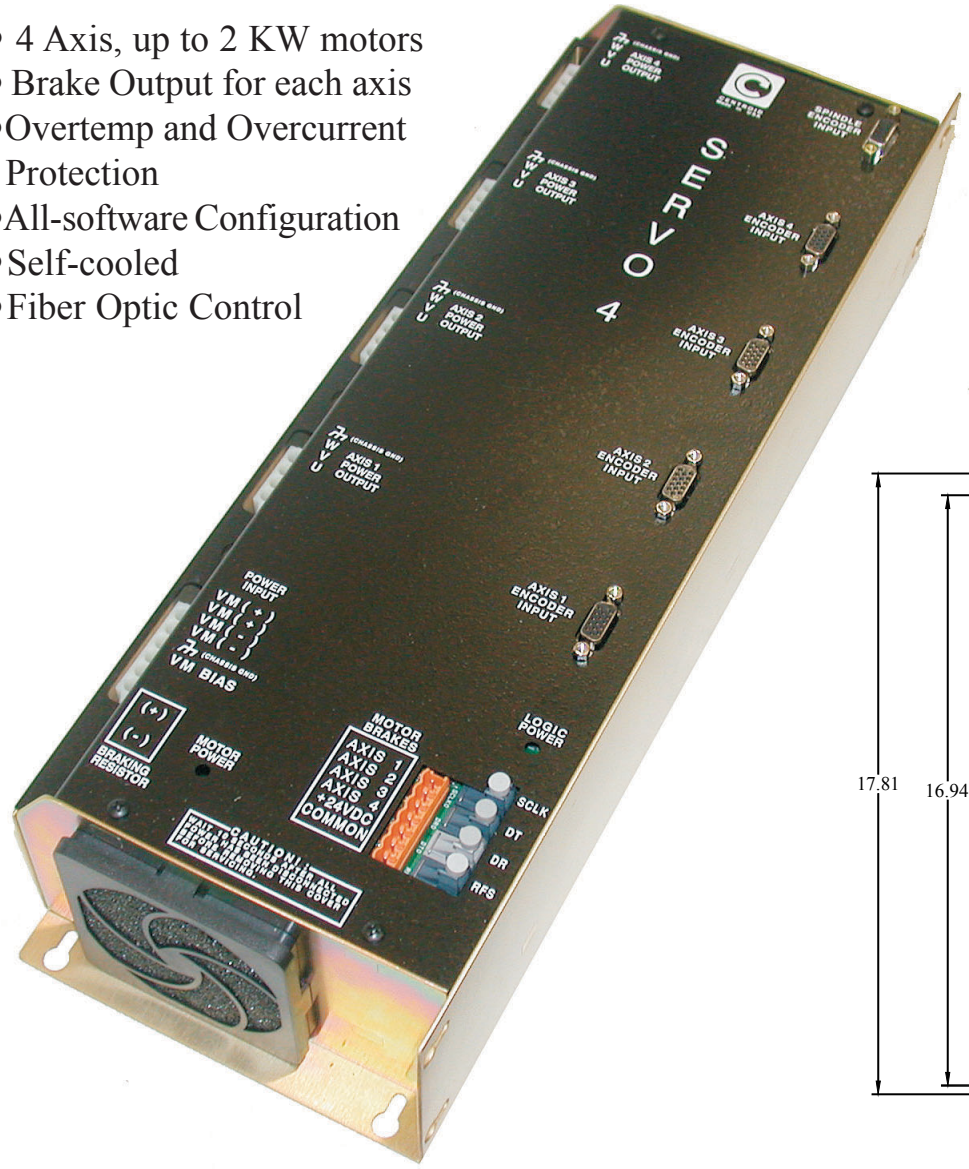
CENTROID™

AC Brushless Drive

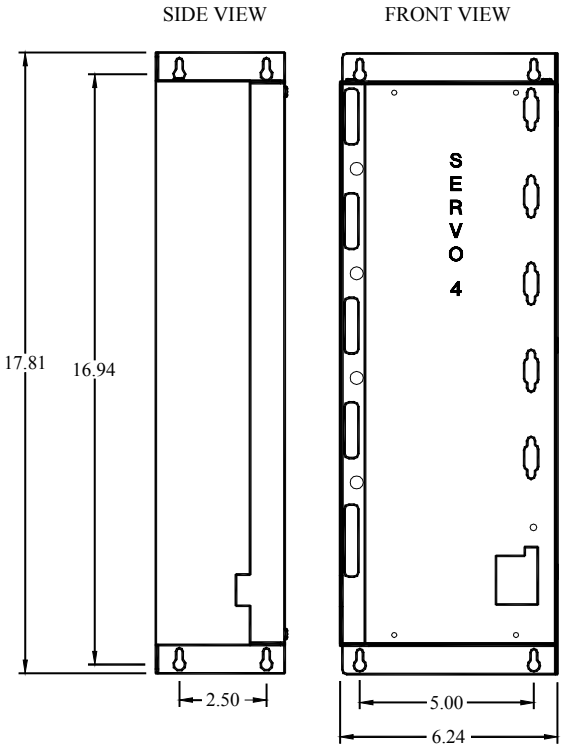
Product Spec Sheet

- 4 Axis, up to 2 KW motors
- Brake Output for each axis
- Overtemp and Overcurrent Protection
- All-software Configuration
- Self-cooled
- Fiber Optic Control



AC Brushless Motor Drive Amplifier	
Dimensions:	17.75" x 6.25" x 3.875" 451 x 160 x 98 mm
Weight:	6 lbs. / 2.7 Kg.
Power Input	100 - 340 Vdc
Output Power	2 KW continuous
Axis Brake	24 Vdc nominal 0.5 Amps DC max.

DRIVE MOUNTING OPTIONS



Centroid's 4 axis brushless drive amplifier and motors provide a complete solution for a variety of CNC machine tool applications.

Motor feedback is wired directly to the drive where the incremental encoder is read by an individual processor for each axis.

The amplifier will drive four motors and accept an encoder input for the control of an external spindle inverter. An open collector transistor is available for a brake on each axis.

The drive is fully enclosed and all connections have isolated connectors. An internal fan provides cooling. Thermal sensing will warn and then shut down the drive in case of overload.

Please see the installation manual for more information.

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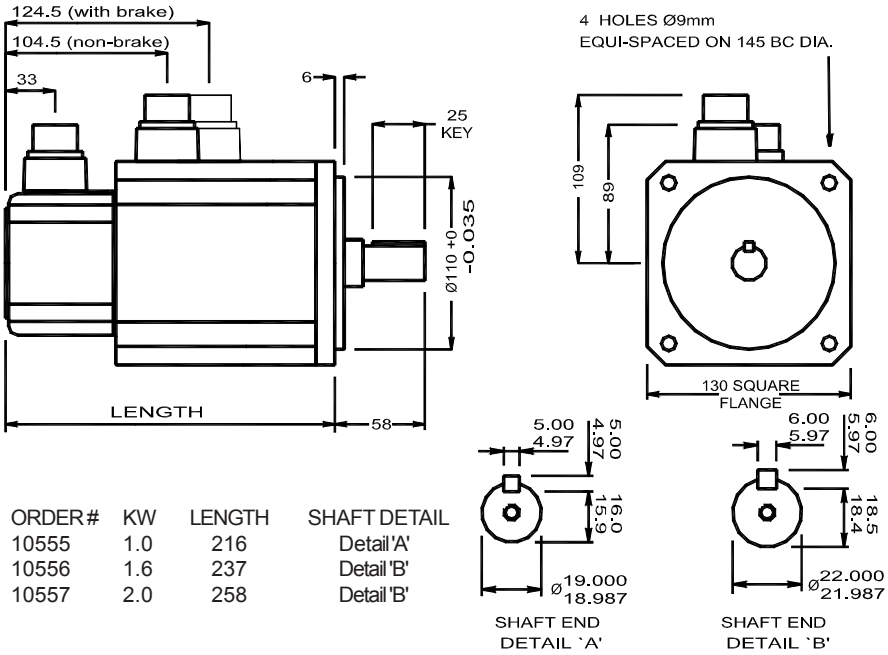
www.centroidcnc.com

CENTROID™

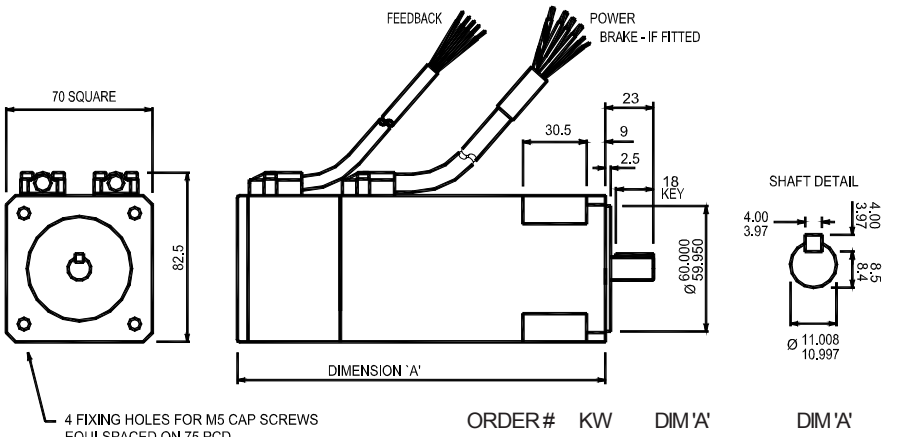
AC Brushless Motors

Product Spec Sheet

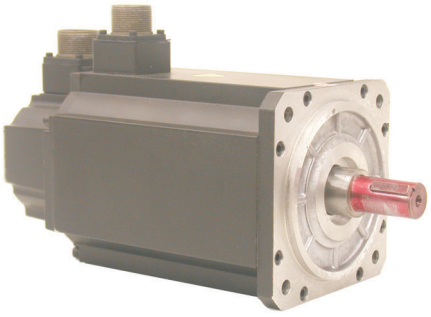
	0.4 KW	1 KW	1.6 KW	2 KW
Stall torque (in -lbs / N-m)	5.3 / 0.6	50 / 5.65	74 / 8.4	102 / 11.5
Peak torque (in-lbs / N-m)	19 / 2.2	150 / 17	230 / 26	306 / 34.5
Max. rotation speed (rpm)	3400	3400	3400	2500



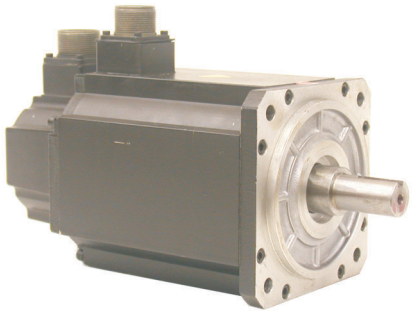
ORDER #	KW	LENGTH	SHAFT DETAIL
10555	1.0	216	Detail 'A'
10556	1.6	237	Detail 'B'
10557	2.0	258	Detail 'B'



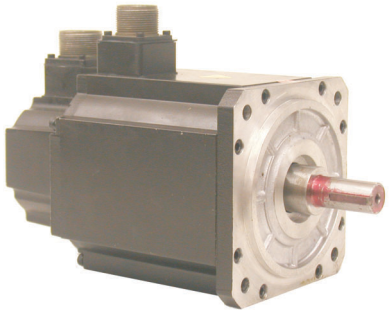
ORDER #	KW	DIM 'A' NO BRAKE	DIM 'A' WITH BRAKE
10558	0.4	149	176



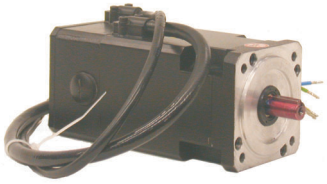
2 KW



1.6 KW



1 KW



0.4 KW

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SERVO4 INSTALLATION MANUAL

Rev 020626

Description:

The Servo4 Drive is an integral part of the Centroid CNC control solution. Packaged as a complete motor drive for brushless as well as DC brushed motor control, the Servo4 can be configured through software for a wide variety of applications. Breaking away from previous Centroid designs, the Servo4 interfaces exclusively with an updated interface card (CPU9) installed in the PC. Motor feedback is wired directly to the drive where the incremental encoder is read by an individual processor for each axis. Fiber optic communications with the drive are bi-directional so that status reporting can be viewed at the PC.

The Servo4 will drive four motors, any combination of brushed or brushless, and accept an encoder input for the control of an external spindle inverter. All motors can run off a single power input or have separate input voltages as required. Bias supply voltage is developed from a DC input of 100 volts to 320 volts, which can be the same source as the motor power. An open collector transistor is available for a brake on each of the axes. This can be wired to an external relay to drive any type of motor brake.

In order to provide greater safety, the drive is fully enclosed and all connections have isolated connectors. An internal fan provides cooling to the main switching IGBT as well as the entire circuit. Thermal sensing will warn and then shut down the drive in case of an overload. All motors are protected against over-currents through a fuse on each axis as well as current sensing circuitry that will shutdown and automatically reset on command. Fuses are mounted internally. All safety precautions must be followed when replacing fuses.

Specifications:

Outside Dimensions:

17.75 X 6.25 X 3.875 (in)
451 X 160 X 98 (mm)

Weight:

6 lbs / 2.7 Kg

Power Input:

Bias	100-340 Vdc	
Motor Power	0 – 340 Vdc	2000 Watts Continuous 5700 Watts Peak

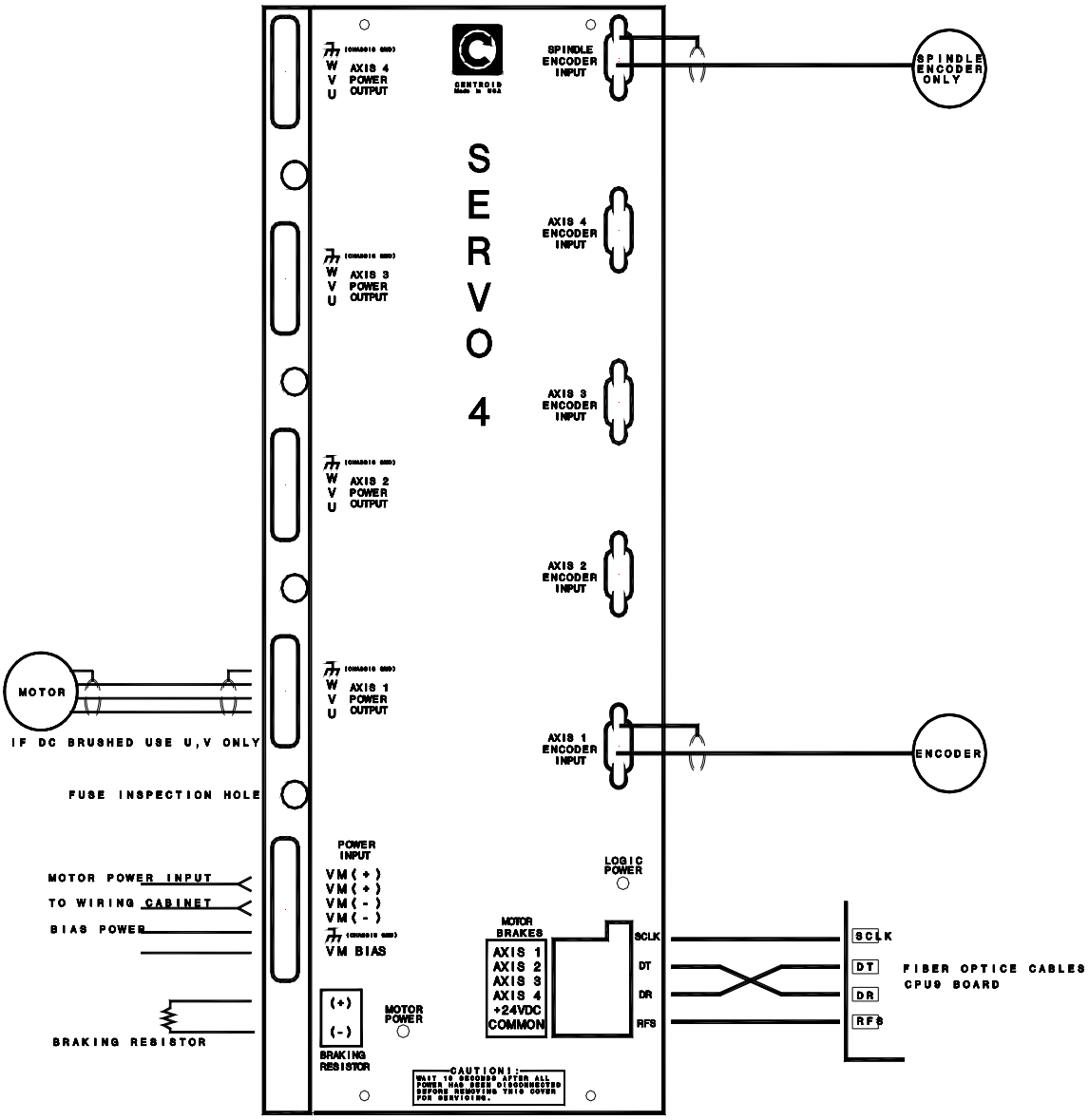
Encoder Input: Quadrature differential pair incremental encoder plus plus commutation. 5V Max voltage. 5 inputs. Brushless motors are limited to 1024, 2048 , 4096 line encoders. Spindle encoder input is for control of an

	external spindle drive through PLCIO module or equivalent.	
Control Interface:	Synchronous Serial Communication Full Duplex to CPU9 – 4 optical fibers.	
Motor Output Voltage:	0- 220 Vac Brushless 0- 320 Vdc Brushed DC (follows input)	
Motor Output Power:	2000 Watts continuous 5700 Watts Peak 4 independent outputs.	@ 220 Vac @ 220 Vac, 15A 3 Phase
Axis Brake Driver:	50 Volts DC Max. 0.5 Amps DC Max.	

Installation:

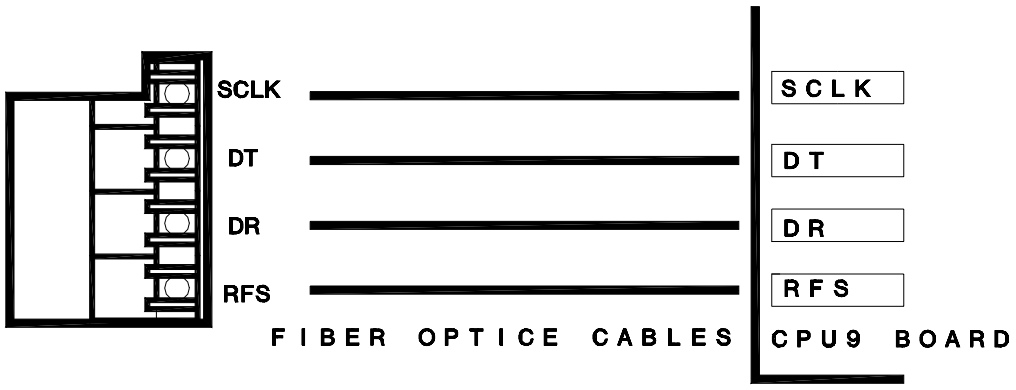
Optimal mounting for the Servo4 drive is vertical onto a metal backing. Note the direction of the airflow through the drive must go up. The drive chassis must be electrically connected to the same structure as the motors. Two indicators visible through the drive cover should be visible without removing the unit for trouble-shooting purposes.

Wiring:

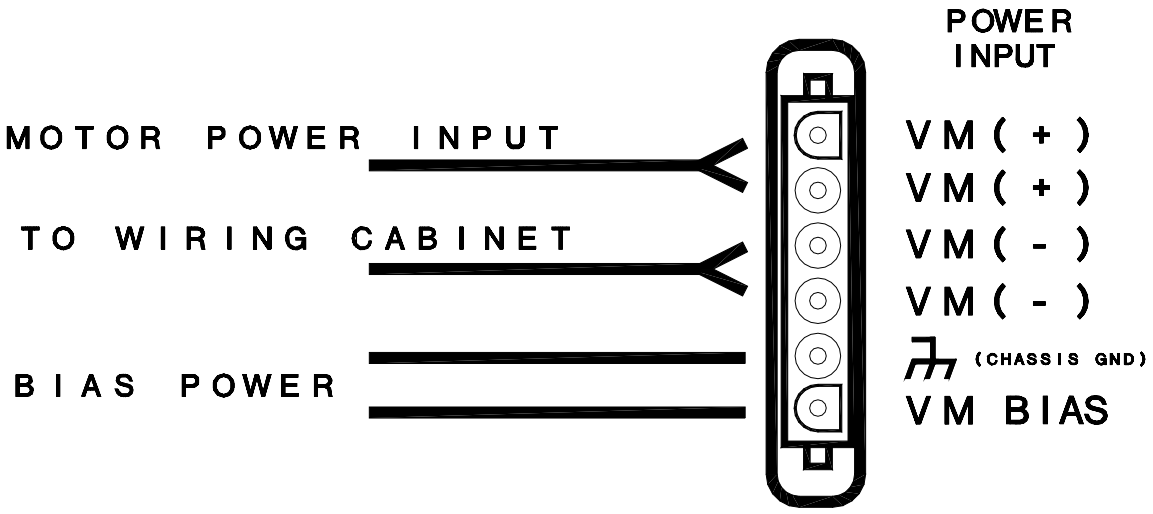


Motor power and encoder cables should not be run together. Only specified connectors are to be used.

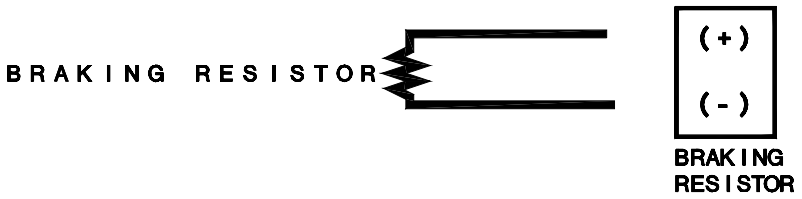
Fiber optic cable connections are as shown. Note that the Data Transmit from the CPU9 connects to the Data Receive of the Servo4 and the Data Receive connects to the Data Transmit. Length of these cables should be limited to 30 meters (100 feet).



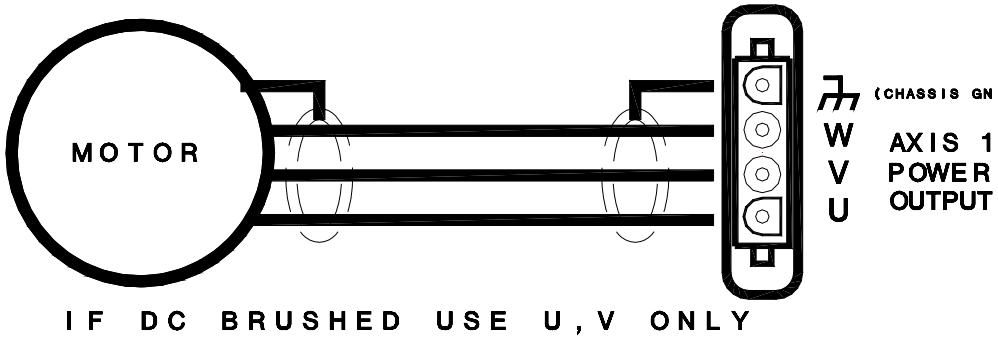
Input Power. Power to the drive is DC only. Motor power and Bias power can be from the same source. The Motor power must be run through the E-STOP contactor before connecting to the drive. This voltage should match all the motors being driven. Motors of different voltage inputs may be used but a special input must be wired at the factory. All input power connector contacts must be used in order to avoid overrating the connection and causing damage. VMBIAS voltage should be wired to come on with the main power disconnect. If power is removed from VMBIAS the machine power will need to be cycled to reboot the drive processors.



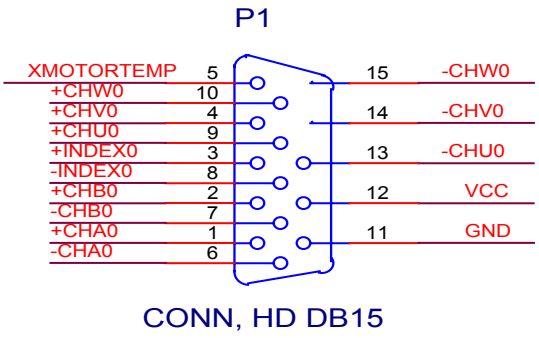
Brake resistor. High inertia systems may require braking, as in the case where a motor back generates into a drive and may cause damage. This resistor will help save the drive and slow the system under extreme braking. Braking current is limited to 40A for 5 seconds.



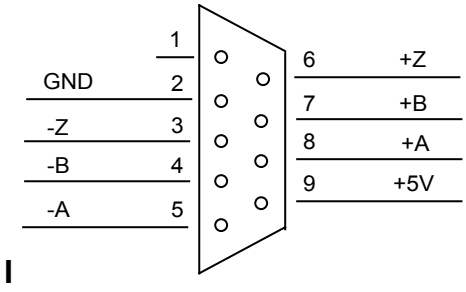
Motor power. Wiring to any motor must be with the approved connector and cable. The cable must include a shield that attaches at both ends. Brushless motors are wired to spin clockwise as viewed from the front of the motor while performing the sync-up operation in the drive menu. Brushed DC motors should wire the RED lead to the V connection and the Black to the U connection. W will remain unconnected for brushed motors. Cable lengths up to 5 meters may use 16 awg wire but 14 awg must be used for cables up to 15 meters.



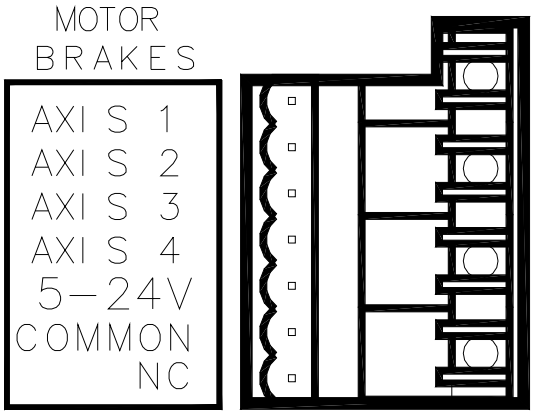
Encoder Input. Incremental encoders are used for either motor type but must be binary count for brushless motors (1024, 2048, 4096 lines). Encoders are wired to the drive only. Cables must be shielded with the shield screen attached to the drive side only. DO NOT ATTACH SHIELD AT THE MOTOR SIDE! To check encoder wiring, power system and go to the PID menu. Turn the shaft clockwise as viewed from the front of the motors; the absolute position should count up in positive numbers.



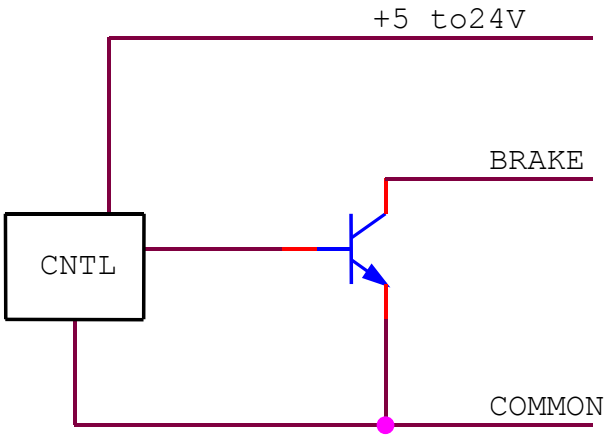
Spindle Encoder Input This input does not require commutation channel and is compatable to previous wiring.



Axis Brake. A brake output is provided for each motor axis. It will engage whenever the motor drive is active. The circuit is an open-collector transistor that can be wired to a relay with a DC coil to operate the brake circuit. This circuit is isolated from the drive electronics and will need a separate power source ranging from 5 to a max. of 24 volts DC.



Brake Circuit::



Operation:
There are no manual adjustments on the Servo4 or the CPU9. All configuration is done with software via the machine configuration, PID setups and Drive Configuration menu. Drive current may be limited for smaller motors through the menu setting. The maximum current setting is 16 amps per axis. Brushless motors are designed with multiples of magnetic poles requiring numbers of cycles of the sine wave inputs to rotate the shaft a full revolution. Brushless motors may have 4,6, and 8 poles and must be configured in the DRIVE MENU. A setting of 0 (zero) poles changes that axis to a Brushed DC drive. PID settings in the drive menu are factory set and must not be changed.

Driving brushless motors requires the knowledge of the motor's rotational position at all times. The encoder commutation channel gives the angular information to the drive. The drive generates 3 sine wave voltages phased relative to the motor position and the direction the motor is commanded to turn.

Motor Sync Procedure:
This procedure may be performed at any time to verify the operation of the motor and the encoder feedback.

a) Go to the Drive menu by pressing Setup -> Config -> PID -> MOTOR SYNC.
b) Press F2 (Move Sync)
c) Press F1 (Change Axis) .
d) Press F10 to move the motor, verify that the motor turns clockwise. Verify also that the encoder reading counts up and rolls over at the max line count. The Commutation reading should count sequencially up to the pole number listed above.
e) Repeat steps b) through d) 4 times for each motor.

Repeat procedure for remaining motors.

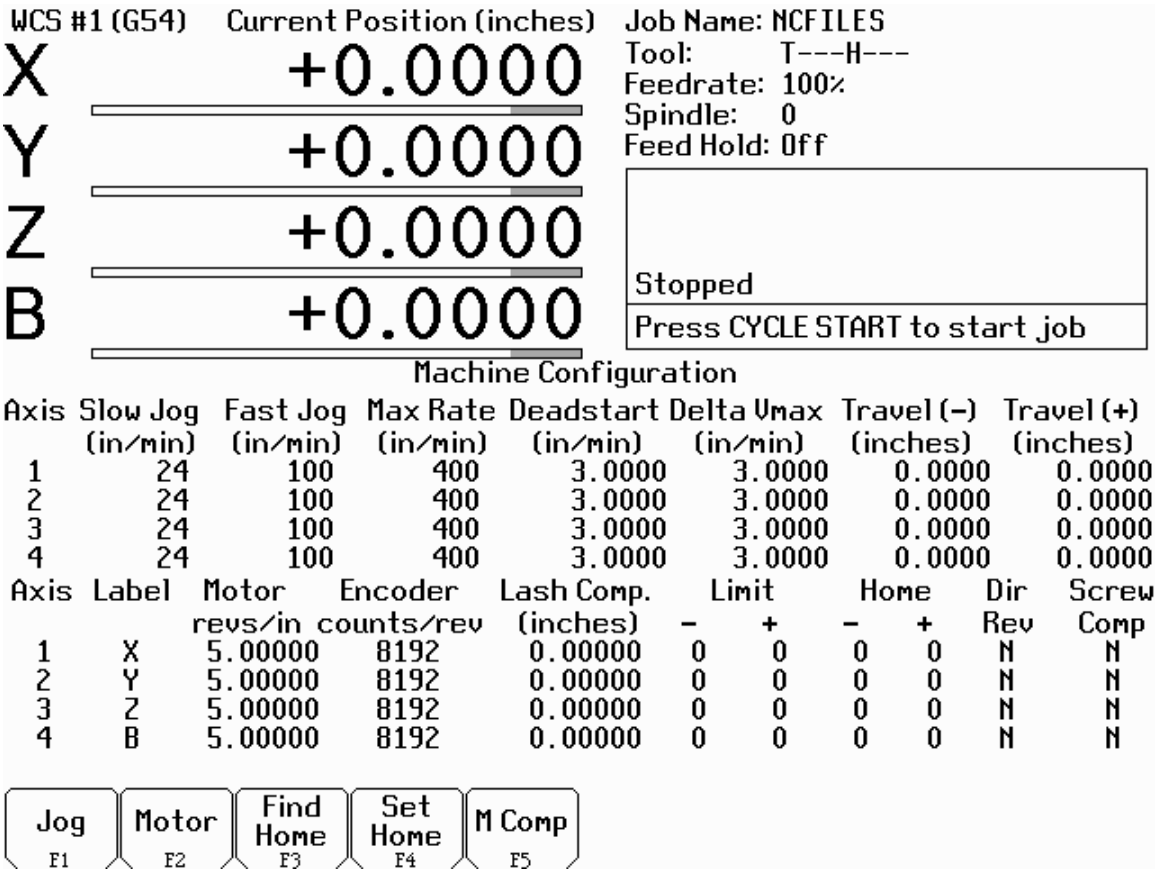
After the procedure is complete back out to the first menu by pressing escape four times. Press Cycle Start to start the homing procedure.

Troubleshooting Guide:

Symptom	Cause	Corrective Action
Motor Power Indicator OFF	This indicates the proper level of input voltage to the supply input. This voltage must be above 90 volts	Check supply voltage for a value greater than 90 volts.
Logic Power Indicator OFF	This indicates the presence of power the logic circuits internal to the Servo4.	If this lamp is out and the Motor power lamp is on then there is no power to the logic circuit. The factory must service the unit.
Motor turn backwards during the alignment procedure. (message)	The motor power wiring must be backwards in the cable of the motor itself.	Examine the cable and reverse two of the motor wires.
Encoder Counts runs backward.	The A and B signals from the encoder may be swapped. Encoder may operate in the reverse.	Check encoder cable. Check encoder spec- A must lead B when rotated clockwise as viewed from the front of the motor.
Motor jerk when first moved.	The motor may be wired backward or the encoder counts backwards. Motor may have lost its alignment from movement when unpowered or never aligned.	Go through the motor sync procedure in the DRIVE menu with the motor unloaded.
Servo Drive processor failure.	This is a loss of signal coming back from the drive to the CPU9.	Power the system down and then back up. Check the Logic Power indicator. If illuminated then start the system. Run through the motor alignment procedure.
Servo Drive Over voltage	Indicates the Input power has gone higher than 340 volts and will shut down the drive and remove power. The Motor brake will engage for 5 seconds in this condition.	Check input voltage. It must be below 340 volts DC.

Servo Drive Under voltage	Indicates that the input voltage to the supply is less than 80 volts.	Check supply voltage.
No encoder detected	The Servo4 check the encoder line for differential signals. –A must have the opposite voltage level as +A.	Check the wiring of the encoder cable, then the encoder itself.
Servo Drive Over Temperature	There is a temperature sensor mounted on the heat sink internal to the Servo4 that detects over temperature.	The drive is being run at over capacity. The cooling fan is not functioning or the inlet or outlet is blocked.
Over Current.	Individual axis current is monitored and will shut down the drive when a level is measured above the preset limit.	Try to jog the axis. The Servo 4 will reset the current limit and try to move the motor. If you continue to get an over current check for a short in the motor output.
Axis runaway	If the motor moves when not commanded it is possible than noise is getting on the encoder line and creating a constant position error	Check that the motor cable shields are attached. Check that the encoder shield is attached at the drive end only. Check that the Servo4 is electrically grounded to the machine to which the motors are mounted. Separate the motor power cables from the encoder cables and other power cables.

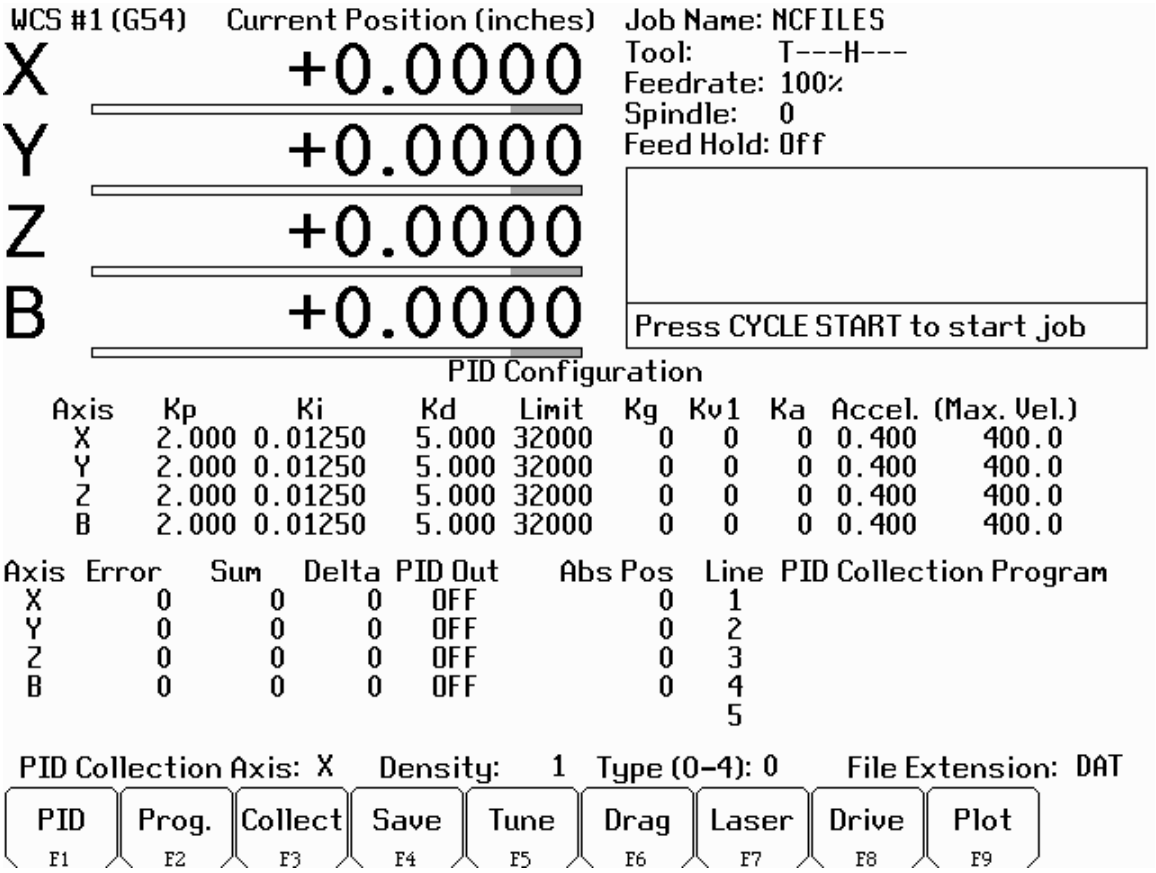
SERVO4 MACH SETUP



Setup notes:

Encoder counts / rev must be a binary count – 2048, 4096, 8192, 16384…
This is four times the line count of the encoder and is usually printed on the encoder device. Servo4 drives accept only binary count encoders with matching commutation tracks. Brushed motor accept all line count encoders and do not require commutation tracks.
Max Rate can not be found using Autotune and must be calculated or found experimentally. The max rate is based on the max motor revs of about 3200 and 3600 RPM for some motors.

SERVO4 PID MENU SETUP



F1 PID Key will enable you to adjust the above parameters. Ka should be left at zero, while the Kg and the Kv1 may be set by observing the PID Out while the axis is at rest and during a slow jog respectively.

F3 Collect Key

-The Data Density can range from 1-32. (It is passed to CPU9 as 0-31).

-The Data Type can range from 0-4.

0=Collect Error(n), Sum Error(n), Delta Error(n)

1=Collect ADC Input A, ADC Input B, ADC Input C

2=Collect PID Request A, ADC Input A, PID Adjusted A

3=Collect PID Request B, ADC Input B, PID Adjusted B

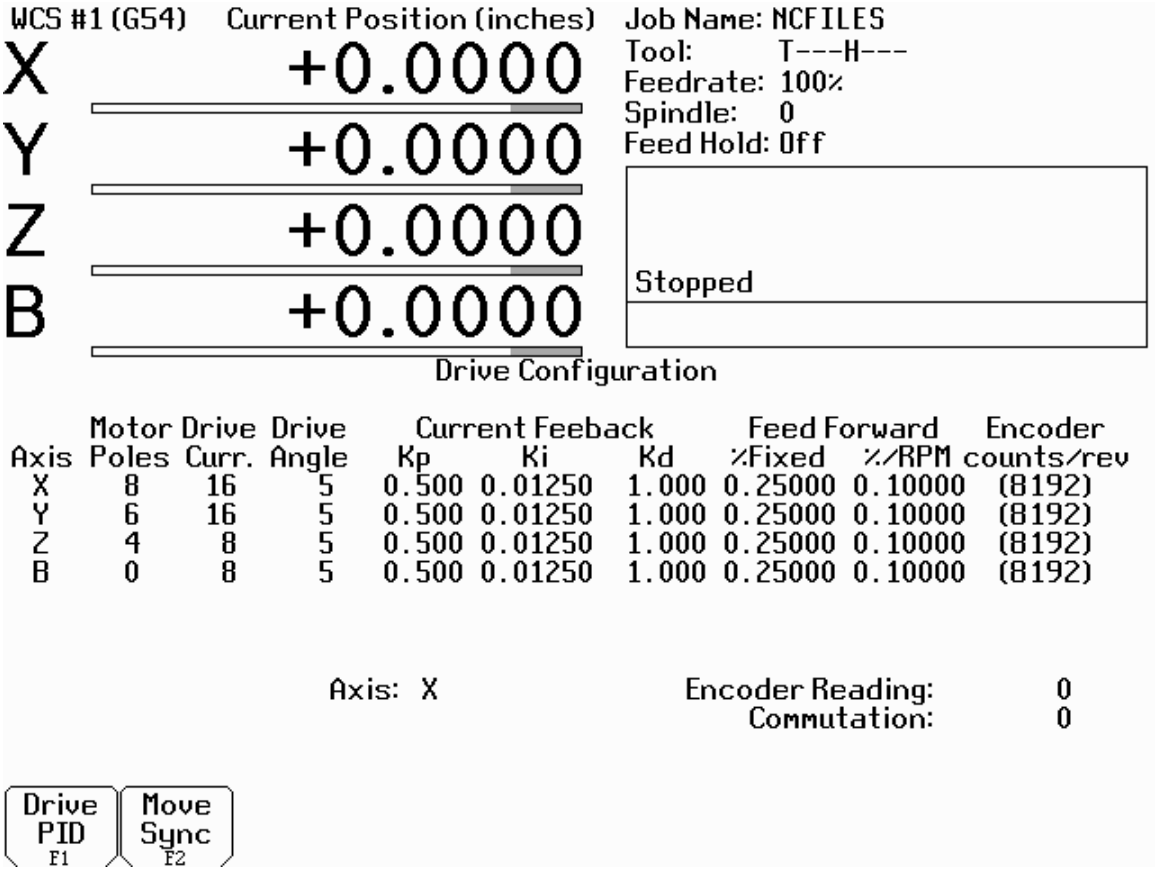
4=Collect PID Request C, ADC Input C, PID Adjusted C

-The Data Density and the Data Type are encoded into one byte and sent to CPU9 via the Set PID Parameters Command 8.

- The File Extension should be unique to your collection.

-The Drive Configuration Screen (F8) is to be keylocked. It is not for general viewing and definitely not for modification by any unauthorized individual.

SERVO4 DRIVE MENU SETUP



The Drive Configuration Screen is to be keylocked. It is not for general viewing and definitely not for modification by any unauthorized individual.
-The Drive Configurations are kept in the CNC7.CFG Configuration File.
-The Report, Backup, Restore and Update functions must be modified to include the Drive Configuration Parameters.
-The Motor Poles may be 0 for Brush Motors or 4, 6, 8 for Brushless Motors. (For 0, Brush Motors, the Drive Angle and the Feed Forward %'s are all passed to CPU9 as 0's). **1KW, 1.6KW, 2KW is an 8 pole. 400W is a 4 pole motor**.
-The Encoder Counts/Rev. parameter is information only in this screen. To modify it you must go to the Machine Configuration Setup Menu.
-Move Synch causes the Axis Motor to move to the Synch Position and Hold Power, ignoring the Encoder Input. At that point, the Synch Position and the Index Pulse will both be at Encoder Position 0 or within 20 counts +/-.
-Move Synch may be executed several times to Move the Motor to the proper quadrant. It takes four cycles on an 8 pole motor. This is a good tool for trouble shooting motor – encoder problems.