VAREDAN
TECHNOLOGIES

VSA1 Series
Digital PWM
Servo Amplifier

VSA1 Series Key Features:

- Operation up to 100VDC max Bus
- 5A Continuous, 10A peak currents
- 24V Keep Alive Option
- Fully Opto-Isolated IO
- Up to 60kHz PWM rate
- Digital Current/Torque, Velocity, and Position Control
- Supports ABSine 2phase external commutation for 3Phase motors
- 1Phase and 3Phase; Linear, Rotary, and Voice Coil Motors
- Ethernet and RS232 Communications Options
- Dual feedback ports, input and output, supporting halls, quad, sine, and absolute digital encoders
- Compact Package (3.55in x 5.5in x 1.45in)
- PC Based VaredanGUI for configuration and tuning

Varedan Technologies has a long history of providing extremely reliable high performance linear servo amplifiers for OEM customers. Following that tradition, the VSA Digital PWM Servo Amplifier line extend our product offerings to include advanced digital controls, efficient power delivery, compact footprint, and simple to use tuning and configuration utilities while retaining the reputation for high reliability and high performance.

The PC based VaredanGUI, with it's built in command stimulus and real time oscilloscope signal tracer views, reduces the requirements for external equipment while setting up new systems. The standard Ethernet based communications easily connects with all modern computers. Full system configuration can be saved and uploaded for quick and easy drive provisioning.

The VSA1 Series DSP provides advanced high speed control in all modes of operation including current, velocity, position, and beyond. By supporting ABSine 2phase external commutation for 3-phase motors, the VSA1 Series Amplifiers is a perfect match for advanced controllers and legacy applications giving the engineer the most flexibility in system configurations. 3-phase torque mode self-commutation is also available from many sources of feedback from standard incremental quadrature to modern absolute digital systems such as BiSS and EnDat.

Contents

READ THIS SECTION BEFORE PROCEEDING.

Warning! Potentially lethal voltages exist within the amplifier when power is applied. Never attempt to handle or probe the amplifier with power applied.

This product contains static sensitive devices and requires proper handling with ESD protection.

These amplifiers are capable of producing large amounts of energy. Serious injury or death can result from improper motor or load movement. Verify proper motor phasing and direction before connecting any load to a motor.

Do not connect the motor to the system load during initial testing and installation.

These amplifiers often require customer supplied airflow for proper operation. Contact the factory for information on adequate airflow for your application.

Be sure power is off when inserting or removing connectors or connections.

1   VSA1 Series Specifications

Power	VSA1 Series
Bus Voltage Input	24VDC Minimum, 100VDC Maximum
Keep Alive Voltage (optional)	24VDC
Continuous Current (peak)	5A
Peak Current (peak)	10A

IO	VSA1 Series
Digital Inputs	5 Inputs, Opto-Isolated (Sink or Source), 5-24V
Digital Outputs	3 Outputs, Opto-Isolated (Sink or Source), 5-24V, Up to 100mA load current
Analog Inputs	2 Inputs, Differential, +/-10V
Analog Outputs	1 Output, 0-5V

Feedback	VSA1 Series
Primary Feedback Port	Incremental Quadrature Input (Differential), Analog Sine/Cos Input (Differential), BiSS, EnDat, Step/Direction Input
Auxiliary Feedback Port	Incremental Quadrature Input/Output (Differential), Synthesized Quadrature Output (Differential), 3 Additional Differential Digital IO
Halls (Digital)	3 Inputs U,V,W (Single-Ended)

PWM Power Stage	VSA1 Series
Phases	3-Phase MOSFET based power section
Modulation	Center based modulation
Switching Frequency	20kHz, 40kHz, 60kHz
Current Loop Bandwidth	Up to 4kHz (dependent on switching frequency and motor parameters)

Communications	VSA1 Series
Communications Ports	Ethernet (UDP), RS232 (optional)

Operation	VSA1 Series
Operational Modes	1-Phase Current/Torque, 3-Phase Current/Torque (Internal Commutation), 3-Phase ABSine Torque (External 2phase Commutation), Velocity Control, Position Control, Step/Direction, Stored Motion, Cam/Following

Protection Feature	VSA1 Series
Amplifier Protection Features	Under-Voltage Protection, Over-Voltage Protection, Over-Temperature Protection, Over-Current Protection, Short Circuit Protection
Motor Protection Features	Motor Over-Temperature Input (NTC, PTC), Continuous Current Limit (I2T), Peak Current Limit

Mechanical	VSA1 Series
Length	5.5in (139.7mm)
Width	1.45in (36.8mm)
Height	3.55in (90.1mm)
Weight	0.7lb (0.31kg)

2   Product Model Numbering

Characters in **RED (X,Z)** are configuration fields.

Field Number		0		1	2	3		4
VSA1	-	**CCCC**	-	**WW**	**XX**	**YY**	_	**ZZZ**

Part Number Break Down by Field Number:

Field Number	Description	Present Options	Notes
VSA1	Varedan Switching Amplifier 1		Product Series
0 (CCCC)	Current Levels	0510 = 5A Continuous, 10A Peak	Required for valid number
1 (WW)	Bus Voltage	01 = 100VDC Max	Required for valid number
2 (XX)	Output Filter Board	00 = No Filter Board See Output Filter Board Table 2.1	Required for valid number
3 (YY)	Expansion Interface Board	00 = No Expansion Board 01 = RS232 Board (RJ11)	Required for valid number
4 (ZZZ)	Unique _CustomerConfigCode	Contact Varedan Engineering	Optional, (Note1)

Note1: The unique _CustomerConfigCode defines factory configuration of specific firmware versions, software configuration files, and/or any non-standard physical configuration options to be applied at production time by the factory. If no _CustomerConfigCode is specified, current firmware versions and generic configurations settings will be used. If required, this option must be requested by the customer, approved by Varedan engineering, and a unique number will be assigned.

2.1 Output Filter Board Options

For sensitive applications, an internally mounted LRC power output filter board can be added to the VSA1 amplifier module. The addition of the filter board does not increase the package size. The following table describes the filter board configurations currently available. Please contact Varedan Engineering for custom filter configurations.

Option Code	-3dB Roll-Off Frequency	Peak Current	Max PWM Frequency	Notes
00	N/A	N/A	N/A	No Filter Board
01	2MHz	10A	60kHz	
02	715kHz	10A	20kHz	

3   Package Views

3.1 Front View

3.2 Side View

4   VSA1 Connector Pinouts

4.1 P1 – IO, Aux-Encoder Interface, Current/Velocity/Position Analog Command

Mating Connector = Amphenol 17EHD-026-P-AA-0-00 or equivalent.

Pin Number	Signal	Direction	Levels	Description
1	IN1 (Enable)	Input	5-24V	Opto-Isolated Input - Enable - (Note1)
2	IN2	Input	5-24V	Opto-Isolated Input - (Note1)
3	IN3	Input	5-24V	Opto-Isolated Input - (Note1)
4	IN4	Input	5-24V	Opto-Isolated Input - (Note1)
5	IN5	Input	5-24V	Opto-Isolated Input - (Note1)
6	IN COM	–	–	Return for all Opto-Isolated Inputs - (Note1)
7	OUT1 (Fault)	Output	5-24V	Opto-Isolated Output - Fault - (Note2)
8	OUT2	Output	5-24V	Opto-Isolated Output - (Note2)
9	OUT3	Output	5-24V	Opto-Isolated Output - (Note2)
10	Analog Output	Output	0-5V	DAC generated Analog Output
11	CMD A+	Input	+/-10V	Differential Current/Velocity/Position Command
12	CMD A-	Input	+/-10V	Differential Current/Velocity/Position Command
13	CMD B+	Input	+/-10V	Differential Current/Velocity/Position Command
14	CMD B-	Input	+/-10V	Differential Current/Velocity/Position Command
15	Common	---	---	System Common
16	Common	---	---	System Common
17	OUT COM	–	–	Return for all Opto-Isolated Outputs - (Note2)
18	+5V Out	Supply	+5VDC	Encoder/IO power - (Note3)
19	+5V Out	Supply	+5VDC	Encoder/IO power - (Note3)
20	Common	---	---	System Common
21	Aux Encoder I-	In/Out	+/-5V	Auxiliary Encoder Interface - Index
22	Aux Encoder I+	In/Out	+/-5V	Auxiliary Encoder Interface - Index
23	Aux Encoder B-	In/Out	+/-5V	Auxiliary Encoder Interface – B Channel
24	Aux Encoder B+	In/Out	+/-5V	Auxiliary Encoder Interface – B Channel
25	Aux Encoder A-	In/Out	+/-5V	Auxiliary Encoder Interface – A Channel
26	Aux Encoder A+	In/Out	+/-5V	Auxiliary Encoder Interface – A Channel

4.2 P2 – Main Feedback Interface

Mating Connector = Amphenol 17EHD-015-P-AA-0-00 or equivalent.

Pin Number	Signal	Direction	Levels	Description
1	Hall U	Input	0-5V	Hall Position Sensor Input
2	Hall V	Input	0-5V	Hall Position Sensor Input
3	Hall W	Input	0-5V	Hall Position Sensor Input
4	BiSS/Endat Data -	In/Out	+/-5V	Digital Encoder Data-
5	BiSS/Endat Data +	In/Out	+/-5V	Digital Encoder Data+
6	Main Encoder I +, BiSS/Endat Clock +	In/Out	+/-5V	Quadrature/Sine-Cosine Index +, Digital Encoder Clock +
7	Main Encoder I -, BiSS/Endat Clock -	In/Out	+/-5V	Quadrature/Sine-Cosine Index -, Digital Encoder Clock -
8	Motor Temp +	Input	---	NTC/PTC Motor Temp Sensor
9	Motor Temp -	Input	---	NTC/PTC Motor Temp Sensor
10	+5V Out	Supply	+5VDC	Encoder/IO power
11	Common	---	---	System Common
12	Main Encoder A+	Input	+/-5V	Quadrature/Sine-Cosine A+
13	Main Encoder A-	Input	+/-5V	Quadrature/Sine-Cosine A-
14	Main Encoder B+	Input	+/-5V	Quadrature/Sine-Cosine B+
15	Main Encoder B-	Input	+/-5V	Quadrature/Sine-Cosine B-

4.3 P3 – Power Connector

Mating Connector = On-Shore EDZ950/7

Pin Number	Signal	Direction	Levels	Description
1	Bus Common	---	---	Bus Common / Return
2	Keep Alive	In	+24V	Keep Alive Input, Shares return with Bus Input (P3-Pin1)
3	Bus Input	In	+24-100VDC	Bus Input Terminal
4	Motor Phase A	In/Out	---	Motor Lead A
5	Motor Phase B	In/Out	---	Motor Lead B
6	Motor Phase C	In/Out	---	Motor Lead C
7	Chassis Ground	---	---	Connection to Backplate

4.4 IO Notes

Note1: Each Opto-isolated Input has the following circuit with bi-directional Opto-isolator. The Input circuit can be either pulled up or pulled down using the "IN COM" pin that is shared across all input channels. If no external voltage is available, and the opto-isolation is not required, +5V or Common from the amplifier can be used.
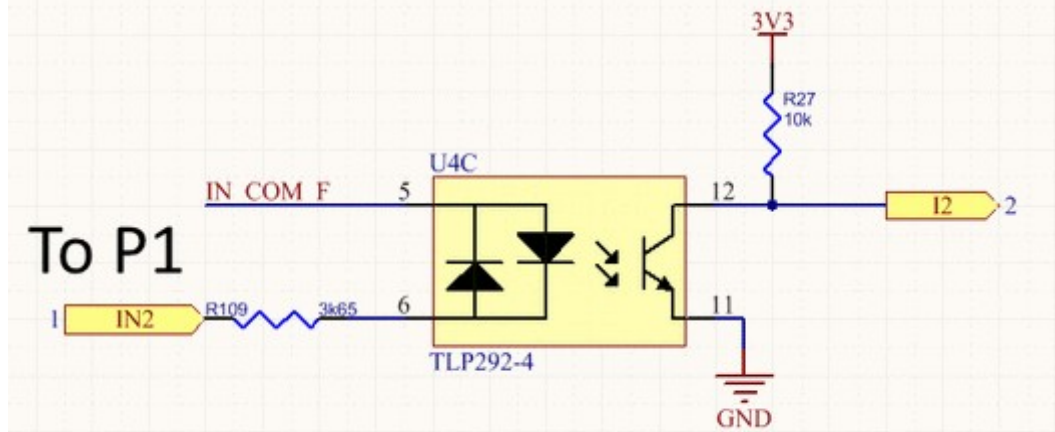
Note2: Each Opto-isolated Output has the following circuit with a solid-state relay capable of 100mA load current. The Output circuit can be either pulled up or pulled down using the "OUT COM" pin that is shared across all output channels. If no external voltage is available, and the opto-isolation is not required, +5V or Common from the amplifier can be used.
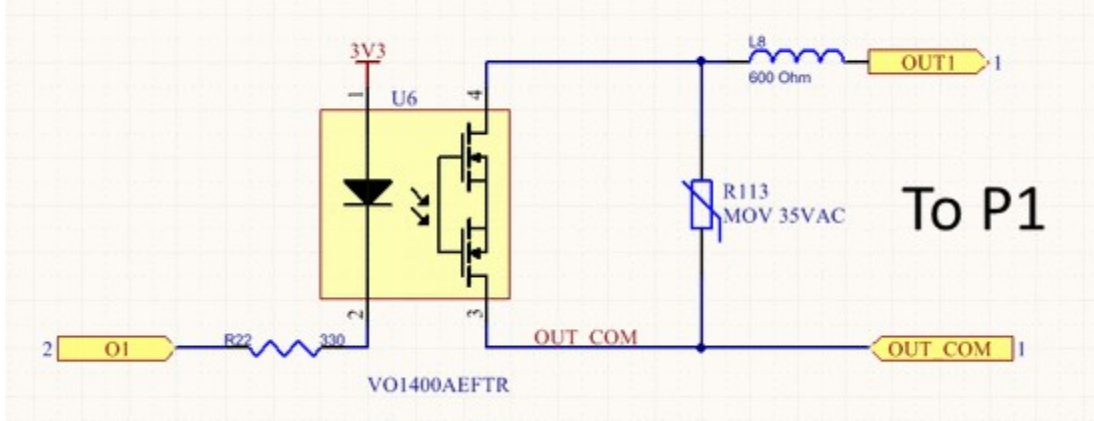
Note3: Total +5V Out current is limited to 1A.

Note6: Shells of all DSUB connectors are Chassis Ground Referenced to the amplifier heatsink.

5   Expansion Interface Boards Connector Pinouts

5.1 (01 Expansion Board Option) E1 - RS232 Board RJ11

Mating Connector = Standard RJ11

Pin Number	Signal	Direction	Levels	Description
1	No Connect	---	---	---
2	RS232 – RX	In	+/-15V	Input to RS232 Card
3	Common	---	---	System Common
4	Common	---	---	System Common
5	RS232 - TX	Out	+/-15V	Output from RS232 Card
6	No Connect	---	---	---

5.1.1   RS232 Board - Firmware Update Bootloader Button

This tactile off-mom push button is manually pressed to enter the DSP serial bootloader for updating VSA1 firmware. See section on firmware updating for more information.

6   RS232 Serial Port

The E1 port optional plug in card adds RS232 serial communications to the VSA1 amplifier. This card has a standard RJ11 connector which brings out RS232 level signals.
The VaredanGUI is the preferred method of communicating with the drive, but a standard ASCII terminal can also be used.

6.1 PC Based Terminal Options

Many terminal programs can be used to communicate with the VSA1 series amplifiers over the serial port. We recommend the use of the freely available Open Source TeraTerm.
TeraTerm can be downloaded from the following link:
https://ttssh2.osdn.jp/

6.2 Serial Port Software Configuration

The COM port settings for the VSA1 amplifier using the RS232 card are:
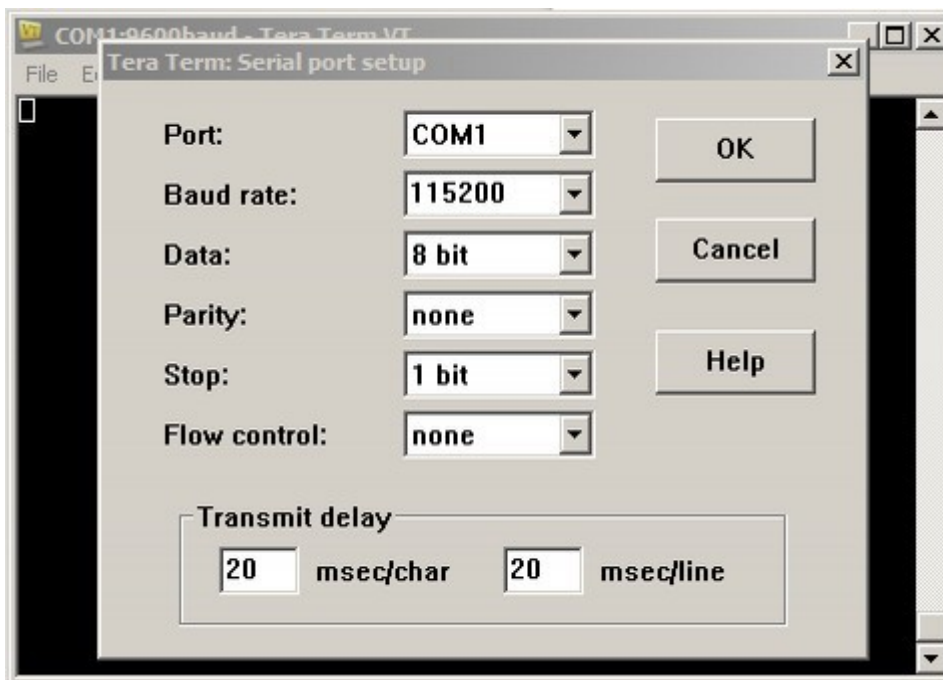
Baud Rate = 115200
Data = 8bit
Parity = none
Stop = 1bit
Flow Control = none
If using TeraTerm, we recommend a transmit delay of 20ms/char and 20ms/line while sending configuration files. Substitute your active COM port in the setup information shown.

7   Software Commands

See the VaredanGUI for instructions on software commands.

8   Operational Modes

See the VaredanGUI for instructions on changing operational modes and configuration.

9   Firmware Upgrade Procedure

9.1 VaredanGUI Firmware update

The VaredanGUI should be used as the primary tool for updating drive firmware and making system configuration changes. If this option is not available, the 3rd party C2Prog program can also be used. Contact Varedan Engineering for firmware images for each program.

9.2 C2Prog Firmware Update

1. Download and install CodeSkin C2Prog v1.7j from the following link:
http://www.codeskin.com/c2prog-download
C2Prog will be used to flash the firmware hex file onto the VSA1 amplifier.

2. Press and hold the indicated Firmware Bootloader Button before and during supply power-up. The button can be released once the amplifier has finished powering up (typically 2-3 seconds). The LED below connectors P1/P2 must be solid orange, indicating that the amplifier is in Firmware Flash Mode. If it is not, power down the amplifier and repeat the process.

E1-RS232

Firmware Bootloader Button
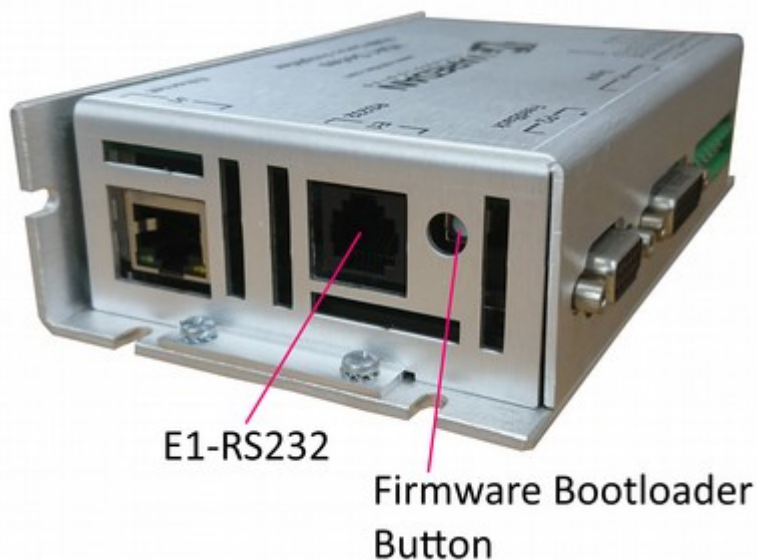
3. Connect the RJ12 serial cable as shown above to the E1 RS232 port.

4. Open C2Prog and select the firmware hex file from its saved location as shown.
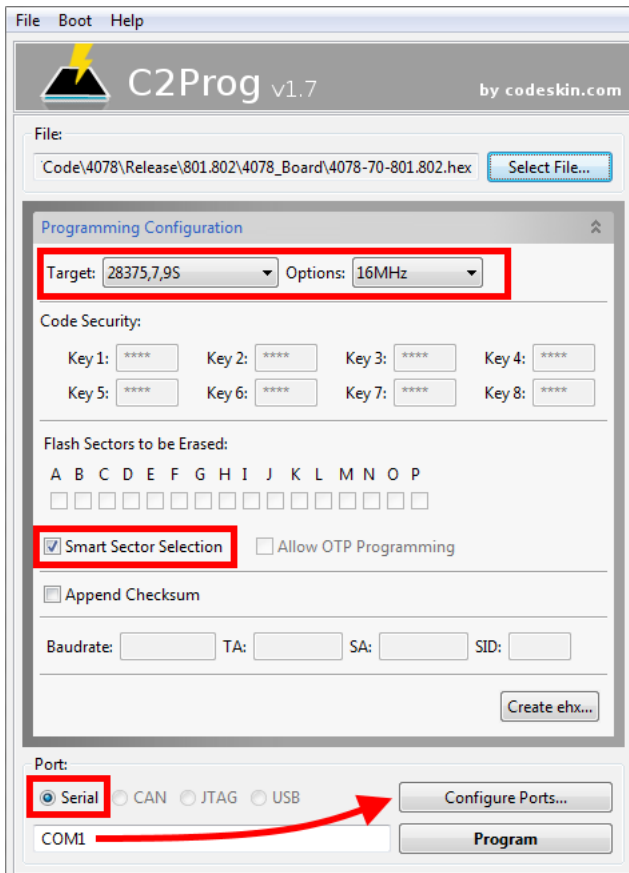
4. Expand the Programming Configuration section as shown by clicking on the double arrows.
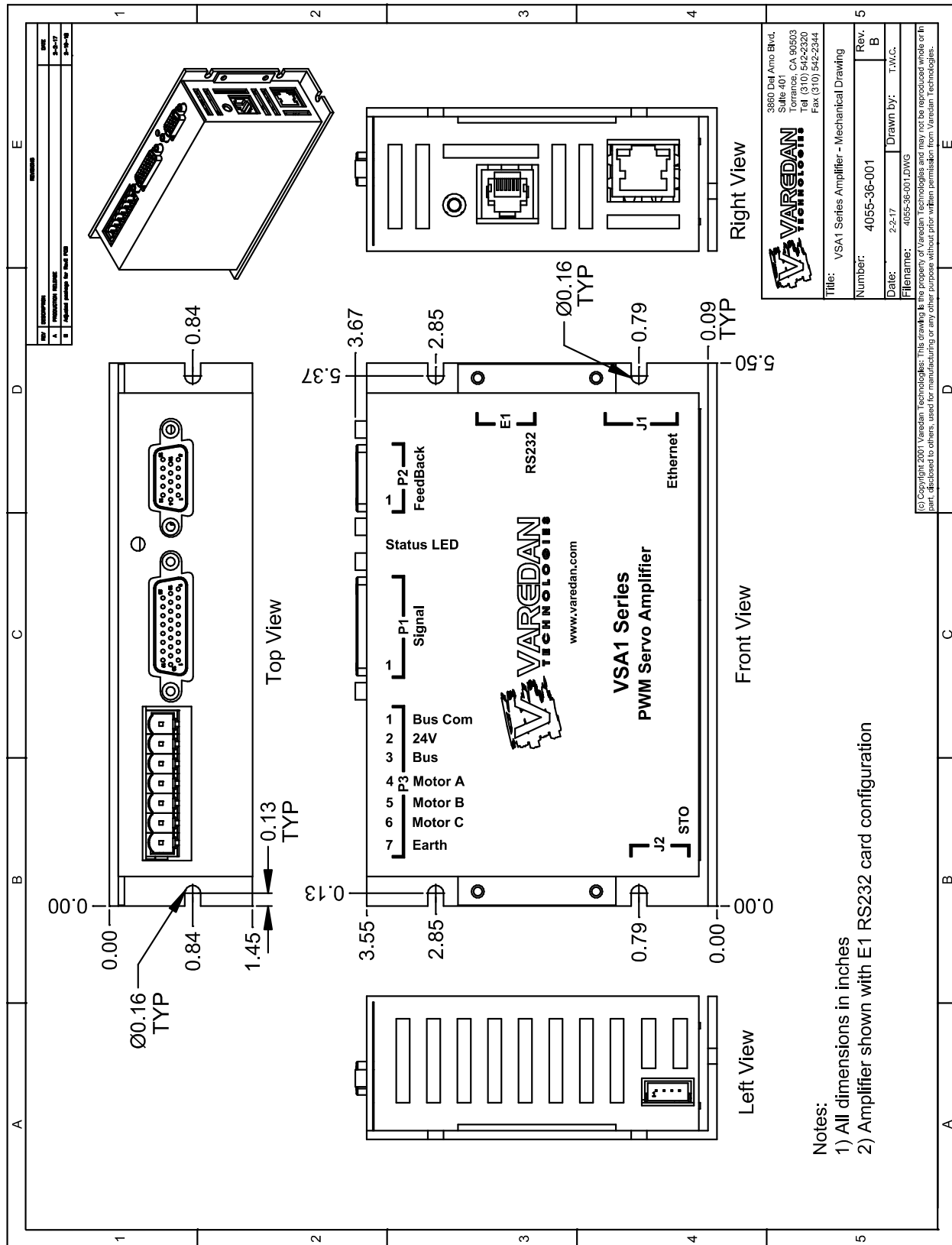
5. Set the following fields as shown:
   - Target: 28375,7,9S
   - Options: 16MHz
   - Smart Sector Selection: checked
   - Port: Serial

6. Click on the "Configure Ports..." button to open the Port Configuration pop-up.

7. Click on the "Scan Ports" button and select the appropriate port from the drop down menu.
Close the Port Configuration pop-up window after the correct port has been selected.

8. Click on the "Program" button to flash the firmware hex file onto the amplifier.

9. Verify that the "Programming...OK" dialogue is present and close the Programming pop-up window.

10. Power the amplifier off and then back on, this time without holding the Flash Mode button.

11. This procedure should be followed by reloading the configuration file as described in the previous section.

10 Physical Dimensions

Right View

Top View

Front View

Left View

VSA1 Series
PWM Servo Amplifier
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P2 FeedBack

Status LED

P1 Signal

1	Bus Com
2	24V
3	Bus
4	Motor A
5	Motor B
6	Motor C
7	Earth

P3

E1
RS232

J1
Ethernet

J2
STO

Ø0.16 TYP
0.84
3.67
2.85
5.37
Ø0.16 TYP
0.79
0.09 TYP
5.50

0.00
0.84
1.45
0.13 TYP
3.55
2.85
0.13
0.79
0.00
0.00
0.00
Ø0.16 TYP

Notes:
1) All dimensions in inches
2) Amplifier shown with E1 RS232 card configuration

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Title: VSA1 Series Amplifier – Mechanical Drawing
Number: 4055-36-001
Rev. B
Drawn by: T.W.C.
Date: 2-2-17
Filename: 4055-36-001.DWG

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11 Document Revision History

(4055-42-001)

Revision	Release Date	Notes
A	2-2-2017	Initial release of manual.
B	2-27-17	Added filter board options table
C	3-21-18	Updated dimensions, P1 Pinout, Part Numbering

12 Contact Information

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13 Warranty Information

Varedan Technologies warrants this product series to be free of manufacturing defects for a period of one year.

If your product requires service, please contact our factory for troubleshooting information and if needed, return material authorization (RMA) information.