TEKdrive TM Servo Drives

TEK10 (LV) & TEK20 (HV) Series

The TEKdrive range of fast, smooth and accurate servodrives are specifically designed for use with Brushed DC Motors in smaller CNC Machine applications. Utilisation of Step and Direction input signals enables the TEKdrive to be used as a direct replacement for stepper motor controllers while delivering greater accuracy and increased speeds. Easy to mount, compact and versatile, the TEKdrive range offer increased safety features with opto-isolated drive circuitry and internal fusing for component failure protection.

Features

- Power Output over 2000W
- Dual high speed processors for smooth control
- Full trimpot PID adjustment during operation
- Up to 25A continuous current (TEK10)
- Up to 15A continuous current (TEK20)
- Encoder dividable by 2, 4 or 8
- Input and encoder speeds in excess of 2MHZ
- Accepts either Single or Differential encoders
- Over-current trip, fully adjustable
- Over-temperature protection
- Separate Drive and Fault indicator LEDs
- Analogue voltage input options
- Minimal heat generation
- Mounts vertically or horizontally
- All controls on one edge for rack mounting
- Full opto-isolation of motor drive circuitry
- Separate enable and fault signals
- +/- 1V to +/-10V Output, with zero and scale adjustments, for motor tuning or analog motor control.
- Output voltage can reflect instantaneous Power output or Following error.
- Logic power supply to motor drivers fused for extra safety.
- Separate fault indication for following error or over-current faults.

Applications

- DC brushed motor control
- CNC machine conversion & retrofits
- Analog Servo retrofit
- Spindle Motor Control
- Industrial Automation
- Process Control

Functional Diagram

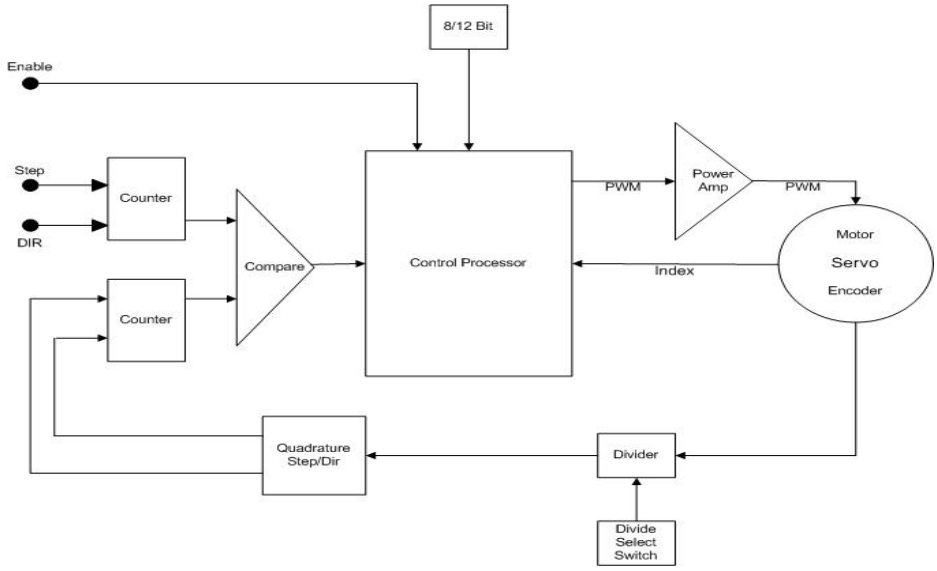
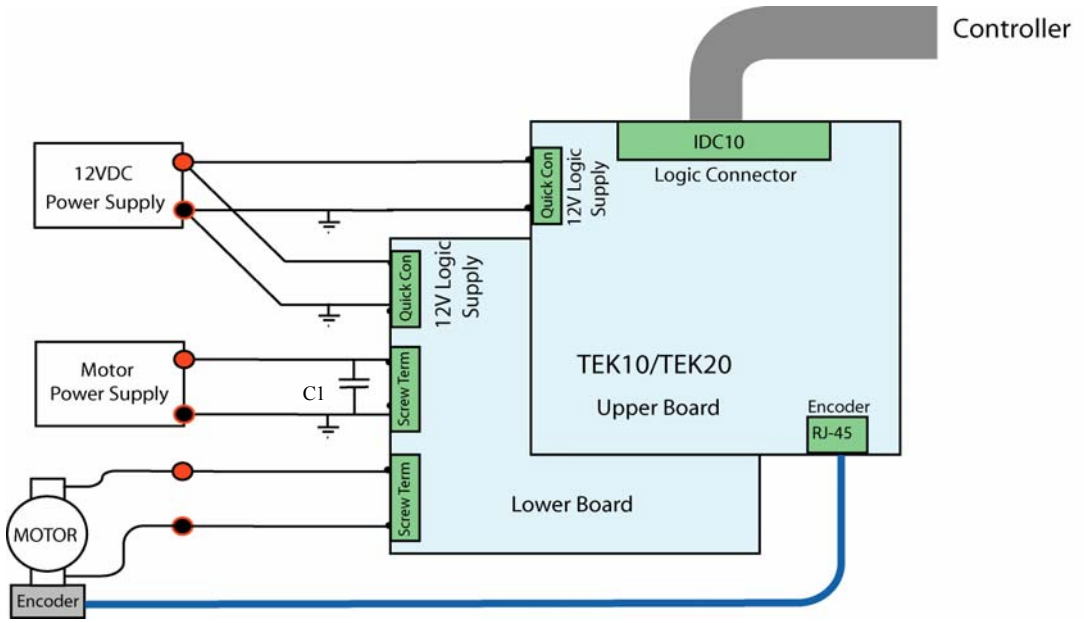


Figure 1 Functional block diagram of TEK10/20

Connection Diagram



NOTE:

1. Values are common to both TEK10 and TEK20 unless specified.
2. The addition of a capacitor (C1 in Connection Diagram) near the power input terminal may be required to reduce supply ripple voltage. This is particularly important when using high current motors**. (**See Design Notes Section)

Figure 2 Diagram detailing all available connections

Figure 2, above, shows the typical setup configuration. The drive connections are all located along one end of the controller to provide easy access when mounted.
Encoders are connected to the drive via a standard computer Cat 5 cable which is available, in various lengths and with plugs attached, from almost any computer store. Differential encoder connections have greatly increased noise immunity and are highly recommended. To connect the Cat 5 cable to the encoder we have available cable adaptors which allow connection to either single or differential encoders. In the case of single ended encoders we further recommend the use of single to differential converters, which convert the single signals to differential (RS485) close to the encoder, thus further reducing induced noise.
The two boards in each TEKDrive possess separate power supply inputs in order to reduce noise reaching the top processor board when using high current motors. When operating with motors rated 10A or less, they can be connected to the same power supply, dual supplies are recommended for currents above this. Wrapping the supply wires to the top motor through a ferrite bead will further help to block any HF noise. Detailed descriptions of each pin and functions are given in table 2

Technical Specifications & Characteristics

Parameter	TEK10	TEK20
Drive Specification		
Motor Power Supply (Maximum)	80V,	200V
Motor Power Supply (Minimum)	15V,	15V
Motor Power Supply Ripple Voltage	<2% See Fig 2, Note 2	<2% See Fig 2, Note 2
Drive Current (Peak)	35A,	20A
Drive Current (Continuous)	25A,	15A
Drive Current Trip Value (MAX)	30A,	15A
Drive Transistors Current Rating (MAX)	72A	38A
Drive Transistors Voltage Rating (MAX)	100VDC	250VDC
Drive Current Trip Time	2mSec,	1mSec
PWM Switch Frequency	24Khz	24Khz
Thermal Resistance	0.165R @ 80degC	0.265R @ 80degC
Thermal Heat Dissipation (Maximum)	65W	65W
Motor Suitability		
Servo Motor Resistance (Minimum)	1 ohm	1 ohm
Servo Motor Inductance (Minimum)	1mH	1mH
Servo Motor Voltage Rating	20-80VDC	75-200VDC
Logic Power Supply		
12V Upper Board Supply	12-15V @ 0.25A	12-15V @ 0.25A
12V Lower Board Supply	12-15V @ 0.1A	12-15V @ 0.1A
Encoder Specifications		
Encoder Type	Quadrature Incremental, Single/Differential output	Quadrature Incremental, Single/Differential output
Encoder Index Signal	Needed for VMODE option only	Needed for VMODE option only
Encoder 5V Supply Current (Maximum)	100mA	100mA
Encoder Pulse Frequency (Maximum)	2Mhz	2Mhz
Encoder terminal Input impedance	10K Ohms	10K Ohms
Encoder Voltage	5V – 15VDC	5V – 15VDC
Physical Specification		
Dimensions	88mm (W) 118mm(H) 40mm(D) 3.46in (W) 4.65in(H) 1.58in(D)	88mm (W) 118mm(H) 40mm(D) 3.46in (W) 4.65in(H) 1.58in(D)
Weight	250gms or 8.8oz	250gms or 8.8oz
Mounting	3M tapped holes	3M tapped holes
Motor Terminals	Screw Tab rated 500V 32A	Screw Tab rated 500V 32A
12V Supply Terminals	Quick connect – lever action	Quick connect – lever action
Logic Connector	IDC10	IDC10
Encoder Connector	RJ45	RJ45
Operating Temperature Range	0 ~ 55 DegC RH 90% non condensing	0 ~ 55 DegC RH 90% non condensing
Storage Temperature Range	-30 ~ 85 DegC RH 90% non condensing	-30 ~ 85 DegC RH 90% non condensing
Vibration/Shock Resistance	0.5/2G	0.5/2G

Table 1 TEKdrive $_{TM}$ 10 & 20 technical specifications

I/O Descriptions – Upper Board *(See Figure 5, Page 7)*

Logic Connector - IDC10		
Pin	**Label**	**Description**
1	CC	Input – In VMODE logic high selects clockwise rotation of the servo motor. Speed is proportional to the VMODE Input voltage.
2	CCW	Input - In VMODE logic high selects counter clockwise rotation of the servo motor. Speed is proportional to the VMODE Input voltage.
3	STEP	Input – When NOT in VMODE the rising edge of the step input commands a single encoder step rotation in the direction selected by DIR.
4	DIR	Input – When NOT in VMODE a logic high selects a clockwise step and logic low a counter clockwise step.
5	VMODE	Input – Logic high commands the controller into VMODE. See VMODE description for further information
6	ENABLE	Input – Logic high enables the driver to control the servo motor. Logic low stops all output to the servo motor.
7	PAUSE	Output – Logic high is output when: The drive is in transition from VMODE to Step/Dir and is rotating the motor to find the Index. The drive is in VMODE and the motor is ramping up to speed.
8	RUN	Output – Logic high output indicating the drive is running correctly. This corresponds with the Green LED on the drive. If the drive is ENABLE and an error occurs the RUN output will indicate logic low.
9	GND	Logic ground connection.
10	GND	Logic ground connection.
Encoder Connection - RJ45 Connector		
Pin	**Label**	**Description**
1	GND	Signal ground to encoder
2	+5V	5V supply to encoder
3	INDEX-	Optional index signal input from encoders fitted with index pulse generation. One pulse per encoder revolution. *
4	INDEX	Optional index signal input from encoders fitted with index pulse generation. One pulse per encoder revolution. See VMODE description for application.
5	CHA-	-Input of encoder A channel *
6	CHA	+Input of encoder A channel
7	CHB-	-Input of encoder B channel *
8	CHB	+Input of encoder B channel
	NOTE	Max voltage for any of the signal pins (3-8) is 15VDC (with external supply)
	*	Leave unconnected for use with single ended encoders
12V Logic Supply – Quick Connect Terminal		
Pin	**Label**	**Description**
1	+12VDC	12V logic supply positive. For operations with motors drawing less than 10A this supply can be connected to the same power source as the 12V Driver Supply. The supply lines should be wrapped through a ferrite bead to block HF noise propagating from the driver supply. For high current motors the supplies should be separated to reduce driver noise entering the logic 12V supply.
2	VMODE Input	In VMODE the controller accepts a 0-5V input signal. The servo motor is driven in the direction set by CW and CCW at a speed proportional to the input voltage level. See VMODE (page 9) for further information
3	GND	12V Logic Supply ground.

I/O Descriptions – Lower Board *(See Figure 5, Page 7)*

12V Drive Supply – Quick Connect Terminal

Pin	Label	Description
1	+12VDC	12V driver supply input connection.
2	GND	12V driver supply ground connection.

Power Input - Terminal Barriers

Pin	Label	Description
1	+	Power input positive connection. See technical specifications above for voltage and current limits.
2	GND	Power input ground connection.

Motor Output - Terminal Barriers

Pin	Label	Description
1	+	Connection to the positive terminal of the servo motor.
2	-	Connection to the negative terminal of the servo motor.

Table 2 Input Output Descriptions for TEK10/TEK20 Servo driver

Switches and Adjustment Descriptions

Controls –Upper Board *(See Figure 4, Page 6)*

Label	Signal	Description
SWU1	VCAL	Selecting ON when RUN is logic LOW enables VMODE calibration button to calibrate spindle speed. After the drive is enabled SWU1 controls the function of VOUT (see Fig. 4). OFF allows the instantaneous power setting to be reflected through the VOUT socket as a +/- 10V voltage, useful for motor tuning or external drive control. ON reflects the instantaneous following error.
SWU2	ERROR	ON selects 12 bit error mode. OFF selects 8 bit error mode. This selection must be made before enabling the drive. A following error will occur if the encoder count is > +/-120 from the commanded position in 8 bit mode and > +/- 1800 counts in 12 bit mode. If the error mode needs to be changed the drive must be re-enabled before the setting will take effect.
SWU3	DIV2	Divides the encoder input pulse count by 4. Can be used in conjunction with SW4.
SWU4	DIV4	Divides the encoder input pulse count by 2. Can be used in conjunction with SW3.
POT1	DER	Derivative: This POT adjusts the rate of change of error gain.
POT2	INT	Integral: This POT adjusts the steady state error gain.
POT3	PRO	Proportional: This adjusts the amount of output power relative to the error signal that the drive will supply.
POT4	SPAN	Adjusts the gain of the VOUT signal. The range is +/-1V to +/-10V
POT5	ZERO	Adjusts the zero voltage of the VOUT signal.
BUT1	CAL	VMODE calibration button.
JACK	VOUT	VOUT function is selected by SWU2 as follows: SWU1 ON – VOUT voltage is proportional to the following error. SWU1 OFF – VOUT is proportional to the PWM power. With VOUT proportional to PWM power this signal can be used to control analogue servo motor. (2.5mm Mono Jack Socket)
LED	GREEN	ON - indicates drive engaged and OK
LED	RED	ON – Drive disengaged due to following error trip FLASHING - Drive disengaged due to over current trip

Table 3 Control Signal Descriptions for TEK10/TEK20 Upper Board

Controls - Lower Board *(See Figure 4, Below)*		
Pin	**Label**	**Description**
POT6	TRIP	Adjusts the drive current trip limit between 0.5A and the maximum current limit selected by SWL1 and SWL2. See current limit logic table for values.
SWL1	CUR1	ON increases the driver peak current error trip limit. See current limit logic table for values.
SWL2	CUR2	ON increases the driver peak current error trip limit. See current limit logic table for values.

Table 4 Control Signal Descriptions for TEK10/TEK20 Lower Board

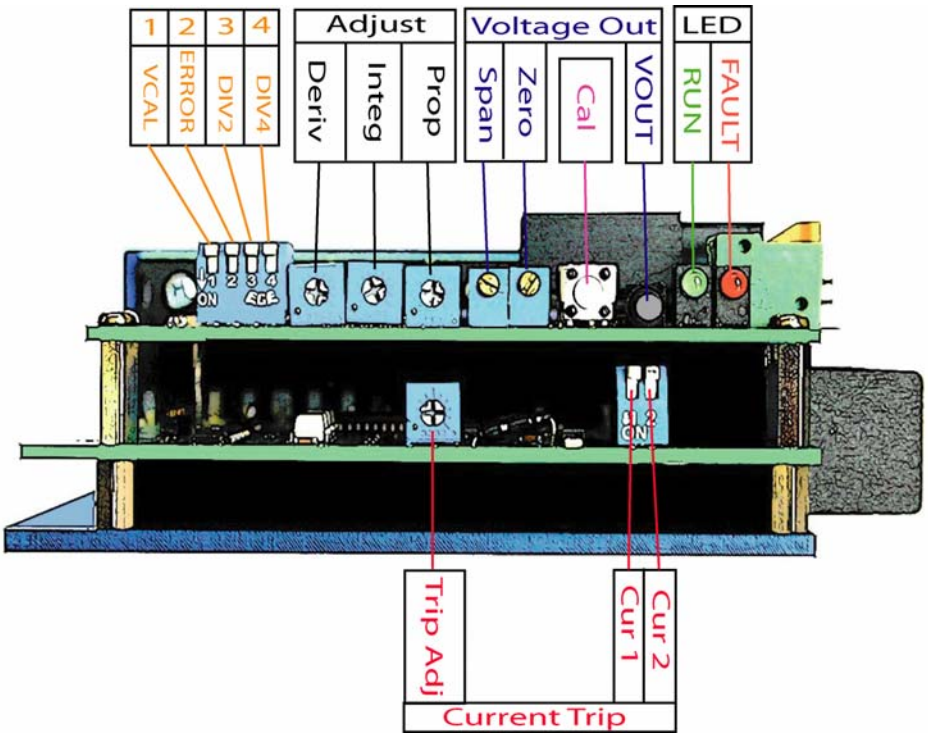


Figure 4 Switches and adjustments

Peak Current Limit - Logic			
SW1	SW2	TEK10	TEK20
Off	Off	10A	5A
On	Off	20A	10A
Off	On	20A	10A
On	On	30A	15A

Table 5 Current Limit Logic Table

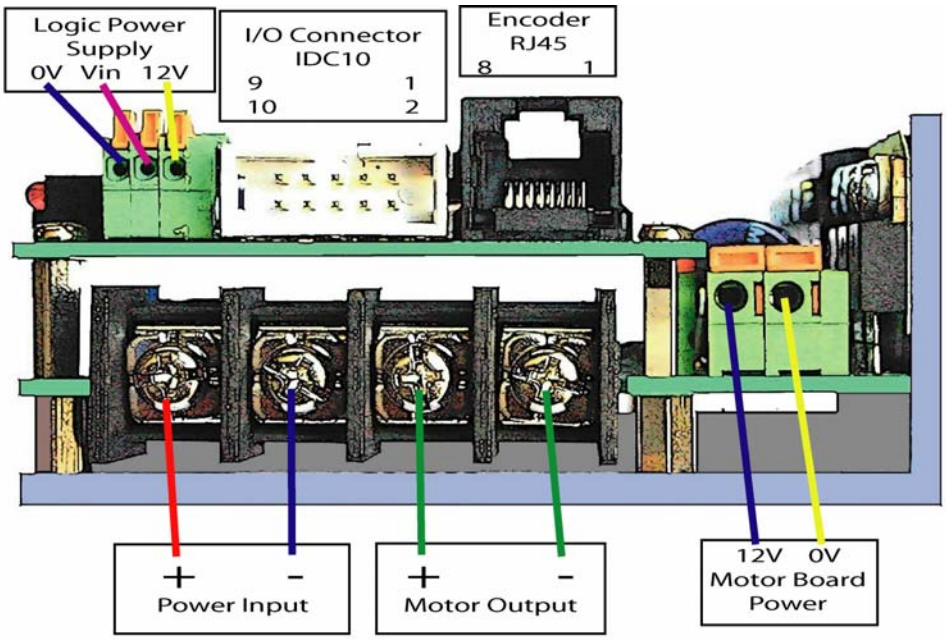
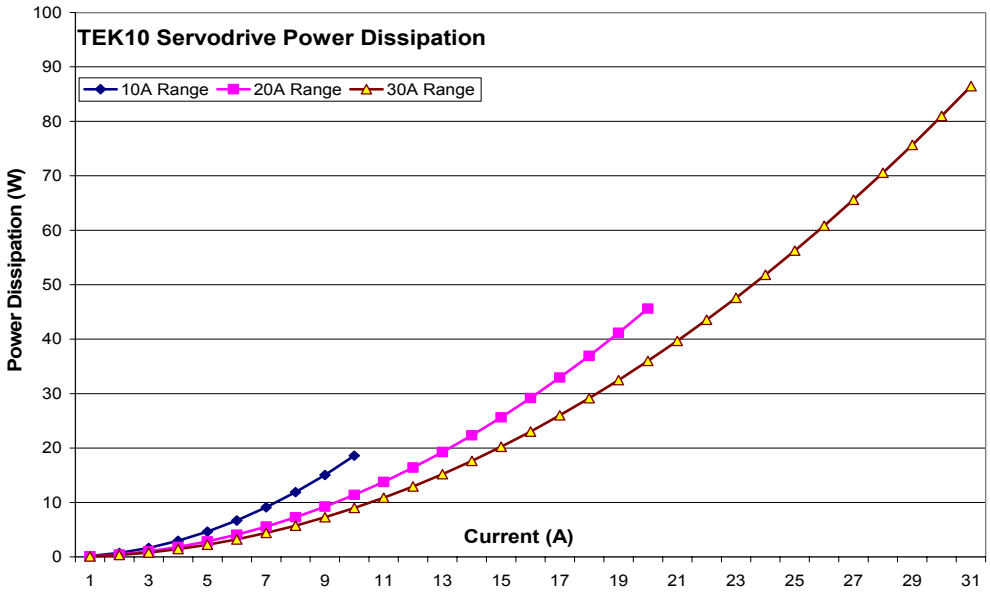


Figure 5 Connector Diagram

Design Notes

A Few important design considerations when using the TEKDrive	
Power Supply Ripple	Under higher current situations the increased ripple from the motor power supply can become destructive, it is important therefore to locate a capacitor as close as possible to the motor power input terminals to reduce this effect.
Motor Power Supply	The TEKdrive works best with a basic power supply constructed from a transformer, bridge rectifier and capacitor combination. The capacitor(s) should have a total value of at lease 2000uF/Amp. Switchmode power supplies are NOT recommended.
Motor Inductance	TEKDrives are designed to drive motors with an inductance of 1mH or greater. If the motor has less than this it will be necessary to add an inductor, of sufficient current capacity, in series with one of the motor power leads to raise the total inductance to this value or greater.
Grounding	It is important to ensure that the TEKDrive case, as well as the enclosure it is mounted in, is connected to the earth of the main power supply. This can be achieved by attaching an earth cable to any of the unused 3mm mounting holes.
EMC Considerations	To reduce EMC emissions and to fully comply with the CE directives it may be necessary to install ferrite beads on all power supply and encoder cables. It is especially recommended for the 12VDC logic supplies to both top and bottom boards.

Thermal Characteristics



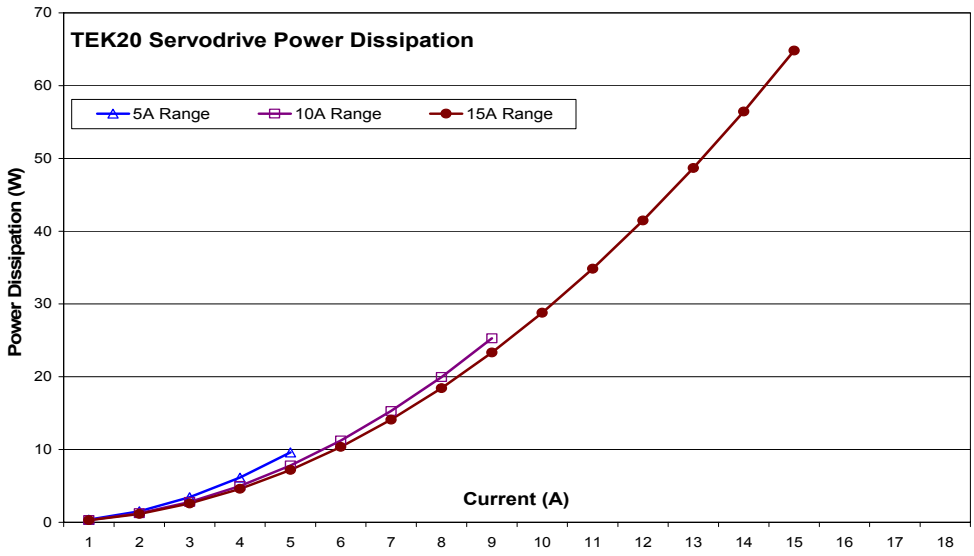


Figure 7 Drive heat generation in various configurations

Figure 7, above, graphs the power generation of the drives in terms of heat they generate in relation to their current output in their various configurations. Each current trip switch reduces the heat generated as it reduces the value of the sense resistors used in the current trip circuitry.

It is very important to keep the drives within their operating temperature range at all times. As an added safety feature, built into the drives is a heat detection system which decreases the current trip setpoint based on the drives temperature, thus causing the drive to trip out on “Overcurrent” if the drive is unable to dissipate the heat generated by the continuous load. For higher current applications it is important to provide adequate heatsinking to minimize this effect.

Use these graphs as the basis for selecting a suitable heat sink and fan combination for the drives’ intended use.

VMODE Options

The TEK10 and TEK20 drives are available with the VMODE option. This allows the drive to switch between step/direction servo control and a voltage input speed control. It is optional and should only be requested if the drive is to be used to control a machine spindle.

In VMODE the servo drive controls the motors velocity proportional to the VMODE input voltage between 0 and 5 volts. The direction of rotation is set by the CW and CCW inputs. The drive can be calibrated to provide proportional RPM control across the full speed range of the motor.

When switching between modes, the driver will output a PAUSE signal to stop axis movement until the drive either reaches speed on entering VMODE or reaches the index position on re-entering Servo mode.

Calibration of the VMODE proportional control is achieved by selecting VMODE high with the drive NOT enabled and selecting SWU1 to ON. Pressing the CAL button then causes the driver to slowly ramp the motor up to full power and remain at full power for 5 seconds before ramping down to zero. During the full power application the drive reads the speed of the encoder pulses from the motor and saves this to flash memory. SWU1 should be returned to its original position on completion.

Following calibration, motor RPM is controlled in proportion to the VMODE Input signal, with the encoder feedback frequency used to regulate the motor speed. For example, an input of 2.5 volts would control a motor of max 4000rpm to maintain 2000rpm.

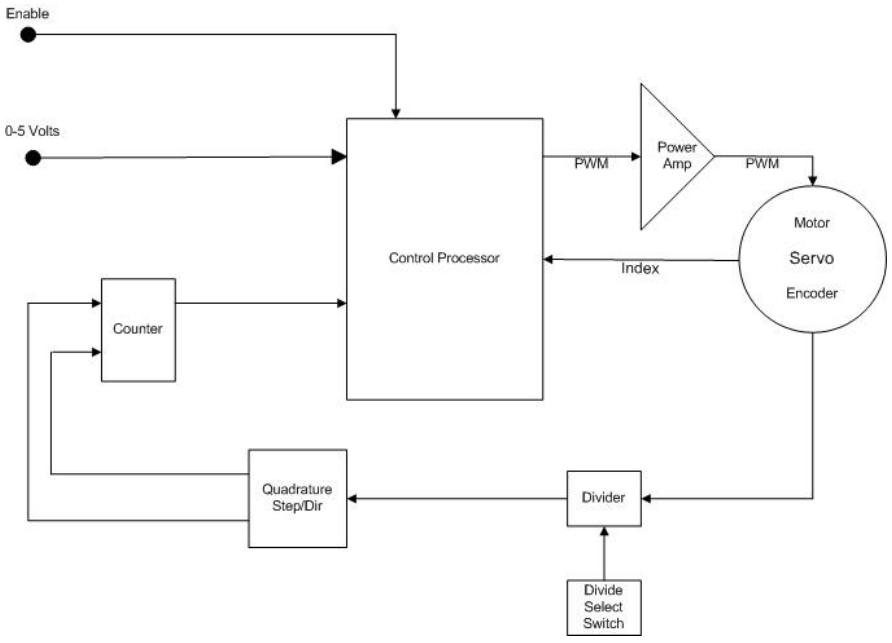


Figure 6 VMODE Functional Block Diagram

Ordering Information for TEK10 Servodrive

TEK	**10**	☐	☐	
	VMODE	**V**	**E**	Encoder Feedback
	No VMODE	**N**	**T**	Tacho Feedback
			N	No Feedback

Ordering Information for TEK20 Servodrive

TEK	**20**	☐	☐	
	VMODE	**V**	**E**	Encoder Feedback
	No VMODE	**N**	**T**	Tacho Feedback
			N	No Feedback

Options not available at time of printing.

Insert the corresponding letters in each square
to indicate mode and feedback requirements.

CNC teknix
Designers & Manufacturers of
CNC Machines and Controllers

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EC Declaration of Conformity

In accordance with EN 45014:1998

We CNC Teknix Pty. Ltd.
of Unit 1 - 113 Industrial Road
Oak Flats NSW 2529
Australia

declare that:

Equipment: **DC Servomotor Drive**
Models: **Tekdrive TEK10**

in accordance with the following Directives:

89/336/EEC The Electromagnetic Compatibility Directive and its amending directives;

73/23/EEC The Low Voltage Directive and its amending directives;

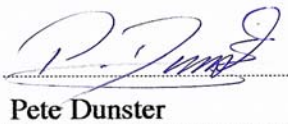
has been designed and manufactured to the following specifications:

EN 55011 Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement;

EN 60947-1 Low-voltage switchgear and controlgear — Part 1: General rules;

EN 60947-4-1 Low-voltage switchgear and controlgear — Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor starters;

We hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

Signed by: 
Name: Pete Dunster
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Done at: Sydney, Australia
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Notes

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