INSTALLATION

&

OPERATION MANUAL

Model SMB9675-1A-1-7700

GLENTEK

"Solutions for Motion Control"

FADAL REPLACEMENT
SPINDLE DRIVE

MANUAL#: 9675-1035-000
REVISION: (B)
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Chapter One: General

1.1 Overview

The Glentek Inc. SMB9675-1A-1-7700 spindle drive uses flux vector technology to close a torque (current) feedback loop. When applied to a three phase induction motor, the result is servo motor like performance from a standard three phase induction motor. The Digital Signal Processor (DSP) based spindle drive uses its high speed math processing capability to continuously calculate flux and torque vectors and to maintain a constant 90 degree phase difference between the vectors. This technique allows torque control from zero speed to base speed and above. Encoder feedback provides the shaft position data needed to calculate the vectors and velocity data, thus, Vector Control allows precise speed control down to and including zero speed of an induction motor.

The SMB9675-1A-1-7700 spindle drive can operate in sensor-less mode (no feedback is needed). This mode of operation is usually referred to as inverter mode or VFD (Variable Frequency Drive) mode. With advanced mathematic algorithms and the latest DSP technology, the Glentek SMB9675-1A-1-7700 is optimized to produce a steady starting torque from standstill right up to full speed with high efficiency. The applied frequency and voltage are increased at a controlled rate and ramped up to accelerate the load without drawing excessive current.

1.2 Intended Application

The SMB9675-1A-1-7700 is intended as a drop-in replacement spindle drive for FADAL ENGINEERING VMC's. See the part numbers listed in the Mode of Operations section (Section 1.3) for the available configurations.

1.3 Mode of Operation

Changing the Mode of Operation dial (SW1) (see drawing D-2 Vector Drive Installation Drawing 2 for dial location) will modify the configuration of the spindle drive. Aligning the dial to any of the positions listed below will alter the drive to those settings. If none of the settings below match your preferences, please contact one of Glentek's sales engineers for assistance. The drive is shipped with the dial at position 0 (zero).

To change modes, rotate the dial to the desired position before installation or disable the drive with an M5 (spindle stop) command BEFORE rotating the dial. The four rightmost seven-segment displays will display the operation mode selected (i.e. 7700, 7701, etc.) for seven seconds, then it will revert back to displaying motor rpm. Enable the drive to run in the new mode.

Mode of Operation Position Settings

Position	Power (HP)	RPM	Sensor/VFD	Part Number	Model Number
0	15	10K	Sensor	7700	SMB9675-1A-1-7700
1	15	7.5K	Sensor	7701	SMB9675-1A-1-7701
2	15	10K	VFD	7702	SMB9675-1A-1-7702
3	10	10K	Sensor	7703	SMB9675-1A-1-7703
4	10	7.5K	Sensor	7704	SMB9675-1A-1-7704
5	10	10K	VFD	7705	SMB9675-1A-1-7705
6	20	10K	Sensor	7707	SMB9675-1A-1-7707
7	20	7.5K	Sensor	7708	SMB9675-1A-1-7708
8	20	10K	VFD	7709	SMB9675-1A-1-7709
9	5	10K	Sensor	7710	SMB9675-1A-1-7710
A	5	7.5K	Sensor	7711	SMB9675-1A-1-7711
B	5	10K	VFD	7712	SMB9675-1A-1-7712
C	-	-	-	-	-
D	-	-	-	-	-
E	-	-	-	-	-
F	-	-	-	-	-

Note: Positions C, D, E, and F are reserved for future configurations.

Chapter Two: Installing a Glentek Spindle Drive into a Fadal VMC

2.1 Removing the old drive

Turn off the power to the VMC and wait 5 minutes before beginning removal. Disconnect all the wires and cables. If any wires are not labeled take note of their location. Of the cables, only the Control cable and the Delta/Wye cable can be confused, both are 6 terminal connectors. The control cable has 6 sockets in the connector and Delta/Wye cable has 3 sockets in the connector. Unbolt the old drive and remove.

2.2 Mechanical Installation

The new drive may be mounted with four screws, four studs and nuts, or a combination of the two, depending on the machine. Install the drive (slots down) by first resting the drive on the lower mounting studs or loosened screws in the cabinet and positioning the drive over the studs at the top. Hold the drive against the cabinet and loosely install four screws or nuts, top two first. Then tighten all four screws or nuts.

2.3 Electrical Installation

2.3.1 Power Terminal Block Connections

Begin the wiring by connecting the AC, regenerative braking, motor, and green ground wires. Match the wire labels to the terminal block labels. Check connections for tightness. (See Appendix A for more details.)

2.3.2 Load Meter Cable

Connect the load meter cable by connecting the black wire to P1-1 screw terminal and the red wire to P1-2.

2.3.3 Spindle Control Cable

Connect the spindle control cable to P2. The spindle control cable has 6 sockets installed; do not confuse it with the wye/delta connector, which only has 3 sockets installed.

2.3.4 Wye/Delta Cable

Connect the wye/delta cable to P4 (wye/delta is an option for 7500 RPM spindles; your VMC may not have this cable).

2.3.5 Encoder Feedback Cable

Connect the encoder feedback from the motor (9 terminal connector) to P3 (VFD drives do not need this cable).

2.3.6 Rigid Tap Cable (Encoder Output To CNC Control)

For VMC's with the Rigid Tap option, connect the rigid tap cable from the CNC to P5 of the spindle drive. Use the installation drawing (see Appendix D) to match the wires by color to the correct terminal.

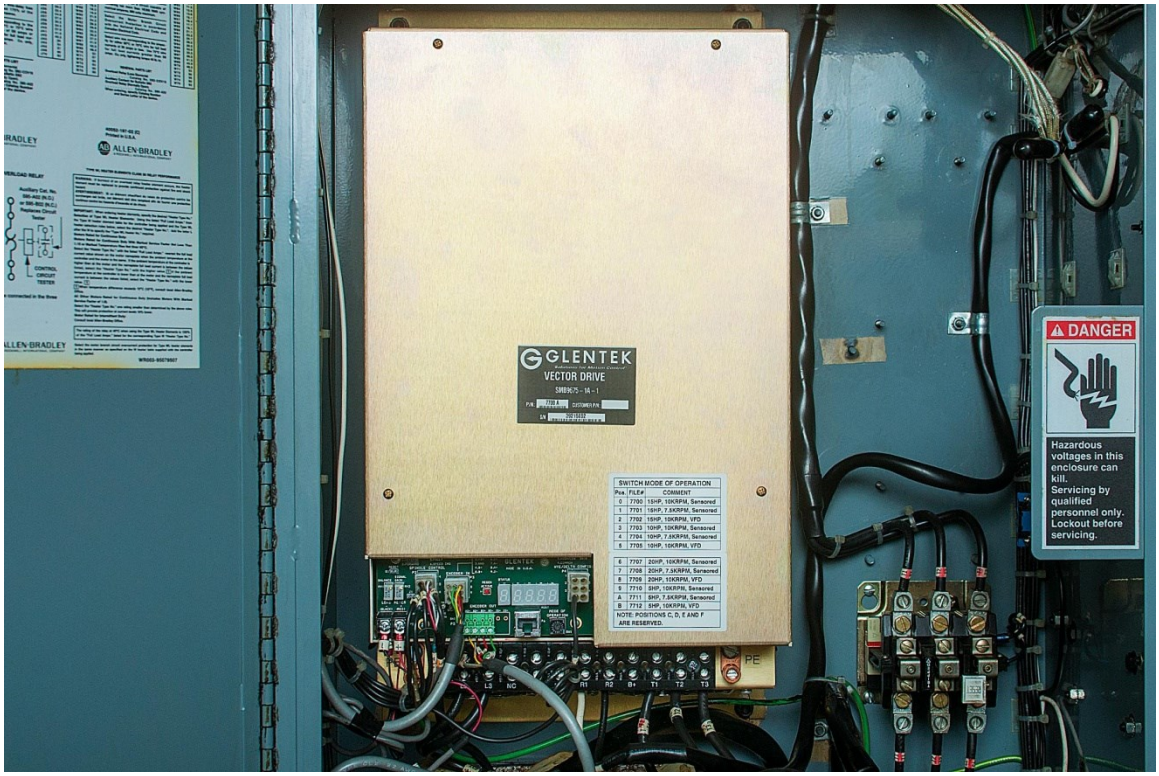


Photo 1: A successful spindle drive installation.

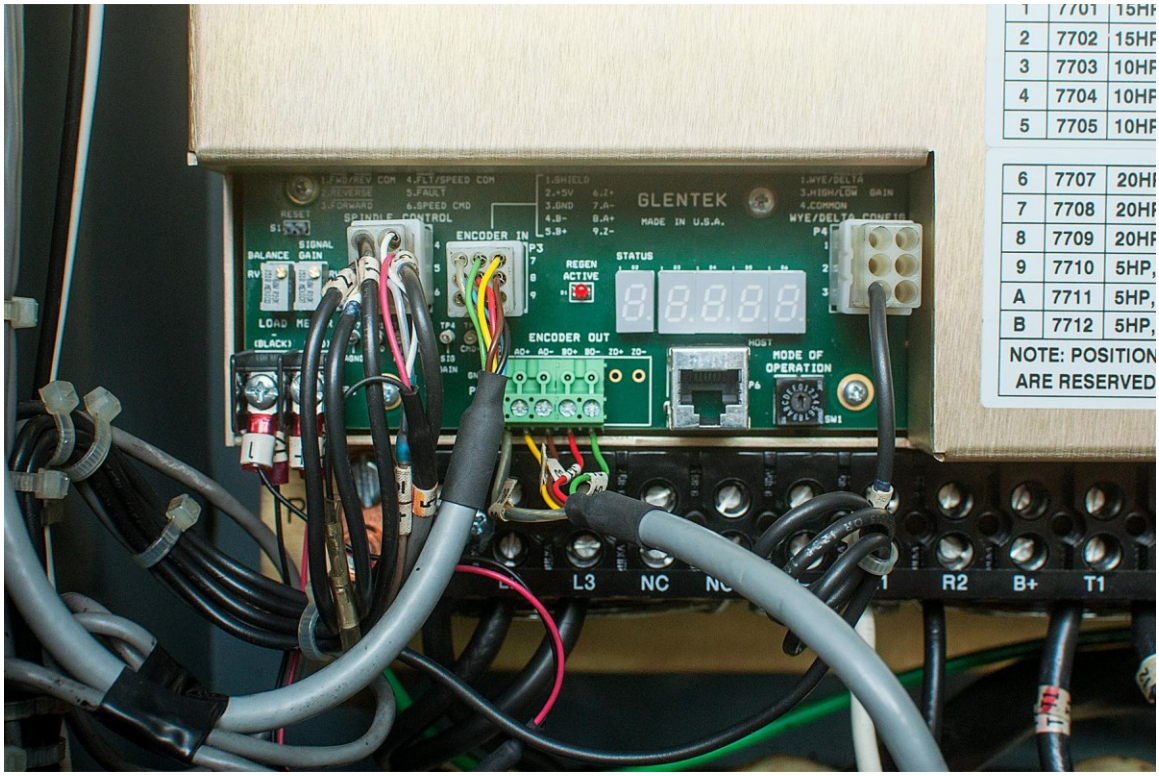


Photo 2: Close up of a successful spindle drive installation.

Chapter Three: Initialization and Power Up

3.1 Before Any Initialization

The only setup required by the end user is to select the mode of operation (see Section 1.3 for changing the mode of operation). All the tuning has been preset at the factory, meaning the drive will run correctly. If applying minor changes (adjusting input command offsets, etc.) to the spindle drive, use the procedures below for reference.

3.2 Turning the Power On

Carefully recheck the wiring. Restore power to the VMC. For seven seconds the four rightmost seven-segment displays will show the spindle drive configuration. Afterwards, those four displays will show the rpm value of the spindle motor, not the spindle itself. Confirm the desired mode of operation has been selected.

3.4 Operating the Spindle

From the VMC control panel operate the spindle and confirm the spindle runs at the commanded speeds and in the correct direction (CW and CCW). It is important to note, the 4 digit display on the drive reports the speed of the spindle motor, the speed of the spindle itself may be different depending on the machine design and mode. The drive calculates the rpm from the encoder signals when operating in vector mode, when the drive is used in VFD or inverter mode (no encoder) the rpm is calculated from the input command signal voltage received from the Fadal control.

3.5 Pot Adjustments

Normally, no adjustments are needed. However, for convenience, there are 2 pots (see drawing D-2 Vector Drive Installation Drawing 2 for pot locations), the signal gain and the balance. These pots have limited range and are only for small adjustments. The signal gain pot should always be adjusted first. To adjust the signal gain, command 500 rpm from the control panel and take note of the ***motor*** rpm as reported by the inverter drive digital display. Now command 1000 rpm and note the ***motor*** rpm, it should be double the rpm noted when commanding 500 rpm. Adjust the signal gain pot as needed.

Continue commanding 1000 rpm. Fadal VMC's may have motor/spindle ratios of 2:1, 1:1, 1:2, and 1:3. Adjust the balance pot until the inverter drive digital display reads the calculated ***motor*** rpm below.

2:1 = 2000 rpm	1:1 = 1000 rpm	1:2 = 500 rpm	1:3 = 333 rpm

3.6 Rigid Tap Test (Optional)

If desired you can test the rigid tap mode of your VMC by performing the following procedure. This procedure is drawn from the FADAL maintenance manual. Install the test screw (SVT-0077) in a toolholder and place in the spindle. The screw can be fabricated from 1.000" round stock, by

threading a 14 TPI Acme thread. Program is for Format 1. Use test program #6000 or the following program:

```
%
N1 O6000 (RIGID TAP CYCLE)
N2 G84.2
N3 G84.1 R0+0 Z-1. Q0.0714 F500.
N4 X0.0001
N5 X-0.0001
N6 M99 P4
%
```

Once the program is loaded, jog the z axis down to an appropriate height so that the screw can be indicated. Type “SETZ” and press ENTER. If you moved from you home position, also type “SETX” and press ENTER, then type “SETY” and press ENTER.

Start the test program and observe that the program is running correctly. Press the SINGLE STEP key. Be sure the test screw returns to its original position.

Set the indicator as shown below in Photo 3. The tip of the indicator must be touching the bottom face of the thread halfway into the thread, the second thread from the bottom.

Press start to run the program observe the indicator. The reading should not deviate from zero by more than .002” on either side of zero. If necessary, consult the FADAL maintenance manual for your machine.

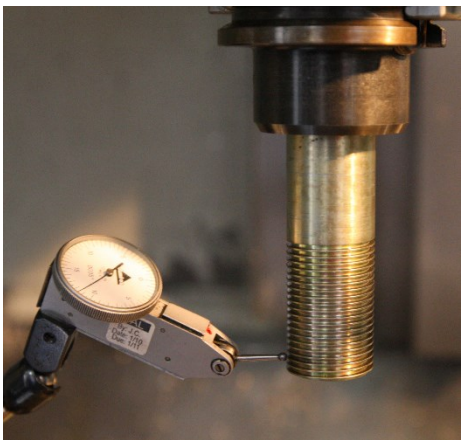


Photo 3: Test screw in setup with dial

Photo 4: Test screw

Photo 5: Test screw in toolholder

Chapter Four: Troubleshooting and Maintenance

4.1 Status Display Codes

Display	Name	Description	Possible Cause
1	EEPROM Fault	Parameter EEPROM checksum fault	Internal problem, contact Glentek
8	Reset	External reset	Improper configuration setting
8.	Reset	Drive processor is in reset	Internal problem, contact Glentek
A	Overspeed	Motor RPM is over speed limit	Mechanical linkage problem
b	Bus Over Voltage	DC bus exceeded 450VDC	Regenerative braking circuit not working, regen resistor does not match spindle, check fuse in regen circuit
C	Clamp (Disabled)	Spindle drive disabled	Control is disabling the drive
E	Encoder Fault	Encoder fault detected	Encoder faulty or encoder wiring broken
F	Foldback	Motor current draw exceeded set point	Mechanical binding in motor or spindle
H	Heatsink Over Temperature	Heatsink exceeded 65ºC	Fan(s) failed
L	LS/ECB	Motor RMS over current	Mechanical binding in motor or spindle
0	Normal Operation	Drive enabled	Normal when rotating
S	HS/ECB	Output short circuit detected	Motor windings shorting
U	Bus Under Voltage	DC bus below 50VDC nominal	AC input voltage to drive is low or off
Single segment	Normal Operation	Drive enabled	Normal @ zero speed

4.2 Maintenance

The only maintenance required is to periodically inspect the fans. The blades should be turn freely and built up dirt or dust should be removed from the blades.

Chapter Five: Warranty, Factory Repair, and Safety

5.1 Warranty

Any product, or part thereof, manufactured by Glentek, Inc., described in this manual, which under normal operating conditions, in the plant of the original purchaser, thereof proves defective in material or workmanship within one year from the date of shipment by us, as determined by an inspection by us, will be repaired or replaced free of charge, FOB our factory, El Segundo, California, U.S.A. provided that you promptly send to us notice of the defect and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage, and that no factory sealed adjustments have been tampered with. Glentek's liability is limited to repair or replacement of defective parts.

Any product or part manufactured by others and merely installed by us, such as an electric motor, etc., is specifically not warranted by us and it is agreed that such product or part shall only carry the warranty, if any, supplied by the manufacturer of that part. It is also understood that you must look directly to such manufacturer for any defect, failure, claim or damage caused by such product or part.

Under no circumstances shall Glentek Inc. or any of our affiliates have any liability whatsoever for claims or damages arising out of the loss of use of any product or part sold to you. Nor shall we have any liability to yourself or anyone for any indirect or consequential damages such as injuries to person and property caused directly or indirectly by the product or part sold to you, and you agree in accepting our product or part to save us harmless from any and all such claim.

5.2 Factory Repair

Should it become necessary to return a spindle drive to Glentek for repair, please follow the procedure described below:

1. Reassemble the unit, if necessary, making certain that all the hardware is in place.
2. Tag the unit with the following information:

    A. Serial number and model number
    B. Company name, phone number, and name of representative returning the unit
    C. A brief note explaining the malfunction
    D. Date the unit is being returned

3. Repackage the unit with the same care and fashion in which it was received. Label the package with the appropriate stickers (e.g. FRAGILE: HANDLE WITH CARE).
4. Contact a Glentek representative, confirm that the unit is being returned to the factory and obtain an RMA (Return Material Authorization) number. The RMA number must accompany the unit upon return to Glentek.
5. Return the unit by the best means possible. The method of freight chosen will directly affect the timeliness of its return.

5.3 Safety

- Serious or fatal injury can result from failure to work safely on this equipment.
- Only qualified personnel should install and maintain this spindle drive.
- The drive has capacitors that remain charged after the power is shutoff. Wait 5 minutes to allow the capacitors to discharge before removing the cover or working on the drive.
- Be sure the system is properly grounded before applying power.
- Regenerative braking resistors can generate temperatures that ignite combustible materials or vapors. Keep all combustible materials way from braking resistors.
- Braking resistors should be shielded to prevent burn injuries.
- The motor will rotate when autotuning, take precautions to prevent injury and damage to equipment.

Appendix A - Spindle Drive Connections

A-1 Motor Power Connectors

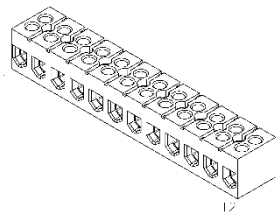


Table A-1.1 Motor Power Designations

Pin #	I/O	Name	Function
1	Input	L1	AC LINE 1, three phase AC input
2	Input	L2	AC LINE 2, three phase AC input
3	Input	L3	AC LINE 3, three phase AC input
4	Rsvd	N/C	Reserved
5	Rsvd	N/C	Reserved
6	Output	B-	DC BUS Return output
7	Output	R1	Brake/Regen resistor output
8	Output	R2	Brake/Regen resistor output
9	Output	B+	DC BUS + output
10	Output	T1	Motor Output Phase T1
11	Output	T2	Motor Output Phase T2
12	Output	T3	Motor Output Phase T3

Table A-1.2 Motor Power Connectors

Connector Type/Description	12-Pin Terminal Block
Terminal Block, Barrier, 12 Position, 10-4 AWG	Marathon 985-GP-12

A-2 Controller I/O Connectors

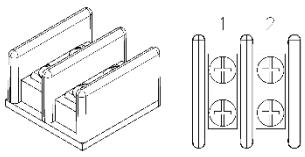


Table A-2.1 Load Meter Designations: Labeled as P1 on spindle drive

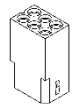
Pin #	I/O	Name	Function
1	Output	- (BLACK)	GND
2	Output	+ (RED)	Current Monitor Output

Table A-2.2 Load Meter Connector

Connector Type/Description	2-Pin Terminal Block
Terminal Block, Single Row,2 Position, 22-12 AWG	Magnum A202202NL

Table A-2.3 Spindle Control Designations: Labeled as P2 on spindle drive

Pin #	I/O	Name	Function
1	Input	$\overline{\text{FWD}}/\overline{\text{REV}}$ COM	Spindle Common (for Forward & Reverse)
2	Input	$\overline{\text{REVERSE}}$	Spindle Reverse
3	Input	$\overline{\text{FORWARD}}$	Spindle Forward
4	Input	$\overline{\text{FLT}}$/SPEED COM	CMD Common (for Fault & Speed)
5	Input/ Output	$\overline{\text{FAULT}}$	Emergency Stop/Spindle Fault
6	Output	SPEED CMD	Spindle Speed Command



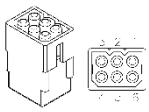


Table A-2.4 Wye/Delta Config Designations: Labeled as P4 on spindle drive

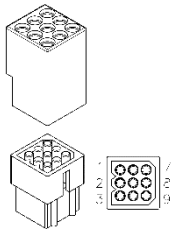
Pin #	I/O	Name	Function
1	Input	WYE / $\overline{\text{DELTA}}$	Wye or Delta modes
2	N/C	Reserved	Reserved
3	Input	HIGH / $\overline{\text{LOW}}$ GAIN	High Gain or Low Gain modes
4	Input	Common	Common for Wye/Delta and High Gain/Low Gain modes
5	N/C	Reserved	Reserved
6	N/C	Reserved	Reserved

Table A-2.5 Spindle Control and Wye/Delta Config Connectors

Connector Type/Description	6-Pin Male Mating Connector Housing	Female Crimp Terminal
Receptacle, 6 Position, 22-18 AWG	Molex 03-09-1064	Molex 02-09-1119

A-3 Encoder Input Connector

Table A-3.1 Encoder Input Designations: Labeled as P3 on spindle drive.



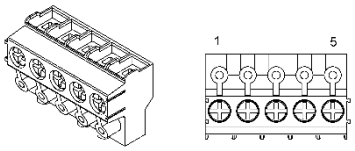
Pin #	I/O	Name	Function
1	Input	Shield	Cable Shield
2	Power	+5V	Encoder +5VDC out, 150mA max
3	Power	GND	Encoder Power Return
4	Input	B -	Encoder Channel B -
5	Input	B +	Encoder Channel B +
6	Input	Z +	Encoder Index + (Channel Z +)
7	Input	A -	Encoder Channel A -
8	Input	A +	Encoder Channel A +
9	Input	Z -	Encoder Index - (Channel Z -)

Table A-3.2 Encoder Input Connector

Connector Type/Description	9-Pin Male Mating Connector Housing	Female Crimp Terminal
Receptacle, 9 Position, 22-18 AWG	Molex 03-06-1092	Molex 02-06-1103

A-4 Encoder Output Connector

Table A-4.1 Encoder Output Designations: Labeled as P5 on spindle drive.



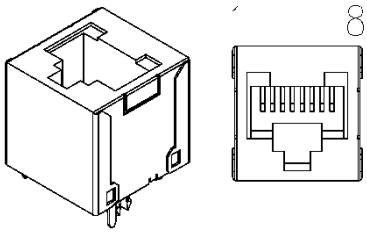
Pin #	I/O	Name	Function
1	Power	GND	Encoder Power Return
2	Output	AOut +	Encoder Channel A +
3	Output	AOut -	Encoder Channel A -
4	Output	BOut +	Encoder Channel B +
5	Output	BOut -	Encoder Channel B -

Table A-4.2 Encoder Output Connector

Connector Type/Description	5-Pin Terminal Block
Terminal Block,5 Position, 22-12 AWG	Phoenix Contact 1934890

A-5 Host (Serial Communication) Connector

Table A-5.1 Host (Serial Communication) Designations: Labeled as P6 on spindle drive.



Pin #	I/O	Name	Function
1	Reserved	Reserved	Reserved
2	Reserved	Reserved	Reserved
3	Reserved	Reserved	Reserved
4	Input/output	COMMON	Logic Ground
5	Output	RS-232 TX	RS-232 Transmit
6	Input	RS-232 RX	RS-232 Receive
7	Reserved	Reserved	Reserved
8	Reserved	Reserved	Reserved

Table A - 5.2. Host (Serial Communication) Connector

Connector Type/Description	8-Pin Male Mating Connector
Standard Commercial, RJ-45	Commercial, RJ45

A-6 Power and Signal Wiring

A-6.1 Recommend 3-phase input, 3-phase output, and chassis GND power wiring, 8 AWG (8.36 mm^2) or larger, 105°C rated PVC or better.

A-6.2 Recommend BUS+, BUS Return, and brake power wiring, 10 AWG (5.26 mm^2) or larger, 105°C rated PVC or better.

A-6.3 Recommend all signal wiring, 22 AWG (0.326 mm^2) or larger, 105°C rated PVC or better.

Appendix B - Spindle Drive Connection Interface

This section describes the spindle drive connections and how they are used in the typical application. Refer to the spindle drive's installation drawings in Appendix D. This drawing indicates the location of the pins described below along with the location of the connector they can be found on.

B-1 Status and RPM Display

Five 7-segment LED displays are provided for displaying the status and RPM of the spindle drive. (See drawing D-2 Vector Drive Installation Drawing 2 for LED display locations.)

The left most LED is the drive status display. If the motor is properly commutated, the outermost segments of the LED display will light up one-by-one in a sequential manner when the motor runs. If the motor reverses direction, the LED will cycle through the segments in the opposite direction.

When the motor's current is clamped, (i.e. held to zero), or the spindle drive is in a fault condition, one of the fault characters will be displayed as is appropriate to the fault or state.

Note: See Chapter 4 for more information on Drive status codes.

The four LEDs on the right are the RPM display. For drives in vector control mode, the actual motor speed is shown. For drives in VFD mode, when the drive is operating normally, the commanded motor speed is shown.

Note: Motor speed and spindle speed will not necessarily be the same. Fadal VMC's may have motor/spindle ratios of 2:1, 1:1, 1:2, and 1:3.

B-2 Controller Input and Output Signals

Signals that typically are connected to an external controller are described in this section. These signals include the primary command signal interface to the spindle drive, Forward/Reverse, Wye/Delta, Hi Gain/Lo Gain, Estop/Fault, load meter, encoder output signal, and common.

Signal	Description
SPEED CMD	Command signal analog input, reference to CMD Common.
SPINDLE $\overline{\text{FORWARD}}$	Enable the motor in the CCW direction.
SPINDLE $\overline{\text{REVERSE}}$	Enable the motor in the CW direction.
WYE / $\overline{\text{DELTA}}$	Enable the motor either in WYE or DELTA mode.
HIGH / $\overline{\text{LOW}}$ GAIN	Enable the motor either in HI or LO gain mode.
$\overline{\text{ESTOP}}$ / $\overline{\text{FAULT}}$	Bi-directional, functions as Emergency Stop input or Fault output.
LOAD METER	Analog output, indication of the load current on the motor.
AOut	Encoder A channel Output.
BOut	Encoder B channel Output.
ZOut	Encoder Z index Output (not used).

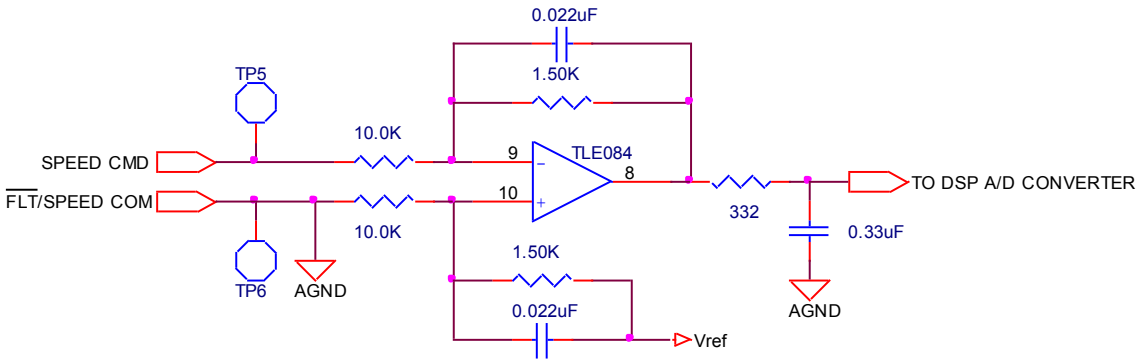
For the actual pin out of above signals, see Appendix A - Controller I/O Connector section

B-3 Analog Input, Command Signal

Pins SPINDLE CMD and $\overline{\text{FLT}}$/SPEED COM are the command input pins. The command input takes a differential analog signal as referenced to the spindle drive's ground. Input voltage is expected to range from -10 volts to +10 volts (typical).

The velocity command signal will be 0 to +10 VDC in unipolar control (non-rigid tap mode), ±10 VDC for bipolar control (rigid tap mode).

Note: CMD COMMON (AGND) is connected to Logic Common (Digital GND) inside the spindle drive.



Command Signal Analog Input Schematic

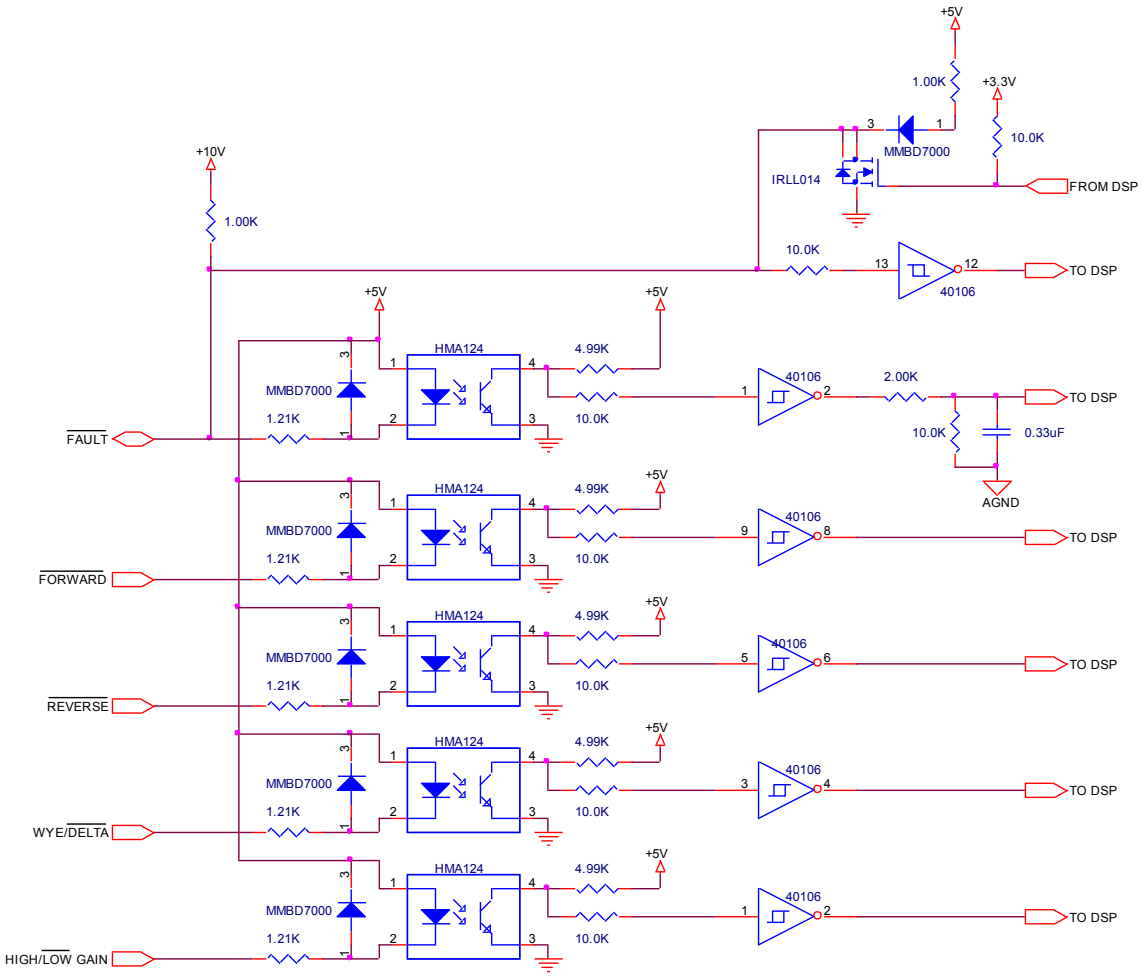
B-4 Controller Inputs/Outputs - Direction Control, WYE / $\overline{\text{DELTA}}$, HIGH/$\overline{\text{LOW}}$ GAIN Inputs, $\overline{\text{ESTOP}}$ Input, and $\overline{\text{FAULT}}$ Output

The spindle drive accepts SPINDLE $\overline{\text{FORWARD}}$ and SPINDLE $\overline{\text{REVERSE}}$ signals for operating four rotation commands.

$\overline{\text{FORWARD}}$	$\overline{\text{REVERSE}}$	ACTION
closed	open	drive on, CCW rotation, unipolar speed control
open	closed	drive on, CW rotation, unipolar speed control
closed	closed	drive on, bipolar speed and direction control
open	open	drive off, no voltage or flux to the motor

SPINDLE $\overline{\text{FORWARD}}$ and SPINDLE $\overline{\text{REVERSE}}$ are enable and direction control signals. That is, each signal enables motor movement in one direction. If both signals are closed (the signals are pulled low), motor movement in both directions is enabled. When only one enable is closed ($\overline{\text{FORWARD}}$ or $\overline{\text{REVERSE}}$ on), the velocity command is unipolar, and when both enables are closed ($\overline{\text{FORWARD}}$ and $\overline{\text{REVERSE}}$ on), the velocity command is bipolar.

When both $\overline{\text{FORWARD}}$ and $\overline{\text{REVERSE}}$ are closed, the spindle drive is in rigid tap mode. When only $\overline{\text{FORWARD}}$ or $\overline{\text{REVERSE}}$ is closed, the spindle drive is in non-rigid tap mode (sometimes called "inverter" mode). Both rigid tap mode and non-rigid tap ("inverter") mode are used with vector drives. Inverters or VFD drives use non-rigid tap mode only.



Controller I/O Schematic

When FORWARD and REVERSE are both open (signals are left floating) the spindle is off and spins freely. However, the change from closed to open (FORWARD and/or REVERSE on to both off) is also a signal to stop (just like Emergency Stop); the drive is never supposed to coast to a stop.

The change from WYE to DELTA or vice versa occurs only when the drive is off (FORWARD and REVERSE open) and the motor is stopped or below 50 rpm. When the CNC wants DELTA mode, the signal WYE / DELTA is pulled low.

When the CNC wants LOW GAIN, the signal HIGH / LOW GAIN is pulled low.

ESTOP and FAULT share the same I/O pin at the spindle drive. A spindle FAULT is declared by the spindle drive. Status good is 10 VDC thru a 1K pull-up resistor. 0 VDC indicates a fault condition to the CNC. The Fault output is open collector that can sink 500 mA max. When ESTOP is asserted (signal is pulled low), drive is to totally ignore FORWARD, REVERSE, and the velocity command, and ramp down to a stop.

B-5 Encoder Feedback

The following pin description defines the main encoder feedback input port.

Signal	Description
+5V	Drive supplied 5 volt source (output)
A+ / A -	Encoder A channel input
B + / B -	Encoder B channel input
Z + / Z -	Encoder Z channel input (not used)

The spindle drive can supply 5 volts of encoder power. The source is rated at 150 mA.

The encoder input uses a DS26LV32 differential line receiver. By default, the encoder feedback is configured for receiving differential signals (single-ended configuration is available upon request). The spindle drive accepts nominal encoder frequency of 5 MHz (maximum frequency of up to 10 MHz is possible, but is system dependent). The Z channel is edge sensitive such that swapping Z + and Z - does not change the behavior of the spindle drive.

B-6 Encoder Output

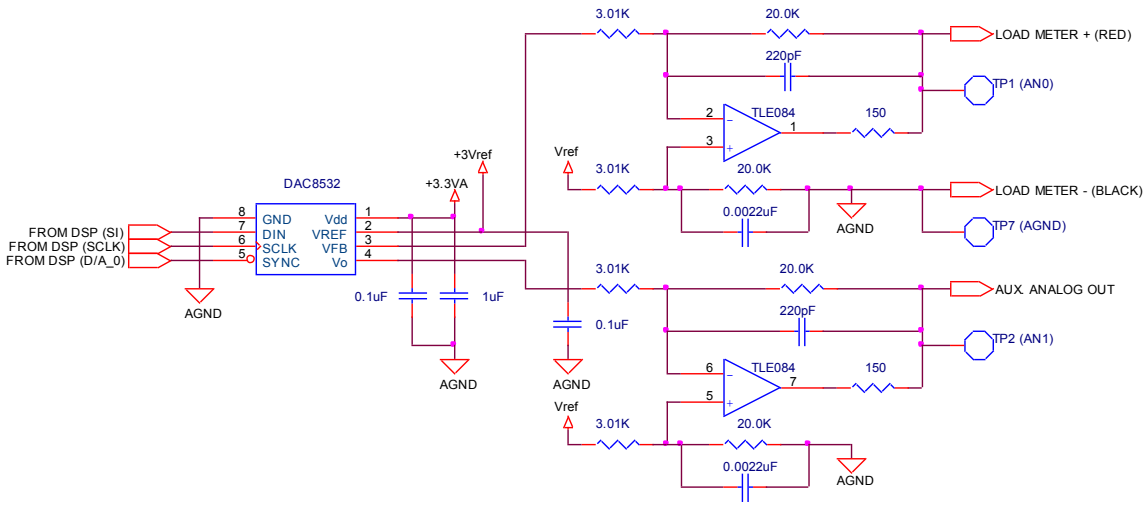
The encoder out signals are differential output signals. The encoder output pins are buffered representation of the motor encoder feedback. The encoder output uses a 26C31 differential line driver.

Encoder channels A and B are available as pins AOut +, AOut -, BOut +, BOut - on P5.

B-7 Load Meter Output

This is an indication of the load on the motor. The output ranges from -10 volts to +10 volts and has 16-bit resolution.

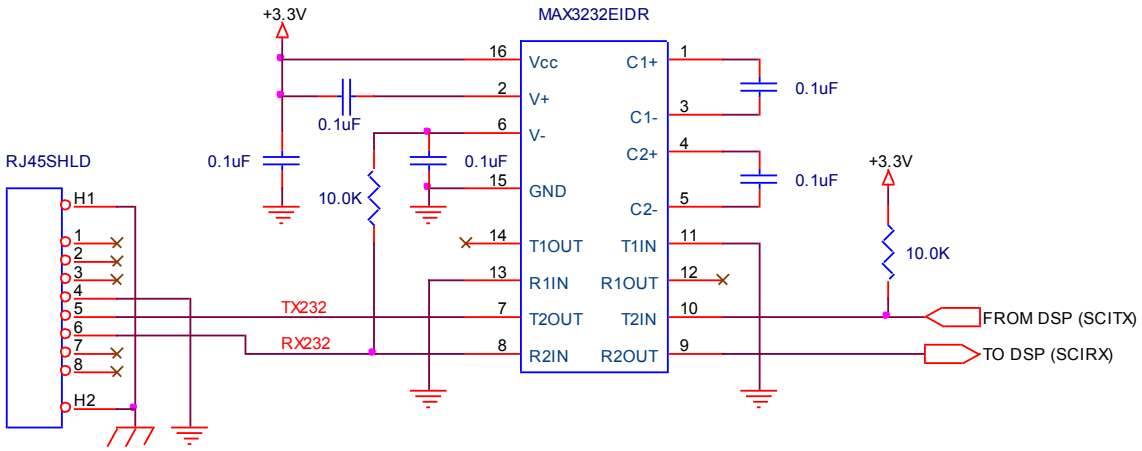
2.5 VDC = 100% absolute motor current (100% of continuous current)
3.75 VDC = 150% absolute motor current (150% of continuous current)



Load Meter Output Schematic

B-8 PC Interface

The PC interface can be found at the HOST connector. A RS-232 interface is on the external of the spindle drive. This port is the primary means of communication with the spindle drive for setup and control. The port utilizes an RJ-45 type connector.



RS-232 Input Schematic

The serial cable can be made or purchased for communicating with a PC by configuring a cable with one end being a male RJ-45 plug and the other end being a DB-9 female connector.

Note: If required, Glentek can customize a serial port digital interface to adapt to your controller as required to meet your protocols. We are currently doing this for high speed Ethernet ports.

B-9 Power Input and Motor Output

The signal names for power are listed below:

Pin Name	Description
L1, L2, L3	Input - AC voltage (line 1, line 2, and line 3, respectively).
PE	Protective Earthing, Chassis GND.
B+	Output - DC BUS +.
B-	Output - DC BUS Return.
R1	Output - Brake/Regen resistor.
R2	Output - Brake/Regen resistor.
PHASE T1	Output - Motor phase T1.
PHASE T2	Output - Motor phase T2.
PHASE T3	Output - Motor phase T3.

L1, L2, and L3 are 3-phase, 208-240 VAC, 50/60 Hz AC inputs. The maximum inrush current at power up is 510 A @ 240 VAC.

B+ and B- are unregulated DC BUS output (derived from 3-phase inputs). Total DC BUS capacitance is 4,080 uF. BUS under-voltage trips nominally at 50 VDC ± 5%. BUS overvoltage trips nominally at 450 VDC ± 5%.

R1 and R2 are external Regen resistor (brake) outputs. Acceptable resistance range is 12 - 30 Ohms. Regen turns on at 395 VDC ± 5%. Regen circuit uses a Ferraz Shawmut TRS10R time delay fuse.

Motor power is delivered at pins PHASE T1, T2 and T3. The motor power is Pulse Width Modulated signals used to drive the motor.

It is recommended that the wire size for 3-phase AC inputs and motor outputs is 8 AWG (8.36 mm^2) or larger, 105°C rated PVC or better.

It is recommended that the wire size for DC BUS, and Brake/Regen resistor inputs is 10 AWG (5.26 mm^2) or larger, 105°C rated PVC or better.

Note: It is best not to connect the motor power pins until it is established that the logic section is working and operational. This means that with the AC input pins connected, one should be able to communicate with the spindle drive via a serial cable and the motor encoder feedback should be functioning properly.

Appendix C - Application Software

C-1 MotionMaestro©

MotionMaestro is Glentek's Windows based application software that you will need to setup and tune the spindle drive. MotionMaestro has many features that allow users to easily configure and tune the entire Glentek digital product line. However, for the Fadal VMC replacement spindle drive most of the setup has been done at the factory. The installer only needs go through a quick tuning procedure to get the spindle drive up and running. But first, MotionMaestro needs to be installed.

C-2 Installing MotionMaestro

C-2.1 Requirements

MotionMaestro requires either Windows 95, Windows NT 4.0, Windows 98 SE, Windows 2000, Windows ME, Windows XP, Windows 7, or the Windows 8 operating system. A computer with a serial port or a USB port is also required. It is suggested that you have a minimum of 3 megabytes of application program disk space available prior to installation.

C-2.2 MotionMaestro v1.37

Only MotionMaestro v1.37 or later will work with Glentek Inc. spindle drives, earlier versions are not compatible.

C-2.3 Installation

The MotionMaestro install disk is set up to utilize *Install Shield* to simplify installation.There are only a few setup options offered. In general you can press NEXT or YES until installation is complete. When installation is complete, you will find a MotionMaestro icon in the Windows Start\Programs menu. The MotionMaestro installation program is named Setup.exe. It is found in the MotionMaestro \disk1 directory of the distribution CD, included with the spindle drive. The installation will also create a Glentek folder in the Program Files folder.

A MotionMaestro 1.37 folder is created when 1.37 installed. You can have multiple versions of MotionMaestro installed, if you wish, and they will be placed into their own directories. When MotionMaestro is directed to establish communications with the spindle drive, the spindle drive is queried for a model ID and Firmware version. MotionMaestro will configure itself and select the appropriate configuration files based on the spindle drive’s returned values.

C-3 Communicating With the Spindle Drive or VFD Drive

C-3.1 Serial Port

If your PC has a serial port (RS-232), you can connect to the spindle drive with Glentek cable (GTK # GC2400-AL005AM-000). This cable has a female DB-9 (computer) on one end and an RJ-45 (spindle drive) on the other.

Photo 6: Serial port on the spindle drive

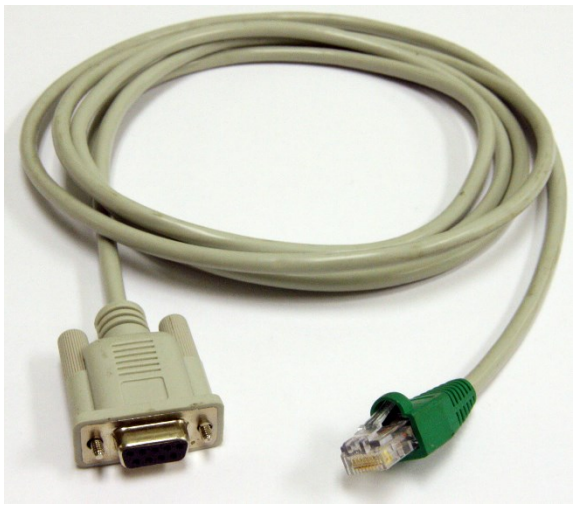
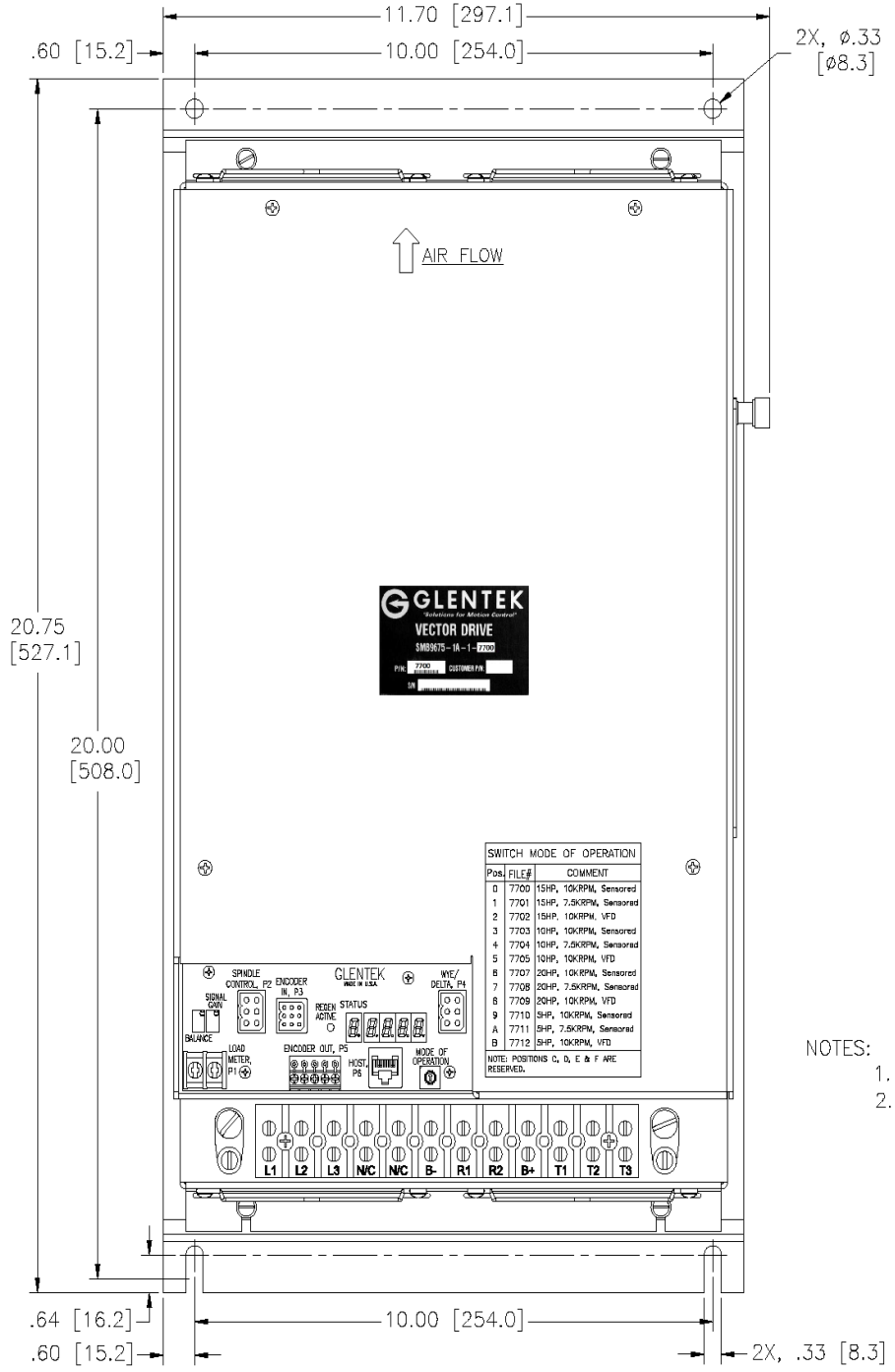


Photo 7: GC2400-AL005AM-000

C-3.2 USB Port

If your PC has a USB port, a USB to serial port (RS-232) adapter (GTK # GC2410-001) is necessary in addition to the cable above. Two known tested adapters are available: USBG-232 from USBGEAR and US232R-10 from FUTURE TECHNOLOGY DEVICES INTERNATIONAL Ltd.

Appendix D - Drawings & Diagrams



REVISION HISTORY						
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	1	INITIAL REVIEW	4207	13AUG15	NTHALLA	J.M.

Motor Power

Pin	Signal Name
L1	3 Phase AC Input
L2	3 Phase AC Input
L3	3 Phase AC Input
N/C	Reserved
N/C	Reserved
B-	B- Output
R1	Regen Resistor
R2	Regen Resistor
B+	B+ Output
T1	Motor Output Phase
T2	Motor Output Phase
T3	Motor Output Phase

Status Display

Display	Fault Description
1	EEPROM Fault
8	External Reset
8.	Drive Processor is in Reset
A	Overspeed
b	Bus Overvoltage
C	Clamp
E	Encoder Fault
F	Foldback
H	Heatsink Overtemp
L	LS/ECB
O	Normal Operation
S	HS/ECB
U	Under Voltage

P1 Load Meter

Pin	Signal Name
1	Load Meter - (Black)
2	Load Meter + (Red)

P2 Spindle Control

Pin	Signal Name
1	Forward/Reverse Common
2	Spindle Reverse
3	Spindle Forward
4	Fault/Speed Common
5	Fault
6	Speed Command

P3 Encoder Input

Pin	Signal Name
1	Shield
2	+5V
3	Ground
4	B -
5	B +
6	Z+
7	A -
8	A +
9	Z-

P4 Wye/Delta

Pin	Signal Name
1	Wye/Delta
2	N/C
3	High Gain/Low Gain
4	Common (Wye/Delta & High Gain/Low Gain)
5	N/C
6	N/C

P5 Encoder Output

Pin	Signal Name
1	GND
2	AOut +
3	AOut -
4	BOut +
5	BOut -
6	ZOut + (N/A)
7	ZOut - (N/A)

P6 Host

Pin	Signal Name
1	Reserved
2	Reserved
3	Reserved
4	COM232
5	TX232
6	RX232
7	Reserved
8	Reserved

Mating Connectors

		Provided
P2 / P4 Controller I/O 6-Pin Molex	Glentek P/N: EJ558M06; Molex P/N: 03-09-1064	No
P2 / P4 Controller I/O Pins	Glentek P/N: EJD21F09; Molex P/N: 02-09-1119	No
P3 Encoder Feedback 9-Pin Molex	Glentek P/N: EJ761M09; Molex P/N: 03-06-1092	No
P3 Encoder Feedback Pins	Glentek P/N: EJD21F06; Molex P/N: 02-06-1103	No
P6 Host RJ45	Glentek P/N: EJ018083; Molex P/N: 87522-8012	No
P6 Host RJ45	Glentek P/N: EJB61F05 ; Phoenix P/N: 1934890	Yes

Specifications and Features

AC Input Voltage	240 VAC 3-phase, 50/60 Hz
Inrush Current at Power Up	510A max @ 240VAC
Logic Power	Logic power is derived from Input BUS Voltage. Powers all amplifier logic and encoders (250 mA max.)
Peak Current Output	125 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	75 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis gnd). Amplifier RMS over current. DC bus over/under voltage. Encoder broken wire. Overspeed fault.
Drive Status Indication	7 segment display indicates drive status & diagnostics.
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (75 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	Trips nominally at 450VDC ± 5%
Bus Undervoltage	Trips nominally at 50VDC ± 5%
External Regen	Acceptable Resistance Range: 12 - 30 Ohms. Regen turns on at 395VDC ± 5%.
Drive Type	Sensored Vector Drive
Analog Command Input	±10V for analog velocity command
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	Wye/Delta, HI Gain/Lo Gain, Spindle Forward/Spindle Reverse
Bi-directional Input/Output	Emergency Stop input or Fault output
Analog Output/Load Meter	±10V Analog output for monitoring the load on the motor
RS-232 Host Port	High speed serial communication interface for set-up and tuning. 115.2 Kbaud, 8 bits, no parity, 1 stop bit
Software Configurable	All parameters are downloaded using the RS232 port / Glentek's Windows™ based MotionMaestro™ software.
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
Non-Volatile Memory	All parameters are stored in non-volatile memory
PWM Switching Frequency	5 KHz Standard
Amplifier Isolation	Logic completely isolated from high voltage output stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	6/16 x .75
Dimension (L x H x W - Inches)	L. 20.75, H. 8.02 W. 11.70
Backup File	7700-5.BK (for 15HP, 10KRPM, Sensored machine)

NOTES:

1. VECTOR CONFIGURATION SHOWN.
2. RECOMMENDED WIRE SIZE:
   L1, L2, L3, – 8 AWG [6.63 mm²]
   R1, R2, – 10 AWG [5.26 mm²]
   T1,T2,T3, – 8 AWG [6.63 mm²]
   CONTROL SIGNALS – 22 AWG [0.326 mm²]
3. REGEN FUSE IS FERRAZ SHAWMUT TRS10R. REMOVE FUSE COVER TO CHANGE THIS FUSE.
4. MAINTAIN MINIMUM OF 2"–3" SPACE AT BOTH ENDS TO ENSURE PROPER VENTILATION.

APPROVAL	DATE
DWN BY: NTHALLA	13AUG15
CHK'D BY: L.P.	13AUG15
APP'D BY: J.M.	13AUG15

GLENTEK "Solutions for Motion Control"

DRAWING TITLE: INSTALLATION, VECTOR DRIVE, SMB9675-1A-1-7700

SIZE	MODEL	DRAWING NUMBER	REV
D	SMB9675-1A-1	7700-1	1

SCALE: 1:1.25 FILE NAME: 7700-1-1.DWG SHEET 1 OF 2

CONFIGURATION CODE:

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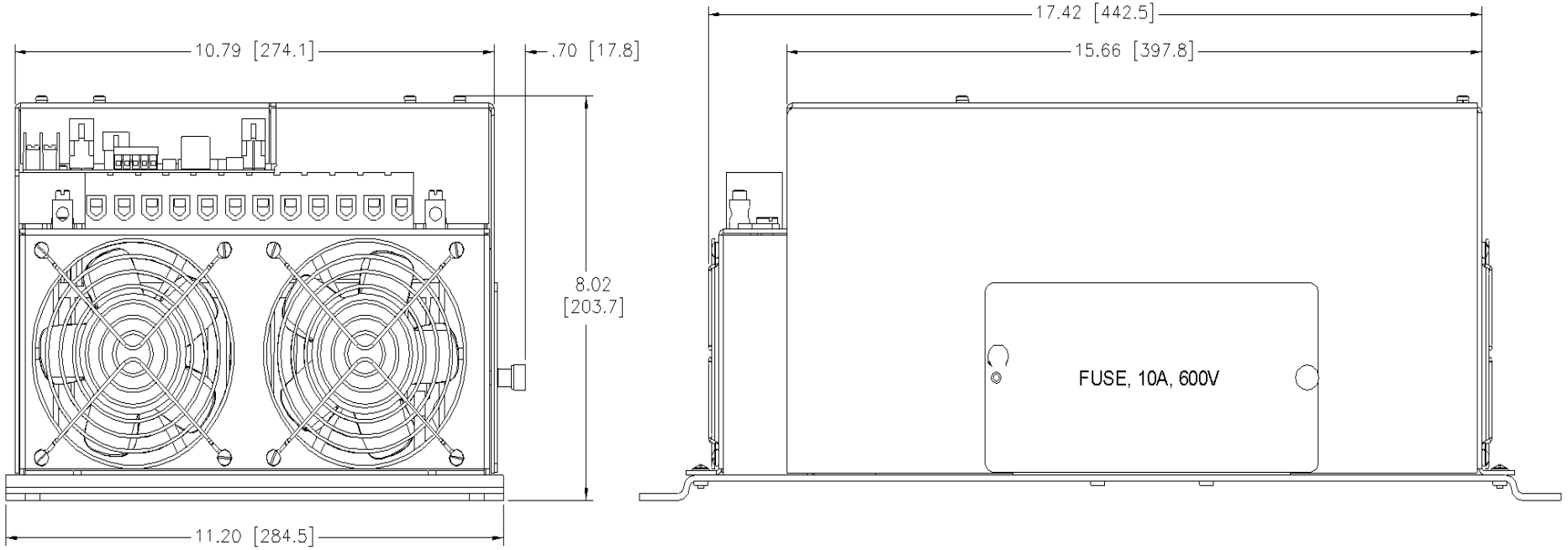

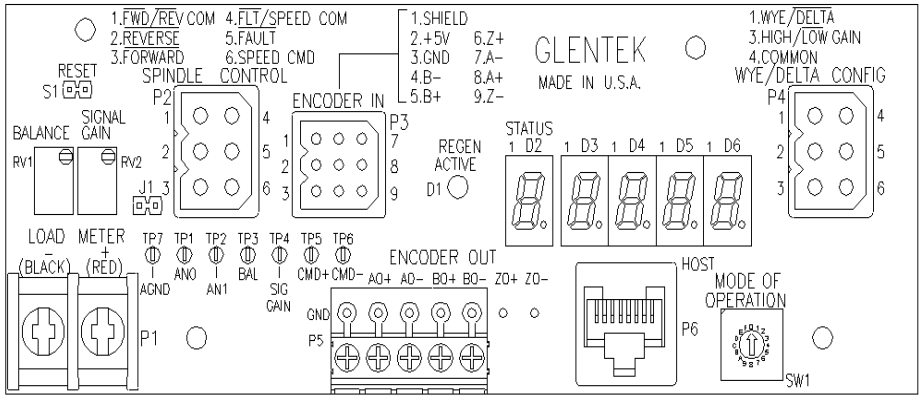

SCALE: 3:1

SWITCH MODE OF OPERATION		
Pos.	FILE#	COMMENT
0	7700	15HP, 10KRPM, Sensored
1	7701	15HP, 7.5KRPM, Sensored
2	7702	15HP, 10KRPM, VFD
3	7703	10HP, 10KRPM, Sensored
4	7704	10HP, 7.5KRPM, Sensored
5	7705	10HP, 10KRPM, VFD
6	7707	20HP, 10KRPM, Sensored
7	7708	20HP, 7.5KRPM, Sensored
8	7709	20HP, 10KRPM, VFD
9	7710	5HP, 10KRPM, Sensored
A	7711	5HP, 7.5KRPM, Sensored
B	7712	5HP, 10KRPM, VFD

NOTE: POSITIONS C, D, E & F ARE RESERVED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01, .XXX = ±0.005; ANGULAR < = ±0.5°; FINISH 125 MAXIMUM	DWN BY: NTHALLA	19AUG15
	CHK BY: L.F.	19AUG15
	APPR BY: J.H.	19AUG15

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GLENTEK 208 Standard Street, El Segundo, CA 90245 USA, 310.322.3026 FAX: 310.322.7709, sales@glentek.com

DRAWING TITLE: INSTALLATION, VECTOR DRIVE, SMB9675-1A-1-7700

SIZE	MODEL	DRAWING NUMBER	REV
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SCALE 1:1.25	FILE NAME 9675-1036-000-A.DWG	SHEET 2 of 2	

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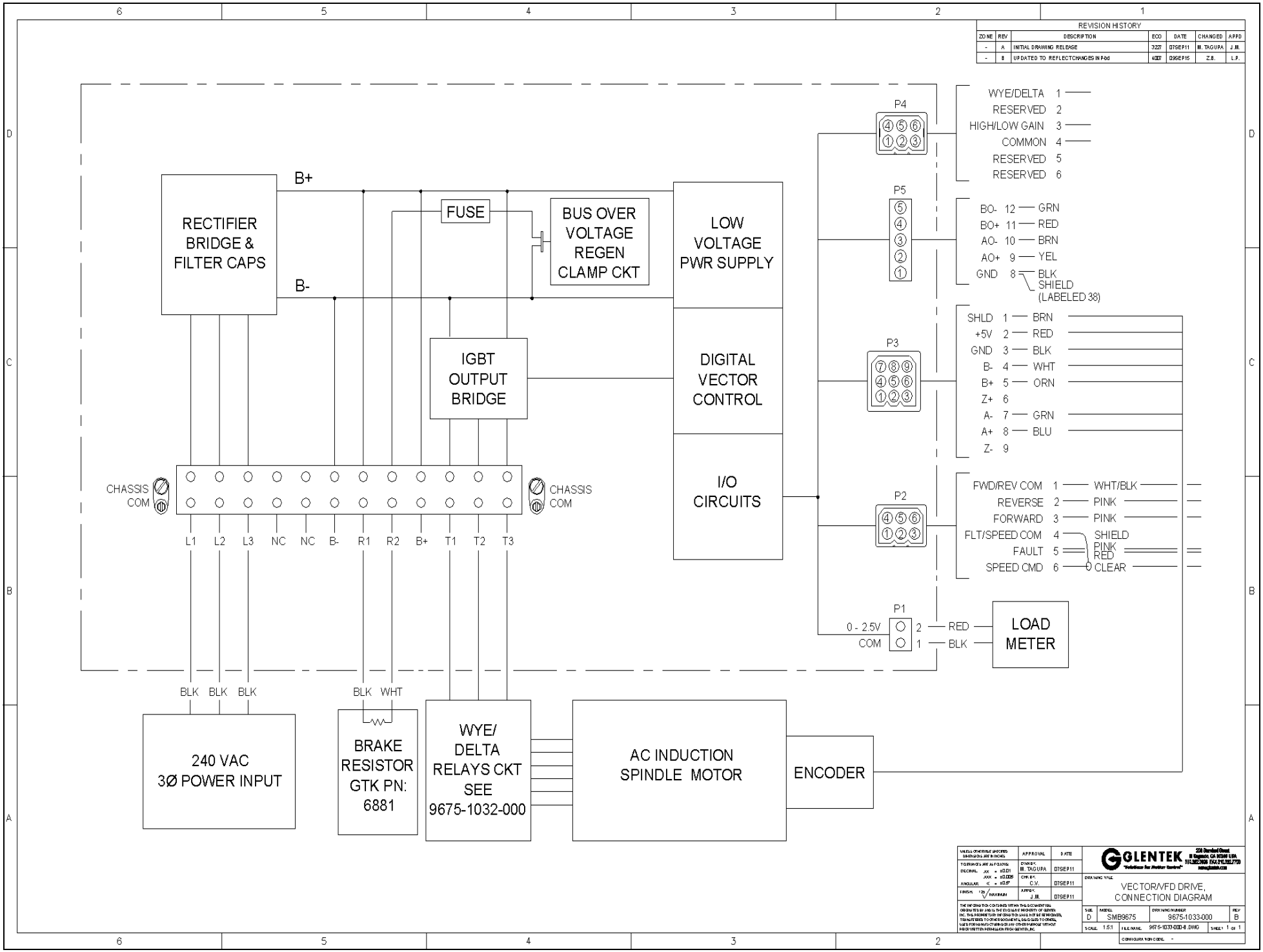
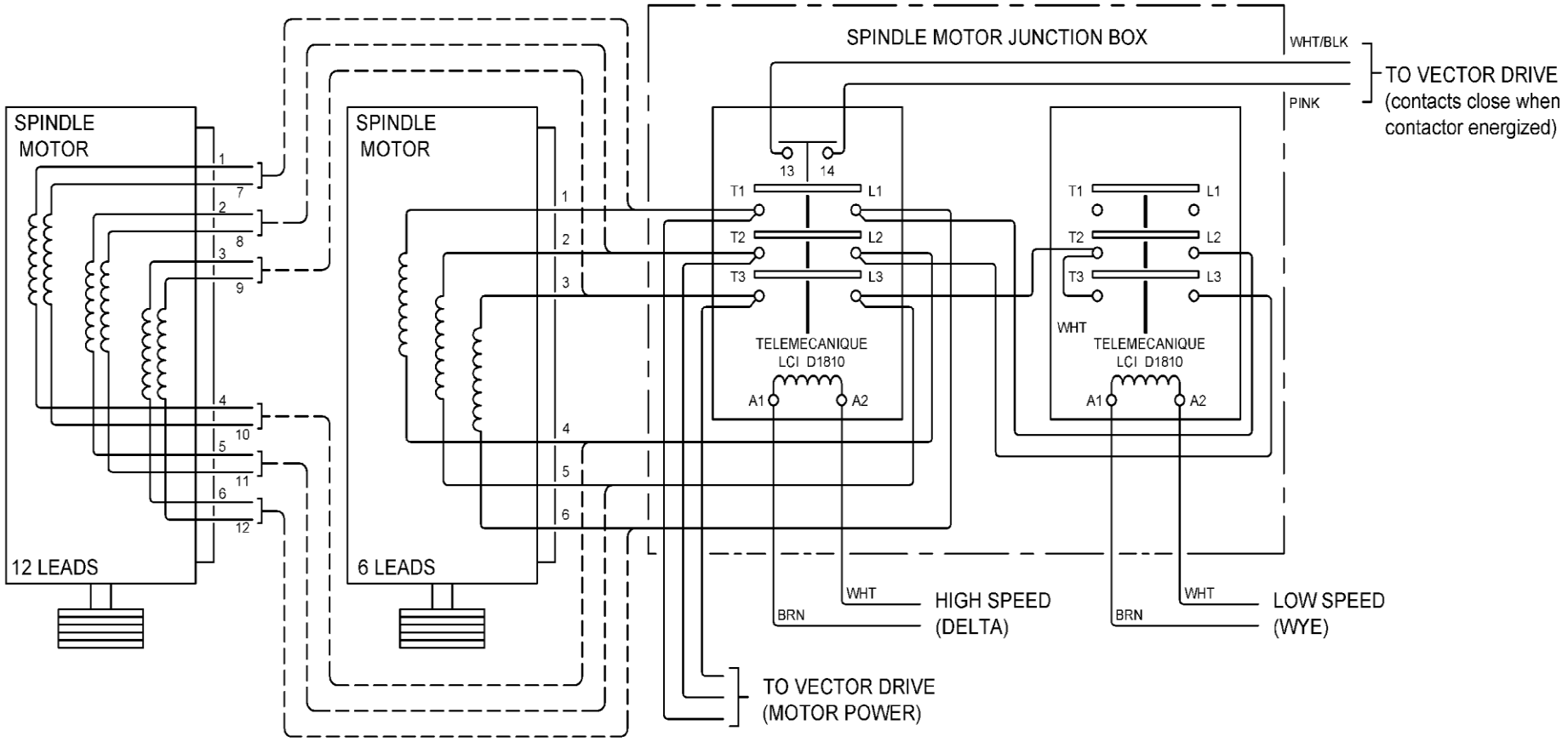

REVISION HISTORY
ZONE REV DESCRIPTION ECO DATE CHANGED APPD
- A INITIAL DRAWING RELEASE 3227 07SEP11 M. TAGUPA J. M.
- B UPDATED TO REFLECT CHANGES IN P4 4007 09SEP15 Z.B. L.P.
RECTIFIER BRIDGE & FILTER CAPS
B+
B-
FUSE
BUS OVER VOLTAGE REGEN CLAMP CKT
LOW VOLTAGE PWR SUPPLY
IGBT OUTPUT BRIDGE
DIGITAL VECTOR CONTROL
I/O CIRCUITS
CHASSIS COM
CHASSIS COM
L1 L2 L3 NC NC B- R1 R2 B+ T1 T2 T3
P4
WYE/DELTA 1
RESERVED 2
HIGH/LOW GAIN 3
COMMON 4
RESERVED 5
RESERVED 6
P5
BO- 12 GRN
BO+ 11 RED
AO- 10 BRN
AO+ 9 YEL
GND 8 BLK
SHIELD
(LABELED 38)
P3
SHLD 1 BRN
+5V 2 RED
GND 3 BLK
B- 4 WHT
B+ 5 ORN
Z+ 6
A- 7 GRN
A+ 8 BLU
Z- 9
P2
FWD/REV COM 1 WHT/BLK
REVERSE 2 PINK
FORWARD 3 PINK
FLT/SPEED COM 4 SHIELD
FAULT 5 PINK
RED
SPEED CMD 6 CLEAR
P1
0 - 2.5V 2 RED
COM 1 BLK
LOAD METER
BLK BLK BLK
BLK WHT
240 VAC 3Ø POWER INPUT
BRAKE RESISTOR GTK PN: 6881
WYE/ DELTA RELAYS CKT SEE 9675-1032-000
AC INDUCTION SPINDLE MOTOR
ENCODER
GLENTEK
VECTOR/VFD DRIVE, CONNECTION DIAGRAM
SIZE D MODEL SMB9675 DRAWING NUMBER 9675-1033-000 REV B
SCALE 1.5:1 FILE NAME 9675-1033-000-B.DWG SHEET 1 of 1



REVISION HISTORY

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-	A	INITIAL DRAWING RELEASE	3227	07SEP11	M. TAGUPA	- M.

	APPROVAL	DATE
DWN BY: M. TAGUPA		07SEP11
CHK BY: C.V.		07SEP11
APP BY: J.M.		07SEP11

DECIMAL: XX = ±0.01, XXX = ±0.005 ANGULAR: < = ±0.5° FINISH: 125 MAXIMUM

GLENTEK "Solutions for Motion Control" 206 Standard Street El Segundo, CA 90245, USA 310.322.3516 FAX 310.322.1169 www.glentek.com

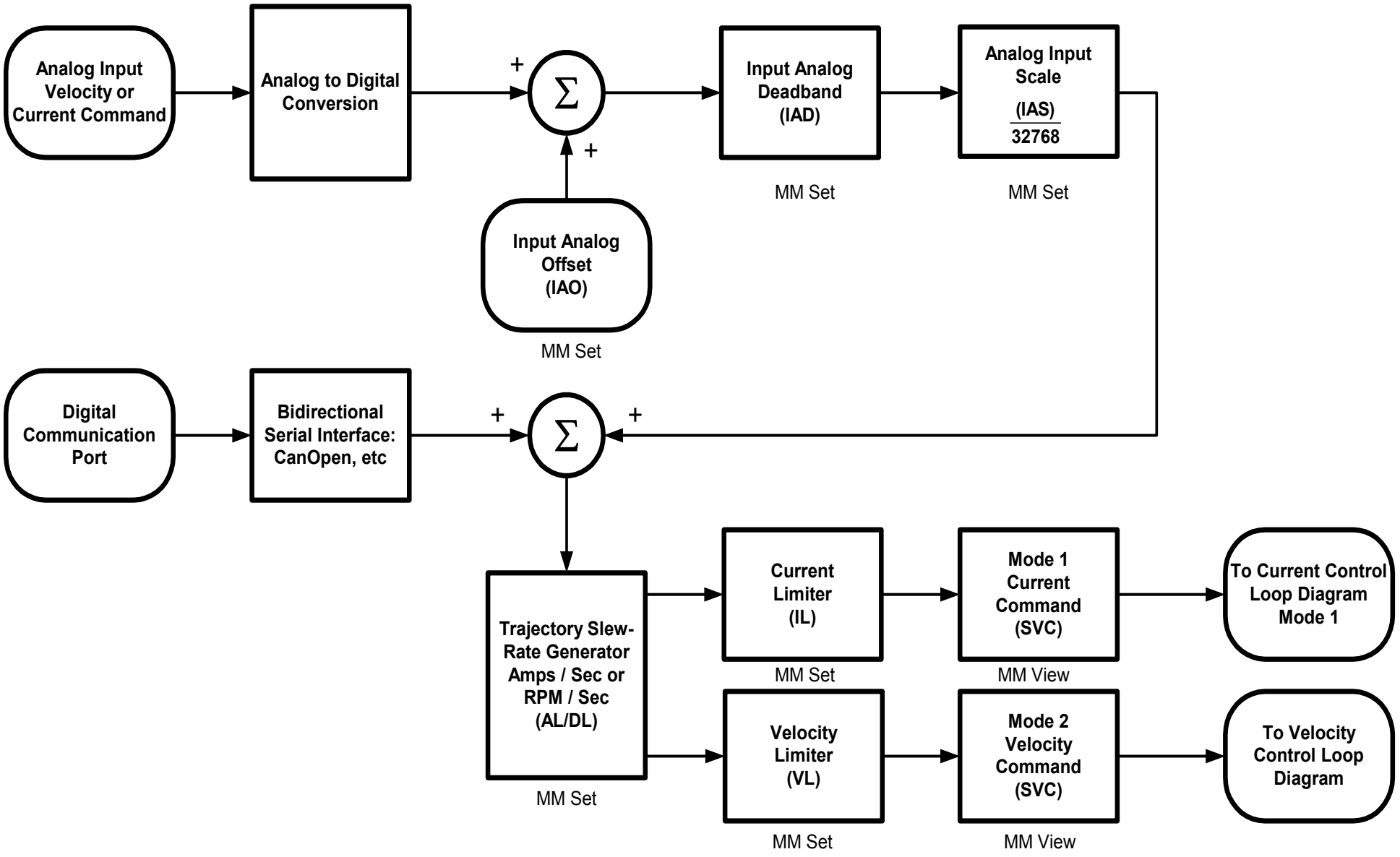
DRAWING TITLE: VECTOR/VFD DRIVE, WYE/DELTA RELAYS CONNECTION DIAGRAM

SIZE	MODEL	DRAWING NUMBER	REV
D	SMB9675	9675-1032-000	A

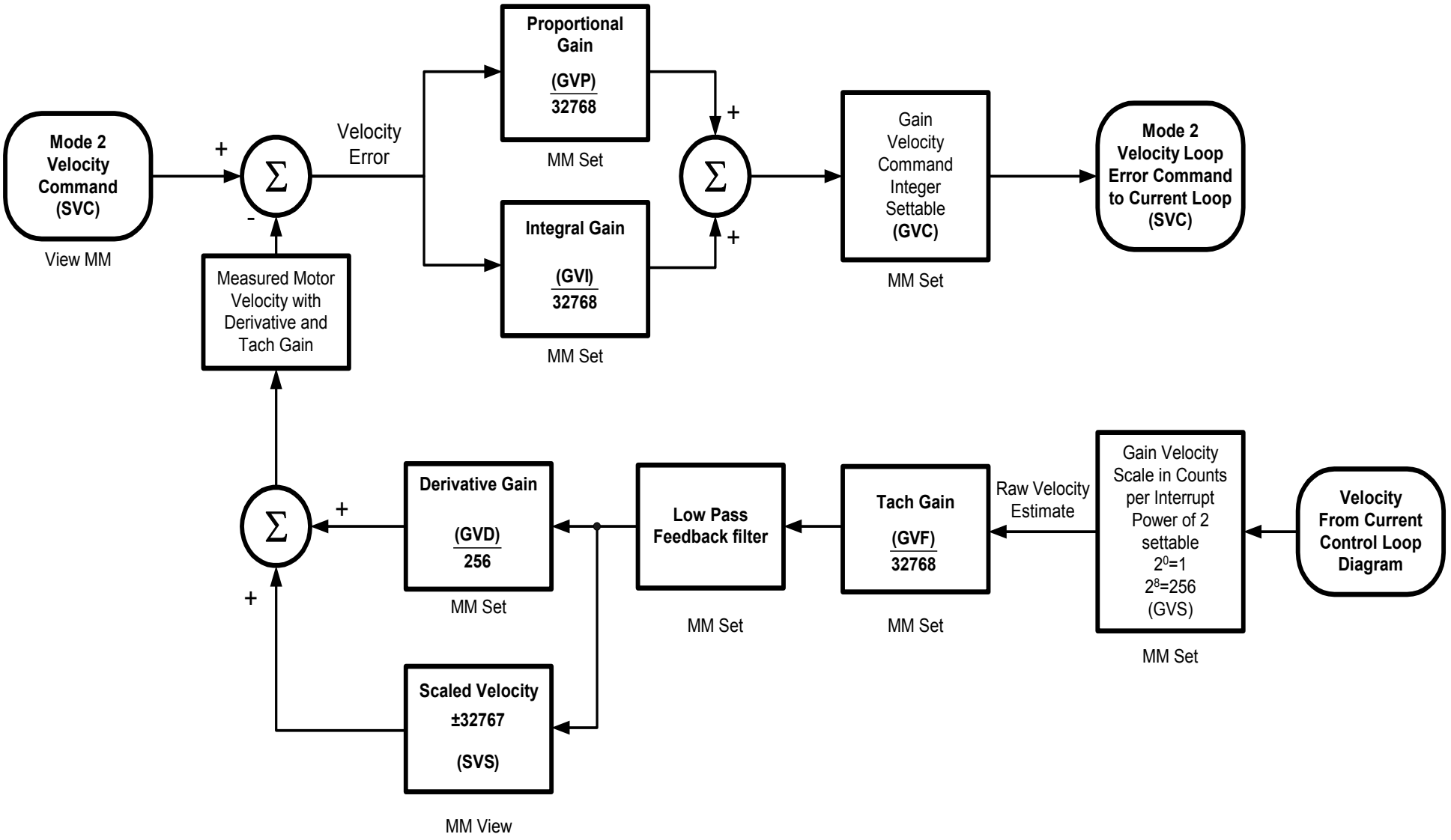
SCALE: 1.5:1 FILE NAME: 9675-1032-000-A.DWG SHEET 1 OF 1

CONFIGURATION CODE: -

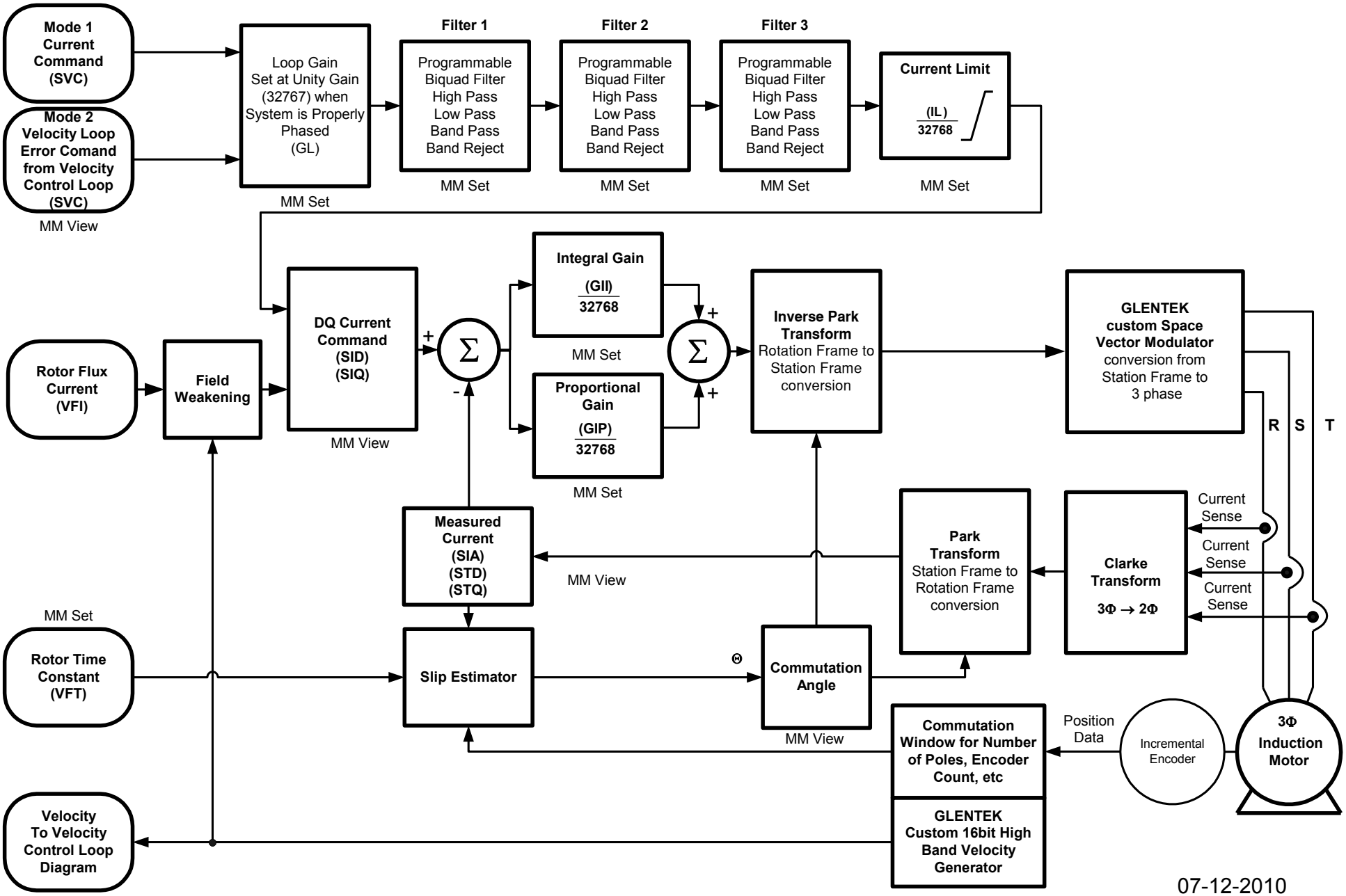
Sensored Vector Command Input Control Diagram



Sensored Vector Velocity Control Loop Diagram



Sensored Vector Current Control Loop Diagram



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