Preliminary
VS808 AC Servo
Technical Manual

YASKAWA

VS-808 Manual

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1. General Overview

State of the art technology makes the VS-808 an extremely flexible and a very reliable drive package which can be user customized via software executed features and functions. The All Digital design incorporates a 32 bit RISC processor that controls the electronic commutation of the permanent magnet, synchronous motor. Precise control of the current loop, speed loop, position loop and input and output signals (Servo On etc.) is maintained with resultant high performance operation. Two main operating modes, ±6 VDC speed command and pulse-train-and-direction position command, allow easy integration with common control systems, such as stepper-motor-indexing modules for PLCs. 25 programmable digital control parameters allow easy set-up and configuration of the drive for a multitude of different applications. A numeric keypad facilitates simple and efficient programming of the control constants. The LED display on the numeric keypad provides extensive diagnostic and status information, guiding the user through the commissioning and trouble shooting process.

A magnetic 1024 pulse per revolution incremental encoder is the principle feedback device for the digital speed and position loops. It also serves as the magnetic pole sensor for the electronic commutation. It is mounted internally to the motor negating vibration, noise, and environmental concerns.

Power topology includes a diode bridge converter and insulated gate bipolar transistor output. High carrier frequency and sinusoidal PWM-current-control algorithms afford full peak torque even at zero motor speed and maximize motor performance by minimizing switching and motor losses. Motor magnetic noise is also greatly reduced providing for extremely quiet operation in applications requiring low audible resonance. Permanent magnet, synchronous motors allow totally-enclosed-non-ventilated motor construction (TENV). Standard NEMA 23, 34 and 56 flanges simplify selection of standard off-the-shelf gearboxes and mounting hardware. Synchronous motor design using Neodymium, Iron, and Borox (Nd-Fe-B) bonded magnet materials improves the overall system efficiency and reduces the current required to produce output torque. Amplifier size is reduced and overall torque/amp ratio increases dramatically.

2. Ratings and Specifications

2.1 Servo Motor Rating and Specifications

Table 2.1: Servo Motor Rating and Specifications

Servo Motor Type	USAEE□□B-5	P5	01	02	04	08	15
Rated Output	kW	0.05	0.1	0.2	0.4	0.75	1.5
Rated Torque	N-m	0.16	0.32	0.64	1.27	2.38	4.77
	lb-in	1.42	2.83	5.66	11.2	21.1	42.2
Rated Speed	rpm	3000	3000	3000	3000	3000	3000
* Rated Armature Current	Apms	0.3	0.73	1.0	2.5	4.2	8
Power rating	kW/s	0.7	2.0	3.0	4.8	5.7	11.4
Instantaneous Maximum Torque	N-m	0.32	0.64	1.27	2.55	4.76	9.55
	lb-in	2.83	5.66	11.2	22.6	42.1	84.5
* Instantaneous Maximum armature Current	Apms	0.58	1.48	1.95	4.8	8.5	16
Maximum Speed	rpm	3600	3600	3600	3600	3600	3600
Armature Inertia (J_N)	~~kg • m² x 10⁻⁴~~ kg • in • s² x10⁻³	0.36	0.52	0.84	5.4	11.3	20
	lb	0.319	0.46	0.743	4.78	10.0	17.7
* Torque Constant	N-m/A	0.53	0.58	0.64	0.51	0.57	0.60
	lb-in/A	4.69	5.13	5.66	4.51	5.04	5.31
Mechanical Time Constant	ms	9.5	4.4	2.6	9.7	6.5	4.8

- Time rating: Continuous
- Insulation: Class B
- Isolation Voltage: 1500VAC for 1 min
- Insulation Resistance: DC500V10M
- Coating Color: Black
- Enclosure: Totally-enclosed
- Ambient Temperature: 0 ~ +40°C
- Ambient Humidity: 80% RH Max. (non-condensing)
- Excitation Method: Permanent magnet

Note: Values measured at an armature winding temperature of 20°C.

2.2 Servo Driver Rating and Specifications

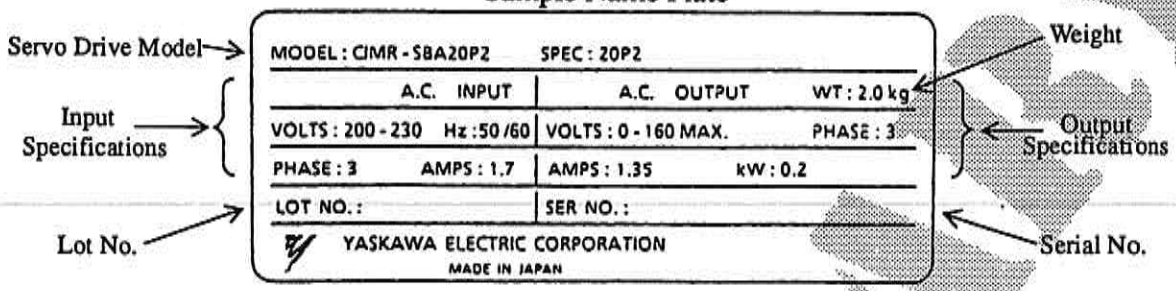
Table 2.2: Rating and Specifications of Servo Drive

Item	Specifications					
1. Motor Output (W)	50	100	200	400	750	1500
Rated Output Current (Arms)	0.3	0.55	1.35	2.5	4.2	8.0
2. Rated Voltage & Frequency	3 phase 200/208/220V 50Hz, 200/208/220/230V 60Hz					
Allowable Voltage Variation	±10%					
Allowable Frequency Variation	±5%					
3. Control Method	Sine Wave PWM					
Speed Control Range	1 : 500					
Speed Response	30Hz					
Rated Speed	3000 rpm					
Maximum Speed	3600 rpm					
Overload Rating	200% 10sec					
4. Input/Output Signal Position Reference	Step + Direction, 2-phase bidirectional pulse (Max. 400kpps)					
Speed Reference	Analog Input (±6V / ±3600rpm)					
Motor Feedback Input Signal	Incremental Encoder 1024PPR(A,B-phase), w/ marker Differential Signal					
Position Output Signal	Incremental Encoder 1024PPR(A,B-phase), w/ marker Differential Signal					
Sequence Input	Servo ON, P-control, Forward Run Inhibit, Reverse Run Inhibit, Command Inhibit, Position Deviation Counter Clear, Alarm Reset					
Sequence Output	Servo ON Output, Positioning Completion, Alarm					
Analog Output	Speed, Torque Indication					
5. Protective Function	Overcurrent, Overvoltage, Undervoltage, Overload, Cooling Fan Overheat					
6. Display Function	Status Display . . 7 Segment LED, Power ON Indicator					
7. Recommended Peripheral Devices MCCB Rated Current (A)	5	5	5	10	20	30
Power Capacity (kWA)	0.3	0.5	0.75	1.3	2.2	2.8
Power Supply Contactor Rating (A)	30					
Wire Sizing Main Circuit (AWG)	#14					#12

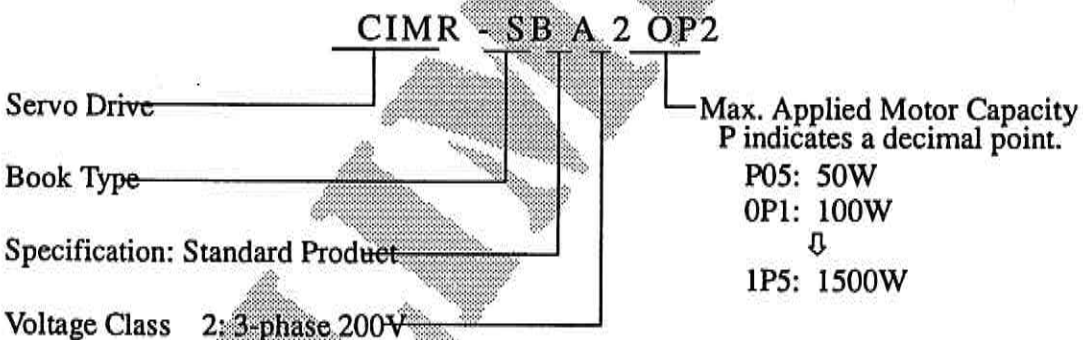
3. Receiving and Inspection

The VS808 is thoroughly tested at the factory. After unpacking, verify the part numbers with the purchase order (invoice). Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from your sales representative.

Sample Name Plate



Model No. Description

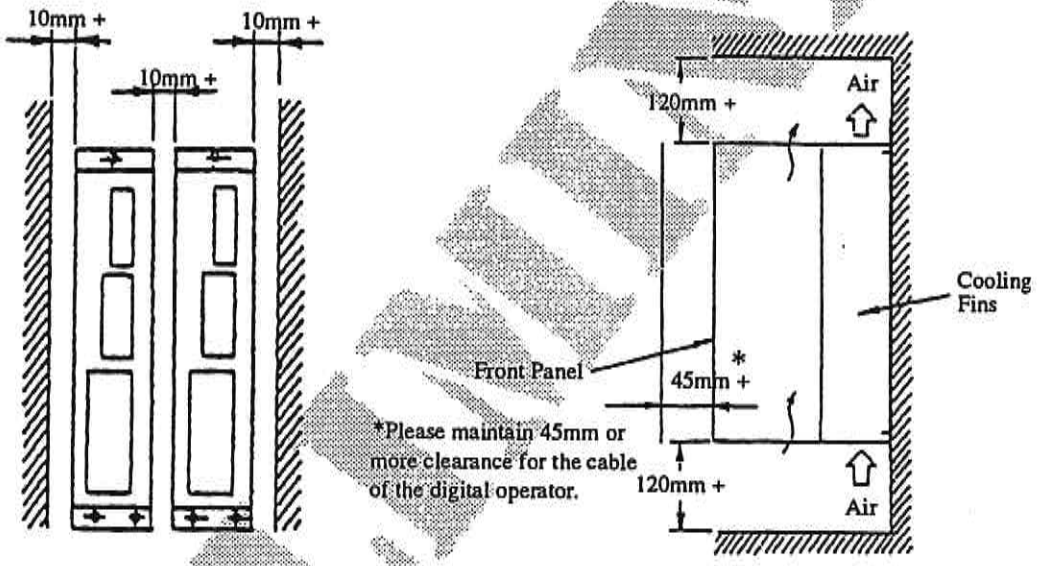


4. Physical Installation

The location of the VS-808 is important to achieve proper performance and operating life. The VS-808 electronics are mounted in an open type chassis. It is designed for installation inside of electrical enclosures. Select the location of this electrical enclosure based on the following considerations. The unit should be installed in areas where it will protected from:

- Direct sunlight, rain or moisture
- Corrosive or gases or liquids
- Airborne dust or metallic particles

Place the VS-808 in areas with little vibration, low humidity (condensation must be avoided), and low electrical noise. Avoid areas where inflammable materials are present and areas with radioactive materials. For effective cooling as well as proper maintenance, install the VS-808 vertically. There must be a minimum of 0.4 inch (10mm) clearance on either side and a minimum of 4.75 inches (120mm) clearance above and below the VS-808, as shown in the illustration below:



The temperature of the air entering the VS-808 should not exceed 113ºF (45ºC).

5. Electrical Installation

The VS-808 allows two main modes of operation, speed control proportional to an analog ±10VDC signal, and position control based on a pulse train and direction signal or two pulse trains with 90º phase shift generated by a motion controller for stepper motors. Control constant Cn24, bit 0 selects the operating mode. If this bit is set to 0 the VS-808 operates in position-control mode, and if it set to 1 it operates in speed-control mode. Depending on the mode of operation (position or speed), different connection diagrams apply as outlined in the following sections. Select the mode of operation appropriate for your application first, and then connect the VS-808 according to the appropriate connection diagram, shown in chapter 5.3.

5.1 Grounding

- The VS-808 must be solidly grounded, using the main-circuit-ground terminal E. Ground resistance should be less than 100Ω. Select the lead size as large as possible and suitable for the size of the terminal screw. Cut the ground lead as short as possible.
- Never ground the VS-808 in common with welding machines, other motors, or high-current, electrical equipment.
- Ground each VS-808 directly or daisy-chain the ground terminals. Never create a loop with the ground leads. See figure 5.1.

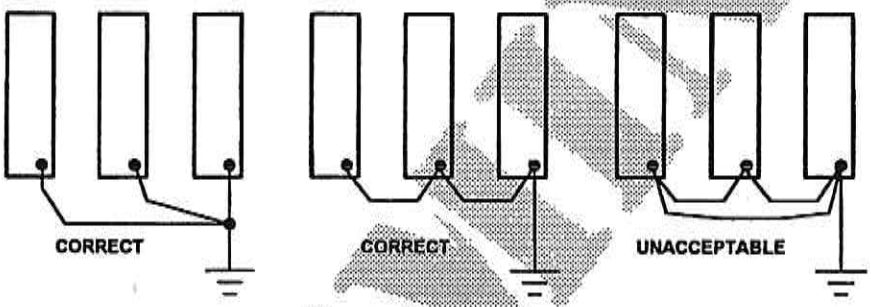


Fig. 5.1: VS-808 Grounding

5.2 Main Circuit Connection

- Use only factory supplied installation instructions to install optional, dynamic braking resistors. Failure to do so may cause equipment damage or personal injury.
- Use 600V vinyl-sheathed lead (75º C copper wires) or equivalent. Wire size should be determined by considering voltage drop of leads. Size of wire must be suitable for Class 1 circuits.
- Never connect AC main power to output terminals U, V, W.
- Never allow wire leads to contact the VS-808 enclosure. Short-circuit may result.
- Never connect power-factor-correction capacitor or noise filter to VS-808 output.

Table 5.1: Terminal Functions and Voltages of Main Circuit

Terminal Signal	Name	Voltage/Signal
R, S, T	Power Input Terminal	3-phase AC 200 -230V 50/60Hz
U, V, W	Motor Connection Terminal	3-phase 200-230VAC
E	Ground Terminal	Less than 100 ohms
B1, B2	Brake Resistor Connection Terminal	Brake resistor connection

Table 5.2: Size of Main Circuit Leads

VS-808 Model	Power Capacity (kVA)	Terminal Signal	Wire Size AWG(mm^2)
CIMR-SBA2P05	0.3	R, S, T, U, V, W, B1, B2, E	14 (2.0)
CIMR-SBA20P1	0.5		
CIMR-SBA20P2	0.75		
CIMR-SBA20P4	1.3		
CIMR-SBA20P7	2.2		
CIMR-SBA21P5	2.8		12 (3.5)

5.3 Control Circuit Connection

All interface signals are accessible on a high density, 50 pin interface connector 3CN manufactured by 3M. The motor encoder is connected to the VS-808 with a 20 pin, high- density connector manufactured by 3M (2CN). See table 5.3

Table 5.3: Interface Signal Connectors

CN	VS-808 Connector	Applicable Receptacle Model-Soldered Type	Case	Manufacturer
3CN	10250-52A2JL (Mfg. by Sumitomo 3M) Right angle 50P	10150-3000VE	10350-52A0-008	Sumitomo 3M
2CN	10220-52A2JL (Mfg. by Sumitomo 3M) Right angle 20P	10120-3000VE	10320-52A0-008	Sumitomo 3M

The encoder connection between the servo motor and the VS-808 is vital for the proper operation of the system. We recommend the use of Fujikura cable type KQVV-SW AWG22x3C AWG26x6P as per YASKAWA specification DP8409123 or equivalent. See figure 5.2.

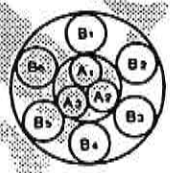


Fig. 5.2: Encoder Connection

The encoder cable cannot exceed 65 feet (20 meters)!

Tables 5.4 and 5.5 below show the pin configuration of the interface connector 3CN and the encoder connector 2CN.

Table 5.4: 3CN Pin Layout

1			2			26			27	FG	Frame ground
3	SEQI-COM	Sequence Input Signal 0V	4	F-ĹST	Sequence Input Signal 0V	28			29		
5	N-OT	Reverse Rotation Prohibit Input	6	P-OT	Forward Rotation Prohibit Input	30			31		
7	P-CON	P Movement Input	8	SV-ON	Servo ON Input	32	S-REF	Speed Reference Input	33	SG	Speed Reference Input 0V
9			10			34	TM	Torque Monitor	35	SG	Torque Reference Input 0V
11	*INH	Reference Read Prohibit Input 0V	12	INH	Reference Read Prohibit	36	SM	Speed Monitor	37	SG	Speed Monitor 0V
13	*CLR	Edit Counter Clear Input 0V	14	CLR	Edit Counter Clear Input	38			39		
15	*SIGN	Reference Code Input 0V	16	SIGN	Reference Code Input	40	SEQO-COM	Sequence Output Signal 0V	41	COINX	Positioning Completion Signal Output
17	*PULSB	Reference Pulse B Input 0V	18	PULSB	Reference Pulse B Input	42	SVONX	Servo ON Signal Output	43		
19	*PULSA	Reference Pulse A Input 0V	20	PULSA	Reference Pulse A Input	44			45	PAO	A Phase
21			22			46	*PAO	PG Output A Phase	47	PBO	PG Output B Phase
23	FLT-A	Out of Order Output A	24	FLT-B	Out of Order Output B	48	*PBO	PG Output B Phase	49	PCO	PG Output C Phase
25	FLT-C	Out of Order Output 0V				50	*PCO	PG Output C Phase			

Table 5.5: 2CN Pin Layout

1	PA	A Phase Signal	11	PW	W Phase Signal
2	*PB		12	+ 5V	Encoder Power 5V
3	PB	B Phase Signal	13	*PW	W Phase Signal
4	*PB		14	+ 5V	Encoder Power 5V
5	PC	C Phase Signal	15	0V	Encoder Power 0V
6	*PC		16	+ 5V	Encoder Power 5V
7	PU	U Phase Signal	17	0V	Encoder Power 0V
8	*PU		18		
9	PV	V Phase Signal	19	0V	Encoder Power 0V
10	*PV		20	FG	Frame Ground

There are two main operating modes for the VS-808, speed control and position control. Figure 5.3 below shows the standard connection for speed-control operating model.

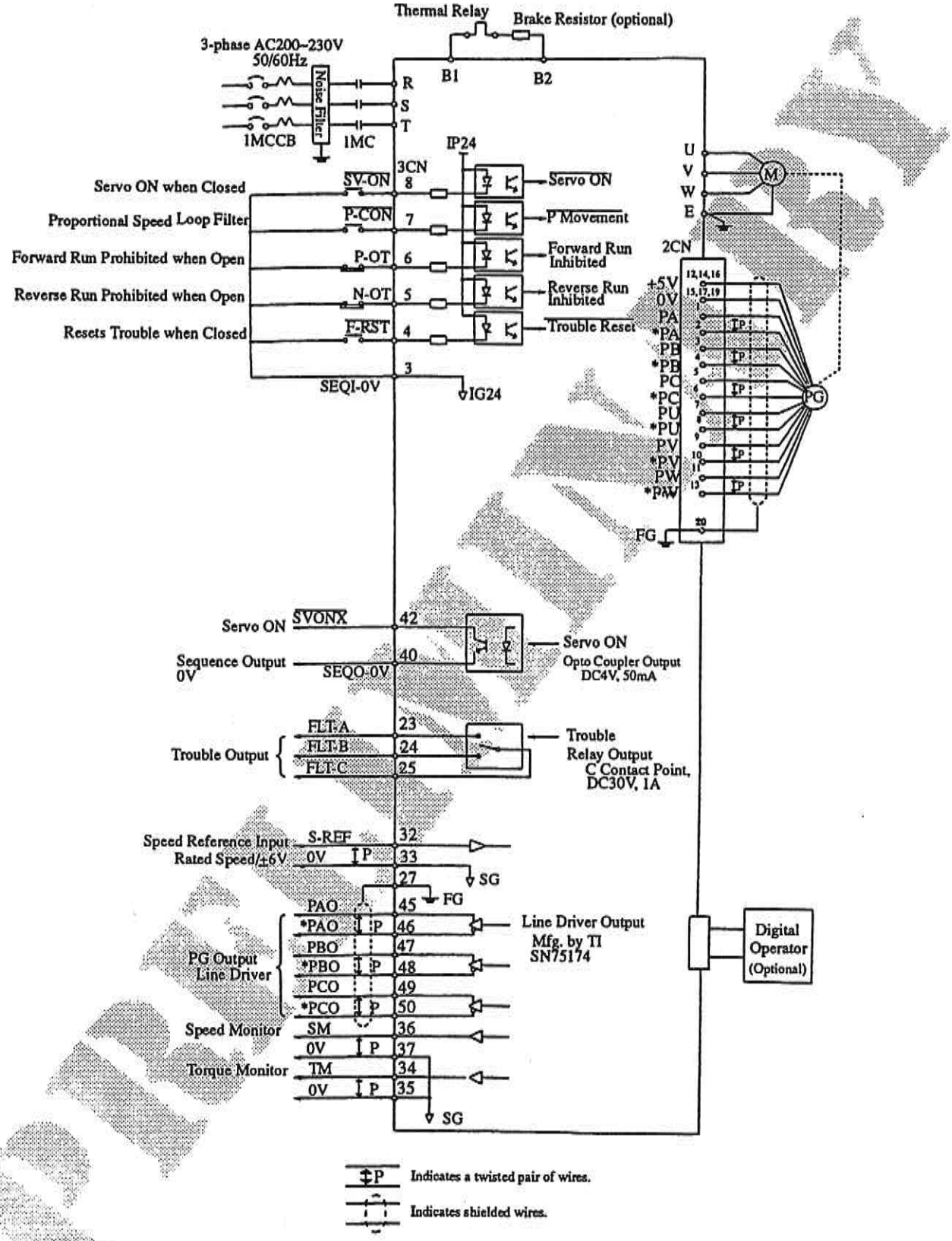


Fig. 5.3: Standard Speed-Control Connection Diagram

Figure 5.4 below shows the standard connection for position-control operating mode.

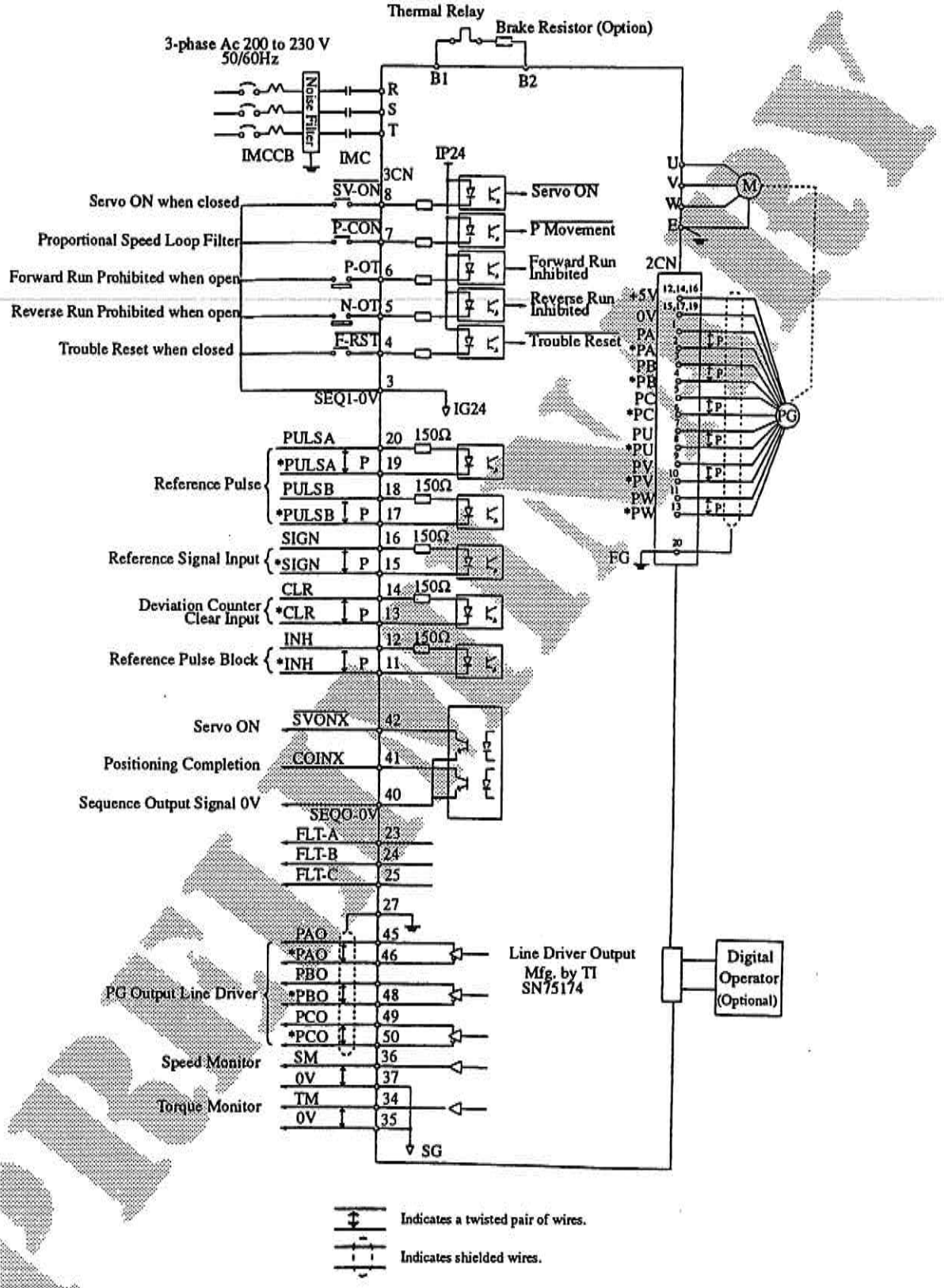


Fig. 5.4: Standard Position-Control Connection Diagram

5.4 Control Signal Details

5.4.1 Sequence Input Signal

Design the input circuit based on the data below:

(1) Power for sequence input uses the internal 24V DC power supply.
The 24V DC power is insulated with the servodriver's control power.
(2) Contact point capacity must be at least 30V, 10mA.
(3) The input filter has a signal delay of about 5ms.
(4) Input circuits are shown in Figure 5.5 and the signals are defined in Table 5.6.

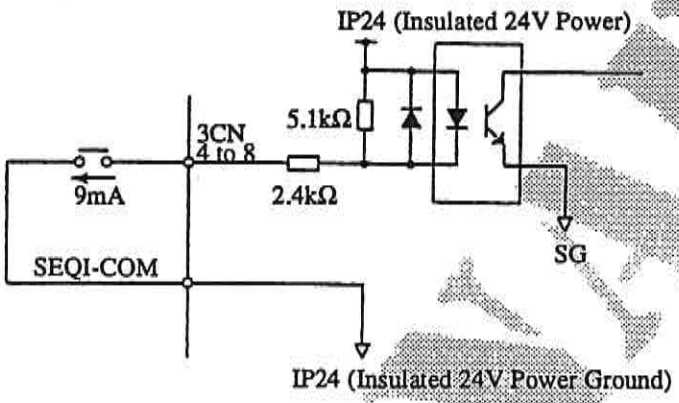


Fig. 5.5 Input Interface Circuit

Table 5.6: Input Sequence Signal

Signal Name	3CN Pin #	Name	Description
SV-ON	8	Servo ON	* Releases base block * After turning on power, wait about 0.5 secondsbefore inputting signal. * If this signal is not necessary, this signal can be disabled by setting user constant (Cn-25 bit to 0).
P-ON	7	Proportional Speed Loop Filter	* Changes the speed-loop filter from proportional and integral control to strictly proportional control when the input is activated.
P-OT N-OT	6 5	Prohibit Forward Run Prohibit Reverse Run	* Disables motor torque for one direction. P-OT - forward direction N-OT - reverse direction * This function can be disabled by setting user constants (Cn-24 bit 3.4).
F-RST	4	Reset	* Resets faults.

5.4.2 Speed Reference Input Signal

- Speed control is selected by setting Cn-24 bit 0 to "1"
- Voltage between 3CN -㉜ and ㉝ comes from the external power.
- Adjust the speed reference gain (Cn-05) so ±6 volt will yield rated motor speed.
- Resolution of the A/D converter is ± 9 bit.
- Input impedance is approximately 50kΩ

5.4.3 Position Reference Input Signal

• Position control is selected by setting Cn-24 bit 0 to "0".

Table 5.7 shows the two possible configurations of the pulse train input. CN24, bit 2 determines which configuration is active.

Table 5.7: Reference Pulse Type

Reference Pulse Type	Input Pin #	Forward Drive Reference	Reverse Drive Reference	Cn-24 bit 1
Pulse + Direction	PULSA 3CN-20 *PULSA 3CN-19 SIGN 3CN-16 *SIGN 3CN-15	"H"	"L"	"0"
Phase A B	PULSA 3CN-20 *PULSA 3CN-19 PULSB 3CN-18 *PULSB 3CN-17	90°	90°	"1"

Input frequency limit is 400 kpps.The input circuits allow connections to line driver as well as 5VDC and 12VDC input circuits as below:

(a) Line Drive Connection

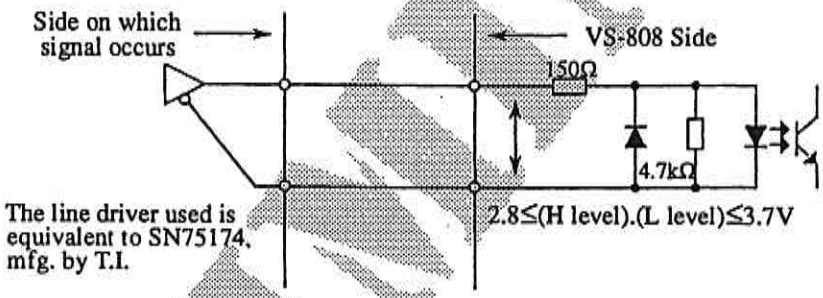


Fig. 5.6: Line Drive Connection

(b) Open Collector Connection

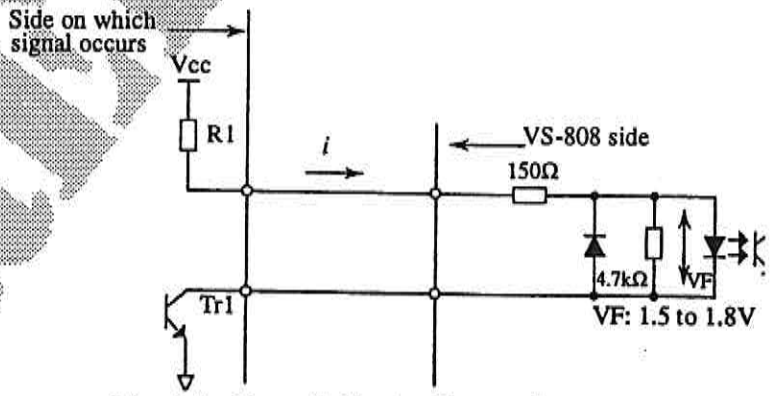


Fig. 5.7: Open Collector Connection

Please select the pull-up resistor R1 so the input current will fall within the range of 6.6mA to 5.3mA.

Example: * When Vcc is 12V ± 5%, R1 = 1000Ω

* When Vcc is 5V ± 5%, R1 = 180Ω

Corresponding to Table 5.4.3, if the reference pulse uses an open collector:

* H corresponds to Tr1 is ON

* L corresponds to Tr1 is OFF

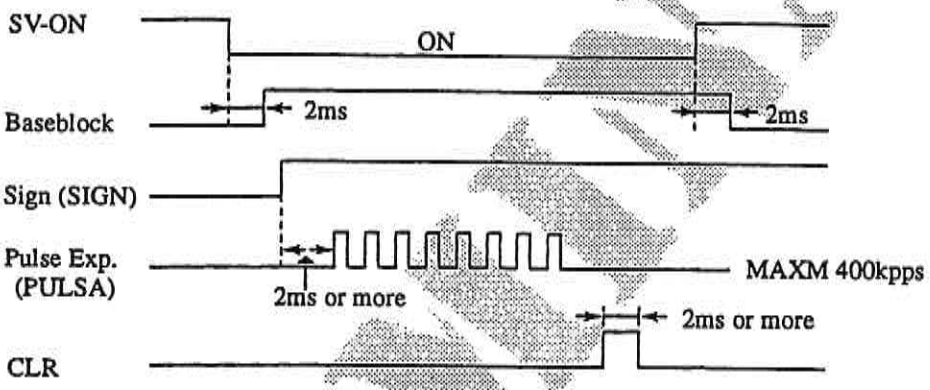
Clear Input Signal (CLR)

CLR signal to H clears the contents of the position error counter, and the position loop becomes ineffective. CLR signal "L" allows normal operation.

Reference Pulse Block Signal (INH)

If INH is to "H", the position reference counter stops counting the reference pulses. The position feed back continues counting. INH signal "L" allows normal operation.

5.4.4 Input Signal Timing



Input Signal Timing

Note: 1. Recognition and accurate counting of the pulse signal may be delayed for 2ms. after the reference signal changes state.

2. The CLR pulse duration must be at least 2ms. otherwise the VS-808 will not recognize this signal.

5.4.5 Sequence Output Signal

(1) 24VDC power supply should be used.

(2) The output capacity is 50mA or below for 24VDC.

(3) Output circuit is shown in Figure 5.4.5 and the signals and the signal pulse are shown in Table 5.4.5.

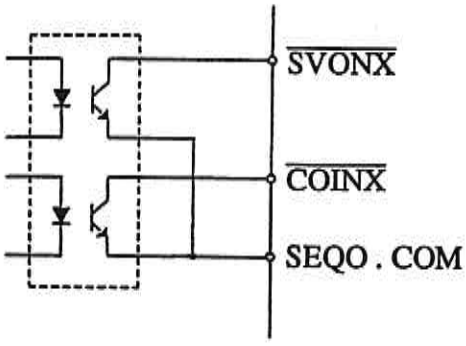


Fig.5.4.5 Sequence Output Circuit

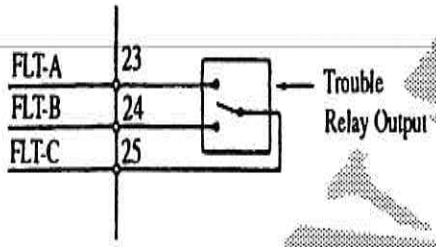
Table 5.4.5: Sequence Output Signal

Signal Name	3CN Pin No.	Summary	
SVONX	42	When Servo is ON	Output after servo is ON
COINX	41	Positioning Complete	Output after pulse count in the error counter falls below the range set in Cn-09

Alarm Signal

(1) A reed relay provides an alarm output as normally open and normally closed contacts.

(2) Contact Rating DC30V, 1A max..



Alarm Signal

Table 5.

Signal Name	3CN Pin #	Function
FLT-A	23	Closes when trouble occurs.
FLT-B	24	Opens when trouble occurs.

5.4.6 Encoder Pulse Output Signal

[PAO *PAO PBO *PBO PCO *PCO] * Indicates inverted drive signal.

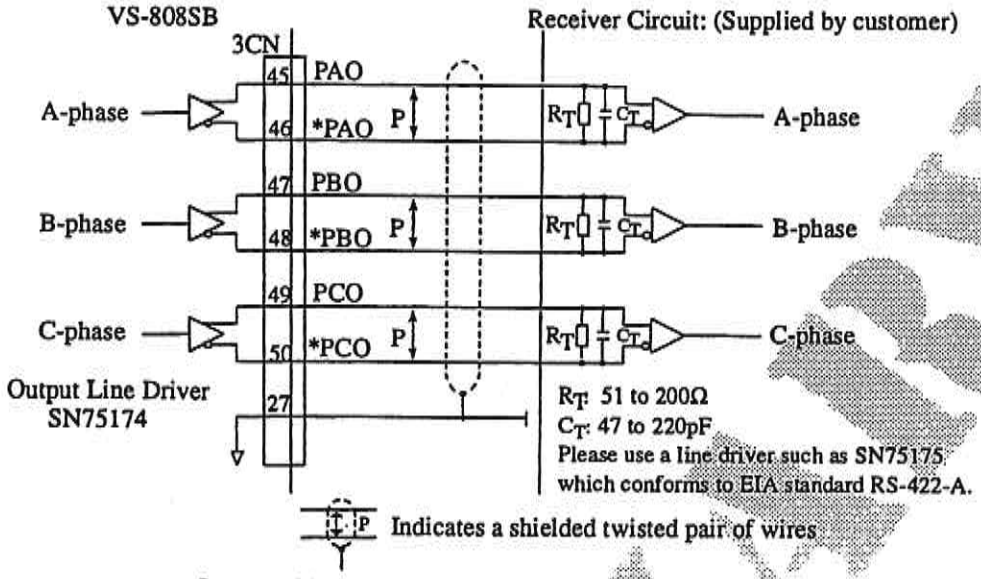
The encoder (1024 P/R) outputs A-phase, B-phase, and C-phase inverted pulse signals. It can be used as a feedback signal for positioning. The specifications of the output signal are as follows.

(1) Signal Shape

90° phase difference 2-phase pulse (A, B) and home pulse (C phase).

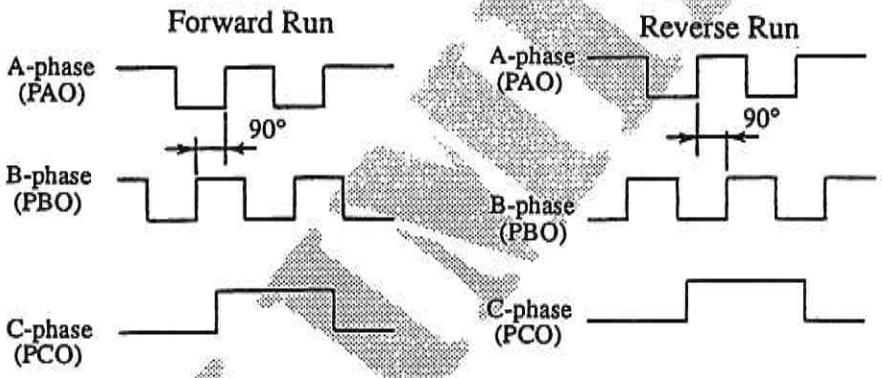
(2) Construction of Output Circuit and Receiver Circuit.

The output circuit is a line driver for RS-422-A specifications.



Output Circuit and Receiver Circuit Example

(3) Output Phase



Output Phase

5.4.7 Analog Monitor Signal

Table 5.: Sequence Output Signal

Signal Name	3CN Pin #	Description
SM	36	10V indicates max speed (Cn-16).
TM	34	10V indicates full torque forward (Cn-07) or reverse (Cn-08).

Note: 0Vfor the analog monitor, is on 3CN ㉟ ,㊲

6. Start-up

When the power is turned on, the LED display will show "b.b." and the digital operator will show the speed display "0000". If another screen appears, please refer to section 10, Troubleshooting.

6.1 Checking the Status Display

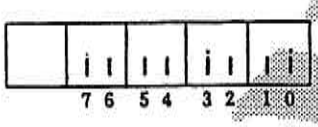
External Signal and Drive Status are checked by looking at the operating display functions Vn-01 - 10. Please confirm that the speed display in Vn-01 properly displays when the motor is turned by hand. Also, check Vn-08 for proper input status. Refer to Table 6.4 for details on the operating status display.

6.2 Setting Constants

Verify the constants below are set properly. Upon shipping from the factory, it is set to Position Control Operation by external pulse reference (1 phase).

* Position Control/Speed Control Selection . . . Cn-24 bit 0
* Pulse Selection . . . Cn-24 bit 1
* Drive Mode Selection . . . Cn-24 bit 5

Factory settings:



Note: a "0" is "|" and "1" is displayed as " | ".
All bits above are displayed as zeros.

6.3 Operating

Before beginning, check over-travel connections. If over-travels are not used, disable by setting Cn-24 bit 3=1, bit 4=1.

6.3.1 Jog Operation with Digital Operator

Jog operation is enabled through the use of the digital operator. Set to Speed Control and Operator Drive Mode (Cn-24 bit 0=1, bit 5=1). Press the Data/Enter key. Begin operation by pressing the "JOG" button on the digital operator. Notice the LED display changes from "b.b" to "S.on". The jog speed can be changed by constant Cn-15.

6.3.2 Speed Operation with External Reference

Set speed reference input voltage to 0V (3CN pin #32). Set to Speed Control with External Reference Mode (Cn-24 bit 0=1, bit 5=0). Enable servo-on signal by closing the "SV-ON" contact (3CN - ⑧) and verify current conduction to the motor. The LED display will show "S.on". If another screen appears, please refer to section 10, Troubleshooting. Slowly increase the speed reference input. Verify the motor is running in the proper direction. When the speed reference has positive polarity, the motor's axis will be turning counterclockwise when looking at it from the load side. Change the speed reference's polarity and confirm that the motor runs in reverse.

Note: The constant Cn-24 cannot be changed while "S.on", only during base blocking "b.b.".

6.3.3 Position Control Operation with Digital Operator

Set to Position Control and Operator Mode (Cn-24 bit 0=0, bit 5=1). Press the Data/Enter key. Next, press the blue "RUN" key on the Digital Operator. Next, press the DSPL key four times until "P0000" is displayed. Change the value to "P1000" and press Data/Enter. Notice the motor moves 1000 pulses. Press the blue "STOP" key on the Digital Operator to complete the test.

6.3.4 Position Control Operation with External Pulse Reference

Set to Position Control and External Mode (Cn-24 bit 0=0, bit 5=0). If you are using a 2 phase pulse 90 degree phase difference signal, set Cn-24 bit 1=1. Change the electronic gear ratio to multiply the input frequency for a noticeable speed. (ex. Cn-12 = 15, Cn-13 = 1). Enable servo-on signal by closing the "SV-ON" contact (3CN -⑧) and verify current conduction to the motor. The LED display with show "S.on". If another screen appears, please refer to section 10, Troubleshooting. Slowly increase the pulse frequency and notice that the speed increases.

7. OPERATIONAL MODES

The VS-808 servo amp's three modes of operation are:

(1) Analog Speed Command, (+/- 6 VDC);
(2) Pulse/Stepper Input, (Pulse & Direction or Phase A,B)
(3) Serial Communication, (RS-232)

7.1 Analog Speed Command - (see Fig. 5.1 for wiring & connection instructions)

The analog control signal is +/- 6 VDC with an input impedance of 50k Ohms from an external source. (For example, a motion controller, PLC, potentiometer, etc.)

The following parameters must be set for the servo amp using the digital operator to function properly in the speed command mode:

Cn-24 bit 0 set to "1" (high),
bit 5 set to "1" (high),
bit 6 set to "1" (high).
Cn-03 set to "6" VDC for rated speed. (Rated speed is 3000 rpm with max. speed being 3600 rpm.)

Note: see section 8. Digital Operator for specifics on entering and changing parameters in the servo amp.

7.2 Pulse/Stepper Input-(see Fig. 5.2 for wiring & connection instructions)

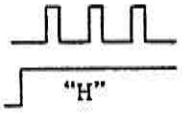
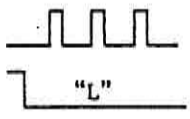
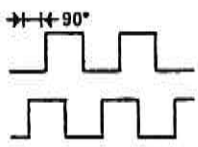
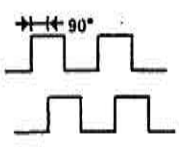
The pulse/stepper input mode is useful for replacing stepper-motors with the higher performance servo solution.

There are two types of input signals that can be used in the pulse/stepper input:

(1) Pulse & Direction: forward sign-bit "high", reverse-sign bit "low, with pulse A providing position/speed data
(2) Phase A, B: 90 degree offset of A,B will provide input to control servo's position and speed. The following parameter(s) must be set for the servo amp using the digital operator to function properly in the Pulse/stepper mode:

Cn-24 bit 1 set to "1" (high) for Pulse & Direction.
bit 1 set to "0" (low) for Phase A,B.
bit 5 set to "1" (high), for either function.
bit 6 set to "1" (high).

Reference Pulse Form

Reference Pulse Form	Input Pin #	Forward Reference	Reverse Reference	Cn-24 bit 1
Pulse & Direction	PULSA 3CN-20 *PULSA 3CN-19 SIGN 3CN-16 *SGN 3CN-15			0
90° Phase Difference 2-phase Pulse	PULSB 3CN-20 *PULSA 3CN-19 SIGN 3CN-18 *SGN 3CN-17			1

Note: see section 8. Digital Operator for specifics on entering and changing parameters

in the servo amp.

7.3 Serial Communication Mode-(see Dimension Diagrams for location of RS-232 port (marked "Operator").

(1) Digital Operator-Currently the serial communication mode only supports the JVOP-100 digital operator.
Control functions such as JOG, FORWARD, REVERSE, ETC. can be commanded through this device. (Detailed explanation of functions can be found in section 8 the Digital Operator.

The following parameter(s) must be set for the servo amp using the digital operator to function properly in the Pulse/stepper mode:

Cn-24 bit set to "1" (high), for enabling RS-232 Comm.
bit 6 set to "0" (low).

(2) PC Communication Software-Currently not available, but is under development for release in 1995.

8. Digital Operator

PRECAUTIONS WHEN OPERATING THE DIGITAL OPERATOR

This section describes both the function and operation of the Digital Operator, in addition to describing the control constants. Since the operation procedure may vary according to the user's application, please study the following section for a thorough understanding of each step before turning on power.

8.1 Digital Operator Functions

The VS-808 can perform the following functions using the multifunction Digital Operator display.

(1) Drive Status Display
Allows the operator to monitor internal VS-808 functions including speed reference, speed feedback, torque, I/O, etc.

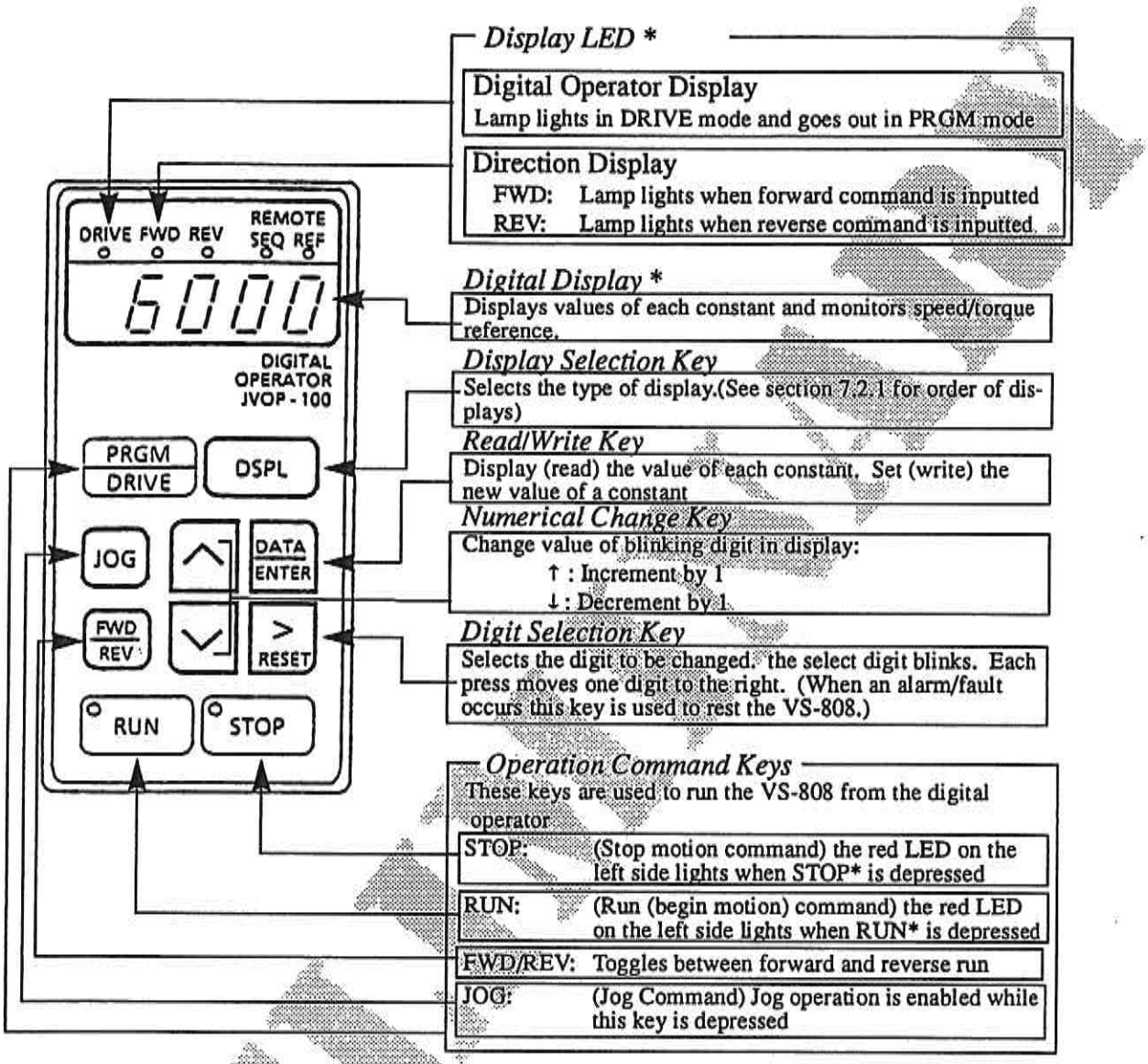
(2) Speed Display
Continuous speed feedback monitor

(3) Control Constant Display
Allows the operator to monitor or set control constants based on application requirements. A summary of constants are listed in Table 8.3 for your reference.

(4) Alarm/Fault Display
If an alarm/fault condition occurs a corresponding code will appear in the display. Table 8.2 lists all possible alarms/faults that may occur during operation.

(5) VS-808 Drive Operation
Allows the operator to run the VS-808 from the Digital Operator regardless of the control input signals.

Figure 8.1 shows the digital operator (JVOP-100) and operation keys.



* LED (Light Emitting Diode) is used for numerical and status displays.

Figure 8.1 Digital Operator Display

Drive Mode and PRGM (Program) Mode

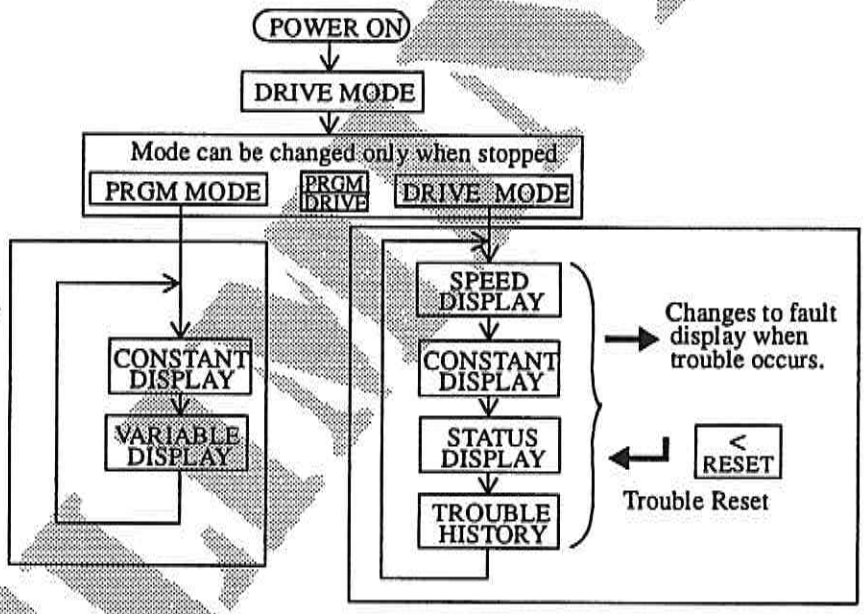
Press the PRGM/DRIVE key during a stop condition to toggle between the DRIVE mode and PRGM mode.

Drive Mode:
* This mode is used to run the VS-808
* The drive can be enabled using these keys *RUN *STOP JOG FWD/REV
* Speed reference value can be changed while running.

PRGM Mode:
* This mode is for making changes to drive constants or monitoring drive status
* Constants can be changed even when an alarm/fault has occurred.
* The VS-808 cannot be run in PRGM mode.

8.2.1 Drive Mode and PRGM Mode Display

Depending on which mode has been selected (DRIVE/PRGM), the display on the Digital Operator will change and the [DSPL] (display) key is pressed.



8.3 Digital Operator Keys and Display

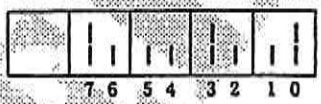
This is an explanation on how to operate the digital operator keys and its display. The alphabetical and numerical characters used are shown below in Table 8.1

Table 8.1: Alphabetical and Numerical Characters Displayed in 7 Segment LED.

Numbers		Letters			
0	0	A	A	N	n
1	1	B	b	O	o
2	2	C	C	P	P
3	3	D	d	Q	—
4	4	E	E	R	—
5	5	F	F	S	5
6	6	G	—	T	—
7	7	H	—	U	U
8	8	I	—	V	u
9	9	J	—	W	—
.	.	K	—	X	—
-	-	L	—	Y	—
		M	—	Z	—

------- = no display

Bits are represented from right to left. Bit 0 is shown as the right most segment of the vertical LED's

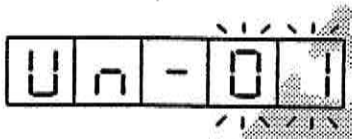


Here bit 0 is displayed as on" | " and bit 1 is displayed as off "|"

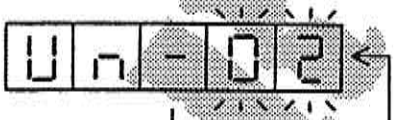
Input Pulse Highest Frequency is 400 kpps.

8.3.1 Drive Status Display Mode

To change the parameter number, push the [>] key once and the cursor position will move once. The cursor will return to the original position when the [>] key is pushed again.



Next, using the [∧] and [∨] keys, select the parameter number to be checked (Un-02).



↓

By depressing the [DATA] key, the display changes and the value of the selected parameter is shown. This example shows the speed reference (Un-02) set to 0.5%.

↓

Press the [DSPL] key when returning to the parameter selection in the Drive Status Display Mode.

For details on the different parameters available in the Drive Status Display Mode please refer to Table 8.4.

8.3.2 Control Constants Display Mode

To change the parameter number, push the [>] key once and the cursor position will move once. The cursor will return to the original position when the [>] key is pushed again.

↓

Next, using the [∧] and [∨] keys, select the parameter number to be checked (Cn-02).

↓

By depressing the [DATA] key the display changes and value of the selected parameter is shown.

↓

Move the cursor with the [>] key and select the digit to be changed.

↓

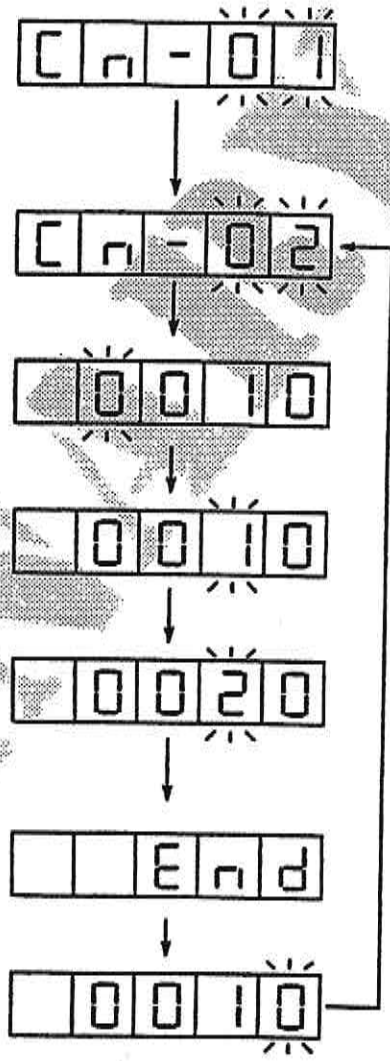
Change the number using the [∧] and [∨] keys (10→20).

↓

If the [DATA] key is held down for a few seconds, the value will be saved and "End" will appear in the display.

↓

If the [DATA] key is held down for a few seconds and "END" does not appear in the display it means the value set was outside the allowable range. As a result all digits will start flashing. If so, press the [DSPL] key to return to the parameter selection display and start over again.

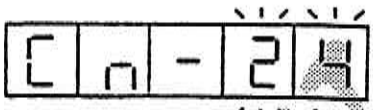


Press the [DSPL] key to return to the parameter selection in the Control Constant Display Mode.

Details on the control constants are shown in Table 8.3.

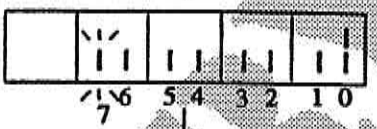
8.3.3 Digital Operator Drive Mode (Speed Control Mode)

Select Cn-24 in the control constant display mode.



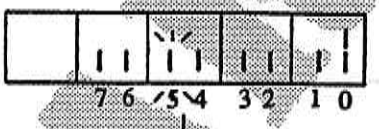
↓

Press the [DATA] key to change the display and show the bit settings for Cn-24.



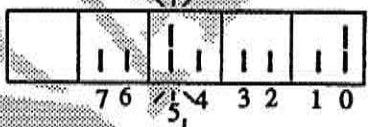
↓

Using the [>] key, move the cursor to the5th bit.



↓

Turn on bit five (5) using the [↑].

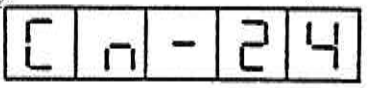


↓

If the [DATA] key is held down for a few seconds the bit settings will be saved and "END" will be displayed.

↓

Press the [DSPL] key to return to the parameter number selection for the Control Constant Display Mode.



↓

Next, set the speed reference.

Press the [DSPL] key until the speed reference display is selected. (S000.0 indicates that the speed reference is at 0%.)

Set the speed reference, using the [>], [↑], and [↓] cursor keys. Speed reference is a % of the maximum speed (Cn-16). If the speed reference set to 25% and the maximum speed is set at 2000 rpm the command reference will be 500 rpm.

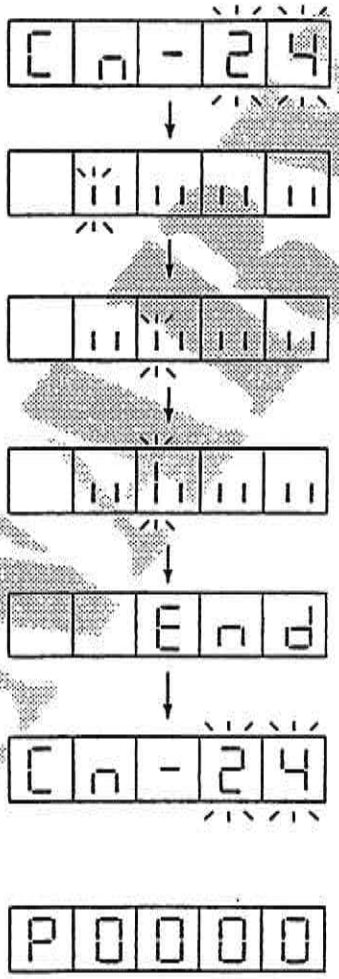
↓

Use Digital Operator's [RUN], [STOP], and [FWD/REV] keys to run, stop and select VS-808 motor direction.

To return to external I/O control, set the 5th bit of Cn-24 to " 1 ".

8.3.4 Digital Operator Drive Mode (Position Control Mode)

First, select Cn-24 in the control constant display mode.



Press the [DATA] key to change the display and show the bit settings for Cn-24.

Using the [>] key, move the cursor to the 5th bit.

Turn on bit five (5) using the [↑].

If the [DATA] key is held down for a few seconds the bit settings will be saved and "END" will be displayed.

Press the [DSPL] key to return to the parameter number selection for the Control Constant Display Mode.

Next, set the positioning reference.

Press the [DSPL] key until the speed reference display is selected (P000.0 indicates that the positioning reference is at 0 pulses.)

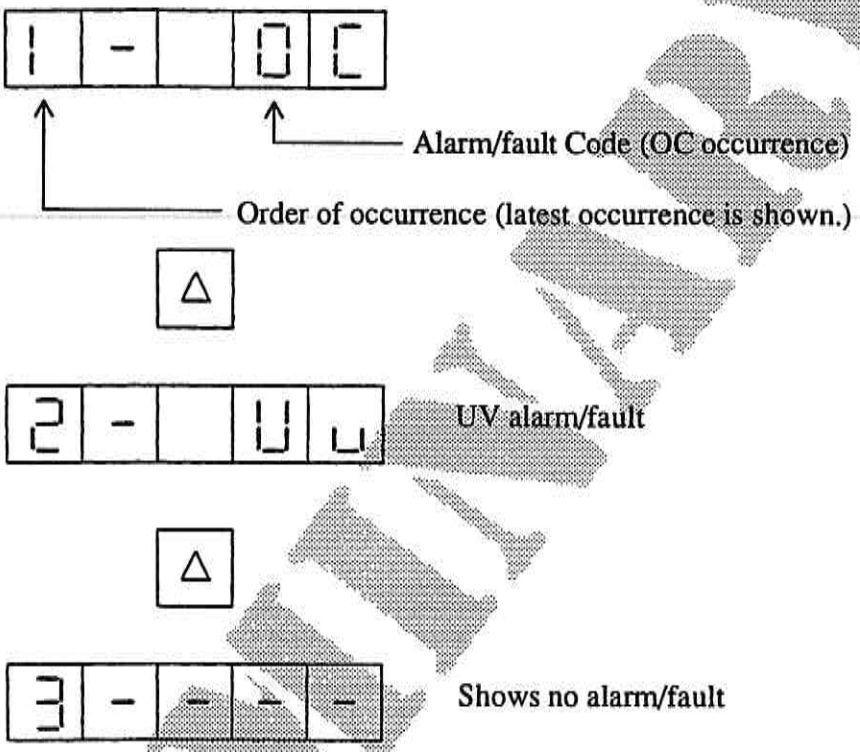
Set the positioning reference, using the [>], [↑], and [↓] cursor keys. The position reference is measured in motor pulses (x4). If the position reference is set to 4000 pulses and the number of encoder pulses (Cn-11) is et to 1000 pulses then the motor will rotate one revolution.

Use Digital Operator's [RUN], [STOP], and [FWD/REV] keys to run, stop and select VS-808 motor direction.

To return to external I/.O control, set the 5th bit of Cn-24 to " ".

8.3.5 Out of Order Display and History

Please refer to Table 8.2 for a listing of alarm/faults and their descriptions. A history of alarm/faults are saved on EEPROM and displayed when power is restored. This alarm/fault traceback display is the same as the alarm/fault display. It shows the order of occurrence and a code which corresponds to the specific alarm/fault.



To erase the out of order history, set Cn-24 bit 7 to " " and cycle the power.

8.4 Control Constants

There are user constants (Cn) and setting constants (Sn) in the VS-808. The user cannot change the setting constants (Sn) since they affect the internal operations of the servomotor and drive. Figure 8.2 shows the internal control block diagram

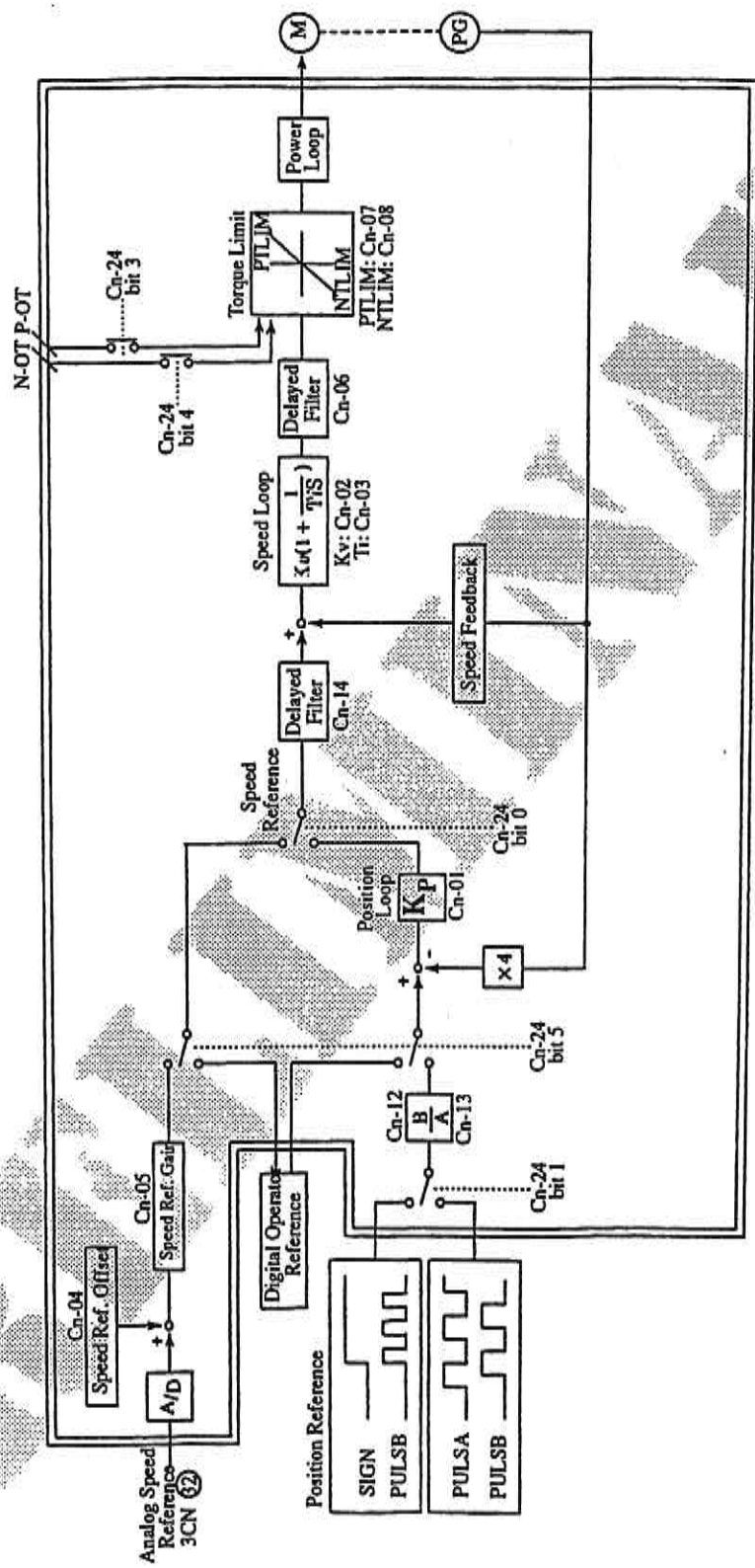


Figure 8.2: Internal Control Block Diagram

and Table 8.3 shows a summary of the user constants (Cn).

Table 8.3: User Constant Summary

No.	Name	Abbr.	Unit	Lower Limit	Upper Limit	Initial Value	Remarks *
Cn-01	Position loop gain	KP	1/sec	1	1000	10	SVON
Cn-02	Speed loop gain	KV	---	1	1000	10	SVON
Cn-03	Speed loop integral time constant	ITIME	ms	0	1000	10	SVON
Cn-04	Speed reference offset	SROFS	---	- 80	80	0	B.B
Cn-05	Speed reference gain adjustment	SRGAIN	---	0.90	1.100	1.000	B.B
Cn-06	Torque reference filter time constant	TRQFIL	ms	0	1000	0	B.B
Cn-07	Positive torque limit	PTLIM	%	0	500	200	B.B
Cn-08	Negative torque limit	NTLIM	%	0	500	200	B.B
Cn-09	Positioning completion range	COINBD	pulse	0	250	10	B.B
Cn-10	Deviation pulse overflow range	OVFBD	*256pulse	1	65535	1024	B.B
Cn-11	Number of encoder pulses	PULSE	pulse	100	32767	1024	B.B
Cn-12	Electronic gear ratio (numerator)	RATB	---	1	32767	1	B.B
Cn-13	Electronic gear ratio (denominator)	RATA	---	1	32767	1	B.B
Cn-14	Speed reference filter time constant	SRFIL	ms	0	1000	0	B.B
Cn-15	JOG speed	JOGSPD	r/min	1	Cn-16	100	B.B
Cn-16	Maximum speed	MAXSPD	r/min	100	Sn-24	4500	B.B
Cn-17 through Cn-22	Not used						
Cn-23	Motor selection code	MOTCD	---	1	FF	1	POWER
Cn-24	Selection code 1	SELCD1	bit	00000000	1111111	00000000	B.B.

BIT7 CLR_ALM	BIT6 MDSEL2	BIT5 SDSEL1	BIT4 NOT_SEL	BIT3 POT_SEL	BIT2 ---	BIT1 PLS_SEL	BIT0 MOD_SEL
alarm clear	drive mode	drive mode	negative over-travel limit	positive over-travel limit	open	pulse type	control mode
1: clear alarm (bit 7 automatically resets to→0	0:	0: ext I/O control 1: digital operator	0: enable NOT 1: disable NOT	0: enable POT 1: disable POT		0: sign + pulse 1: A phase + B phase	0: position control 1: speed control
	1:	0: Personal Computer 1: ext I/O control					

Cn-25	Selection code 2	SELCD2	bit	00000000	1111111 1	00000000	POWER

BIT7 SET_DSP	BIT6 DS_SW	BIT5 MDSEL1	BIT4 ---	BIT3 ---	BIT2 RUN_SEL	BIT1 FIL_SW	BIT0 ---
Sn set 1: settable 0: unsettable	DS detect 1: detect 0: undetected	Drive Mode 1: detect 0: undetected	open	open	Runaway 1: detect 0: undetected	Speed monitor 1: w/ filter 0: w/o filter	open

* SVON = settings can be changed even while servo is on.
* B.B = settings can be change only during base block (SVOFF).
* POWER = power must be cycled after changes are made.

Table 8.2 Alarm/Fault Code Summary through Digital Operator

OC	Overcurrent
Ou	Overvoltage
Uu	Under Voltage
OH	Overheated Heat Sink
OL 1	Overloaded Servodriver
OLn	Overloaded Motor
OS	Overspeed
PGE	Faulty Encoder Signal
PLE	Faulty Poll Sensor Signal
rUn	Runaway
OuF	Excessive Position Deviation
CPF00 (F00)	Abnormal Operator Communication 1
CPF01 (F01)	Abnormal Operator Communication 2
CPF04 (F04)	Abnormal Constant Check
CPF05 (F05)	Faulty AD Converter
CPF07 (F07)	Drive Over Temperature

Note: Items in parenthesis are the actual LED display.

(1) Position Loop Gain: Cn-01 (KP)
* This is the ratio gain for position control.
Setting range: 1 to 1000 (1/msec).
To increase rigidity make KP larger.

(2) Speed Loop Gain: Cn-02 (KV)
* This is the ratio gain for speed control.
Setting range: 1 to 1000 (%/%).
Making KP larger will increase rigidity.
Torque reference (%) = KV x Speed Deviation (%)

(3) Speed Integral Time Constant: Cn-03 (ITIME)
* This is the integral time constant for speed control.
Setting range: 1 to 1000 (msec).
Making ITIME smaller will speed up responsiveness.

(4) Speed Reference Offset: Cn-04 (SROFS)
* This is the offset adjustment for analog speed reference.
Setting range: -80 to 80.
With the speed reference at 0, set positive value for forward rotation and a negative value for reverse rotation. SROFS = {512 - (Un-07)} Un-07

(5) Speed Reference Gain Adjustment: Cn-05 (SRGAIN)
* This gain scales the analog speed reference.
Setting range: 0.900 to 1.100.
Speed reference = SRGAIN x Speed Reference Input

(6) Torque Reference Filter Time Constant: Cn-06 (TRQFIL)
* This is the first-order lag filter time constant for torque reference.
Setting range: 0 to 1000 (msec).
This is used as a countermeasure against mechanical vibration.
Depending on conditions, making the time constants longer can cause irregularity.

(7) Positive Side Torque Limit: Cn-07 (PTLIM)
* This limits the torque reference in the positive direction.
Setting range: 0 to 500 (%).

(8) Minus Side Torque Limit: Cn-08 (MTLIM)
* This limits the torque reference in the minus direction.
Setting range: 0 to 500 (%).

(9) Positioning Completion Range: Cn-09 (COINBD)
* Used in position control.
This sets the range for the in position output signal (COIN).
Setting range: 0 to 250 pulses.

(10) Error Pulse Overflow Range: Cn-10 (OVFBD)
* Used in position control.
This sets the maximum allowable pulse following error.
Setting range: 1 to 65535 (x256 pulses).

(11) Number of Encoder Pulses: Cn-11 (PULSE)
* Sets the number of encoder pulses per motor revolution.
Setting range: 100 to 32767 pulses.

(12) Electronic Gear Ratio: Cn-12 (RATB), Cn-13 (RATA)
* Used for position control.
These constants set the ration between user units (reference units) and encoder pulses.
Setting Range: 1 to 32767. However, B/A (Cn-12/Cn-13) should be greater than 1 to insure the best positioning accuracy. If B/A is 1 or below the minimum reference units are smaller than the encoder pulse resolution.

(13) Speed Reference Filter Time Constant: Cn-14 (SRFIL)
* This is the first-order lag filter time constant for speed reference.
Setting range: 0 to 1000 (msec).

(14) Jog Speed: Cn-15 (JOGSPD)
* Sets the JOG speed. Setting range: 1 to Cn-16 (rpm).
The drive can be "jogged" from the Digital Operator.

(15) Maximum Speed: Cn-16 (MAXSPD)
* Sets the speed corresponding to 100% speed reference.
Setting range: 100 to Sn-24(rpm)

(16) Motor Selection Code: Cn-23 (MOTCD)
* Selects the applicable motor from the motor codes stored in memory.
* It is necessary to shutoff and recycle the power when motor codes are changed.
Setting range: 0 to FF in HEX code.

(17) Selection Code 1: Cn-24 (SELCD1)
* This is a multifunction constant using bit settings.
For details on how to set bits refer to section 8.3 Key Operation.
Setting range: bit patterns of 00000000 to 11111111.
After changing the setting for Cn-24, recycle the power and the revised settings will become effective.
bit 0 . . . Control Mode Selection (MOD_SEL)
0: Position Control
1: Speed Control
bit 1 . . . Pulse Selection (PLS_SEL)
0: Signal + Pulse
1: A-phase + B-phase
bit 2 . . . Not used
bit 3 . . . POT Selection (POT_SEL)
0: P_OT enabled
1: P_OT disabled
bit 4 . . . NOT Selection (NOT_SEL)
0: N_OT enabled
1: N_OT disabled
bit 5 . . . Drive Mode Selection (MOD_SEL1)
0: External I/O Mode
1: Digital Operator Drive
bit 6 . . . Not used
bit 7 . . . Alarm/fault History Clear
Select 1, shutoff and recycle power to clear alarm/fault history.

(18) Selection Code 2: Cn-25 (SELCD2)
* This is a multifunction constant using bit settings.
For details on how to set bits refer to 8.3 Key Operation.
Setting range: bit patterns of 00000000 to 11111111.
After changing the settings for Cn-25, shutoff and recycle the power and the revised settings will become effective.
bit 0 . . . Servo ON Selection (SVON_SEL)
0: Servo ON/OFF using external signal (SV-ON)
1: Servo Always ON
bit 1 . . . Speed Display Filter on Digital Operator (FIL_SW)
0: With Filter
1: Without Filter
bit 2 . . . Overrun Detection (RUN_SW)

0: Enabled
1: Disabled

bit 3 . . . Not used

bit 4 . . . Not used

bit 5 . . . Encoder (PG) Disconnect Detection (PGC_SW)
0: Enabled
1: Disabled

bit 6 . . . Overspeed Detection Alarm Selection (OS_SW)
0: Detects
1: Does not detect

bit 7 . . . Not used

8.5 Drive Status Display

Internal VS-808 operating status can be referenced through the digital operator.

Table 8.4: Summary of Operating Status Display (Un-XX)

No.	Name	Unit
Un-01	Motor speed	r/min
Un-02	Speed reference	%
Un-03	Torque reference	%
Un-04	Pulse following error	pulse
Un-05	V-phase current	A
Un-06	W-phase current	A
Un-07	Speed reference AD converted value	
Un-08	Input sequence signal	
Un-09	Internal status 1	
Un-10	Internal status 2	
Un-11	Not used	

Un-08 (Input Signal)

$\overline{SVON}$	$\overline{PCON}$	$\overline{POT}$	$\overline{NOT}$	$\overline{FRST}$
$\overline{SIGN}$	$\overline{CLR}$	$\overline{INH}$	———	———
———	———	———	———	———
.	.	.	.	.

Un-09 (Internal rack)

$\overline{ALM}$	$\overline{RDY}$	$\overline{COIN}$	$\overline{OVF}$	$\overline{TLIM}$
———	———	———	———	———
———	———	———	———	———
.	.	.	.	.

Un-08 (Input Signal)

$\overline{PU}$	$\overline{PV}$	$\overline{PW}$	———	———
$\overline{PA}$	$\overline{PB}$	$\overline{PC}$	———	———
———	———	———	———	———
.	.	.	.	.

9. Inspection and Maintenance

In order to maintain satisfactory operations of VS-808, periodically perform inspection and maintenance.

Warning of Electric Shock

When inspecting VS-808, turn off the power and wait 5 minutes before putting hand inside the unit. Failure to do so could result in an electrical shock.

9.1 Inspection Schedule for Motors

9.1.1 Inspection Schedule for Servomotor

The AC servomotor has no wearing parts (eg. brushes), so simple daily inspection is sufficient. The inspection schedule for the motor is shown in Table 9.1
Do not disassemble the motor. If disassembly should become necessary, contact your Yaskawa representative.

Table 9.1 Inspection Schedule for Motors

Inspection Item	Frequency	Inspection Operation
Vibration	Daily	Feel manually
Noise	Daily	Aurally
Exterior and Cleaning	As required	Clean with dry cloth or compressed air.
Insulation Resistance	Yearly	Make sure that it is more than 10MΩ by measuring with a 500V megger after disconnecting the motor from the controller
Oil Seal	Every 5,000 hours	If worn or damaged, replace after disconnecting the motor from the driven machine
Total Inspection	Every 20,000 hours	Contact Yaskawa representative

9.1.2 Inspection and Maintenance for Servopack

The Servopack is of contactless construction so that no special maintenance is required. Tighten screws periodically. If any of the electrical parts become dirty or dusty, it may cause it to overheat or lower the resistance. Therefore, please clean periodically. Further, build-up of dirt or oil in the heat sink on inverter's back side will block radiation of heat and cause breakdown.
Please clean once every six months with an air blower or dry cloth.

9.2 Items to Inspect Periodically

Referring to Table 9.2 below, set-up a schedule for periodic maintenance checks.

Table 9.2: Periodic Inspection

Object of Inspection	Inspection Point		Standard	Measures
	Item	Method		
Installation Conditions	Mounting bolts on motor and inverter	Visual	Must not be loose	Tighten bolts.
Grounding	Grounding pins on motor and inverter.	Visual	Must be securely grounded.	Restore the initial condition and tighten
Motor Coating	Peeling and corrosion	Visual	Must be free from damage, discoloration, peeling, and corrosion	Rust-proof and repaint
Cables and Connections	Loose connection, break in wiring insulation, terminal box	Visual	Must be free from loose connections or breakage. Must be free from deterioration or deformation.	Restore to the initial condition and tighten.
Cooling Fan	Vibration Abnormal Noise	Touching Hearing	Must be free from unusual vibration or increase in magnitude. Must be free from unusual noises or increase in noise.	Replace cooling fan.
Relays and Contactors	Abnormal sound when functioning	Listen	Must be free from chattering noise	Replace parts.

Indication of Fault Condition Through LED Display

LED DISPLAY	FAULT CONDITION
OC	Overcurrent
Ou	Overvoltage
Uu	Insufficient Voltage
OH	Overheated Heat Sink
OL 1	Overloaded Servodriver
OLn	Overloaded Motor
OS	Overspeed
PGC	Abnormal Encoder Signal
PLC	Abnormal Hall Sensor Signal
rUn	Runaway
OuF	Excessive Position Deviation
CPF00 (F00)	Abnormal Operator Communication 1
CPF01 (F01)	Abnormal Operator Communication 2
CPF04 (F04)	Abnormal Constant Check
CPF05 (F05)	Abnormal AD Converter
CPF07 (F07)	Abnormal Servodriver Temperature

Note: Items in parenthesis are the actual LED display.

10.1 Trouble Shooting

Diagnosis of trouble according to the LED or digital operator display, are listed below.

Display	Contents	Countermeasure
OC Overcurrent	* Defective main circuit IGBT * Defective current detection circuit	* Replace driver
Ou Overvoltage	* Large GD^2 load. * Defective regenerative circuit detected.	* Check GD^2, check damping resistance. * Replace Servopack.
Uu Insufficient Voltage	* Low power voltage. * Defective voltage detection circuit.	* Confirm power voltage * Replace Servopack.
OH Overheated Heat Sink	* High ambient temperature. * Excessive load. * Defective circuit detected.	* Lower ambient temperature. * Re-examine drive pattern/load. * Replace Servopack.
OL 1 Overloaded Driver	* Excessive load. * Defectivecurrent detection circuit	* Re-examine application. * Replace Servopack.
OLn Overloaded Motor	* Excessive load. * Defectivecurrent detection circuit	* Re-examine application. * Replace Servopack.
OS Overspeed	* Excessive vibration, overshoot. * Defective encoder. * Miswired motor.	* Readjust constants (speed control) * Correct encoder wiring. * Correct motor wiring.
PGC Broken PG Wire	* Locked motor. * Defective encoder. * Defective encoder signal detection	* Adjust machine/load. * Correct encoder wiring. * Replace Servopack.
PLC Abnormal Pole Sensor	* Defective encoder (pole sensor). * Defective encoder signal detection circuit.	* Correct encoder wiring. * Replace Servopack.
rUn Overrun Detected	* Defective encoder (pole sensor). * Defective encoder signal detection circuit.	* Correct encoder wiring. * Replace Servopack. *Correct motor wiring.
OuF Excessive Positioning Deviation	* Large load. * Incorrect constant settings. * Miswired motor.	* Reduce load. * Adjust KP, KV. * Correct motor wiring.
CPF00 (F00) Abnormal Transmission from Operator	* Driver or operator is defective.	* If the Servopack's display is normal, replace the operator. If the operator's display is normal,
CPF01 (F01) Abnormal Transmission from Operator	* Driver or operator is defective.	* If the Servopack's display is normal, replace the operator. If the operator's display is normal,
CPF04 (F04) Abnormal Constants Check	* Improperly set constants. * Servopack is defective.	* Confirm constants. * Replace Servopack.
CPF05 (F05) Abnormal AD Converter	* Servopack is defective.	* Replace Servopack.
CPF07 (F07) Abnormal Driver Temperature Detected	* Servopack is defective.	* Replace Servopack.

Note: The three alarm conditions listed below are detected by the software.

Depending on the operation conditions, it may be required to disable one or more of these alarms. These alarms can be enabled/disabled in Cn-25. When Cn-25 settings are changed, please recycle the power.

OS (Overspeed) . . . . . .This alarm occurs when the detected speed value exceeds 120% of the maximum speed, for a period of 2 msec. Large overshoots, etc. can cause this alarm. This alarm is disabled by setting bit 6 of Cn-25 to 1

PGC (Broken PG Wire) .This alarm occurs when the torque reference is 100% or larger, and the detected speed value is 0, for a period of 320 msec. Large loads, mechanical lock-ups, etc. can cause this alarm.
This alarm is disabled by setting bit 5 of Cn-25 to 1.

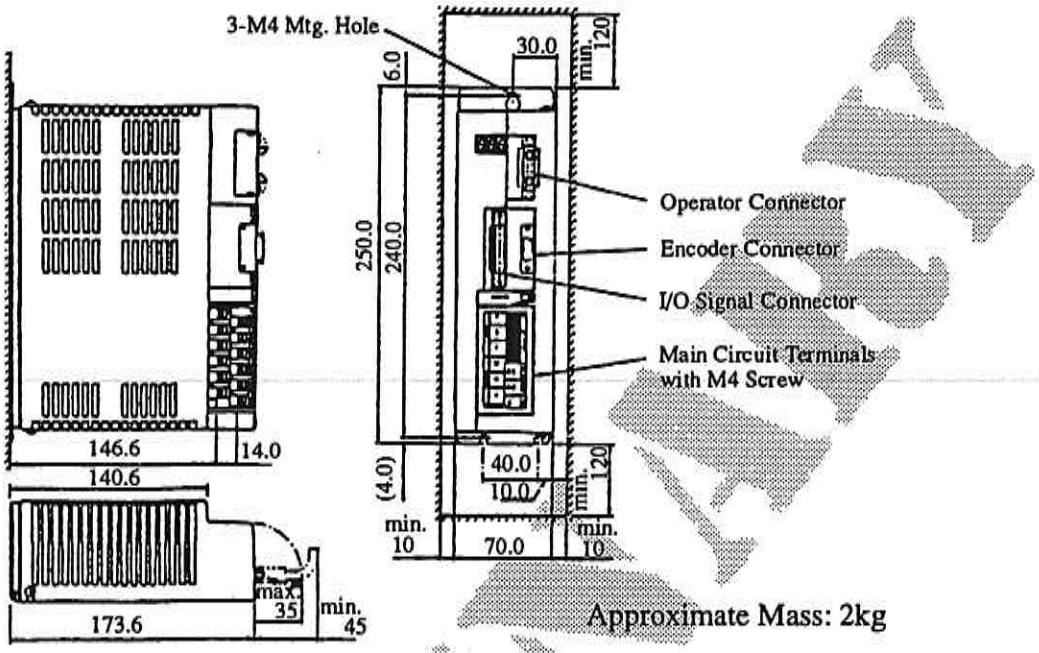
rUn (Runaway) . . . . . .This alarm occurs when the torque reference and detected speed are of the opposite polarity and 50% > than their related values.
When the loads are too large or when the acceleration/deceleration conditions are too strict, the ability to follow is decreased.
This alarm is disabled by setting bit 2 of Cn-25 to 1.

Table 10.2 Troubleshooting Guide for AC Servomotor

Trouble	Cause	What to do
Motor does not start	Loose connection	Tighten connection
	Wrong wiring	Correct
	Overload	Reduce load or use larger motor
Unstable operation	Wrong wiring	Inspect and correct wiring across motor terminals U, V, and W, and PG
Motor Overheats	Excessive ambient temperature	Reduce below 40°C
	Motor dirty	Clean motor surface
	Overload	Reduce load or use a larger motor
Unusual Noise	Motor loosely mounted	Tighten foundation bolts
	Motor misaligned	Realign
	Coupling out of balance	Balance coupling
	Noisy bearing	Check alignment, loading of bearing, lubrication and contact Yaskawa representative
	Vibration of driven machine	Contact the machine manufacturer

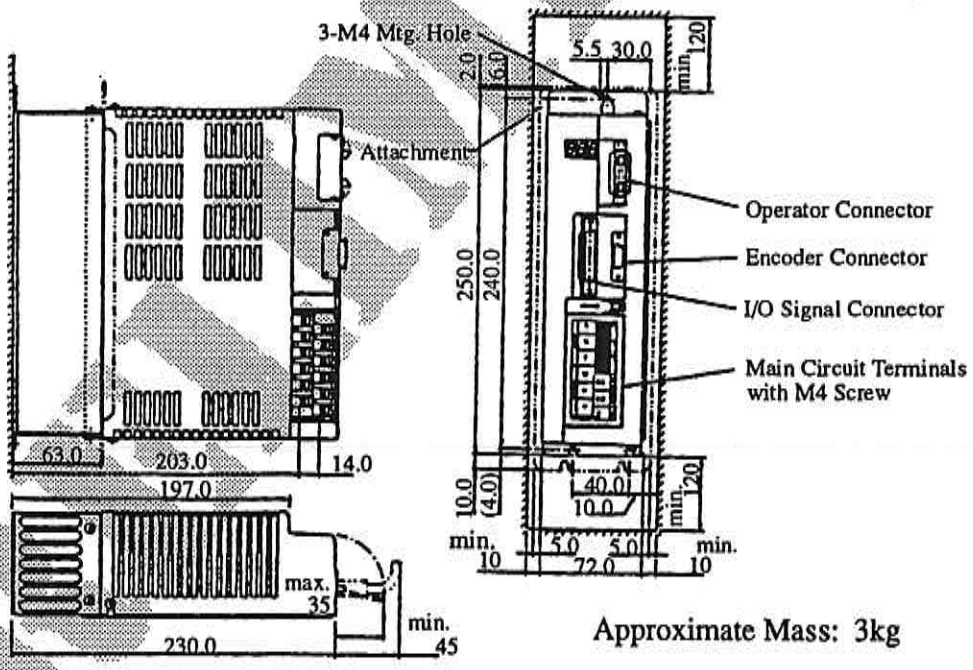
11. Dimensional Drawings

(1) CIMR-SBA2P05 to SBA20P2 (50 to 200W)



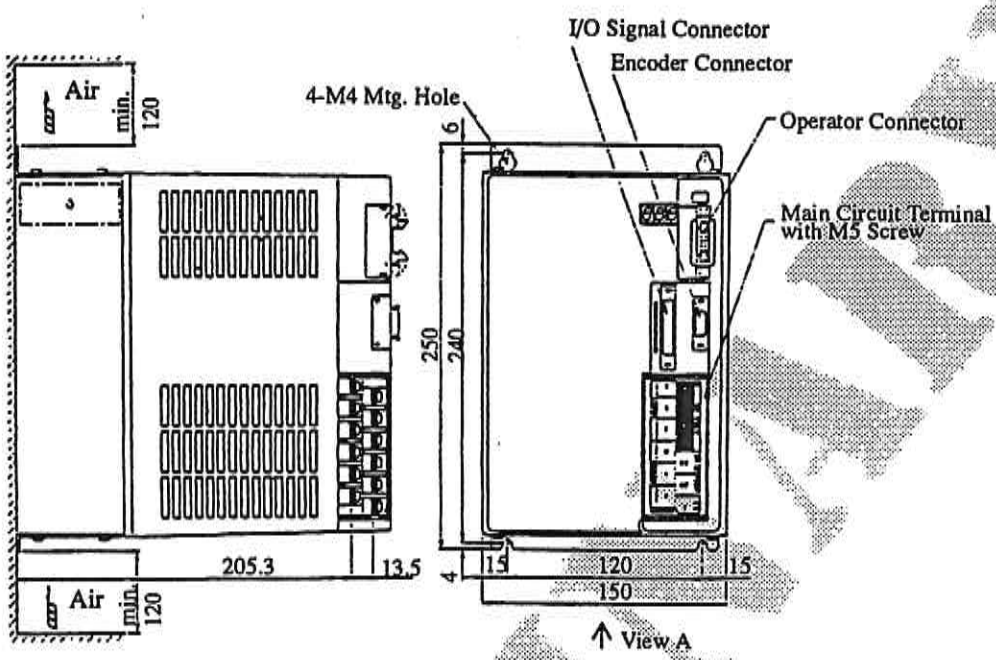
Approximate Mass: 2kg

(2) CIMR-SBA20P4, CIMR-SBA20P7 (400W, 750W)



Approximate Mass: 3kg

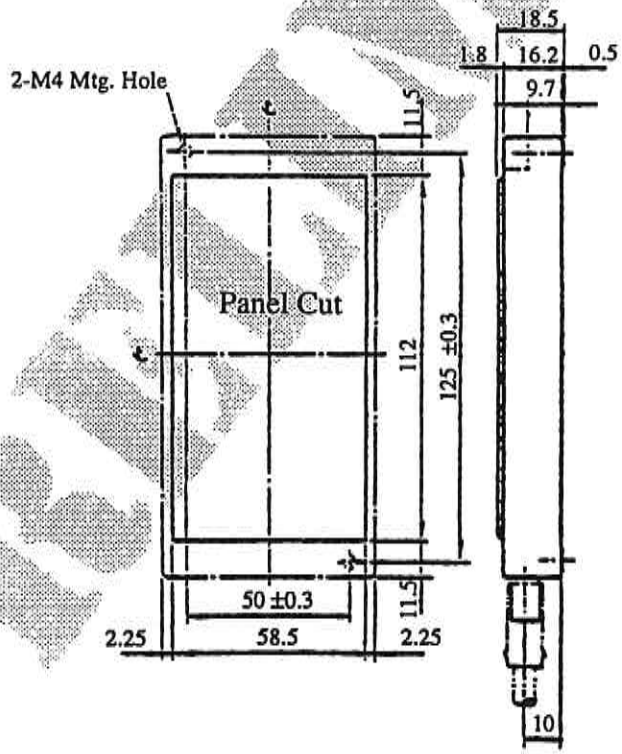
(3) CIMR-SBA21P5 (1500 W)



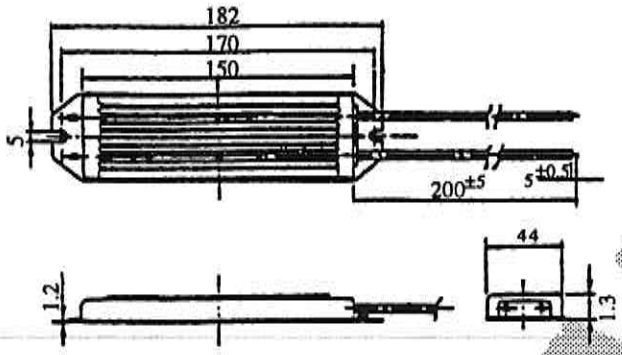
Approximate Mass: 6kg

(4) Exclusive Options

* Digital Operator (JVOP-100)



* Brake Resistor (ERF-150WJ□□)

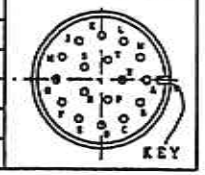


Weight: 0.2kg
(ERF-150WJ□□ All types)

CONNECTION (FOR ENCODER)

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
A	A PHASE	G	0V	N	$\overline{V}$
B	$\overline{A}$ PHASE	H	+5V	P	W
C	B PHASE	J	FG	R	$\overline{W}$
D	$\overline{B}$ PHASE	K	U	S	–
E	Z PHASE	L	$\overline{U}$	T	–
F	$\overline{Z}$ PHASE	M	V		

RECEPTACLE



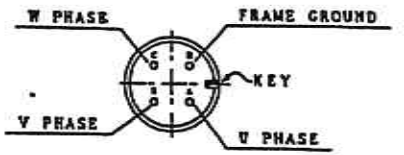
ENCODER SPECIFICATIONS

DC5V, 1024P/R

A, B, Z, U, V, W

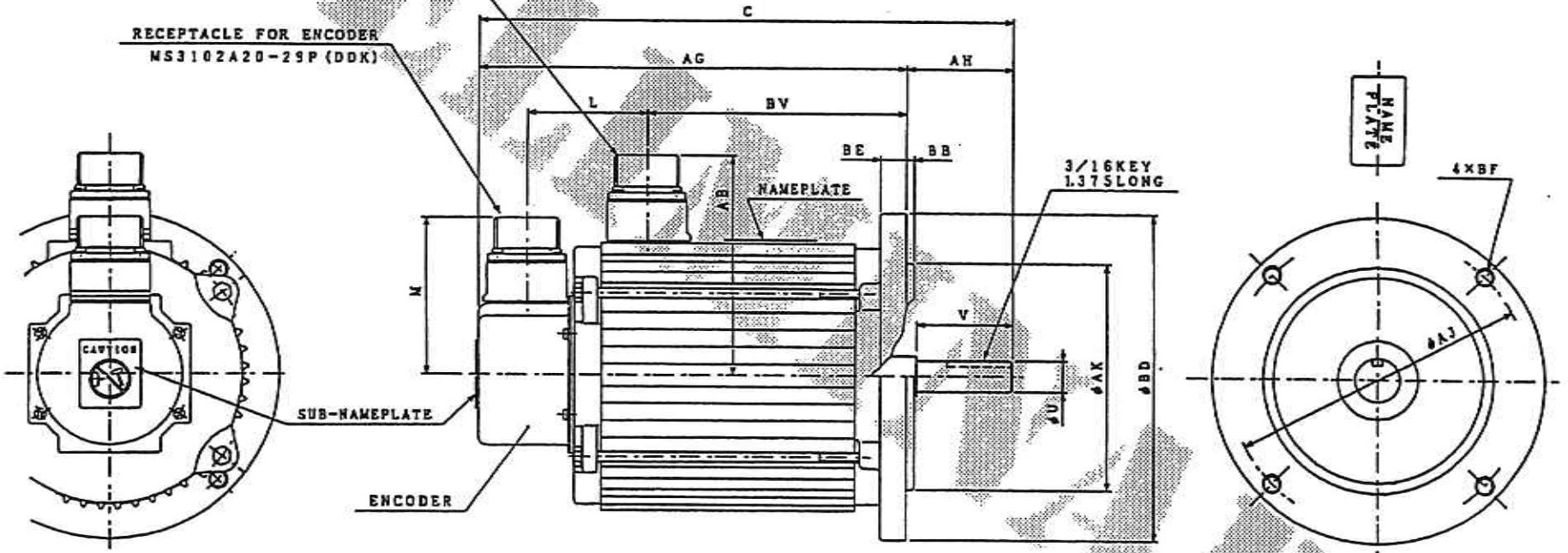
LINE DRIVER TYPE

CONNECTION (FOR SOURCE)



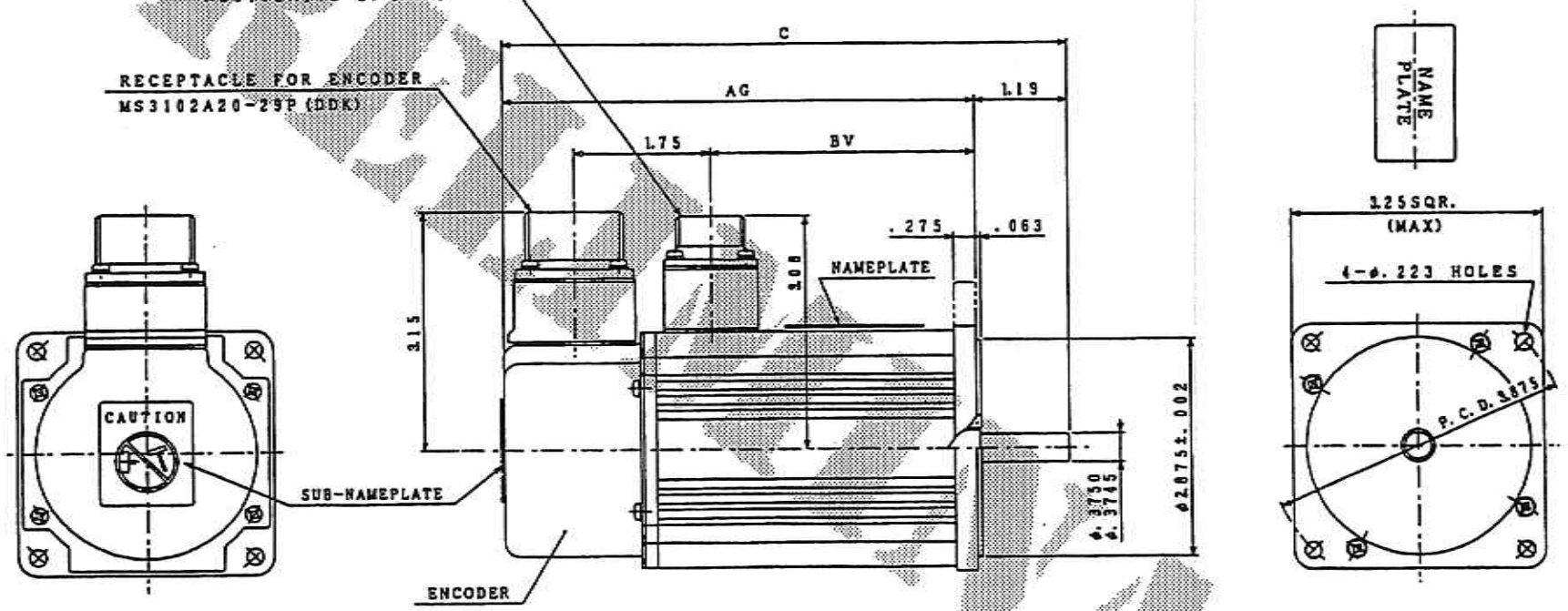
RECEPTACLE FOR SOURCE
MS3102A20-4P (DDK)

RECEPTACLE FOR ENCODER
MS3102A20-29P (DDK)



TYPE	RATED OUTPUT (kW)	RATED TORQUE (N·m)	RATED SPEED (r/min)	RATED VOLTAGE (V)	TIME RATING	DIMENSIONS (INCHES) C	AG	BV	AB	L	M	AH	AJ	AX	BB	BE	BD	BF	U	V	BEARING NO. OPP. DRIVE END	DRIVE END
USAEE04B-5	0.4	1.27	3000	AC 200	CONT.	9.74	7.68	4.45	4.38	2.32	3.14	2.06	5.875	4.500 4.497	0.16	0.5	5.5	3/8-16 (TAP)	0.8250 0.8245	1.87	6204ZZA	6204ZZ
USAEE08B-5	0.75	2.38				10.33	8.27	5.04														
USAEE15B-5	1.5	4.8				12.55	10.43	7.20				2.12							0.8750 0.8745	2.24		6205ZZ

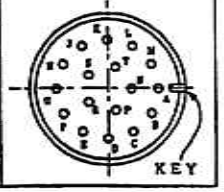
TYPE	RATED OUTPUT (W)	RATED TORQUE (N-m)	RATED SPEED (r/min)	RATED VOLTAGE (V)	TIME RATING	DIMENSIONS (INCHES)		
						C	AG	BV
USAEE02A-5	200	.64	3000	AC 200	CONT.	7.19	6.00	3.35
USAEE01A-5	100	.32				6.25	5.06	2.41
USAEEP5A-5	50	.16				5.85	4.66	2.01



CONNECTION (FOR ENCODER)

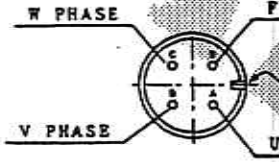
PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
A	A PHASE	G	0V	N	$\overline{V}$
B	$\overline{A}$ PHASE	H	+5V	P	W
C	B PHASE	J	FG	R	$\overline{W}$
D	$\overline{B}$ PHASE	K	U	S	-
E	Z PHASE	L	$\overline{U}$	T	-
F	$\overline{Z}$ PHASE	M	V		

RECEPTACLE



ENCODER SPECIFICATIONS
DC5V. 1000P/R
A, B, ZPHASE.
LINE DRIVER TYPE

CONNECTION (FOR SOURCE)



BEARING NO.	
OPP. DRIVE END	DRIVE END
6000ZZA	6201ZZ

DIMENSIONS IN INCHES

Appendix A

Brake Resistor

A brake resistor is not necessary if the reflected load inertia J_L is within the range below. .

Table 3.2: Allowable Load Inertia J_L

Capacity (W)	50W	100W	200W	400W	750W	1000W
J_L	$J_L < 10 \times J_M$	$J_L < 6 \times J_M$	$J_L < 6 \times J_M$	$J_L < 0.3 \times J_M$	$J_L < 0.2 \times J_M$	$J_L < 0.7 \times J_M$

Note: * J_M is the value of the motor's rotor inertia.
* The above values are calculated when decelerating at 200% of rated torque for standard motors.

If there is an unsupported, vertical load, the external brake resistor may be necessary even if the reflected load inertia is small!

If the load inertia exceeds the above limits an overvoltage alarm may occur during deceleration.

* Lower deceleration torque limit (Cn-07, Cn-08)
* Reduce the deceleration rate
* Lower the maximum speed
* Use a braking resistor

The breaking resistors duty cycle is limited by the built-in braking - transistor performance as noted below:

Brake Transistor Performance: 200% torque, 10sec, 3% Duty Cycle

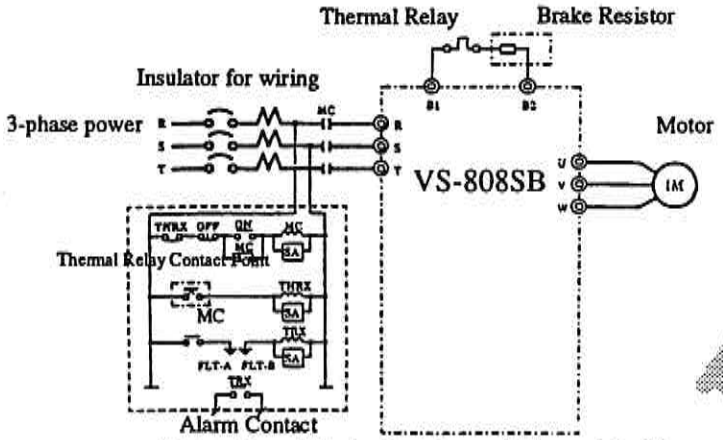
The braking resistor should be connected in series with a thermal-relay element for circuit protection. The appropriate combinations are listed in the table below:.

Specification for Brake Resistors and Thermal Relays

VS-808 CIMR-SBA□□□□	Brake Resistor				Thermal Relay Rated/Set Current
	Model Name ERF-150WJ□□□	Resistance Value(Ω)	Code No.	Qty.	
2P05	751	750	R007508	1	RH-13/0.16P 0.13A
20P1	751	750	R007508	1	RH-13/0.16P 0.13A
20P2	401	400	R007507	1	RH-13/0.3P 0.22A
20P4	201	200	R007505	1	RH-13/0.5P 0.44A
20P7	101	100	R007504	1	RH-13/0.8P 0.91A
21P5	620	62	R007510	1	RH-13/1.4P 1.4A

Connect the thermal relay such that the main power is disconnected from the VS-808 if the

thermal relay trips.



Connection of Brake Resistor and Thermal Relay

Appendix B

Servo Motor - Additional Information

AC servo motor can be mounted either vertically or horizontally. However, the motor's life span can be shortened if the motor is not properly mounted in the specified environment. Also, to prevent accidents, please install according to the following instructions.

(1) Before mounting

Both the motor shaft and flange surface are coated with a sealant, so as to prevent rusting during storage. Remove this coating with paint thinner, being careful not to get any paint thinner on the rest of the equipment.

(2) Mounting location

The AC servo motor is generally used indoors. The motor should be mounted in an environment which meets the following conditions:

1) Free from corrosive gases or explosive gases.
2) Ambient temperature between 0 and 40°C.
3) Well ventilated, with little dust, debris, oil and humidity.
4) Accessible for inspection and cleaning.

If the AC servo motor is used around a lot of water and oil drops, please use a protective cover.

(3) Environment

Ambient temperature:0 ~ +40°C
Storage temperature:-20 ~ +80°C
Humidity:80% RH Max. (non-condensing)

(4) Connection with machine

When coupling the motor to the machine, it is important to accurately align the motor axis with the machine. If the motor is not properly aligned with the machine, vibration will occur and possible damage may occur to the motor and the machine.

Further, when mounting the coupling lightly tap so as not to cause any damage.

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