INSTALLATION
&
OPERATION MANUAL

Model SMB9675-1A-1-6889

FADAL REPLACEMENT

SENSORED VECTOR DRIVE

GLENTEK

"Solutions for Motion Control"

TABLE OF CONTENTS

CHAPTER ONE: GENERAL

1.1. Overview

The Glentek Inc. SMB9675-1A-1-6889 vector 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 vector drive uses it's 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.

1.2. Intended Application

The SMB9675-1A-1-6889 (PN#6889) is a drop-in replacement vector drive on FADAL ENGINEERING VMC's having the part numbers below.

P/N	Description	Spindle RPM	Motor HP
INV-0015	VECTOR,BALDOR; 10HP 10K CL	10000	10
INV-0016	VECTOR,BALDOR; 10HP VMC15 CL	7500	10
INV-0020	VECTOR,BALDOR; 15HT 10K CL	10000	15
INV-0039	VECTOR,BALDOR; 15HT 10K CE	10000	15
INV-0040	VECTOR,BALDOR; 15HT 10K	10K/7.5K	15
INV-0041	VECTOR,BALDOR; 10HP 10K CL	10K/7.5K	10
INV-0042	VECTOR,BALDOR; 10HP 10K CE	10000	10
INV-0043	VECTOR,BALDOR; 15HT 7.5K YD	7500	15
INV-0044	VECTOR,BALDOR; 10HP 7.5K YD CE	7500	10
INV-0045	VECTOR,BALDOR; 10HP 7.5K YD	10K/7.5K	10
INV-0046	VECTOR,BALDOR; 15HT 7.5K YD CE	7500	15
INV-0049	VECTOR,BALDOR; 10HP 7.5K/10K	10K/7.5K	10
INV-0055	VECTOR,BALDOR; 10HP 6.5K CL	6500	10
INV-0056	VECTOR,AMC; 10 or 15HP 10K/7.5K	10K/7.5K	15
INV-0058	VECTOR,BALDOR; 20HPVHT 10K CL	10000	20
INV-0059	VECTOR,BALDOR; 20HPVHT 10K CE	10000	20
INV-0070	VECTOR,BALDOR; 20HPVHT 10K CE	10000	20
INV-0077	VECTO DRIVE,YASKAWA; 15HT 10K CE 104D	10000	15
INV-0083	VECTOR DR,YASKAWA; 10HP CE 7.5/10L	10K/7.5K	10
INV-0086	VECTOR DRIVE, YASKAWA; 20VHT 10K CE CNC88	10000	20
INV-0093	VECTOR DRIVE,YASKAWA; 15HT 10K CE CNC88	10K/7.5K	15
INV-0095	VECTOR,AMC; 10 or 15HP 10K/7.5K CE PWR SUPPLY	10K/7.5K	15
INV-0096	VECTOR,AMC; 10 or 15HP 10K/7.5K	10K.7.5K	15
INV-0097	VECTOR DR, YASKAWA; 10HP CE 104D	10K/7.5K	10

CHAPTER TWO: APPLICATION SOFTWARE

2.1. MotionMaestro©

MotionMaestro© is Glentek's Windows based application software that you will need to setup and tune the vector 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 vector drive most of the setup has been done at the factory. The installer only needs go through a quick tuning procedure to get the vector drive up and running. But first MotionMaestro needs to be installed.

2.2. Installing MotionMaestro©

2.2.1. Requirements
MotionMaestro© requires Windows95, Windows 98 SE, Windows ME, Windows NT 4.0, Windows 2000 or Windows XP operating system running on a laptop with a serial port or a USB port. It is suggested that you have a minimum of 3 mega bytes of application program disk space available prior to installation.

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

2.2.3. 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 on 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 vector drive. The installation will 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 amplifier, the amplifier is queried for a model ID and Firmware version. MotionMaestro© will configure itself and select the appropriate configuration files based on the amplifier returned values.

2.3. Communicating With The Vector Drive

2.3.1. Serial Port

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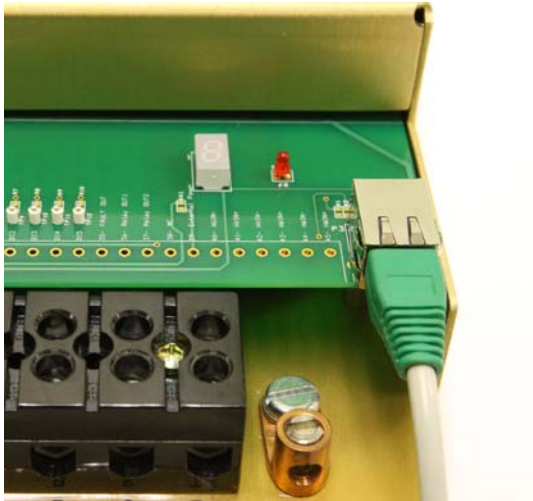
SERIAL PORT ON THE VECTOR DRIVE

GC2400-AL005AM-000

2.3.2. 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.

USBG-232

CHAPTER THREE:
INSTALLING THE GLENTEK VECTOR DRIVE INTO A FADAL VMC

3.1. 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.

3.2. 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 nuts, top two first. Tighten all four nuts.

3.3. Electrical Installation

3.3.1. 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 the appendix for installation drawings.

3.3.2. 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.

3.3.3. Control Cable
Connect the control cable to P5, the Control cable has 6 sockets installed, do not mistake the Wye/Delta connector with only 3 sockets.

3.3.4. Wye/Delta Cable
Connect the Wye/Delta cable to P6 (Wye/Delta is an option, your VMC may not have this cable).

3.3.5. Encoder Feedback Cable
Connect the encoder feedback from the motor (9 terminal connector) to P4.

3.3.6. 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 P2 of the vector drive. Use installation drawing 6889-6 (Appendix) to match the wires by color to the correct terminal.
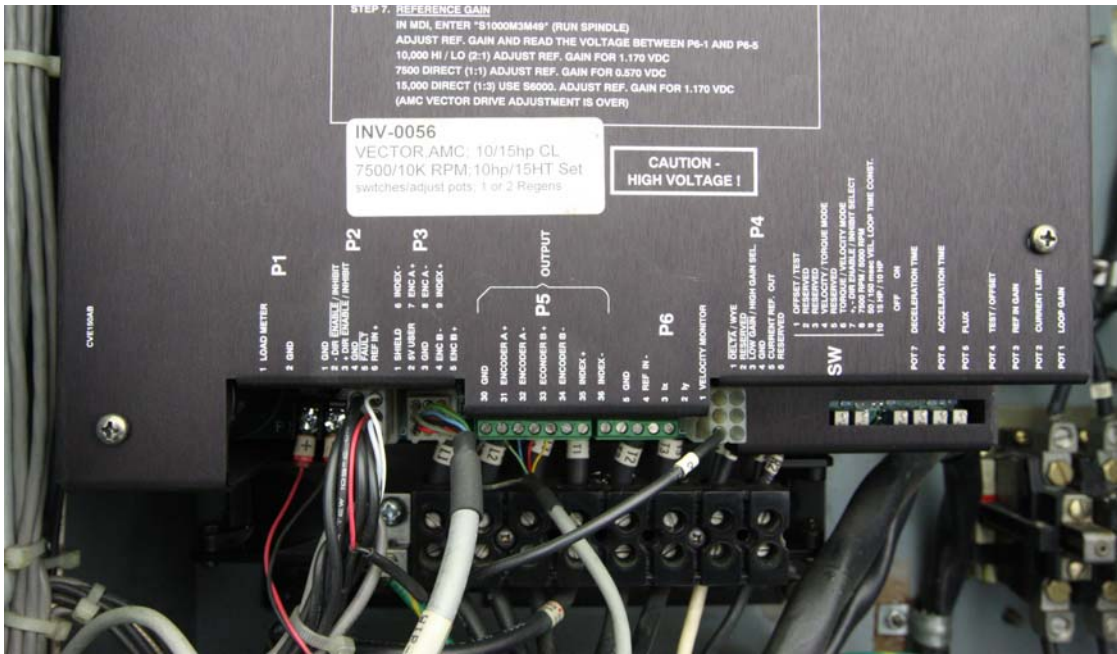
Before and after photos of a typical installation

CHAPTER FOUR: SETUP AND TUNING

4.1. Turning the Power On.

Carefully recheck the wiring. Restore power to the VMC. After the VMC is finished initializing, check the vector drive status 7 segment display. One segment may be lighted or if the spindle is rotating slowly you will see a rotating pattern of segments lighting.

4.2. Establishing Communications

Connect your laptop to the vector drive at P3.
Open MotionMaestro 1.37 or later version and go to the communication menu drop down and select *OPEN*.
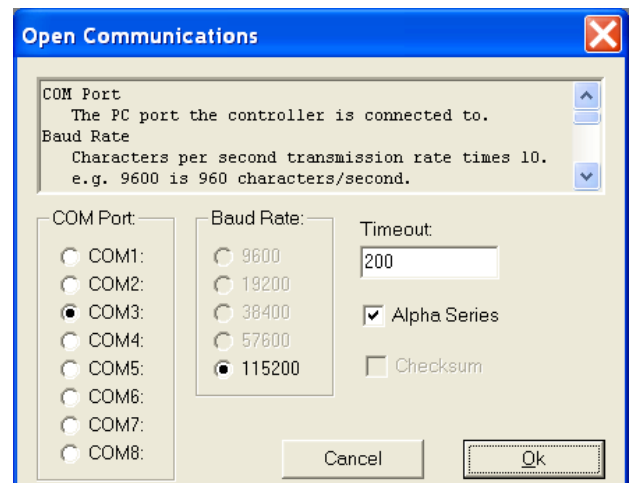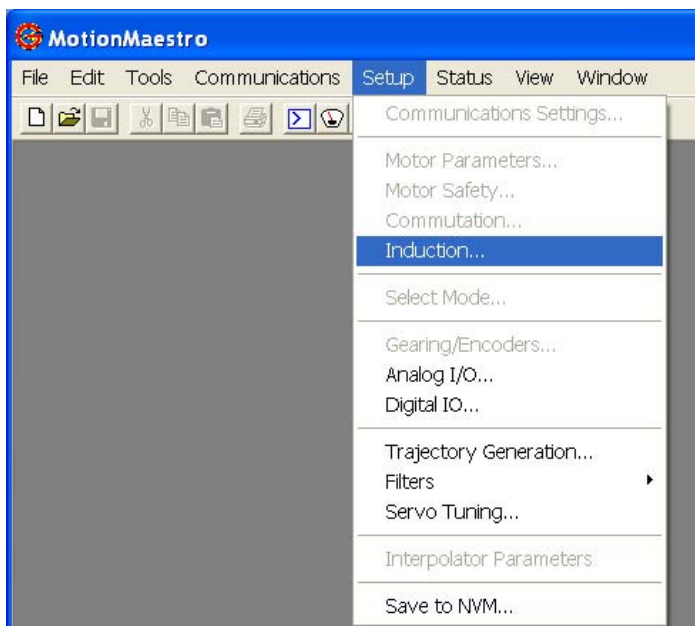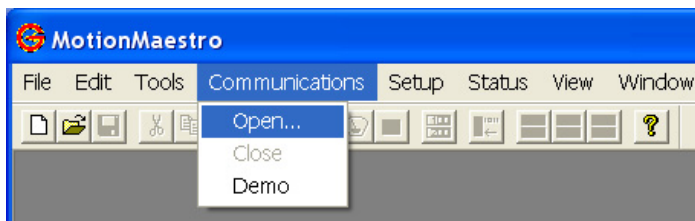The *Open Communications* dialog box will appear.
Press the OK button and the COM status box to the right will turn green.

4.3. Motor Parameters

From the Setup menu drop down, open the Induction Motor Vector Control dialog box as seen below.

Motor Parameters Section;
In the working column enter the Stator Resistance (phase to phase) and the Stator Inductance. The Nominal DC Bus and the Current Loop Bandwidth are preset to 340VDC and 2000 Hz respectively and do not normally need to be changed.

Motor Safety Limits;
These parameters are preset at the factory and do not normally need to be changed

Vector Control Parameters;
In the working column enter the parameters listed.

Check that your parameters are correct and push the Send to Amp button, The parameters in the working column will appear in the Amp column, next push the Enable Amp button, then the Done button.
Close the box and from the Setup menu drop down select Save to NVM. Push the Save button. This will save the parameters in the vector drive.

Induction Motor Vector Control

Motor Parameters

	Working	Amp
Stator Resistance [ohm]:	4.34	5.00
Stator Inductance [mH]:	15.50	15.50
Nominal DC Bus [V]:	230	230
Current Loop Bandwidth [Hz]:	1500	1500
Proportional Current Gain [%]:	99.68	99.69
Integral Current Gain [%]:	3.76	3.76

Motor Safety Limits

	Working	Amp
Current Limit [A]:	75.55	75.55

Low Speed Electronic Circuit Breaker

	Working	Amp
Trip Current [A]:	38.99	38.99
TripTime [s]:	3.00	3.00

Vector Control Parameters

	Working	Amp
Number of Poles:	4	4
Encoder Lines:	1000	1000
Rated Frequency[Hz]:	60	60
Power Factor[%]:	85	85
Rated Speed[RPM]:	1750	1750
Rated Current[A]:	37.00	37.00
Magnetizing Current[A]:	14.80	14.80
Flux Vector Coefficient:	257	257

Mode:
☑ Current Loop
☑ Velocity Loop

Enable Amp   Send To Amp   Done

Press F1 at any time while this dialog is active for a short description of all parameters!

This dialog supplies access to all of the parameters that define a IM characteristics with Vector Control.

Working

4.4. Tuning & Offset

From the Tools menu drop down select the Control Panel dialog box. From the Setup menu drop down select the Analog I/O dialog box. Arrange the boxes side by side. Observe any small rotation in the Actual Velocity box in the control panel dialog. Adjust that rotation to zero by changing the value in the Signal Offset box in the Analog I/O dialog.

4.5. Saving your setup

You are almost done setting up. From the Setup menu drop down select Save To NVM. When queried "Save card setup to Non Volatile RAM?" press the Yes button. Setup is complete

4.6 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 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:

```
%
N1O6000(RIGID TAP CYCLE
N2G80
N3S750
N4G91
N5X0.1Y0.1G1F10.
N6M5
N7G4P2000
N8G84.1Z-1.R+0F500.Q0.0714
N9M45
N10X-0.1Y-0.1G1F10.
N11M45
N12M45
N13M45
N14M45
N15G80
N16G4P2000
N17M99P5
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
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.

TEST SCREW IN SETUP WITH DIAL INDICATOR

TEST SCREW   TEST SCREW W/ TOOL HOLDER

CHAPTER FIVE: TROUBLESHOOTING AND MAINTENANCE

5.1 Status Display Codes

Display	Name	Description	Possible Cause
1	EEPROM Fault	Parameter EEPROM checksum fault	Internal problem
8	Reset (Flashing)	N/A	Internal problem
b	Bus Over Voltage	DC bus exceeded 450VDC	Regenerative braking circuit not working, check fuse in regen circuit
C	Clamp (Disabled)	Vector drive disabled	Control is disabling the drive
E	Encoder Fault	Encoder fault detected	Encoder faulty or encoder wiring broken
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	Amp enabled	Normal when rotating
S	HS/ECB	Output short circuit detected	Motor windings shorting
U	Bus Under Voltage	DC bus below 150VDC nominal	AC input voltage to drive is low or off
Single segment	Normal Operation	Amp enabled	Normal @ zero speed

5.2. 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 SIX: WARRANTY, FACTORY REPAIR AND SAFETY

6.1. 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

6.2. Factory Repair

Should it become necessary to return a vector 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 notation explaining the malfunction.
       D. Date the unit is being returned.
3.   Repackage the unit with the same care and fashion in which it was re-ceived. Label the container 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.

6.3. Safety

- Serious or fatal injury can result from failure to work safely on this equipment.

- Only qualified personnel should install and maintain this vector 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.
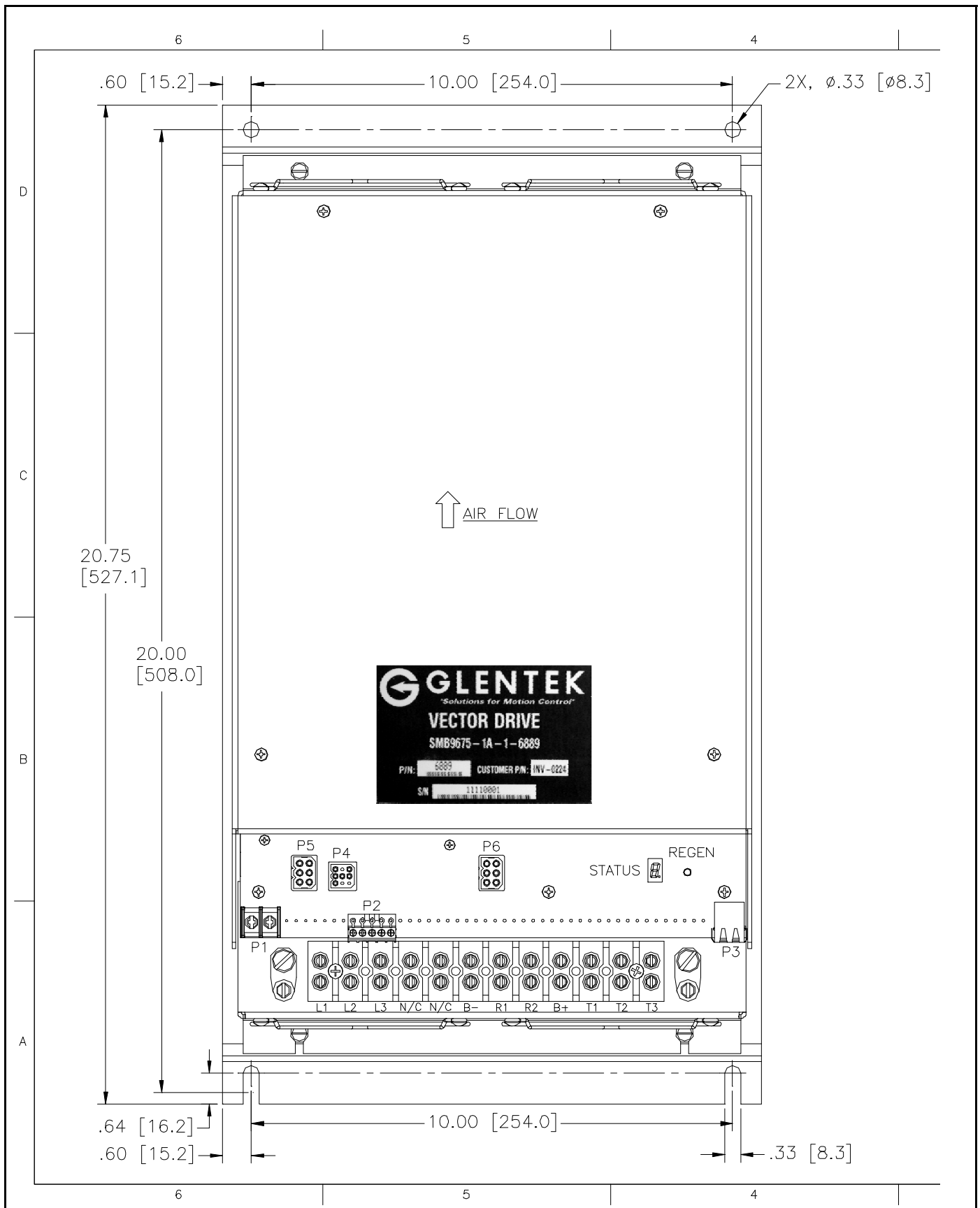
REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	B	INITIAL DRAWING RELEASE	3227	16AUG10	M. TAGUPA	J.A.M.

P1 Load Meter Connector

PIN	SIGNAL NAME
1	BLACK -
2	RED +

P2 Encoder Output Connector

PIN	SIGNAL NAME
8	GND
9	EAOUT +
10	EAOUT -
11	EBOUT +
12	EBOUT -

P3 Host Connector

PIN	SIGNAL NAME
1	N/C
2	N/C
3	N/C
4	COM232
5	TX232
6	RX232
7	N/C
8	N/C

P4 Encoder Input Connector

PIN	SIGNAL NAME
1	SHIELD
2	+5V
3	GND
4	B -
5	B +
6	INDEX +
7	A +
8	A -
9	INDEX -

P5 Inverter Control Connector

PIN	SIGNAL NAME
1	SPINDLE COMMON
2	(SPINDLE REVERSE)
3	(SPINDLE FORWARD)
4	CMD COMMON
5	(SPINDLE FAULT)
6	SPINDLE SPEED

P6 Wye/Delta Connector

PIN	SIGNAL NAME
1	WYE/(DELTA INPUT)
2	N/C
3	HI GAIN/(LOW GAIN INPUT)
4	COMMON FOR WYE DELTA
5	N/C
6	N/C

Motor Power Connector

PIN	SIGNAL NAME
L1	3 PHASE AC INPUT
L2	3 PHASE AC INPUT
L3	3 PHASE AC INPUT
N/C	NOT AVAILABLE
N/C	NOT AVAILABLE
B-	B- OUTPUT
R1	REGEN RESISTOR IN
R2	REGEN RESISTOR IN
B+	B+ OUTPUT
T1	MOTOR OUTPUT PHASE
T2	MOTOR OUTPUT PHASE
T3	MOTOR OUTPUT PHASE

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
8	RESET (FLASHING)
b	BUS OVERVOLTAGE
C	CLAMP
E	ENCODER FAULT
H	HEATSINK OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE

Specifications and Features

AC Input Voltage	240 VAC 3-phase
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. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	See Table
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 450 ± 10 VDC
Bus Undervoltage	Trips nominally at 150 ± 10 VDC
Amplifier Type	Sensored Vector Drive
Analog Command Input	±10V for analog velocity command
Auxiliary Analog Input	Not Available
Pulse & Direction Inputs	Not Available
Encoder Feedback	Accepts TTL level encoder signals
Tachometer Feedback	Not Available
Dedicated Inputs	Inhibit
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	Not Available
Auto Phasing	Not Available
Smart Com Initialization at Amplifier turn on	Not Available
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
Current Loop Bandwidth	Tunable up to 3 KHz
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	5/16 x .75
Dimension (L x H x W - inches)	L. 20.75, H. 8.02 W. 11.20
Backup File	6889-5.BK

Mating Connectors

P5 / P6 Control Connectors 6-Pin Molex	Glentek P/N: EJ588M06; Molex P/N: 03-09-1064
P5 / P6 Control Connector Pins	Glentek P/N: EJD21F09; Molex P/N: 02-09-1119
P4 Inverter Encoder Connector 9-Pin Molex	Glentek P/N: EJ761M09; Molex P/N: 03-06-1092
P4 Inverter Encoder Connector Pins	Glentek P/N: EJD21F06; Molex P/N: 02-06-1103
P3 Host RJ45	Glentek P/N: EJ018083; Molex P/N: 87522-8012

NOTES:

1. MAX HEIGHT 8.02 INCHES
2. FADAL CONFIGURATION SHOWN
3. 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]
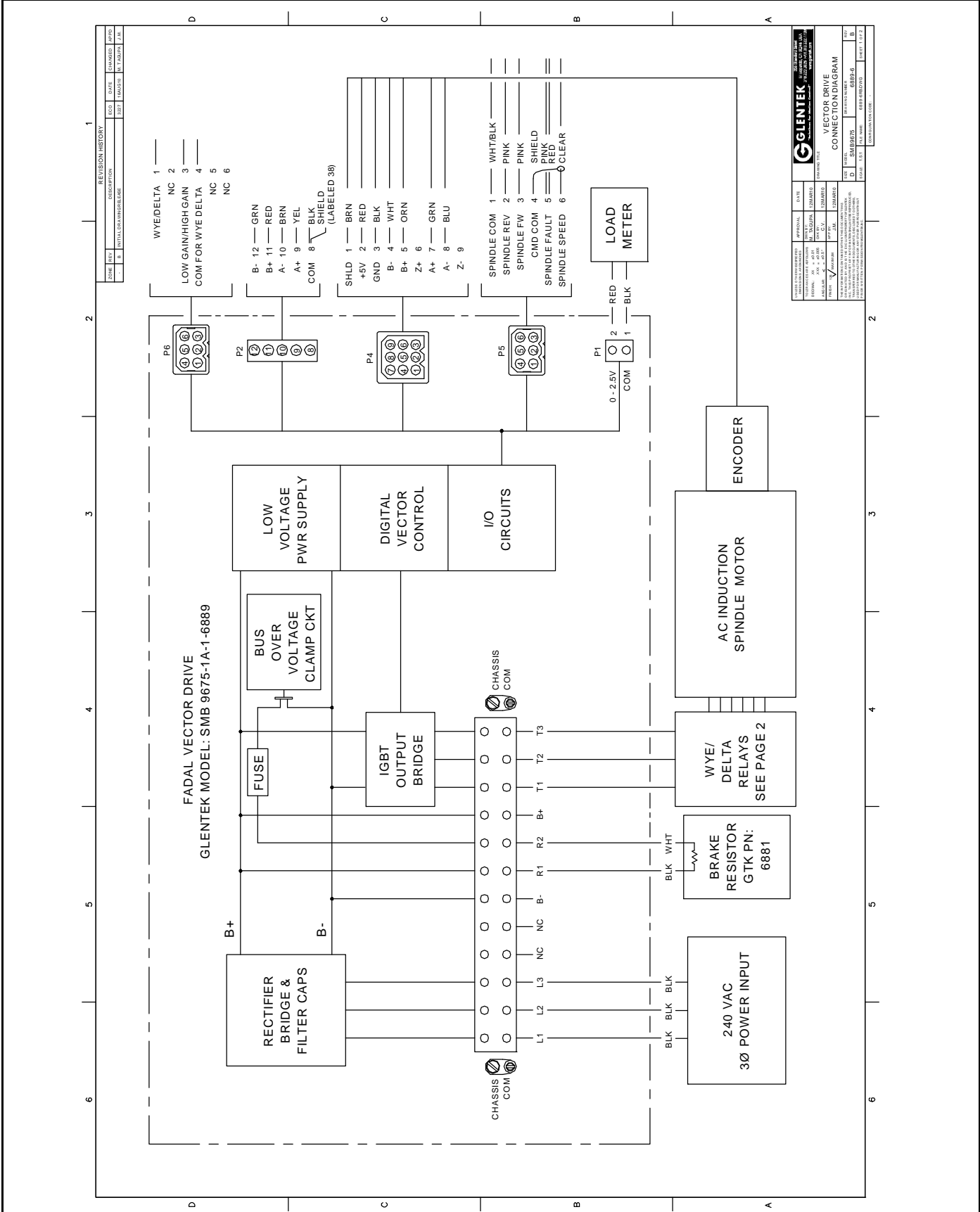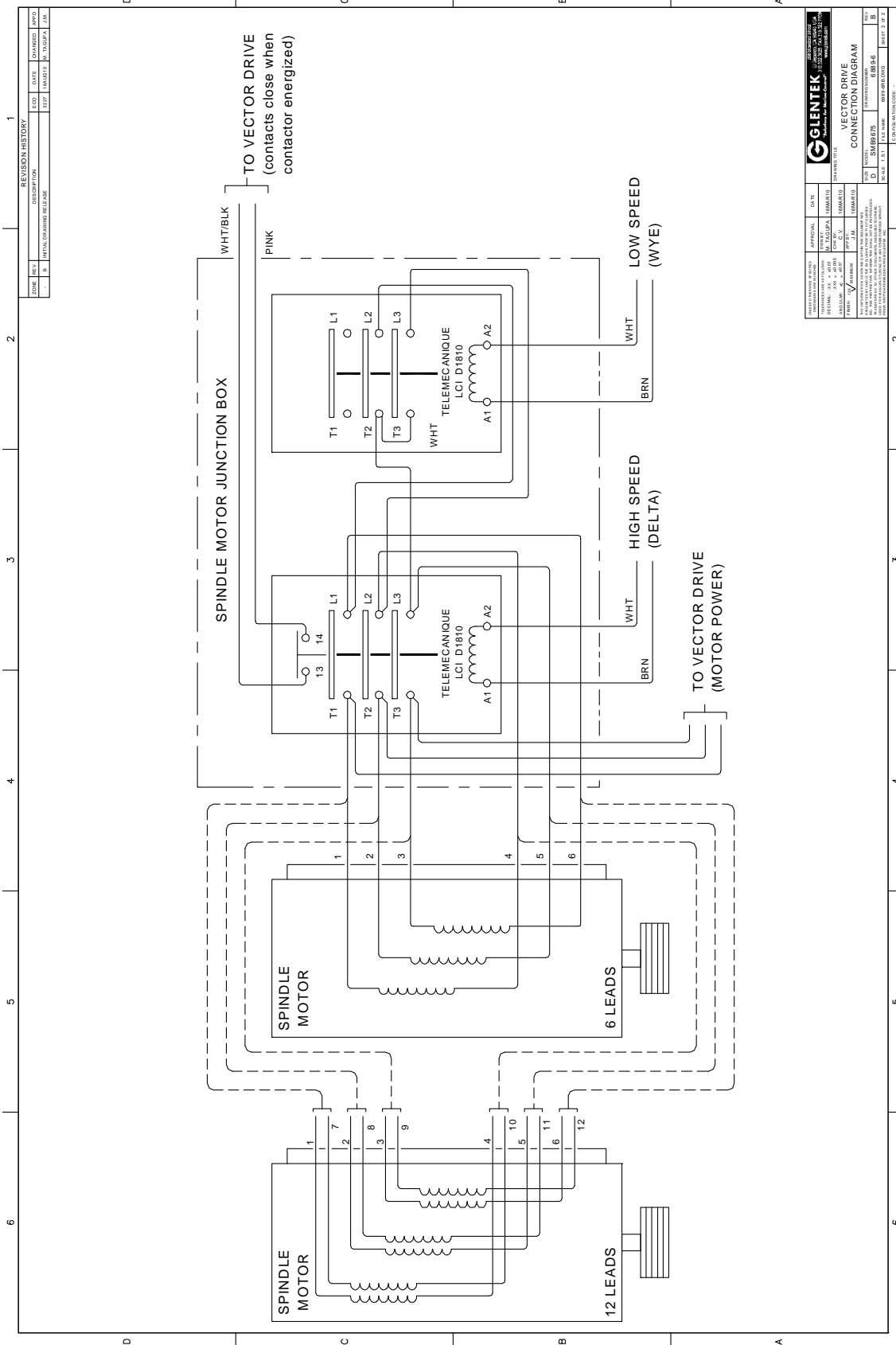4. MAINTAIN MINIMUM OF 2"-3" SPACE AT BOTH ENDS TO ENSURE PROPER VENTILATION.

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: M.TAGUPA	10MAR10
	CHK BY: J.A.M.	10MAR10
	APP BY: J.A.M.	10MAR10

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DRAWING TITLE: **FADAL VECTOR DRIVE INSTALLATION DRAWING**

SIZE	MODEL	DRAWING NUMBER	REV
D	SMB9675-1A-1	6889-1	B

SCALE: 1:1.25	FILE NAME: 6889-1RB	SHEET 1 OF 1

CONFIGURATION CODE: SMB9675

VECTOR DRIVE
CONNECTION DIAGRAM

16

SPINDLE MOTOR JUNCTION BOX

TO VECTOR DRIVE
(contacts close when contactor energized)

WHT/BLK

PINK

LOW SPEED
(WYE)

L1 L2 L3

T1 T2 T3

WHT

TELEMECANIQUE
LCI D1810

A2

A1

WHT

BRN

HIGH SPEED
(DELTA)

13 14

L1 L2 L3

T1 T2 T3

TELEMECANIQUE
LCI D1810

A2

A1

WHT

BRN

TO VECTOR DRIVE
(MOTOR POWER)

SPINDLE
MOTOR

1 2 3 4 5 6

6 LEADS

SPINDLE
MOTOR

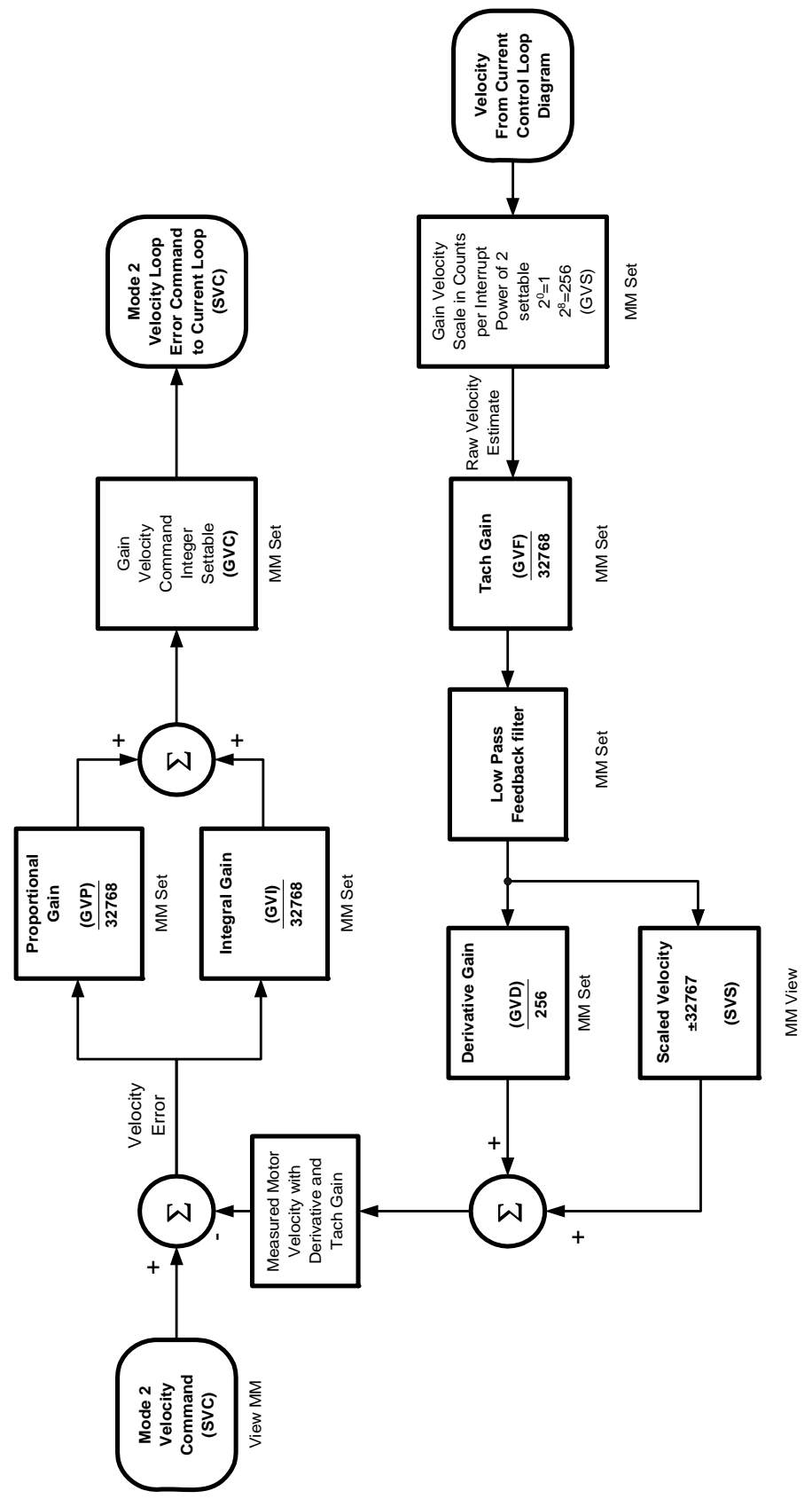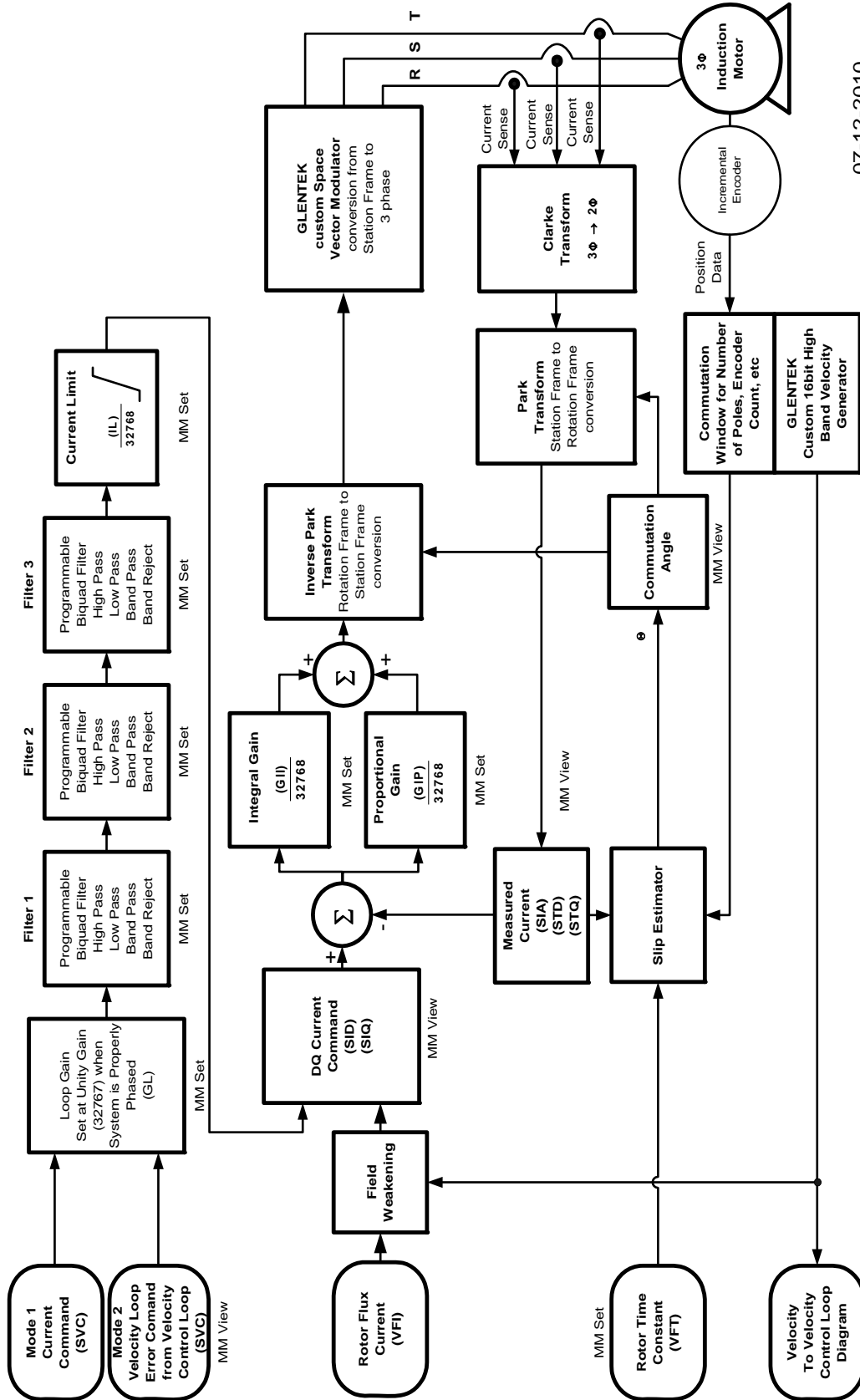1 7 2 8 3 9 4 10 5 11 6 12

12 LEADS

Sensored Vector Command Input Control Diagram
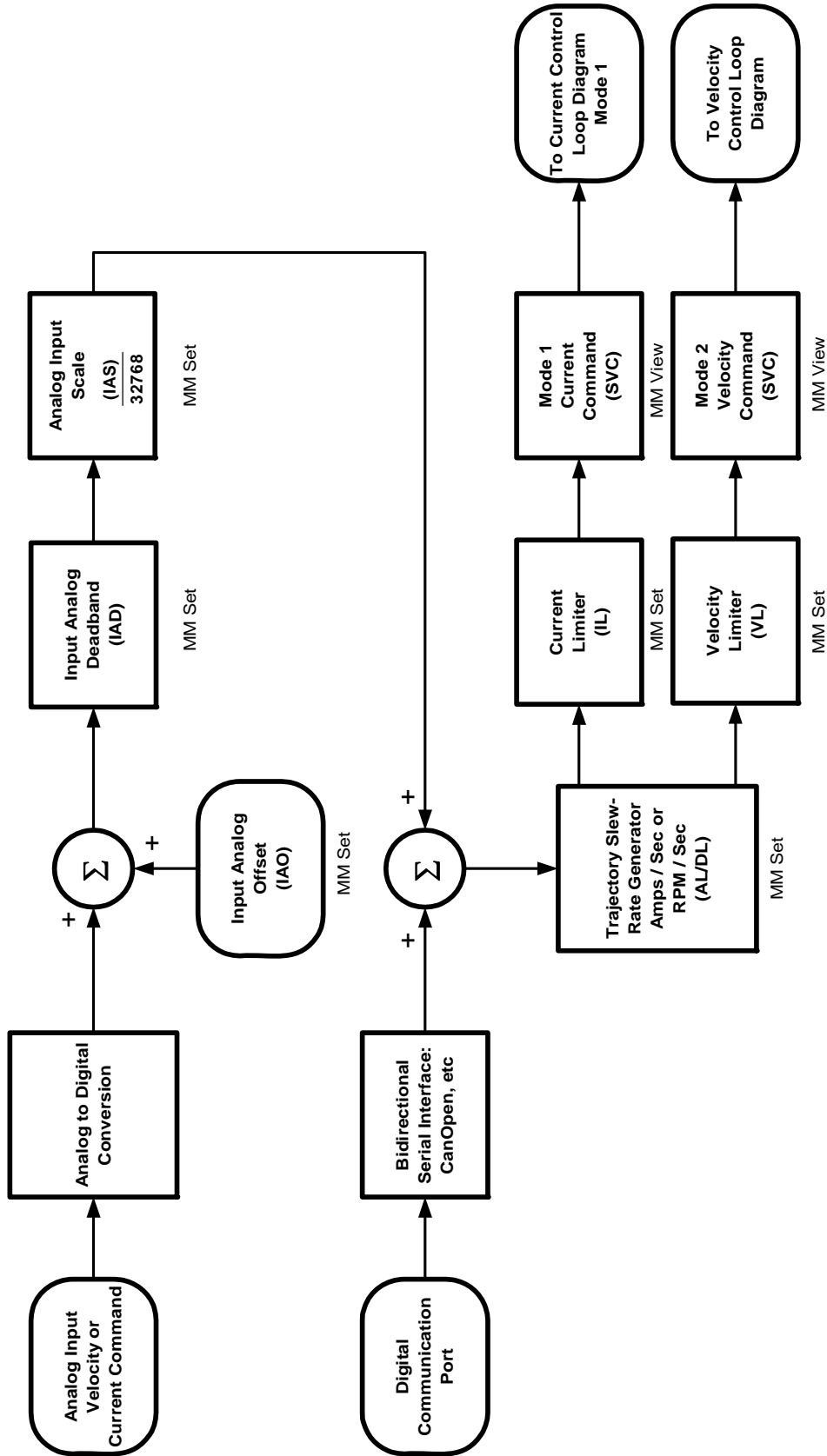
Sensored Vector Velocity Control Loop Diagram

Sensored Vector Current Control Loop Diagram

07-12-2010

GLENTEK

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