

# INSTALLATION & OPERATION MANUAL

***Model SMB9675-1A-1-7700***



**FADAL REPLACEMENT  
SPINDLE DRIVE**

MANUAL#: 9675-1035-000  
REVISION: (A)  
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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 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 pg. 26) 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 preference please contact one of Glentek's sales engineers for assistance. The drive is shipped with the dial at position 0 (zero)

**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.

**Note:** Align the dial to the desired configuration before installation or disable the drive with an M5 (spindle stop) command BEFORE rotating the dial. The four place seven-segment displays will display the operation mode selected (i.e. 7700, 7701, etc.) for seven seconds, then reverts to displaying motor rpm. Enable the drive to run in the new mode.

## 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

Install the new drive (slots down) by first resting the drive on the lower mounting studs in the panel and positioning the drive over the studs at the top. Hold the drive against the panel and loosely install four screws, top two first. Then tighten all four screws.

### 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 mistake the wye/delta connector with only 3 sockets.

#### 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 (Drawings & Diagrams) to match the wires by color to the correct terminal.



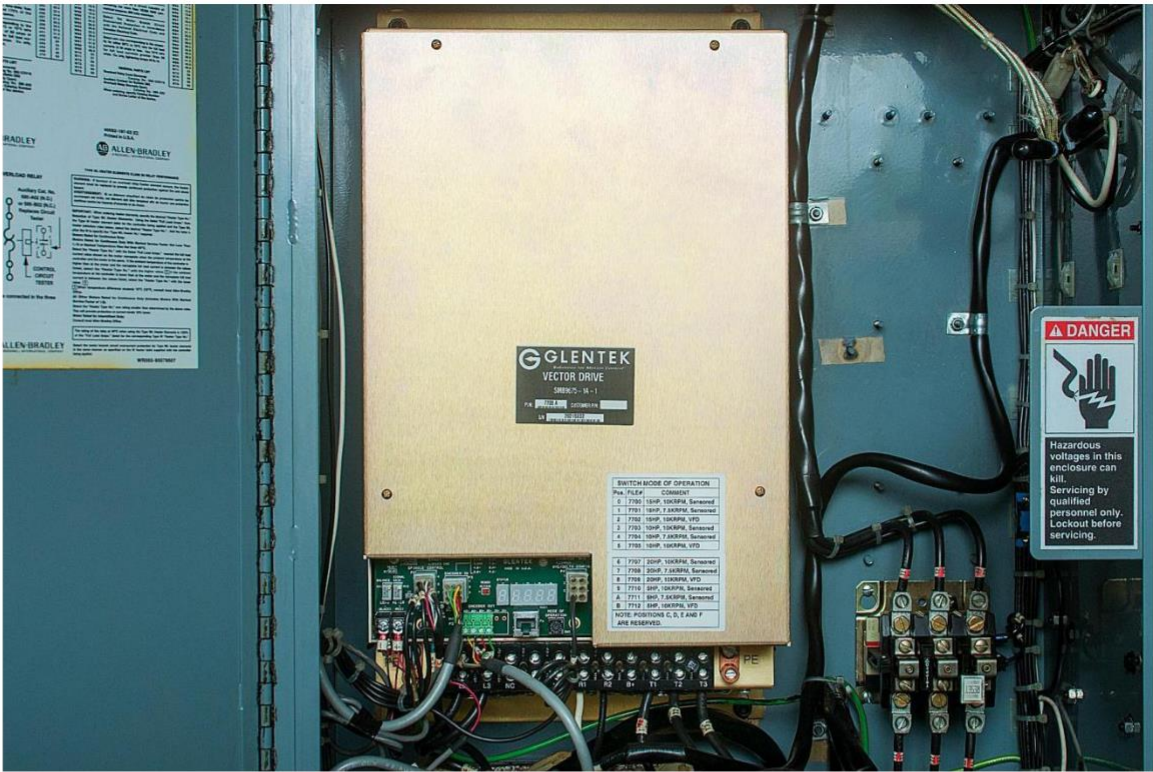


Photo 1: A successful spindle drive installation.

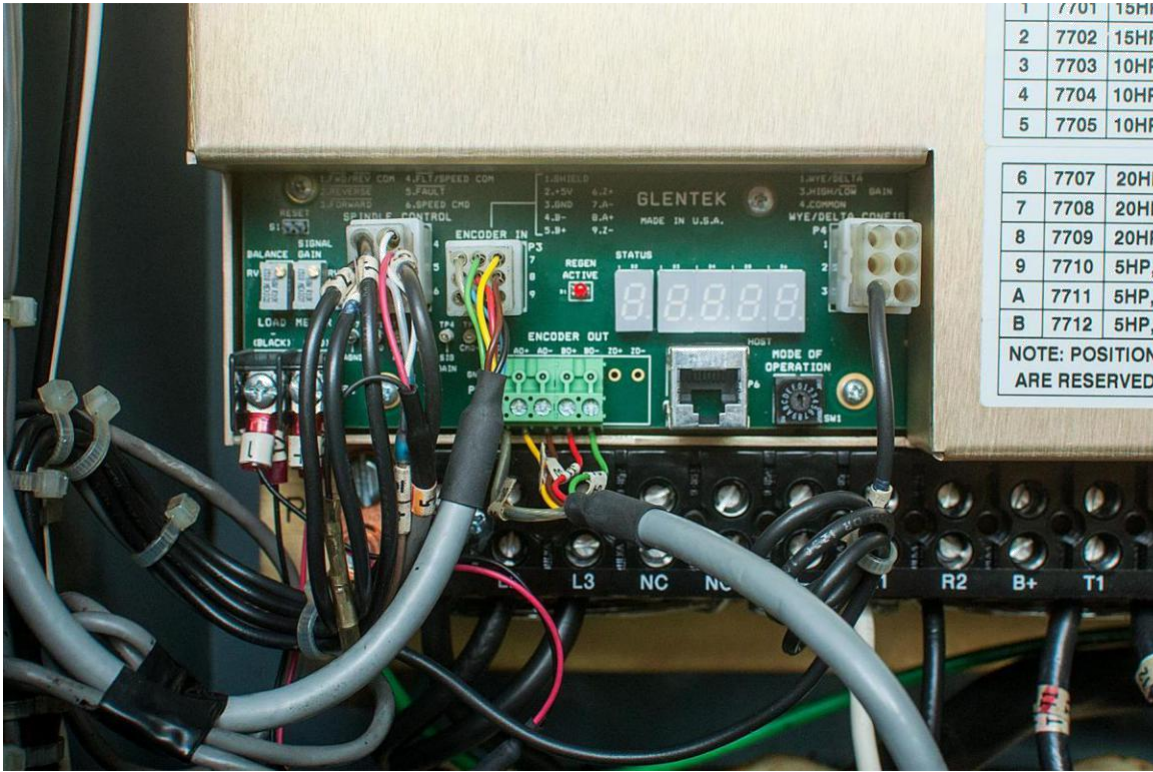


Photo 2: Close up of a successful spindle drive installation.



## 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. 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 two pots (see page 26) the balance pot and the signal pot. The balance pot can be used to equalize the rpm's in the CW and CCW directions. The signal gain pot can be used to make small adjustments to the speed of the spindle. The pots are not intended to correct large differences between commanded speed and actual speed. If after initial installation the expected speeds are significantly different from the commanded speeds double check that the mode of operation from the table is correct for the VMC. Consult your distributor or Glentek technical support for additional help.

The pots can be restored to their starting or "zero" positions by using a voltmeter.

Attach the black lead to TP7 (see page 26) and the red lead to TP3 for balance and to TP4 for signal gain. Adjust the voltage to 1.50VDC.

### 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). 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 G80  
N3 S750  
N4 G91  
N5 X0.1 Y0.1 G1 F10.  
N6 M5  
N7 G4 P2000  
N8 G84.1 Z-1. R+0 F500. Q0.0714  
N9 M45  
N10 X-0.1 Y-0.1 G1 F10.  
N11 M45  
N12 M45  
N13 M45  
N14 M45  
N15 G80  
N16 G4 P2000  
N17 M99 P5  
N18 (!)  
N19 (NOTE: O5827 CNC88 TEST WAS MOVED TO TA, 5!!!)  
%  
3801
```

Once the program is loaded, jog the z axis down so the screw can be indicated.

Type "SETZ" and press ENTER. Start the test program and observe that the program is running correctly. Depress the SINGLE STEP key. Be sure the test screw returns to its original position. Set the indicator as shown below, the tip must be touching the lower thread halfway into the thread, the second thread from the bottom.

Run the test and observe the indicator. The reading should not deviate from zero more than .002" on either side of zero. If necessary, consult the FADAL maintenance manual for your machine.

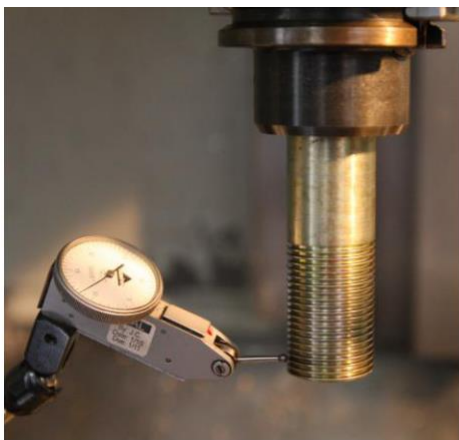


Photo 3: Test screw in setup with dial



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

### 4.2 Maintenance

The only maintenance required is to periodically inspect the fans. The blades should be free turning and built up dirt 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.

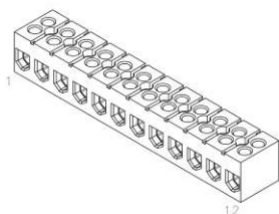
## 5.3 Safety

- 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 away 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



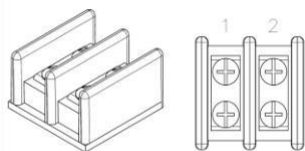
Pin #	I/O	Name	Function
1	Input	L1	AC LINE 1, three phase AC input
2	Input	L2	AC LINE 2, three phase AC input
3	Input	L3	AC LINE 3, three phase AC input
4	Rsvd	N/C	Reserved
5	Rsvd	N/C	Reserved
6	Output	B-	DC BUS Return output
7	Output	R1	Brake/Regen resistor output
8	Output	R2	Brake/Regen resistor output
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	$\overline{FW}/\overline{REV}$ COM	Spindle Common (for Forward & Reverse)
2	Input	$\overline{REVERSE}$	Spindle Reverse
3	Input	$\overline{FRWR}$	Spindle Forward
4	Input	$\overline{FT}/\overline{SPEED}$ COM	CMD Common (for Fault & Speed)
5	Input/Output	$\overline{FT}$	Emergency Stop/Spindle Fault
6	Output	SPEED CMD	Spindle Speed Command

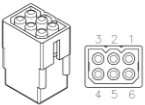
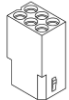


Table A-2.4 Wye/Delta Config Designations: Labeled as P4 on spindle drive

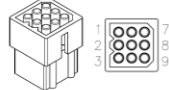
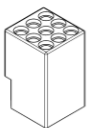
Pin #	I/O	Name	Function
1	Input	WYE / $\overline{ET}$	Wye or Delta modes
2	N/C	Reserved	Reserved
3	Input	HIGH / $\overline{W}$ GAIN	High Gain or Low Gain modes
4	Input	Common	Common for Wye/Delta and High Gain/Low Gain modes
5	N/C	Reserved	Reserved
6	N/C	Reserved	Reserved

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 -)

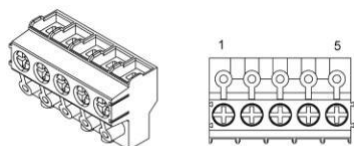
Table A-3.2 Encoder Input Connector

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.



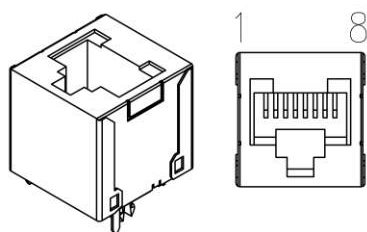
Pin #	I/O	Name	Function
1	Power	GND	Encoder Power Return
2	Output	AOut +	Encoder Channel A +
3	Output	AOut -	Encoder Channel A -
4	Output	BOut +	Encoder Channel B +
5	Output	BOut -	Encoder Channel B -

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<sup>2</sup>) or larger, 105°C rated PVC or better.

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

A-6.3 Recommend all signal wiring, 22 AWG (0.326 mm<sup>2</sup>) 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 drawing in [Drawing & Diagrams](#). 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 Display

A diagnostic 7-segment LED display is provided for determining the general operating condition of the spindle drive.

When the drive is operating normally, one of the outer six segments is lit. Each of the six outer segments represents one of the six commutation states in a commutation cycle of a motor. A commutation cycle consists of two poles. In a 4-pole motor, the LED will cycle through its six outer segments 2 times for one revolution of a rotary motor. 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.

### 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.

<u>Signal</u>	<u>Description</u>
SPEED CMD	Command signal analog input, reference to CMD Common.
SPINDLE $\overline{\text{FRWR}}$	Enable the motor in the CCW direction.
SPINDLE $\overline{\text{REVERSE}}$	Enable the motor in the CW direction.
WYE / $\overline{\text{E T}}$	Enable the motor either in WYE or DELTA mode.
HIGH / $\overline{\text{W GAIN}}$	Enable the motor either in HI or LO gain mode.
$\overline{\text{EST}}$ / $\overline{\text{FT}}$	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).

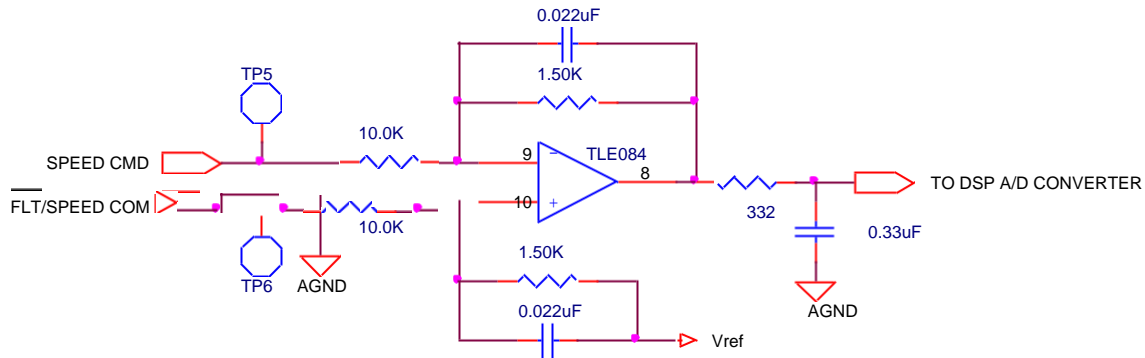
For the actual pin out of above signals, see [Appendix A](#) - Controller I/O Connector section

## B-3 Analog Input, Command Signal

Pins SPINDLE CMD and  $\overline{\text{F T}}/\text{SPEED COM}$  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),  $\pm 10$  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

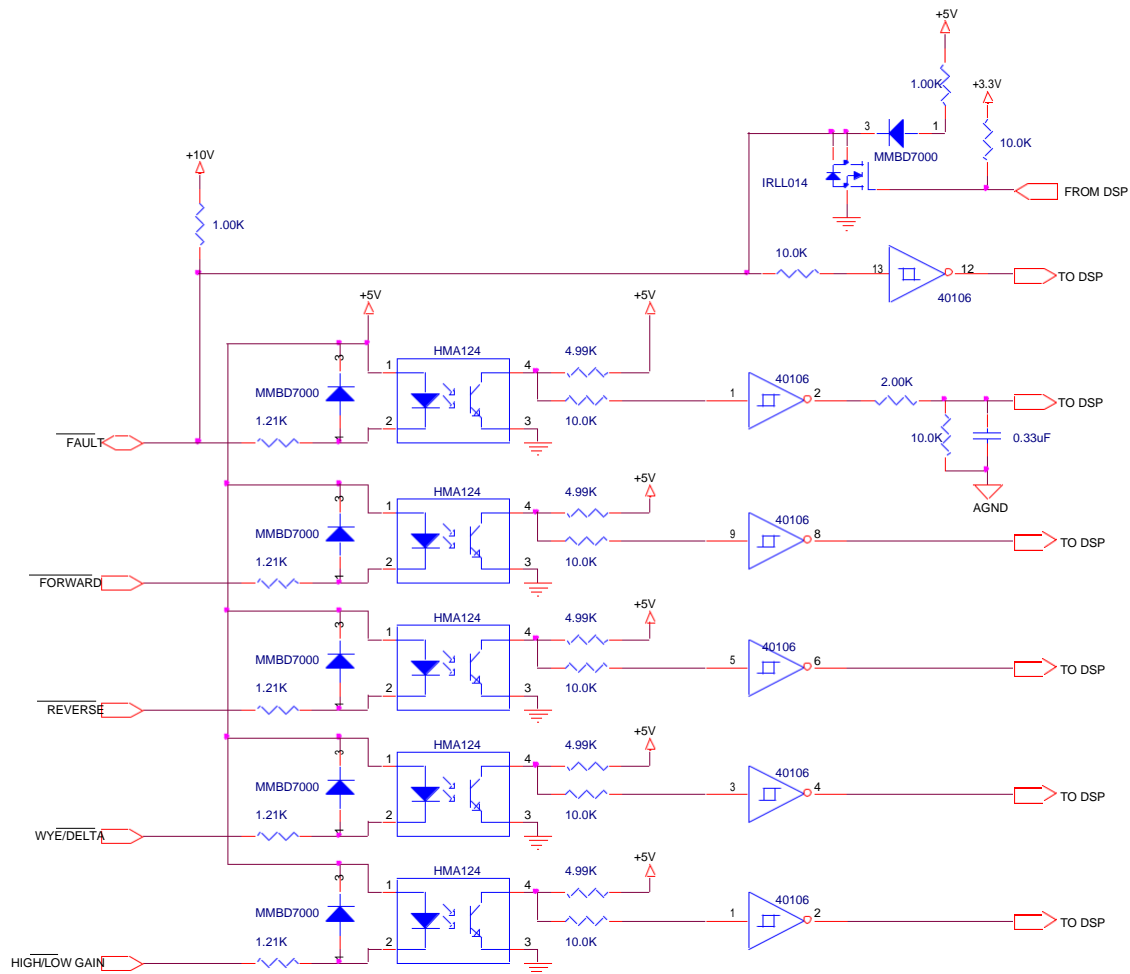
## B-4 Controller Inputs/Outputs - Direction Control, WYE / $\overline{\text{HIGH}}$ GAIN Inputs, $\overline{\text{Input}}$ Input, and $\overline{\text{Output}}$ Output

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

		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  $\overline{\text{F RW R}}$  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 ( $\overline{\text{F RW R}}$  or  $\overline{\text{REVERSE}}$  on), the velocity command is unipolar, and when both enables are closed ( $\overline{\text{F RW R}}$  and  $\overline{\text{REVERSE}}$  on), the velocity command is bipolar.

When both  $\overline{\text{F RW R}}$  and  $\overline{\text{REVERSE}}$  are closed, the spindle drive is in rigid tap mode. When only  $\overline{\text{F RW R}}$  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 VF drives use non-rigid tap mode only.



Controller I/O Schematic

When  $\overline{\text{F R W R}}$  and  $\overline{\text{REVERSE}}$  are both open (signals are left floating) the spindle is off and spins freely. However, the change from closed to open ( $\overline{\text{F R W R}}$  and/or  $\overline{\text{REVERSE}}$  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 ( $\overline{\text{F R W R}}$  and  $\overline{\text{REVERSE}}$  open) and the motor is stopped or below 50 rpm. When the CNC wants DELTA mode, the signal  $\overline{\text{WYE / \Delta T}}$  is pulled low.

When the CNC wants LOW GAIN, the signal  $\overline{\text{HIGH / LOW GAIN}}$  is pulled low.

$\overline{\text{EST}}$  and  $\overline{\text{F T}}$  share the same I/O pin at the spindle drive. A spindle  $\overline{\text{F T}}$  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  $\overline{\text{EST}}$  is asserted (signal is pulled low), drive is to totally ignore  $\overline{\text{F R W R}}$ ,  $\overline{\text{REVERSE}}$ , 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.

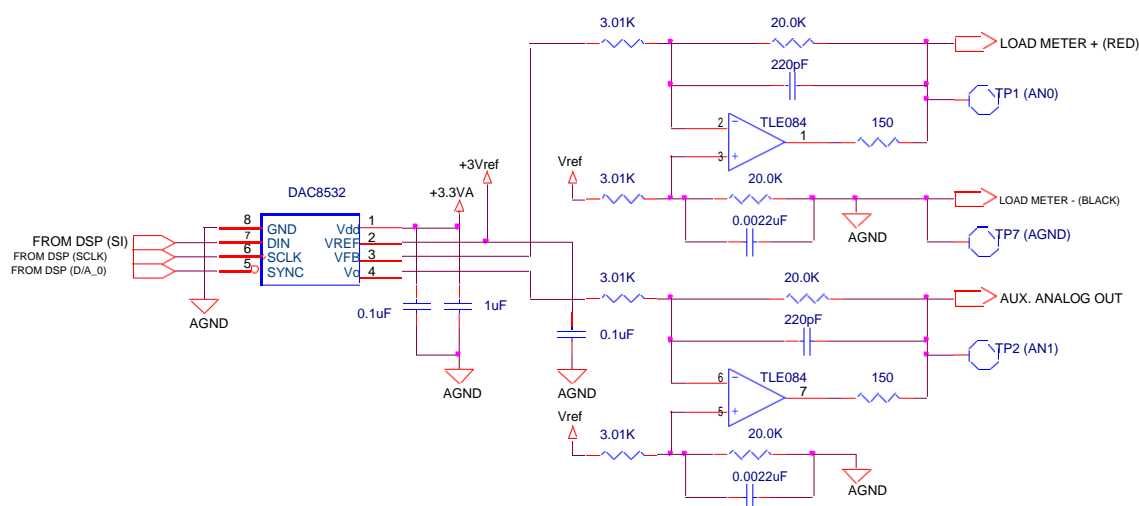
Encoder channels A and B are available as pins AOut +, AOut -, BOut +, BOut - on P5.

## 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)

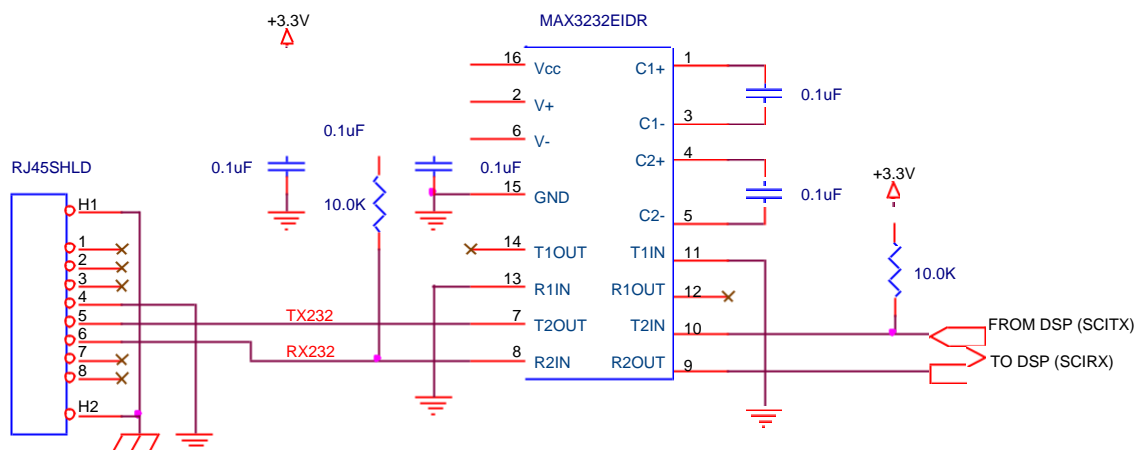
3.75 VDC = 150% absolute motor current (150% of continuous current)



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  $\pm$  5%. BUS overvoltage trips nominally at 450 VDC  $\pm$  5%.

R1 and R2 are external Regen resistor (brake) outputs. Acceptable resistance range is 12 - 30 Ohms. Regen turns on at 395 VDC  $\pm$  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<sup>2</sup>) 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<sup>2</sup>) 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.



Photo 8: USBG-232

	6	5	4	3	2	1



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6						REVISION HISTORY						
						ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPRO

## A

ZONE	REV	DESCRIPTION	DOC	DATE	CHANGED	APP
-	6	UPDATED TO REFLECT CHANGES IN Fed	4067	06/23/98	Z.B.	L.F.

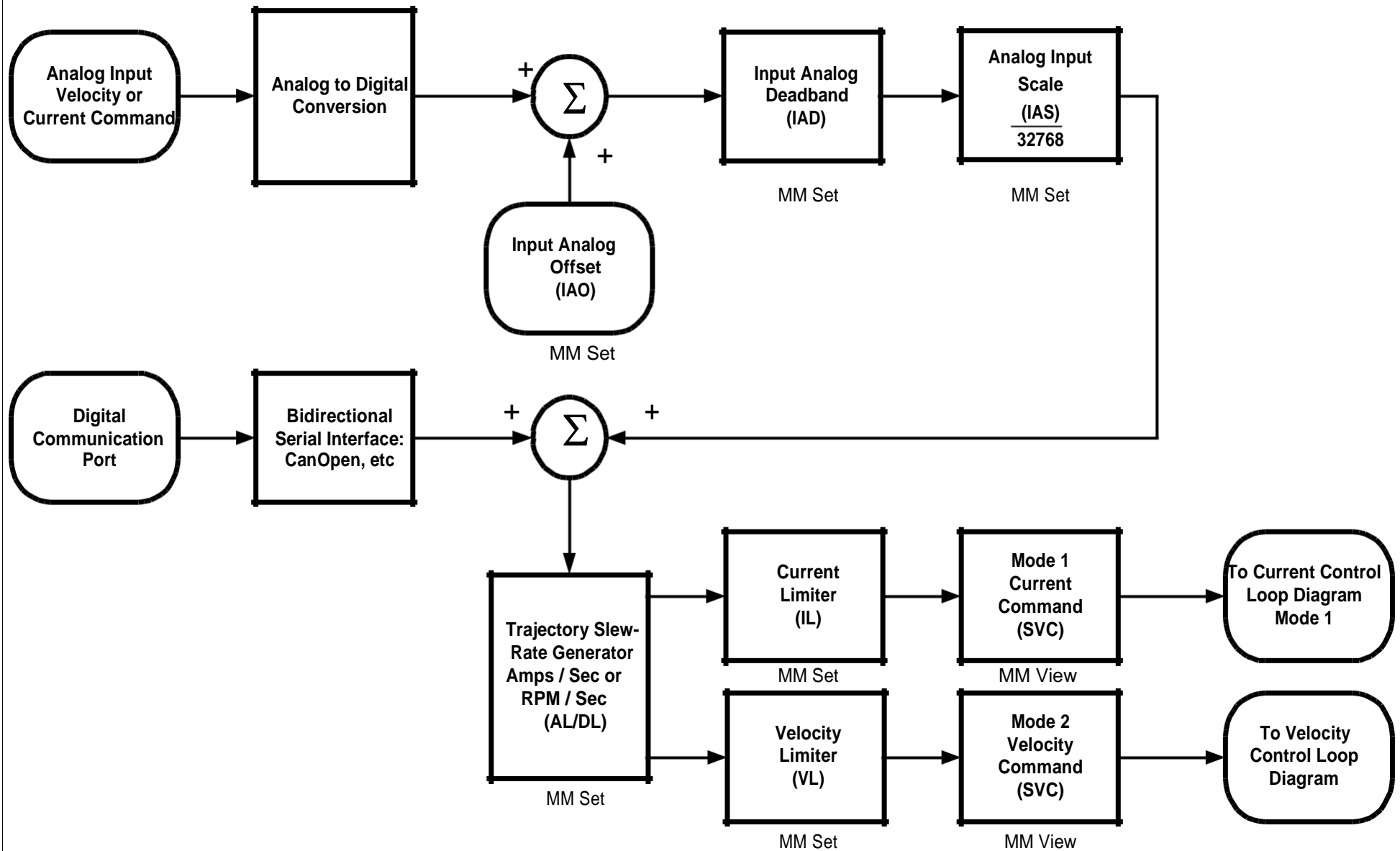
[illegible]

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APP
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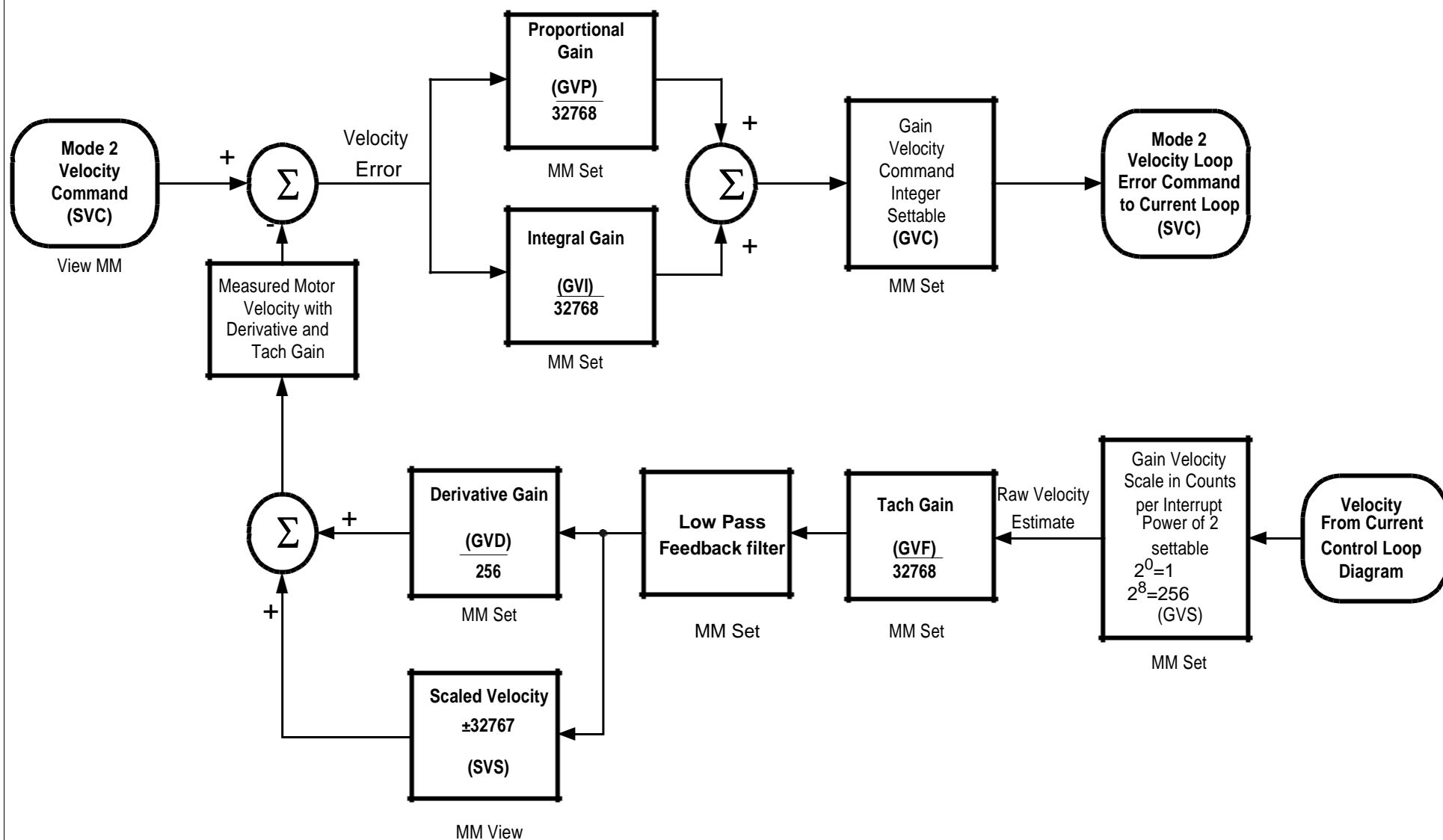
ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APP
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[illegible]

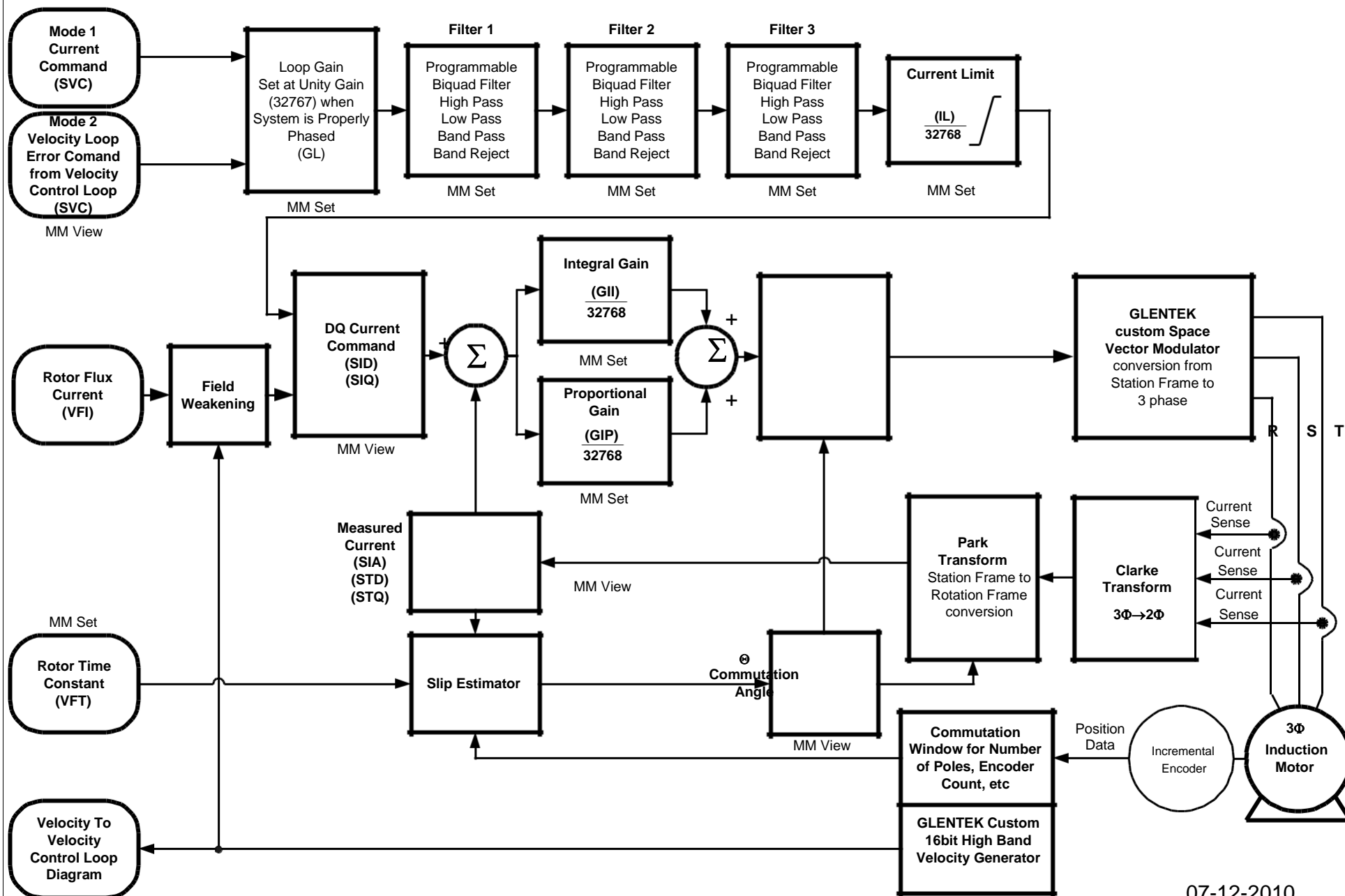
# Sensored Vector Command Input Control Diagram



# Sensored Vector Velocity Control Loop Diagram



## Sensored Vector Current Control Loop Diagram



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