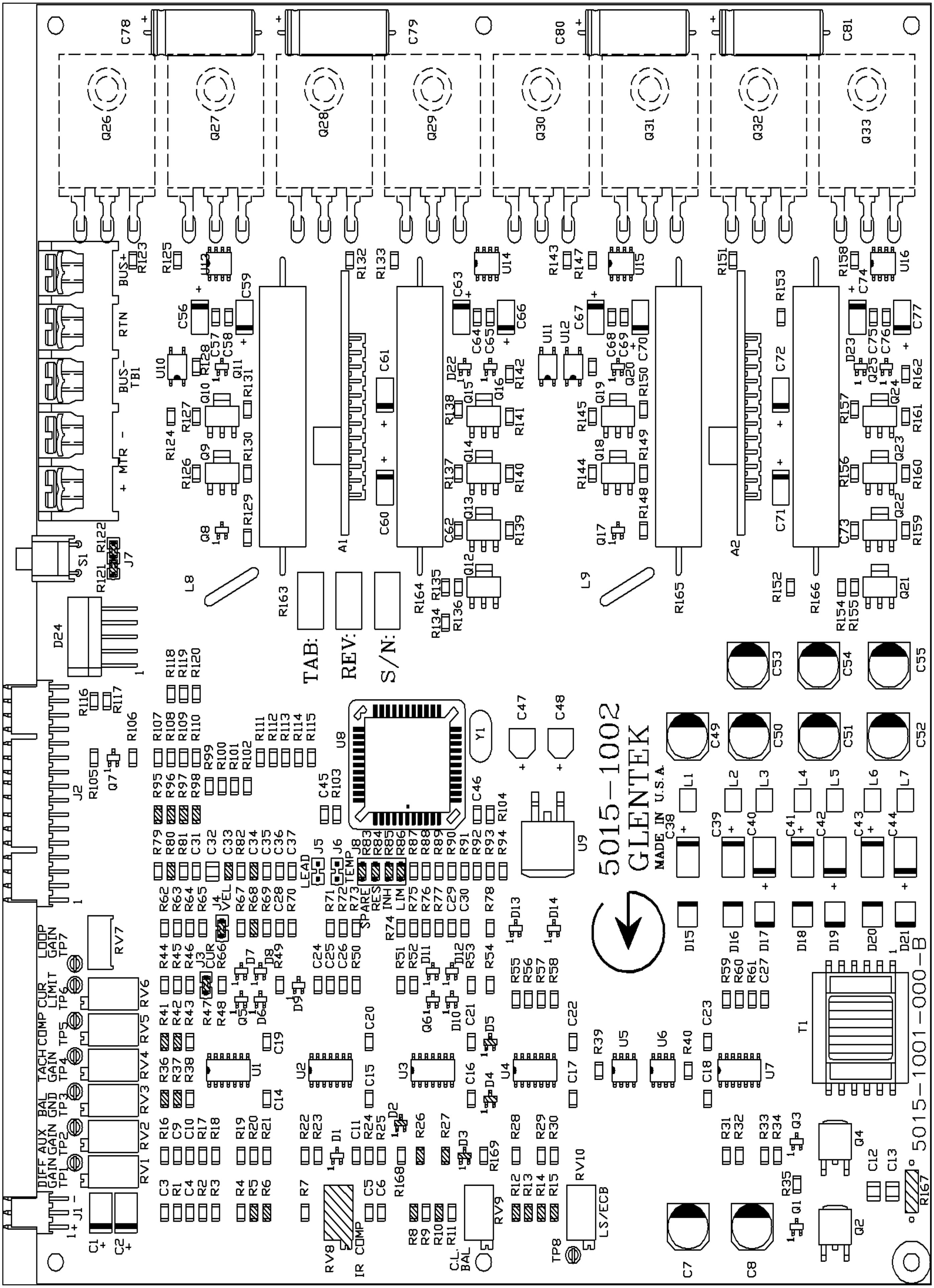
DRAWING TITLE: INSTALLATION, SMA5015-1A-1

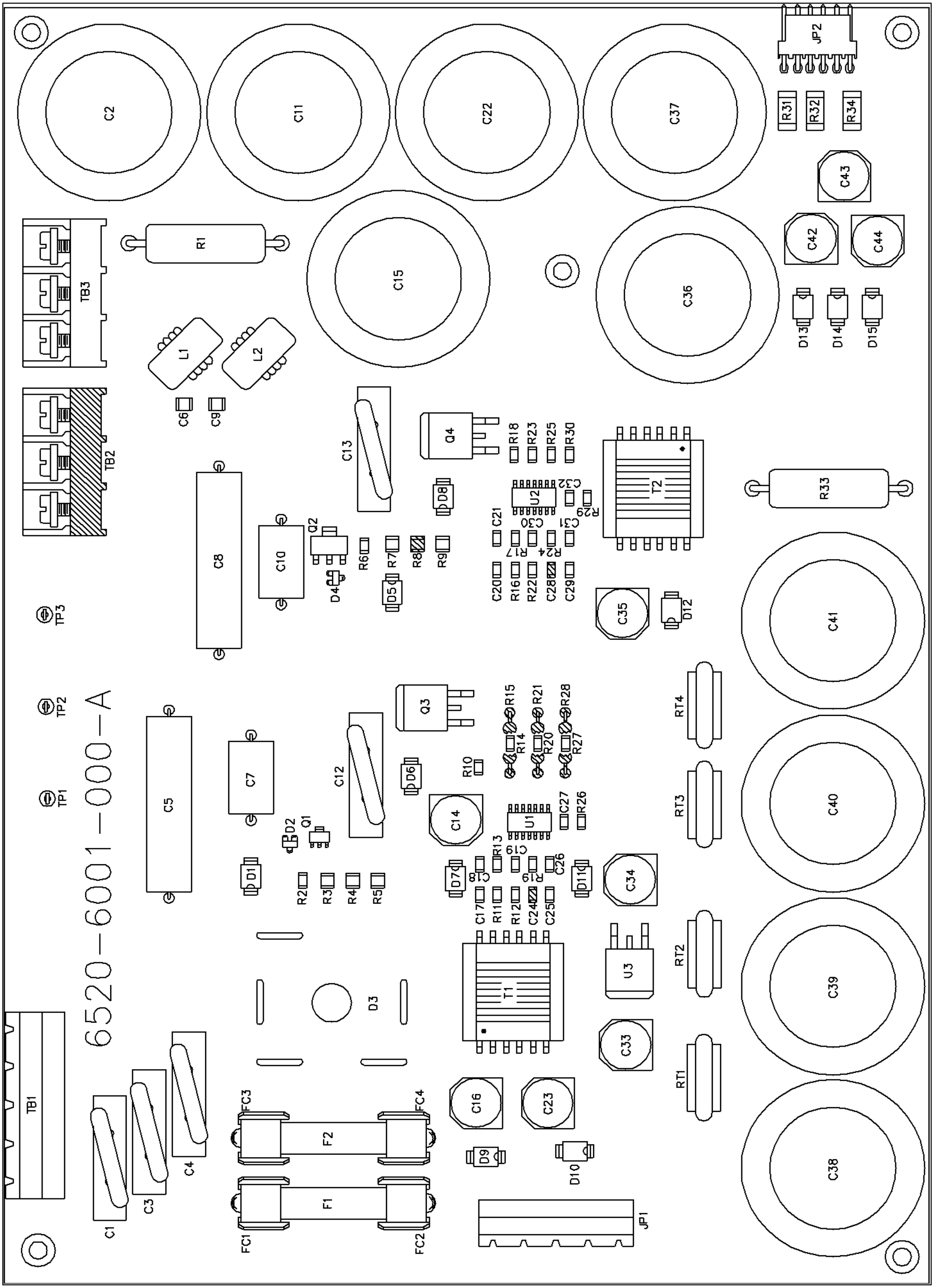
SIZE	MODEL	DRAWING NUMBER	REV
C	SMA5015-1A-1	5015-1034-000	C
SCALE: .875:1	FILE NAME: 5015-1034-000-C.DWG	SHEET 1 OF 3	

CONFIGURATION CODE:


REVISION HISTORY
ZONE
REV
DESCRIPTION
ECO
DATE
CHANGED
APPD
OUTPUT "H" BRIDGE TYPE CIRCUIT
±DC BUSS FROM POWER SUPPLY BOARD
±15VDC FROM POWER SUPPLY BOARD
ISOLATED POWER SUPPLIES FOR CONTROL AND BIAS CIRCUITS
OUTPUT DRIVE CURRENT SENSE AND BIAS CIRCUITS
MICROSHUNT FIELD CONFIGURABLE OPTIONS
Configuration
Install
Omit
Velocity Mode
J4
J3
Current Mode
J3
J4
I/O Pull up Voltage
+5V
J7 @ R121
N/A
+15V
J7 @ R122
N/A
I/O Active High/Low
Reset (J8)
Active Low
Active High
Inhibit (J8)
Active Low
Active High
+/- Limits (J8)
Active Low
Active High
NOTE:
I/O IS PULLED UP TO +5V/+15V OR PULLED DOWN AT THE FACTORY BY 10KΩ RESISTORS
(CONSULT MODEL NUMBERING), NOT FIELD CONFIGURABLE.
PIC MICRO PROCESSOR
7 SEGMENT STATUS DISPLAY
HEATSINK TEMP. MONITOR
MTR CUR FOR HS/ECB = 50A
CURRENT LIMIT
LOOP GAIN
CURRENT COMMAND 10 A/V
SELECT FOR +5 OR +15 PULL UP RESISTORS
DIFF SIG IN
DIFF SIG RET
SIG IN
COM
TACH IN
MOT CUR
LIM+
LIM−
INH
FAULT
COM
RESET
N/C
GLENTEK
DRAWING TITLE SMA5015-1A-1 ELECTRICAL FUNCTIONAL BLOCK SCHEMATIC DIAGRAM
DWN BY: M. TAGUPA 5JAN11
CHK BY: C.V. 5JAN11
APP BY: J.M. 5JAN11
SIZE C
MODEL SMA5015-1A-1
DRAWING NUMBER 5015-1034-000
REV C
SCALE: .625:1
FILE NAME: 5015-1034-000-C.DWG
SHEET 2 OF 3

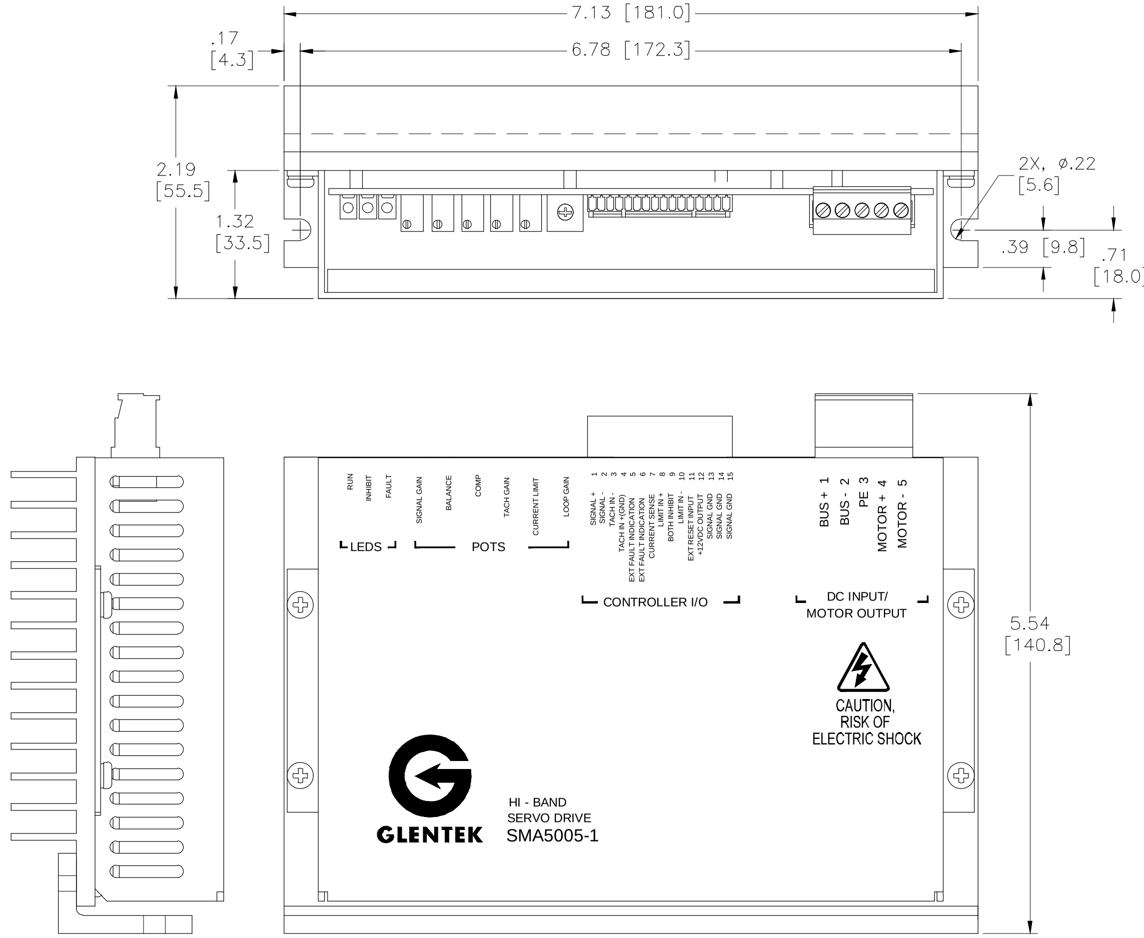

REVISION HISTORY
ZONE
REV
DESCRIPTION
ECO
DATE
CHANGED
APPD
TB2
AC1
AC2
AC3
CENTER TAP
CHASSIS GND
F1
F2
C1
C3
C4
.1
BRIDGE RECTIFIER
3300 µF X 10 63VDC
C2
C11
C22
C37
C15
C36
C41
C40
C39
C38
+V - RED
COM - GREEN
-V - BLACK
HARDWIRED TO DRIVE BOARD
LOW VOLTAGE POWER SUPPLY
FAN POWER SUPPLY
JP1
+15V
+/-15V COM
-15V
+5V
+5V COM
TO AMP
NOT USED
JP2
+FAN 1
+FAN 2
+FAN 3
-FAN
TO FANS
WIRING DIAGRAM
EXAMPLE 1:
3 PHASE (TRANSFORMER SECONDARY INPUT TO THE POWER SUPPLY)
CENT TAP (COMMON)
EXAMPLE 2:
SINGLE PHASE (TRANSFORMER SECONDARY INPUT TO THE POWER SUPPLY)
NOTES:
1. DO NOT OPERATE POWER SUPPLY IF JP1 OR JP2 IS DISCONNECTED.
2. F1 AND F2: 15A, 250VAC MDL TYPE FUSES.
3. STANDARD TRANSFORMER T657TB CONNECTS TO AC1, AC2 AND CENTER TAP.
GLENTEK
DWN BY: M. TAGUPA 5JAN11
CHK BY: C.V. 5JAN11
APP BY: J.M. 5JAN11
DRAWING TITLE
SMA5015-1A-1 SCHEMATIC INSTALLATION, POWER SUPPLY
SIZE C
MODEL SMA5015-1A-1
DRAWING NUMBER 5015-1034-000
REV C
SCALE: 1.5:1
FILE NAME: 5015-1034-000-C.DWG
SHEET 3 OF 3


5015-1002
GLENTEK
MADE IN U.S.A
TAB:
REV:
S/N:
5015-1001-000-B


6520-6001-000-A

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	NTHALLA	J.M.
-	C	SEE ECO	4219	10OCT16	NTHALLA	L.P.



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 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 (LS/ECB)	Latches when current exceeds ±5.5 A for 800 millisec
Drive Over temperature	Drive faults and is inhibited if the heat sink temperature reaches 75 °C
Green Run LED	Drive enabled, normal operating condition
Red Inhibit LED	Drive disabled, non-latched condition (External inhibited)
Red Fault LED	Drive over temperature or LS/ECB (Latched condition)
Internal Pull Up Level	Pulled up to +5VDC or Pull up to +15VDC.
Dedicated Fault Output	Optically Isolated. From the Controller I/O connector, Pin 5 is Collector, and Pin 6 is Emitter (Avago P/N: HCPL-181-000E). When no fault occurs, pin 5 will conduct current into pin 6. Maximum current through transistor is 50mA.
Operating Temperature	0 °C to +55 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing

Mating Connectors		Provided
DC Input / Motor Output	Glentek P/N: EJ741V05; Phoenix P/N: 1792786	Yes
Controller I/O	Glentek P/N: EJ041M15; Molex P/N: 22-12-2154-7478	Yes
Connector Crimp Terminal	Glentek P/N: EH042260; Molex P/N: 08-55-0102	Yes

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

NOTE:

1. PLEASE MAINTAIN A MIN. OF 2" - 3" OF SPACE AT BOTH ENDS AND TOP OF THE DRIVE TO ENSURE PROPER VENTILATION FOR THE UNIT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE AS FOLLOWS:
DECIMAL: .XX = ±0.01
.XXX = ±0.005
ANGULAR: ∠ = ±0.5°
FINISH: 125 MAXIMUM

APPROVAL	DATE
DWN BY: M.T.	01FEB11
CHK BY: KON.P	01FEB11
APP BY: C.V.	01FEB11

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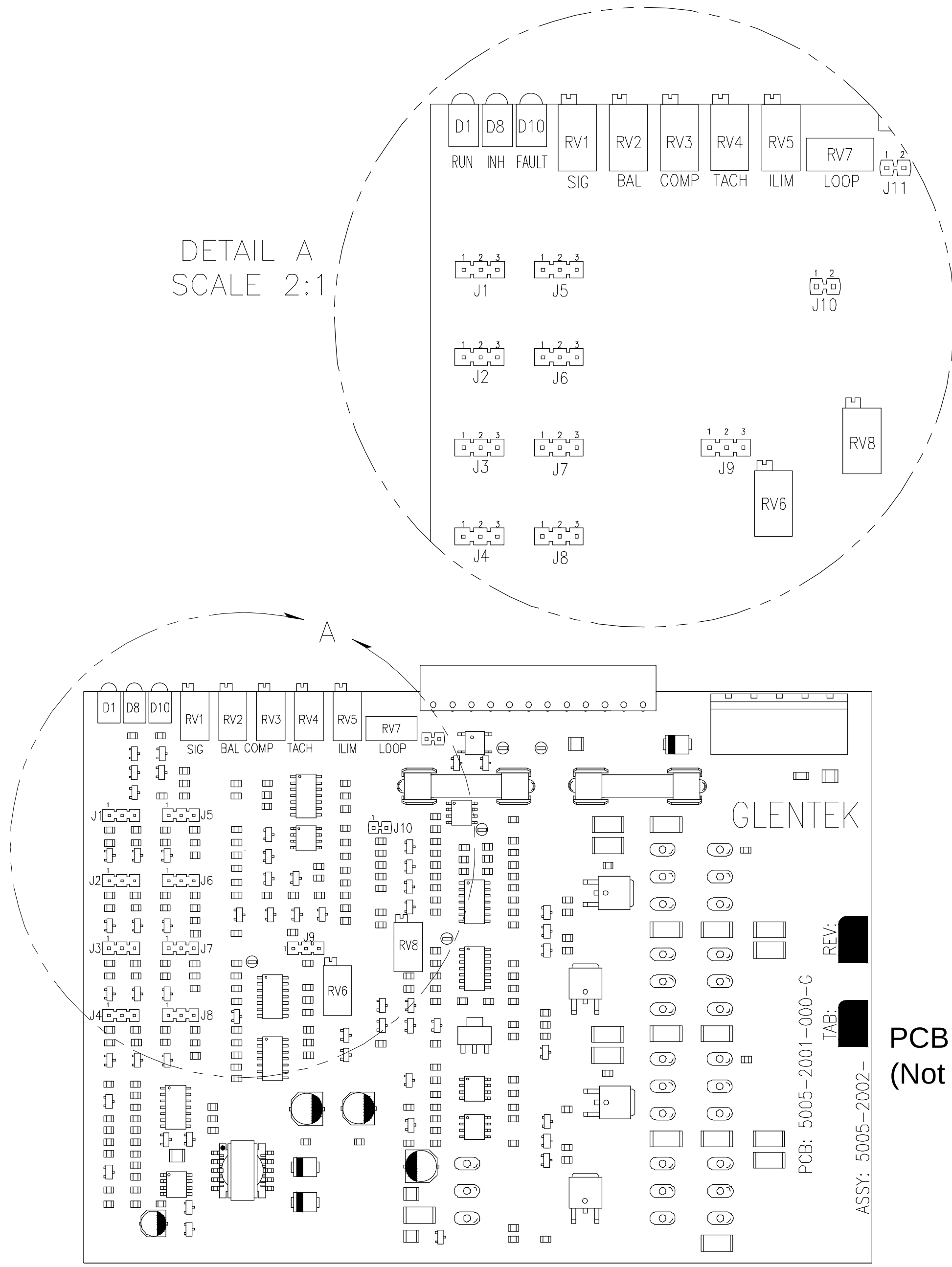
208 Standard Street
El Segundo, CA 90245 USA
310.322.3026 FAX 310.322.7709
www.glentek.com

DRAWING TITLE
INSTALLATION,
SMA5005-1

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

SCALE: 1.125:1 FILE NAME: 5005-2034-000-C.DWG SHEET 1 OF 3

CONFIGURATION CODE:



PCB ASSEMBLY
(Not to scale)

REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD

There are four logic inputs: Limit +, Inhibit, Limit -, and External Reset. These Logic inputs may be configured for active-high or active-low signals, and pulled-up or pulled-down termination (Type A,B,C, and D).

Type "A": Requires grounding of inputs to activate the function (pull-up, active-low).

Type "B": Requires a positive voltage at input to activate the function (pull-down, active-high).

Type "C": Requires grounding of input to deactivate the function (pull-up, active-high).

Type "D": Requires a positive voltage at input to deactivate the function (pull-down, active-low).

The following table shows the Microshunt jumper settings that need to be configured for the Type A, B, C, and D configurations.

Logic Input Configuration Settings

	Type A	Type B	Type C	Type D
Limit +	J1: 1 2 3	J1: 1 2 3	J1: 1 2 3	J1: 1 2 3
	J5: 1 2 3	J5: 1 2 3	J5: 1 2 3	J5: 1 2 3
Inhibit	J2: 1 2 3	J2: 1 2 3	J2: 1 2 3	J2: 1 2 3
	J6: 1 2 3	J6: 1 2 3	J6: 1 2 3	J6: 1 2 3
Limit -	J3: 1 2 3	J3: 1 2 3	J3: 1 2 3	J3: 1 2 3
	J7: 1 2 3	J7: 1 2 3	J7: 1 2 3	J7: 1 2 3
External Reset	J4: 1 2 3	J4: 1 2 3	J4: 1 2 3	J4: 1 2 3
	J8: 1 2 3	J8: 1 2 3	J8: 1 2 3	J8: 1 2 3

Drive and Command Input Configuration Settings

	Configuration	Jumper Settings
Drive Mode	Current Mode	J10- Install
	Velocity Mode	J10- Omit
Command Input	Single Ended	J11- Install
	Differential	J11- Omit

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01 .XXX = ±0.005 ANGULAR: < = ±0.5°	DWN BY: M.T.	01FEB11
	CHK BY: KON.P	01FEB11
FINISH: 125 MAXIMUM	APP BY: C.V.	01FEB11

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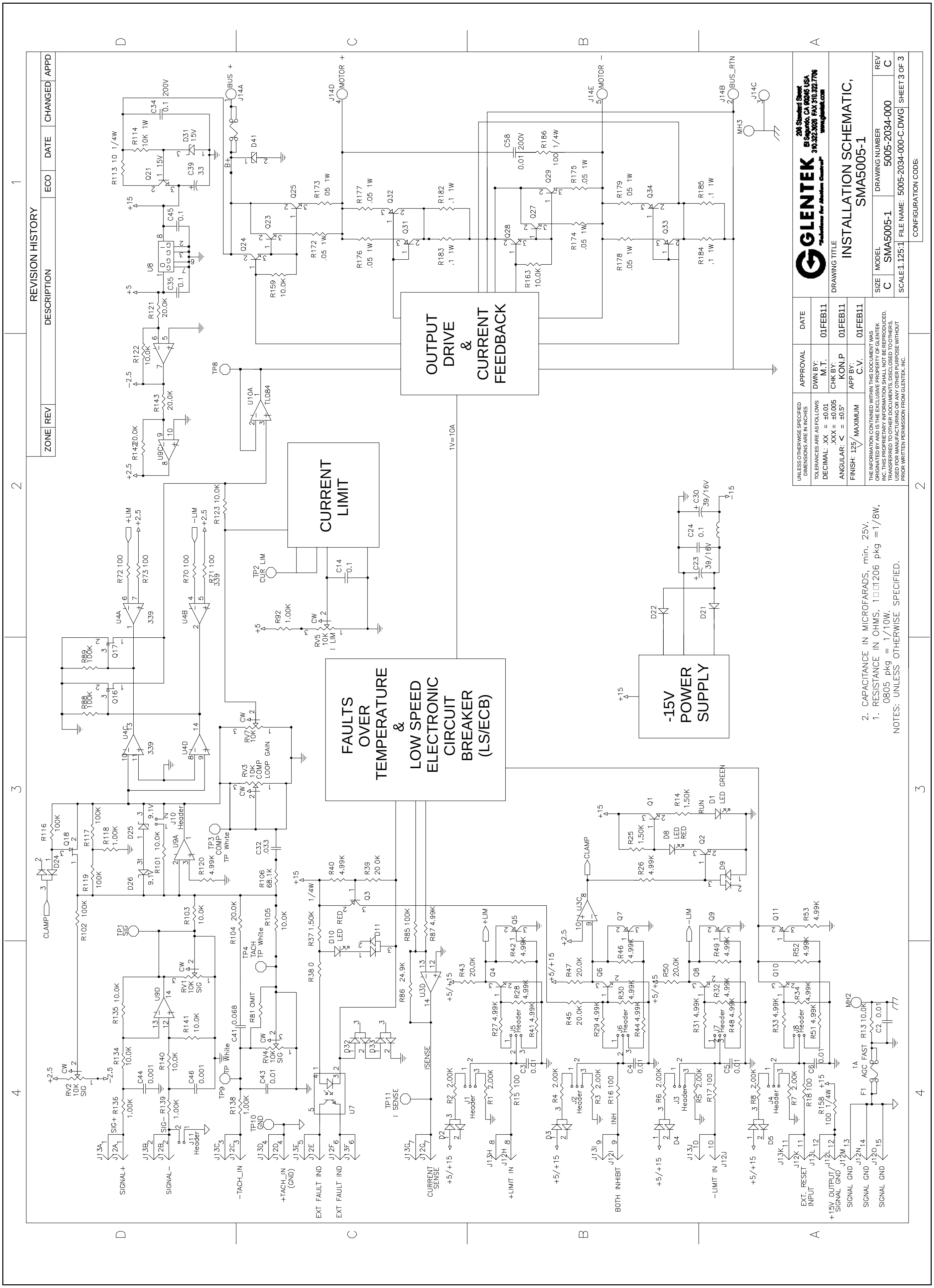
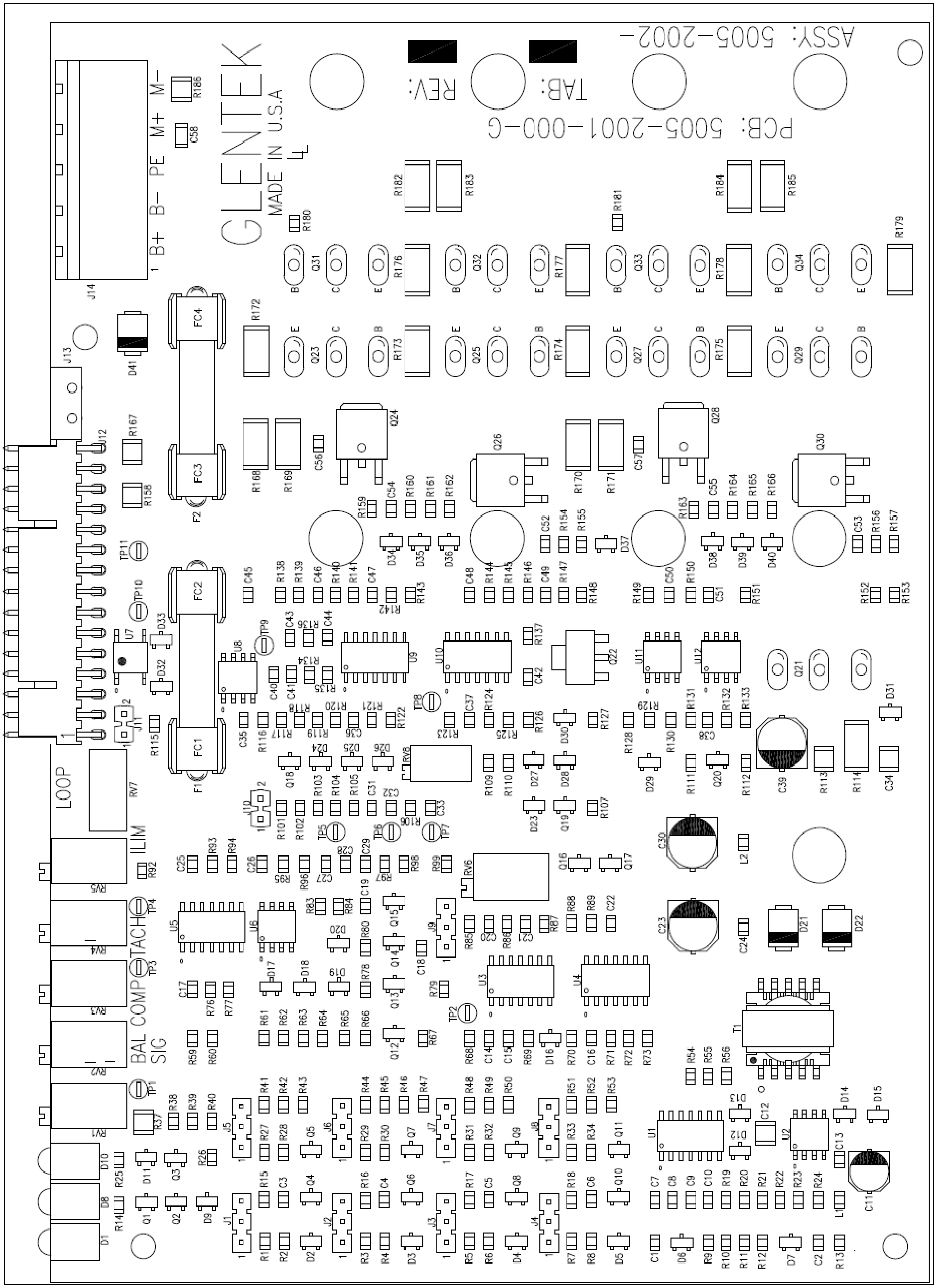
208 Standard Street El Segundo, CA 90245 USA 310.322.3026 FAX 310.322.7709 www.glentek.com

DRAWING TITLE
INSTALLATION, SMA5005-1

SIZE	MODEL	DRAWING NUMBER	REV
C	SMA5005-1	5005-2034-000	C
SCALE: 1:1	FILE NAME: 5005-2034-000-C.DWG	SHEET 2 OF 3	

CONFIGURATION CODE:


REVISION HISTORY
ZONE
REV
DESCRIPTION
ECO
DATE
CHANGED
APPD
OUTPUT DRIVE & CURRENT FEEDBACK
CURRENT LIMIT
FAULTS OVER TEMPERATURE & LOW SPEED ELECTRONIC CIRCUIT BREAKER (LS/ECB)
-15V POWER SUPPLY
NOTES: UNLESS OTHERWISE SPECIFIED.
1. RESISTANCE IN OHMS, 1/8W, 0805 pkg = 1/10W.
2. CAPACITANCE IN MICROFARADS, min. 25V.
GLENTEK
INSTALLATION SCHEMATIC, SMA5005-1
DRAWING NUMBER
5005-2034-000
REV
C
SHEET 3 OF 3
DWN BY: M.T. 01FEB11
CHK BY: KON.P 01FEB11
APP BY: C.V. 01FEB11


ASSY: 5005-2002-
REV:
TAB:
PCB: 5005-2001-000-G
GLENTEK
MADE IN U.S.A
B+ B- PE M+ M-
LOOP
ILIM
TACH
COMP
BAL
SIG

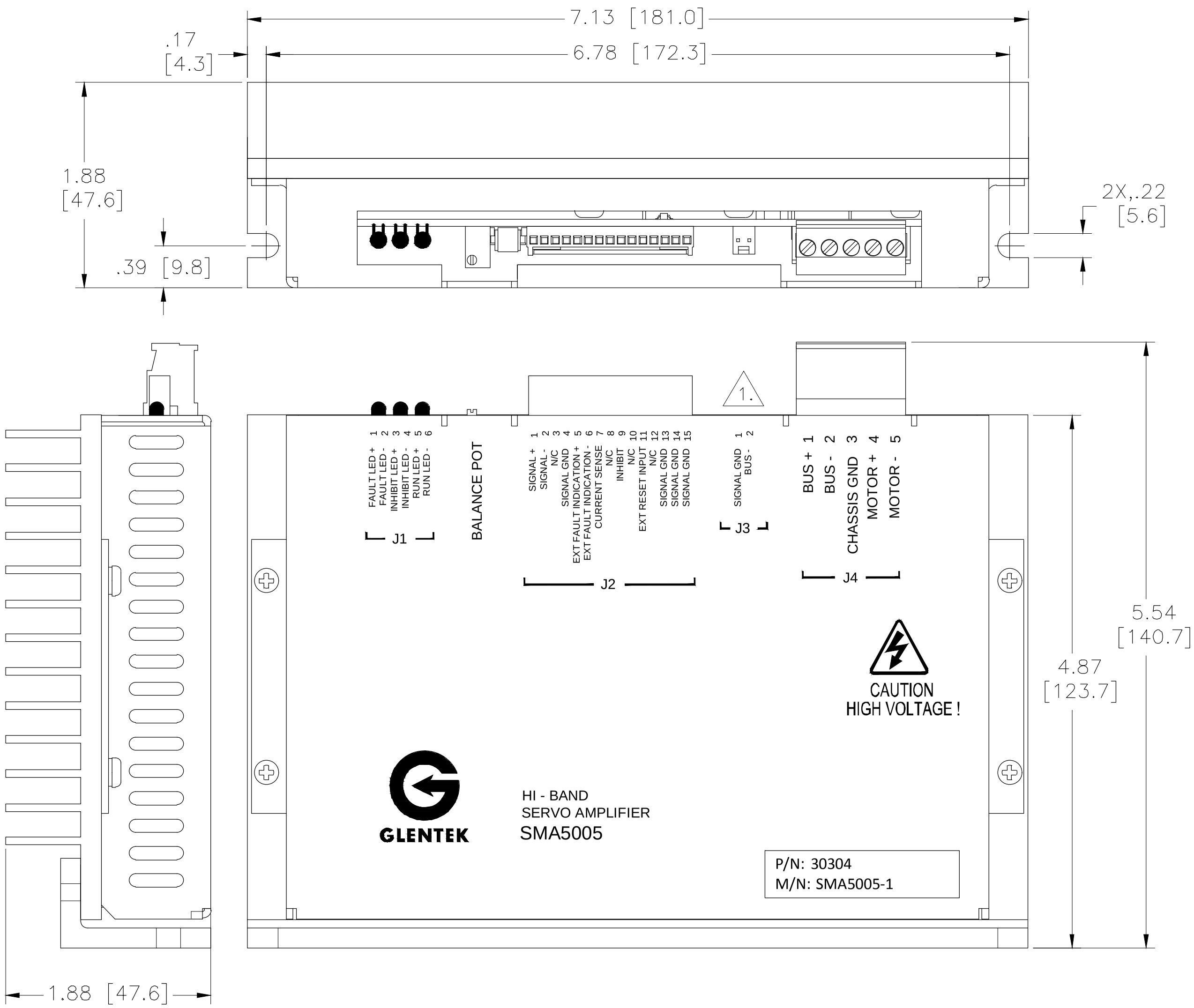
REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	5013	21JUN21	M. TAGUPA	L.P.

Specifications and Features	
DC BUS Input Voltage	20-30VDC max.
Peak Output Current	7A @ 25°C Ambient (with forced air cooling).
Continuous Output Current	
Input Command Signal	±10 VDC (Max.), Single Ended/ Diff. (field configurable).
Input Command Signal Gain	1.0 A/V Nominal.
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when current exceeds ±3 A for 3 sec.
High Speed Electronic Circuit Breaker (HS/ECB)	Latches when current exceeds ±9 A for 30 msec.
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, LS/ECB, HS/ECB (Latched condition).
Bandwidth	10.0 kHz *
Current Monitor Test Point	2.0 A/V Nominal
Fault Output	Opto isolated can sink up to 50 mA or max 150 mW
Maximum output offset (as shipped)	With grounded signal input, output across 3 ohms load will be typically ±2.5 mA
Operating Temperature	0 °C to +55 °C.
Storage Temperature	-40 °C to +80 °C.
Humidity	5% to 95% non-condensing.
L x W x H (inches)	7.13 x 2.18 x 5.54 .

*Tuned for load : R 4.7ohm, L 1.25mH @ 24VDC

Mating Connectors		Provided
Input mating connector (J2)	Glentek P/N:EJ381F15; Molex P/N: 22-01-3157	Yes
Output mating connector (J3)	Glentek P/N:EJ381F02; Molex P/N: 22-01-3027	No
Motor and DC Input Connector (J4)	Glentek P/N: EJ741V05; Phoenix P/N: 17 92 78 6	Yes

Check	Configuration & Pot Settings	
	Amplifier Type	Current Mode
	Inhibit	Pulled up active high
	External Reset	Pulled down active high
	Balance (20 turn)	Adjustable DC offset voltage



NOTES:

1. J3 - FOR EXTERNAL FUSE BETWEEN SIGNAL GND AND BUS-
INTERNAL FUSE INSTALLED : RAYCHEM P/N:TS250-130

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01, .XXX = ±0.005; ANGULAR: ∠ = ±0.5°; FINISH: 125 MAXIMUM

APPROVAL		DATE
DWN BY:	M. TAGUPA	21JUN21
CHK BY:	N.T.	21JUN21
APP BY:	L.P.	21JUN21

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GLENTEK

DRAWING TITLE: INSTALLATION, SMA5005-4SF-34C-1

SIZE: D | MODEL: SMA5005-1 | DRAWING NUMBER: 30304-1 | REV: A

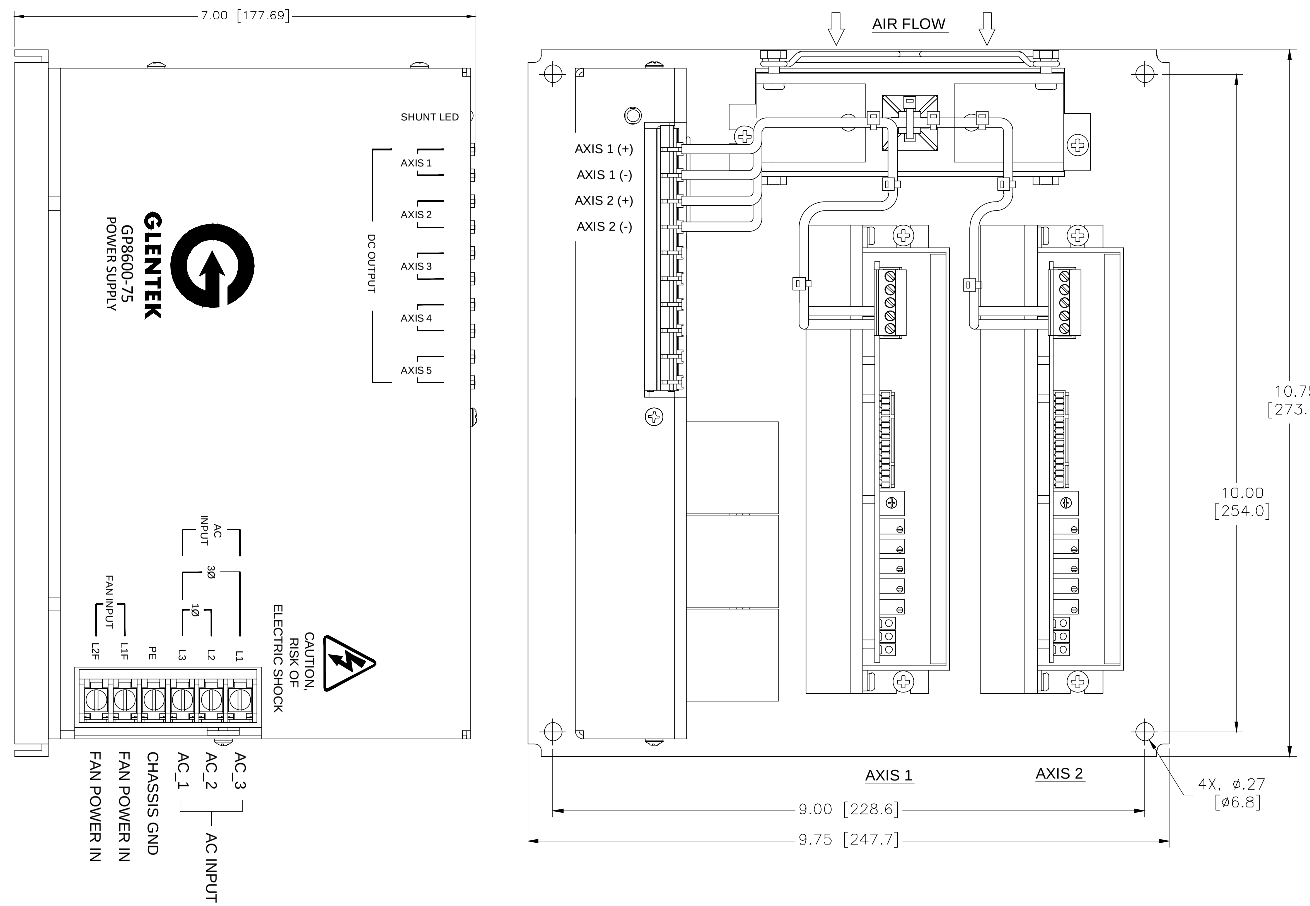
SCALE: 2:1 | FILE NAME: 30304-1-A.DWG | SHEET 1 OF 1

CONFIGURATION CODE: -

REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3427	27DEC11	NTHALLA	J.M.
-	B	UPDATED POWER SUPPLY TO GP8600-75.	4219	01DEC16	NTHALLA	C.V.

Specifications and Features	
AC Input Voltage	17 - 53 VAC, Single or Three Phases
Fan Input Voltage	110 - 130 VAC, Single Phase, 50/60 Hz
Derived DC BUS Voltage	Unregulated 70 VDC max. @ 50VAC input
Continuous Output Current	5.0 A @ 25°C Ambient (with forced air cooling) per drive
Drives Modules	SMA5005-1 (QTY:2)

Mating Connectors	
Motor and DC Input Connector	Glentek P/N: EJ741V05; Phoenix P/N: 17 92 78 6
Signal Connector	Glentek P/N: EJ041M15; Molex P/N: 22-12-2154-7478



NOTE:

1. AC POWER INPUT IS APPLIED TO AC_1/AC_2 (SINGLE PHASE), OR AC_1/AC_2/AC_3 (THREE PHASES) OF POWER INPUT CONNECTOR. FAN POWER IS SINGLE PHASE ONLY.
2. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22AWG (0.326 MM²) OR 24AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).
3. USE SHIELDED CABLE FOR COMMAND SIGNAL.
4. RECOMMEND MOTOR OUTPUTS WIRING, 16AWG (1.31 MM²) OR LARGER. 105°C RATED PVC OR BETTER.
5. RECOMMEND POWER INPUTS WIRING, 16AWG (1.31 MM²) OR LARGER. 105°C RATED PVC OR BETTER.
6. NEVER GROUND THE OUTPUTS OF THE DRIVES.
7. MAINTAIN A MIN. OF 2" to 3" OF SPACE AT BOTH ENDS AND TOP OF THE DRIVES TO ENSURE PROPER VENTILATION FOR THE UNIT.
8. ALLOW 8 INCHES MIN. HEIGHT CLEARANCE.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01 .XXX = ±0.005 ANGULAR < = ±0.5°	DWN BY: NTHALLA	27DEC11
	CHK BY: L.L.	27DEC11
FINISH: 125 MAXIMUM	APP BY: J.M.	27DEC11

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DRAWING TITLE: INSTALLATION, SMA5005-2A-2

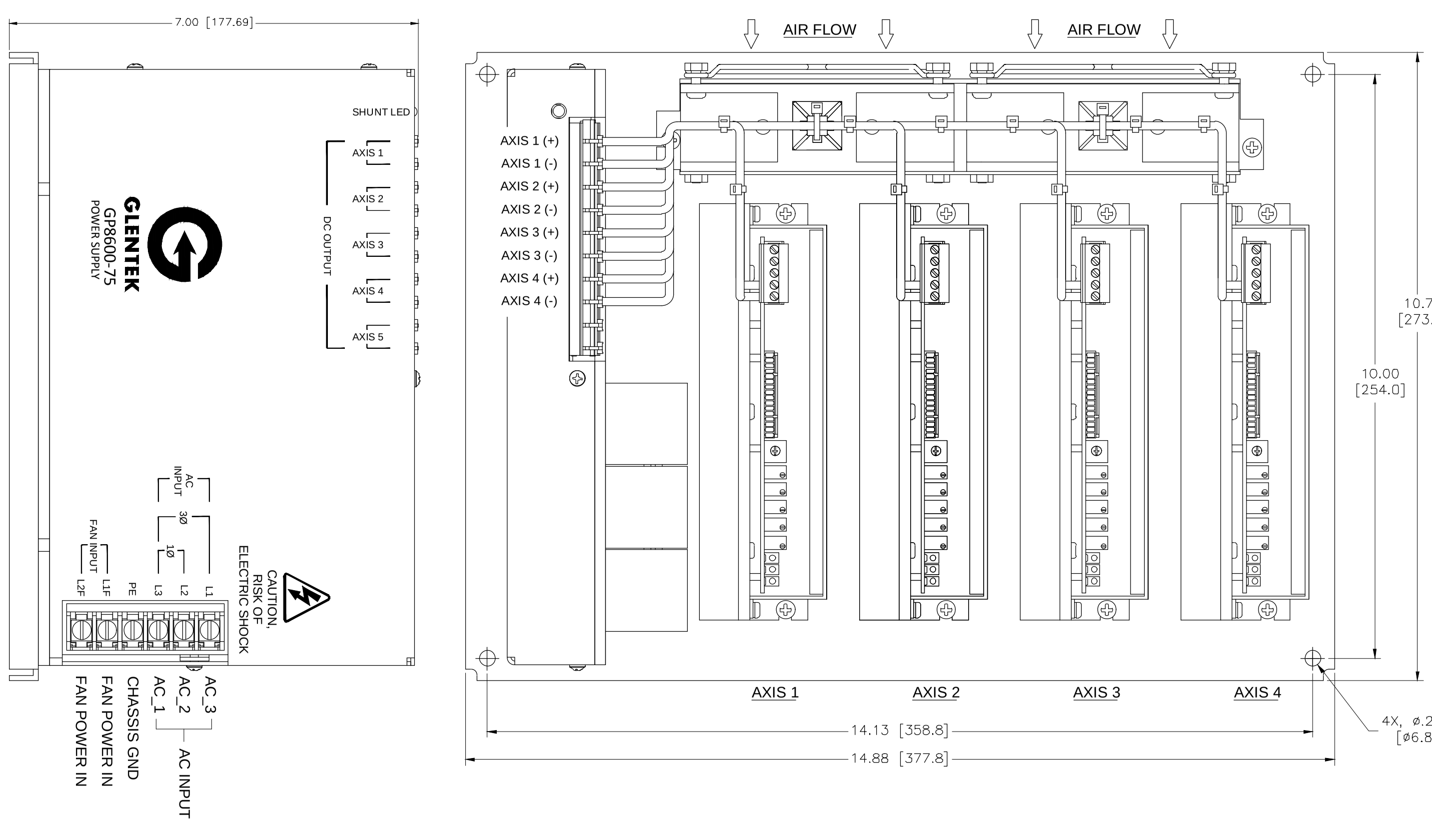
SIZE	MODEL	DRAWING NUMBER	REV
D	SMA5005-2A-2	5005-2035-000	B
SCALE: 1.125:1	FILE NAME: 5005-2035-000-B.DWG	SHEET 1 OF 1	

CONFIGURATION CODE: -

REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3427	27DEC11	NTHALLA	J.M.
-	B	UPDATED POWER SUPPLY TO GP8600-75.	4219	01DEC16	NTHALLA	C.V.

Specifications and Features	
AC Input Voltage	17 - 53 VAC, Single or Three Phases
Fan Input Voltage	110 - 130 VAC, Single Phase, 50/60 Hz
Derived DC BUS Voltage	Unregulated 70 VDC max. @ 50VAC input
Continuous Output Current	5.0 A @ 25°C Ambient (with forced air cooling) per drive
Drive Modules	SMA5005-1 (QTY:4)

Mating Connectors	
Motor and DC Input Connector	Glentek P/N: EJ741V05; Phoenix P/N: 17 92 78 6
Signal Connector	Glentek P/N: EJ041M15; Molex P/N: 22-12-2154-7478



NOTE:

1. AC POWER INPUT IS APPLIED TO AC_1/AC_2 (SINGLE PHASE), OR AC_1/AC_2/AC_3 (THREE PHASES) OF POWER INPUT CONNECTOR. FAN POWER IS SINGLE PHASE ONLY.
2. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22AWG (0.326 MM²) OR 24AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).
3. USE SHIELDED CABLE FOR COMMAND SIGNAL.
4. RECOMMEND MOTOR OUTPUTS WIRING, 16AWG (1.31 MM²) OR LARGER. 105°C RATED PVC OR BETTER.
5. RECOMMEND POWER INPUTS WIRING, 16AWG (1.31 MM²) OR LARGER. 105°C RATED PVC OR BETTER.
6. NEVER GROUND THE OUTPUTS OF THE DRIVES.
7. MAINTAIN A MIN. OF 2" to 3" OF SPACE AT BOTH ENDS AND TOP OF THE DRIVES TO ENSURE PROPER VENTILATION FOR THE UNIT.
8. ALLOW 8 INCHES MIN. HEIGHT CLEARANCE.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL .xx = ±0.01, .xxx = ±0.005; ANGULAR < = ±0.5°; FINISH 125 MAXIMUM

APPROVAL	DATE
DWN BY: NTHALLA	27DEC11
CHK BY: L.L.	27DEC11
APP BY: J.M.	27DEC11

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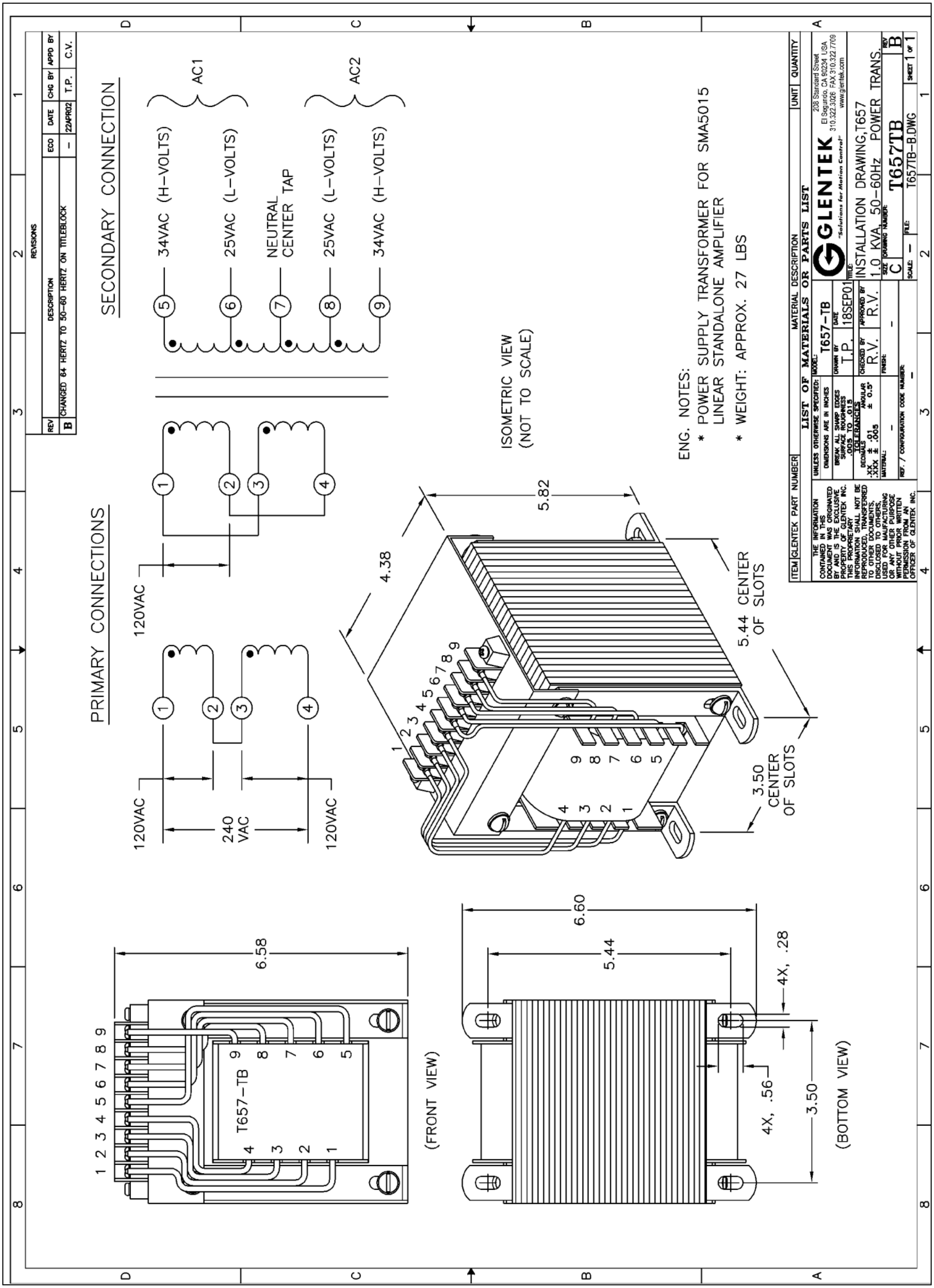
GLENTEK "Solutions for Motion Control"

DRAWING TITLE: INSTALLATION, SMA5005-4A-4

SIZE: D | MODEL: SMA5005-4A-4 | DRAWING NUMBER: 5005-2036-000 | REV: B
SCALE: 1:1 | FILE NAME: 5005-2036-000-B.DWG | SHEET 1 OF 1
CONFIGURATION CODE: -



REVISIONS
REV | ECO | DESCRIPTION | DATE | CHG BY | APPD BY
B | - | CHANGED 64 HERTZ TO 50-60 HERTZ ON TITLEBLOCK | 22APR02 | T.P. | C.V.
PRIMARY CONNECTIONS
120VAC
240 VAC
120VAC
120VAC
SECONDARY CONNECTION
34VAC (H-VOLTS)
25VAC (L-VOLTS)
NEUTRAL CENTER TAP
25VAC (L-VOLTS)
34VAC (H-VOLTS)
AC1
AC2
ISOMETRIC VIEW (NOT TO SCALE)
ENG. NOTES:
* POWER SUPPLY TRANSFORMER FOR SMA5015 LINEAR STANDALONE AMPLIFIER
* WEIGHT: APPROX. 27 LBS
5.82
4.38
5.44 CENTER OF SLOTS
3.50 CENTER OF SLOTS
6.58
T657-TB
(FRONT VIEW)
6.60
5.44
4X, .28
4X, .56
3.50
(BOTTOM VIEW)
LIST OF MATERIALS OR PARTS LIST
ITEM | GLENTEK PART NUMBER | MATERIAL DESCRIPTION | UNIT | QUANTITY
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES SURFACE ROUGHNESS .005 TO .015
TOLERANCES DECIMALS .XX ± .01 .XXX ± .005 ANGULAR ± 0.5°
MODEL: T657-TB
DRAWN BY T.P.
DATE 18SEP01
CHECKED BY R.V.
APPROVED BY R.V.
GLENTEK "Solutions for Motion Control"
208 Standard Street El Segundo, CA 90234 USA 310.322.3026 FAX 310.322.7709 www.glentek.com
TITLE: INSTALLATION DRAWING,T657 1.0 KVA, 50-60Hz POWER TRANS.
SIZE C
DRAWING NUMBER T657TB
REV B
SCALE: -
FILE: T657TB-B.DWG
SHEET 1 OF 1
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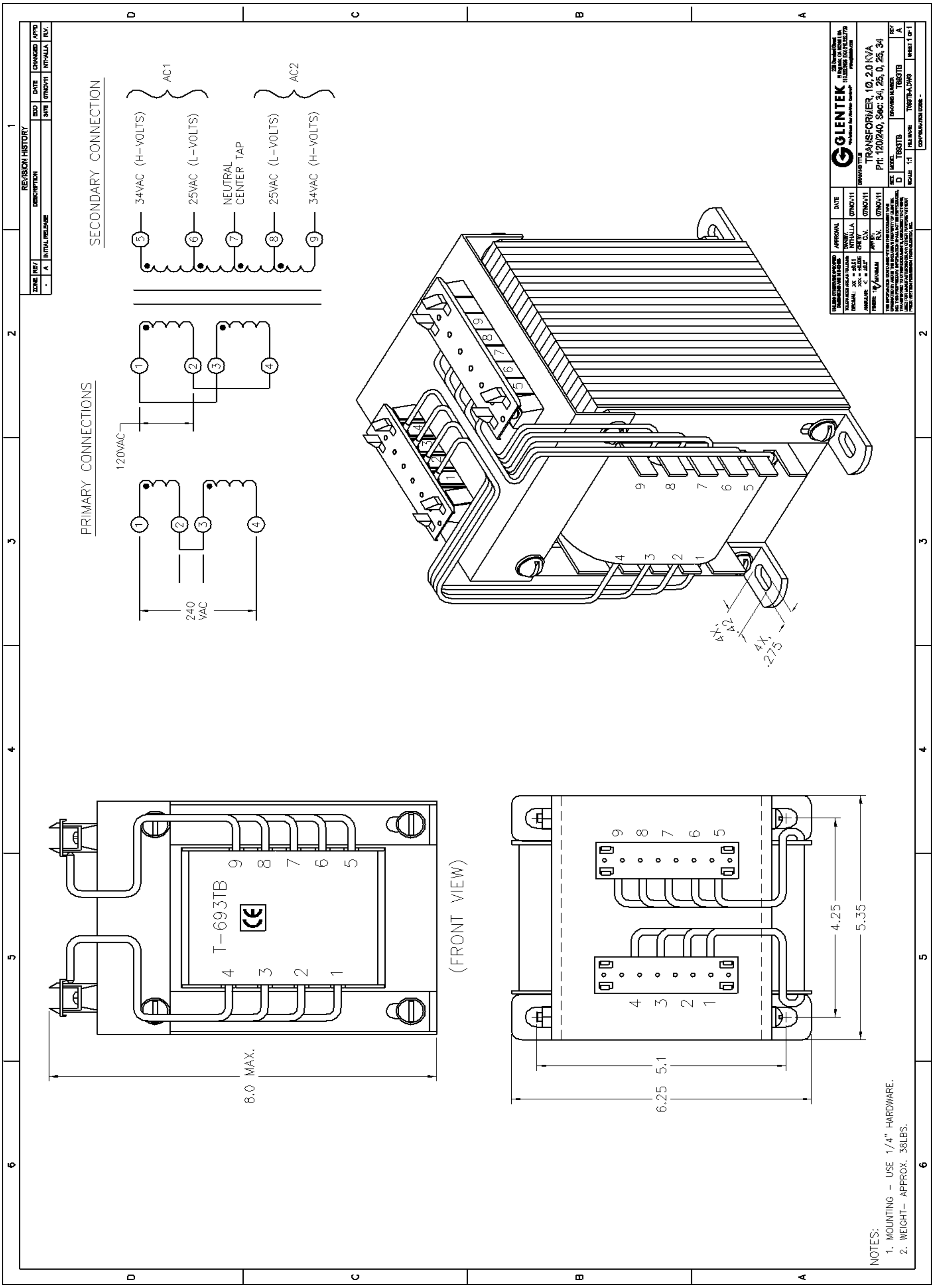
SECONDARY CONNECTION
34VAC (H-VOLTS)
25VAC (L-VOLTS)
NEUTRAL CENTER TAP
25VAC (L-VOLTS)
34VAC (H-VOLTS)
AC1
AC2
PRIMARY CONNECTIONS
120VAC
240 VAC
T-693TB
(FRONT VIEW)
8.0 MAX.
4.25
5.35
5.1
6.25
4X .42
4X .275
NOTES:
1. MOUNTING - USE 1/4" HARDWARE.
2. WEIGHT- APPROX. 38LBS.
GLENTEK
TRANSFORMER, 1Ø, 2.0 KVA
Pri: 120/240, Sec: 34, 25, 0, 25, 34
T693TB
REVISION HISTORY
INITIAL RELEASE

European Union EMC Directives: Electromagnetic Compatibility Guidelines

For Machine Design

This document provides background information about Electromagnetic Interference (EMI) and machine design guidelines for Electromagnetic Compatibility (EMC).

Introduction

Perhaps no other subject related to the installation of industrial electronic equipment is so misunderstood as electrical noise. The subject is complex and the theory easily fills a book. This section provides guidelines that can minimize noise problems.

The majority of installations do not exhibit noise problems. However, these filtering and shielding guidelines are provided as counter measures. The grounding guidelines provided below are simply good grounding practices. They should be followed in all installations.

Electrical noise has two characteristics: generation or emission of electromagnetic interference (EMI) and response or immunity to EMI. The degree to which a device does not emit EMI, and is immune to EMI is called the device's Electromagnetic Compatibility (EMC).

Equipment, which is to be brought into the European Union legally, requires a specific level of EMC. Since this applies when the equipment is brought into use, it is of considerable importance that a drive system, as a component of a machine, be correctly installed.

"EMI Source-Victim Model" shows the commonly used EMI model. The model consists of an EMI source, a coupling mechanism and an EMI victim. A device such as servo drives and computers, which contain switching power supplies and microprocessors, are EMI sources. The mechanisms for the coupling of energy between the source and victim are conduction and radiation. Victim equipment can be any electromagnetic device that is adversely affected by the EMI coupled to it.

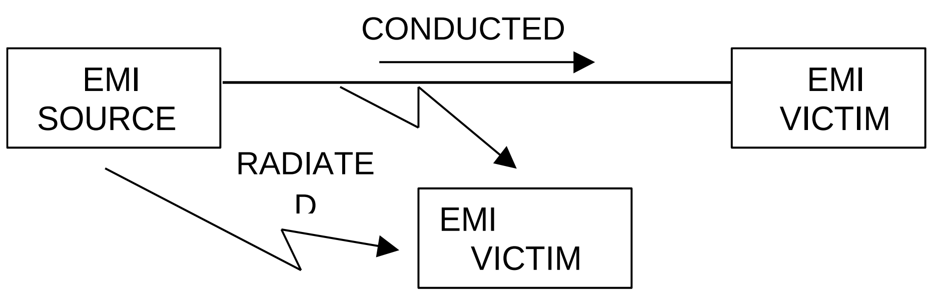

Figure I.1- EMI Source-Victim Model

Immunity to EMI is primarily determined by equipment design, but how you wire and ground the device is also critical to achieving EMI immunity. Therefore, it is important to select equipment that has been designed and tested for industrial environments. The EMI standards for industrial equipment include the EN61000-4-X series (IEC 1000-4-X and IEC8O1-X), EN55011 (CISPR11), ANSI C62 and C63 and

MIL-STD-461. Also, in industrial environments, you should use encoders with differential driver outputs rather than single ended outputs, and digital inputs/outputs with electrical isolation, such as those provided with optocouplers.

The EMI model provides only three options for eliminating the EMC problem:

- Reduce the EMI at the source
- Increase the victim's immunity to EMI (harden the victim)
- Reduce or eliminate the coupling mechanism

In the case of servo drives, reducing the EMI source requires slowing power semiconductor switching speeds. However, this adversely affects drive performance with respect to heat dissipation and speed/torque regulation. Hardening the victim equipment may not be possible, or practical. The final and often the most realistic solution is to reduce the coupling mechanism between the source and victim. Filtering, shielding and grounding can achieve this.

Filtering

As mentioned above, high frequency energy can be coupled between circuits via radiation or conduction. The AC power wiring is one of the most important paths for both types of coupling mechanisms. The AC line can conduct noise into the drive from other devices, or it can conduct noise directly from the drive into other devices. It can also act as an antenna and transmit or receive radiated noise between the drive and other devices.

One method to improve the EMC characteristics of a drive is to use an isolation AC power transformer on the drive's input power. This minimizes inrush currents on power-up and provides electrical isolation. In addition, it provides common mode filtering, although the effect is limited in frequency by the inter-winding capacitance. Use of a Faraday shield between the windings can increase the common mode rejection bandwidth, (shield terminated to ground) or provide differential mode shielding (shield terminated to the winding). In some cases, an AC line filter will not be required unless other sensitive circuits are powered off the same AC branch circuit.

***Note:** "Common mode" noise is present on all conductors that are referenced to ground. "Differential mode" noise is present on one conductor referenced to another conductor.

The use of properly matched AC line filters to reduce the conducted EMI emitting from the drive is essential in most cases. This allows nearby equipment to operate undisturbed. The basic operating principle is to minimize the high frequency power transfer through the filter. An effective filter achieves this by using capacitors and inductors to mismatch the source impedance (AC line) and the load impedance (drive) at high frequencies.

For drives brought for use in Europe, use of the correct filter is essential to meet emission requirements. Detailed information on filters is included in the manual and transformers should be used where specified in the manual.

AC Line Filter Selection

Selection of the proper filter is only the first step in reducing conducted emissions. Correct filter installation is crucial to achieving both EMIL attenuation and to ensure safety. All of the following guidelines should be met for effective filter use.

1) The filter should be mounted to a grounded conductive surface.

2) The filter must be mounted close to the drive-input terminals, particularly with higher frequency missions (5-30 MHz). If the distance exceeds 600mm (2 feet), a strap should be used to connect the drive and filter, rather than a wire.

3) The wires connecting the AC source to the filter should be shielded from, or at least separated from the wires (or strap) that connects the drive to the filter. If the connections are not segregated from each other, then the EMI on the drive side of the filter can couple over to the source side of the filter, thereby reducing, or eliminating the filter effectiveness. The coupling mechanism can be radiation, or stray capacitance between the wires. The best method of

achieving this is to mount the filter where the AC power enters the enclosure. "AC Line Filter Installation" shows a good installation and a poor installation.

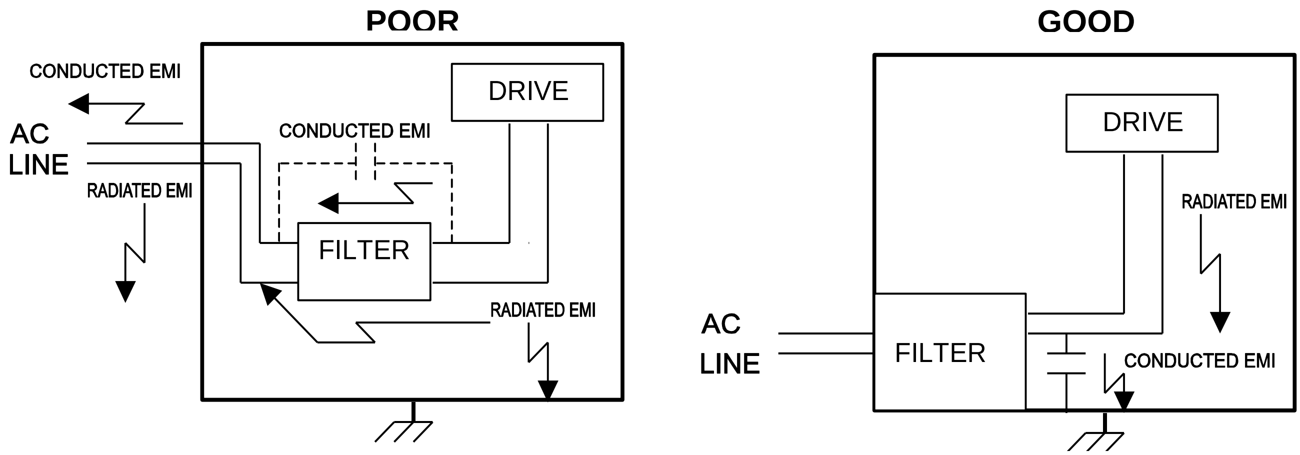

Figure 2- AC Line Filter Installation

When multiple power cables enter A unfiltered line can contaminate a filtered line external to the enclosure. Therefore, all lines must be filtered to be effective. The situation is similar to a leaky boat. All the holes must be plugged to prevent sinking.

If the filter is mounted excessively far from the drive, it may be necessary to mount it to a grounded conductive surface, such as the enclosure, to establish a high frequency (HF) connection to that surface. To achieve the HF ground, direct contact between the mounting surface and the filter must be achieved. This may require removal of paint or other insulating material from the cabinet or panel.

WARNING

Large leakage currents exist in AC line filters. They must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels prior to handling the equipment. Failure to observe this precaution could result in severe bodily injury.

The only reasonable filtering at the drive output terminals is the use of inductance. Capacitors would slow the output switching and deteriorate the drive performance. A common mode choke can be used to reduce the HF voltage at the drive output. This will reduce emission coupling through the drive back to the AC line. However, the motor cable still carries a large HF voltage and current. Therefore, it is very important to segregate the motor cable from the AC power cable. More information on cable shielding and segregation is contained in the section on shielding.

Grounding

High frequency (HF) grounding is different from safety grounding. A long wire is sufficient for a safety ground, but is completely ineffective as a HF ground due to the wire inductance. As a rule of thumb, a wire has an inductance of 8 nH/in regardless of diameter. At low frequencies, it acts as constant impedance, at intermediate frequencies as an inductor, and at high frequencies as an antenna. The use of ground straps is a better alternative to wires. However, the length to width ratio must be *5:1,* or better yet 3:1, to remain a good high frequency connection.

The ground system's primary purpose is to function as a return current path. It is commonly thought of as an equipotential circuit reference point, but different locations in a ground system may be at different potentials. This is due to the return current flowing through the ground systems finite impedance. In a sense, ground systems are the sewer systems of electronics and as such are sometimes neglected.

The primary objective of a high frequency ground system is to provide a well-defined path for HF currents and to minimize the loop area of the HF current paths. It is also important to separate HF grounds from sensitive circuit grounds. “Single Point Ground Types” shows single point grounds for both series (daisy chain) and parallel (separate) connections. A single point, parallel connected ground system is recommended.

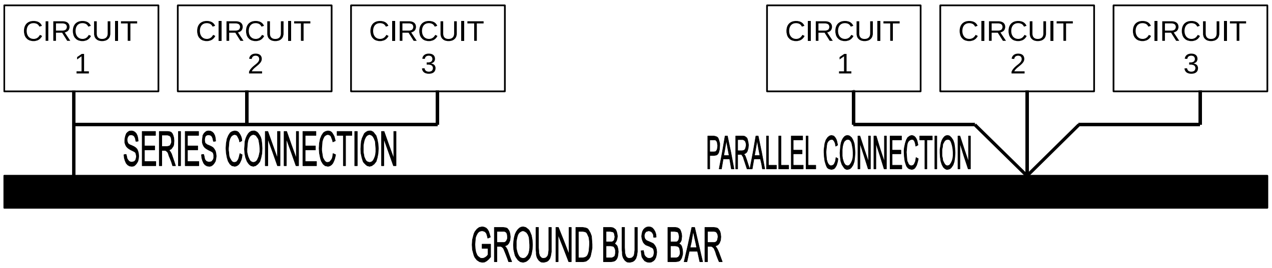

Figure 3-Single Point Ground Types

A ground bus bar or plane should be used as the “single point” where circuits are grounded. This will minimize common (ground) impedance noise coupling. The ground bus bar (GBB) should be connected to the AC ground, and if necessary, to the enclosure. All circuits or subsystems should be connected to the GBB by separate connections. These connections should be as short as possible and straps should be used when possible. The motor ground conductor must return to the ground terminal on the drive, not the GBB.

Shielding and Segregation

The EMI radiating from the drive enclosure drops off very quickly over distance. Mounting the drive in an enclosure, such as an industrial cabinet, further reduces the radiated emissions. The cabinet should have a high frequency ground and the size of the openings should be minimized. In addition, the drive is considered an “open” device that does not provide the proper IP rating for the environment in which it is installed. For this reason, the enclosure must provide the necessary degree of protection. An IP rating or Nema rating (which is similar to IP) specifies the degree of protection that an enclosure provides.

The primary propagation route for EMI emissions from a drive is through cabling. The cables conduct the EMI to other devices, and can also radiate the EMI. For this reason, cable segregation and shielding are important factors in reducing emissions. Cable shielding can also increase the level of immunity for a drive.

For example:

- Shield termination at both ends is extremely important. The common misconception that shields should be terminated at only one end originates from audio applications with frequencies $\leq$20 kHz. RF applications must be terminated with the shield at both ends, and possibly at intermediate points for exceptionally long cables.

- When shielded cables are not terminated at the cable connection and pass through the wall of a cabinet, the shield must be bonded to the cabinet wall to prevent noise acquired inside the cabinet from radiating outside the cabinet, and vice versa.

- When shielded cables are terminated to connectors, the shield must be able to provide complete 360^0 coverage and terminate through the connector backshell. The shield must *not* be grounded inside the connector through a drain wire. Grounding the shield inside the connector couples the noise on the shield to the signal conductors sharing the connector and virtually guarantees failure to meet European EMC requirements.

- The shield must be continuous. Each intermediate connector must continue the shield connection through the backshell.
- All cables, both power and signal should use twisted wire pairing.

The shield termination described above provides a coaxial type of configuration, which provides magnetic shielding, and the shield provides a return path for HF currents that are capacitive coupled from the motor windings to the frame. If power frequency circulating currents are an issue, a 250 VAC capacitor should be used at one of the connections to block 50/60 Hz current while passing HF currents. Use of a properly shielded motor cable is essential to meet European EMC requirements.

The following suggestions are recommended for all installations.

1. Motor cables must have a continuous shield and be terminated at both ends. The shield must connect to the ground bus bar or drive chassis at the drive end, and the motor frame at the motor end. Use of a properly shielded motor cable is essential to meet European EMC requirements.
2. Signal cables (encoder, serial, and analog) should be routed away from the motor cable and power wiring. Separate steel conduit can be used to provide shielding between the signal and power wiring. Do not route signal and power wiring through common junctions or raceways.
3. Signal cables from other circuits should not pass within 300 mm (1 ft.) of the drive.
4. The length or parallel runs between other circuit cables and the motor or power cable should be minimized. A rule of thumb is 300 mm (1 ft.) of separation for each 10 m (30 ft.) of parallel run. The 300 mm (1 ft.) separation can be reduced if the parallel run is less than 1 m (3 ft.).
5. Cable intersections should always occur at right angles to minimize magnetic coupling.
6. The encoder mounted on the brushless servomotor should be connected to the drive with a cable using multiple twisted wire pairs and an overall cable shield. Encoder cables are offered in various lengths that have correct terminations.

Persistent EMI problems may require additional countermeasures. The following suggestions for system modification may be attempted.

1. A ferrite toroid or “doughnut” around a signal cable may attenuate common mode noise, particularly RS-232 communication problems. However, a ferrite toroid will not help differential mode noise. Differential mode noise requires twisted wire pairs.
2. Suppress each switched inductive device near the servo drive. Switch inductive devices include solenoids, relay coils, starter coils and AC motors (such as motor driven mechanical timers).
3. DC coils should be suppressed with a “free-wheeling” diode connected across the coil.
4. AC coils should be suppressed with RC filters (a 200 Ohm 1/2 Watt resistor in series with a 0.5 µF, 600 Volt capacitor is common).

Following these guidelines can minimize noise problems. However, equipment EMC performance must meet regulatory requirements in various parts of the world, specifically the European Union. Ultimately, it is the responsibility of the machine builder to ensure that the machine meets the appropriate requirements as installed.

Declaration of Incorporation Motion Control Systems

EUROPEAN UNION
DECLARATION OF INCORPORATION
MOTION CONTROL SYSTEMS

Classified as Components of Machinery

Model Series SMA5005 & SMA5015

Council Directive 89/392/EEC Machinery Directive

The Products cited below and their accessories comply with the following Safety of Machinery Standards when installed and operated in accordance with the Instructions provided in the Operation & Installation Manuals. The products are declared to comply by virtue of Design Third Party Evaluations and Testing. EMC Testing and Product Safety Evaluations and Risk Assessments were conducted by Intertek ETL SEMKO, an independent Nationally Recognized Test Laboratory, located in Laguna Niguel, CA 92677, USA.

As components of Machinery, please be advised that:

1. These are not individually classified as machinery within the scope of directive 89/392/EEC.
2. These are intended to be incorporated into machinery or to be assembled with other machinery to constitute machinery covered by directive 89/392/EEC, as amended.
3. As such, do therefore not in every respect comply with the provisions of directive 89/392/EEC.

SAFETY STANDARDS

EN60204-1 (IEC204-1)	Electrical Equipment of Industrial Machines
	Collateral Test Standards, Specified by EN60204-1
EN61000-6-4:2001	EMC – Emission standard for industrial environments
EN61000-6-2:2001	EMC – Immunity for industrial environments
	Collateral Test Standards, Specified by EN61000-6-2

Manufacturers Name:	GLENTEK INC.
Manufacturers Address:	208 Standard Street El Segundo, CA 90245, USA
Description of Equipment:	Motion Control Systems including Drives and Servo Motors
Model / Type Reference:	Linear Brush series: SMA5005-ab-ccc where a may be by 4, S, L, or blank, b may be LB or SF, and c may be 0 to 9 or A to F, maybe followed by a 1, 2A or 4A. Maybe followed by a 0, 1, 2, 3 or 4. Linear Brush series: SMA5015-ccc, where c may be 0 to 9 or A to F, followed by 1A-1.

The undersigned hereby declares that the equipment specified above conforms to the noted Directives and Standards.

MANUFACTURER

Helen M. Vasak

HELEN M. VASAK

SECRETARY-TREASURER

6-1-2021

Prepared By: Intertek Testing Services, Laguna Niguel, CA
Confirmed By: John Quigley, Quality Manager

Digital PWM Brushless Servo Drives

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

Analog Brush Type Servo Drives

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

Analog Brushless Servo Drives

- Linear Brushless servo Drives to 3.5KW
- PWM (Pulse-Width-Modulated) Brushless servo Drives 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: (F)
DATE: 1 JUN 2021

208 Standard Street, El Segundo, California 90245, USA.
Telephone: (310) 322-3026; Fax: (310) 322-7709
www.glentek.com e-mail: sales@glentek.com