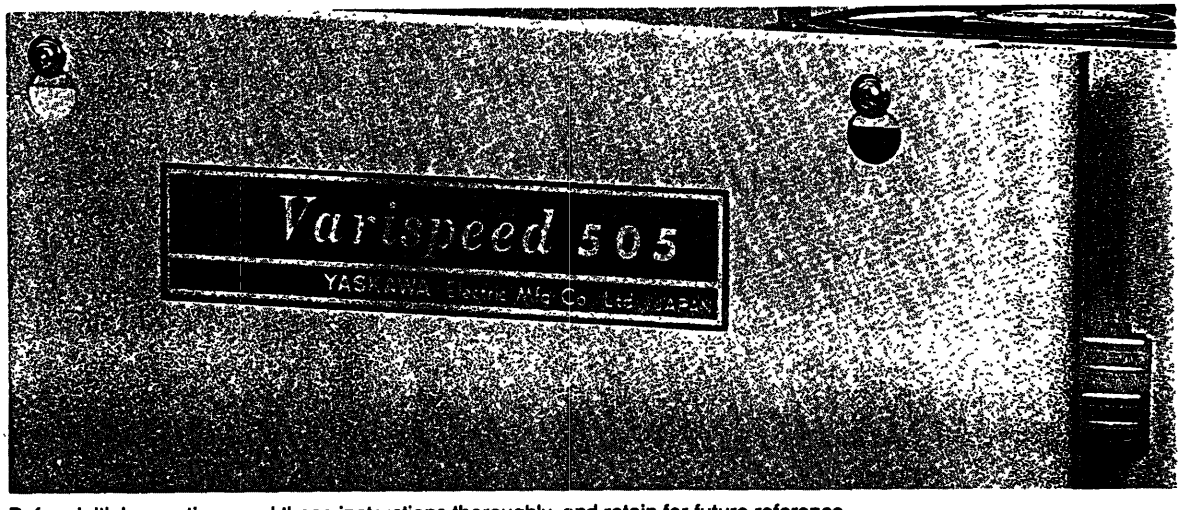
Varispeed-505WII

INDUSTRIAL USE THYRISTOR CONVERTER UNITS



Before initial operation, read these instructions thoroughly, and retain for future reference.

YASKAWA

When properly installed, operated and maintained, this unit will provide a lifetime of optimum operation. It is mandatory that the person who operates, inspects, and maintains this equipment thoroughly reads and understands this manual and has in his possession at all time.

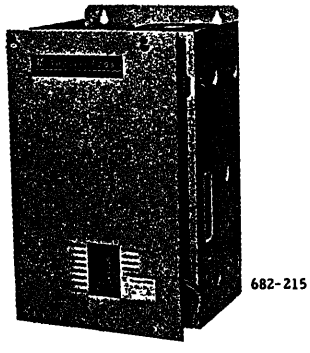
IMPORTANT

- Make no withstand voltage test on the VS-505WII because it incorporates semi-conductor electronic circuits.
- If insulation resistance tests are neccessary, make them only in accordance with the instructions given in this manual.
- Do not tamper with potentiometers of the power units since they were preset at the factory before shipment.

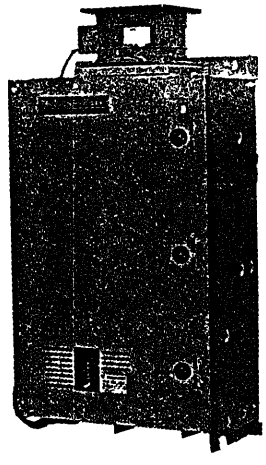
Varispeed-505WII (VS-505WII) is a thyristor converter unit for varispeed reversible operation of industrial DC motors.

For correct operation of VS-505WII, users must thoroughly read these instructions. This manual is also necessary for maintenance and troubleshooting, and threfore should be kept filed for ready reference.

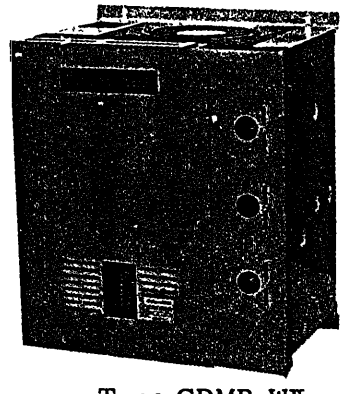
For details on DC motors, refer to "Instructions for Industrial DC Motors" (TOE-C435-3B).



Type CDMR-WII
(Type S)
460 V, 105 A



Type CDMR-WII
(Type L)
460 V, 420 A



Type CDMR-WII
(Type M)
230 V, 260 A

CONTENTS

RECEIVING

The equipment has been put through severe tests at the factory before shipped. After unpacking, however, check and see the following.

- Its nameplate data meets your requirements.
- It has sustained no damage while in transit.
- Fastening bolts and screws are not loosened.
- Devices built in the cabinet are not damaged or missing.

STORAGE

If the equipment is temporarily stored or machine stops for an extended length of time, the following precautions should be taken.

LOCATION

Store the equipment under the following conditions.

- Free from rainfall and drops of water
- Clean and dry
- Free from corrosive gas and liquid
- Ambient temperature: 0°C to 40°C
- Less vibration

INSTALLATION

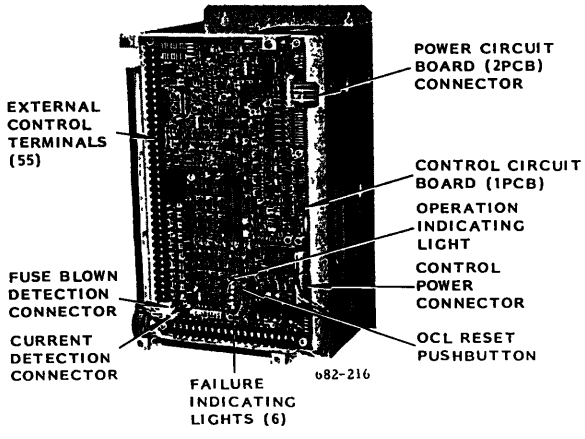
Select a location described in STORAGE and install the equipment by proper procedure in keeping the equipment in good working condition.

WIRING

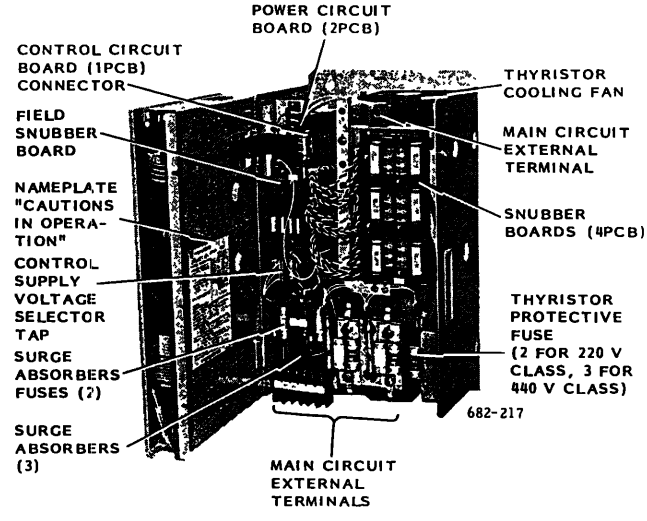
Make wiring in reference to the interconnection diagram furnished on your order and the following.

COMPONENT ARRANGEMENT IN VS-505WII

Figs. 1 to 3 show component arrangement in the VS-505WII.

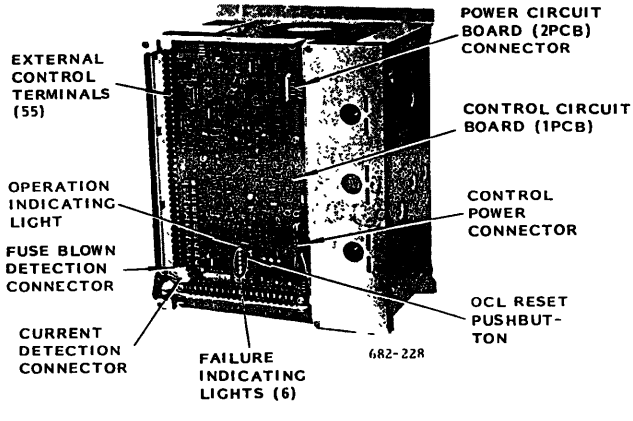


(a) Control Circuit

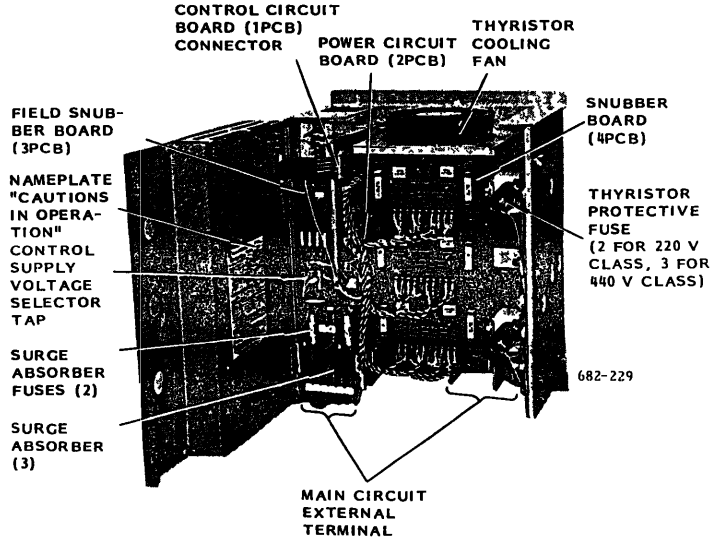


(b) Main Circuit

Fig. 1 Type CDMR-WII, -S (460 V, 115 A)



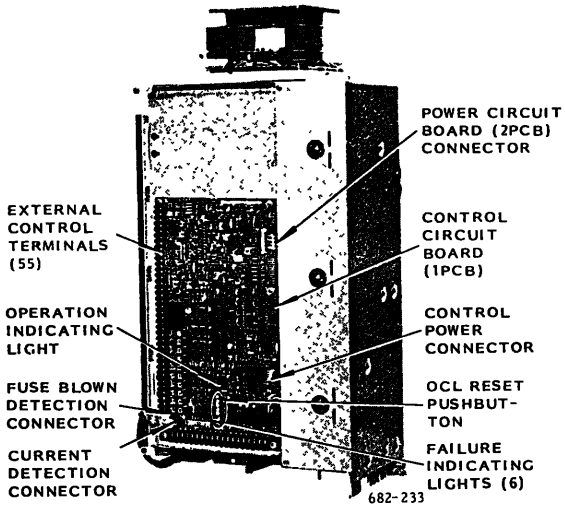
(a) Control Circuit



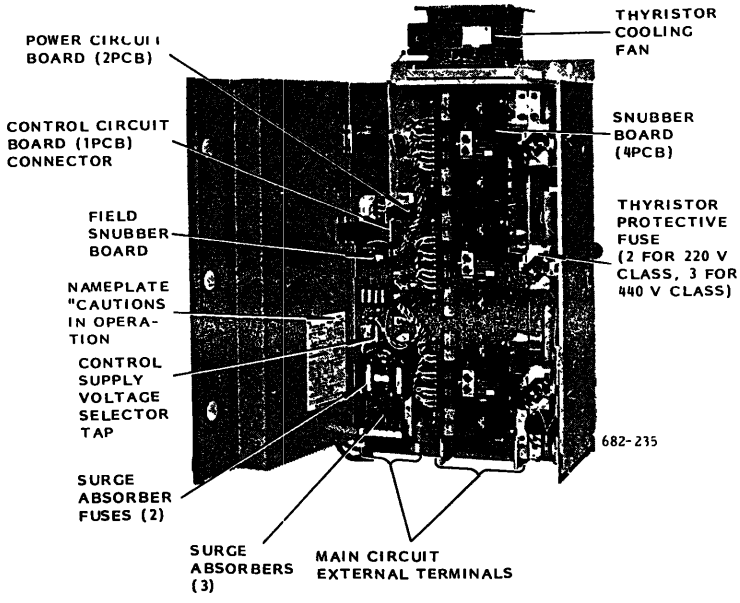
(b) Main Circuit

Fig. 2 Type CDMR-WII, -M (230 V, 260 A)

WIRING (Cont'd)



(a) Control Circuit



(b) Power Circuit

Fig. 3 Type CDMR-WII, -L (460 V, 420 A)

TERMINAL SIZES AND CARRYING CURRENTS

Table 1 shows the size and the current carring capacities of the terminals of VS-505WII. Select leads with sufficient current carrying capacity. Refer to "Cautions when Wiring".

Table 1 Terminal Size and Current Capacity

CDMR-WII		AC Main Circuit		DC Main Circuit		Field Circuit	
Rated Voltage V	Rated Output kW	Terminal Size	Carrying Current A	Terminal Size	Carrying Current A	Terminal Size	Carrying Current A
230	25	M4	21	M5	25	M4	12
	35	M8	29	M8	35		
	45	M8	37	M8	45		
	90	M8	74	M8	90		
	105	M8	86	M8	105		
	180	M10	147	M10	180	M4	22
	260	M10	213	M10	260		
	420	M12	343	M12	420	M4	25
	550	M12	449	M12	550		
460	50	M8	41	M8	50	M4	12
	90	M8	74	M8	90		
	105	M8	86	M8	105		
	180	M10	147	M10	180	M4	22
	260	M10	213	M10	260		
	420	M12	343	M12	420	M4	25
	550	M12	449	M12	550		

Notes :

- Terminal size other than listed above is M4 and current capacity is 2 A or below.
- Rule of thumb of AC main circuit power capacity $1.2 \times \sqrt{3} \times E \times I$ (VA)

  E : Supply voltage

  I : AC main circuit current

INTERCONNECTIONS

Make connections of VS-505WII with associate units according to the interconnection diagram separately furnished.

CAUTIONS WHEN WIRING

Main Circuits

Use 600 V PVC insulated wires or cabtyre cables with the current carrying capacities of the combined DC motor for AC main circuit terminals (U, V, W) and DC main circuit terminals (P, N).

Field Circuits

Use 600 V PVC insulated wires or cabtyre cables with the current carrying capacities of the combined DC motor for field power circuit terminals (U_0, W_0, U_1, W_1) and field circuit terminals (J, K). Use stranded wires of cross-section 5.5 mm^2 or larger for field circuit terminals (J, K).

Signal Circuits

Use shielded wires or twisted wires of twisting pitches 20 mm or smaller for the speed setting circuit terminals (6 to 10), speed feedback terminals (2, 3), tachometer circuit terminals (50 to 52).

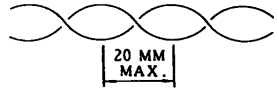


Fig. 4 Pitch of Twisted Wire

Separation of Signal Cables from Main Circuit Cables

To avoid inductive interference from other cables, run the shielded or twisted wires (1 to 55) separate from main circuit cables (U, V, W; U_0, W_0; U_1, W_1; P, N; J, K) in a bundle or thru a duct.

CAUTION

After wiring, check interconnections. Make insulation resistance tests using a 500 V megger. Connect VS-505WII main circuit terminals (U, V, W; U_0, W_0; U_1, W_1; P, N; J, K) with common lead. Measure the insulation resistance between common lead and the ground. When the test result is 2 MΩ or more, it means that wiring is good.

TEST RUN

When the VS-505WII has been correctly installed and wired, the unit shall be tested through a test run as follows.

If trouble is found during the test run, refer to "Check Before Test Run" and "Trouble-shooting Guide" for necessary measures. If the cause of the trouble cannot be located, or repair is impossible, notify our service station, giving the details of trouble conditions.

CHECK BEFORE TEST RUN

Make the following checks prior to the test run.

Table 2 Check before Test Run

Check Points	Check Items
Interconnections between VS-505WII and Associate Units	· Correct wiring · Tightening of terminal screws
DC Motor	· Disconnection from the driven machine · Removal of thrust block · Remove inspection covers and blow out with air to clean commutator. (Fig. 5)
VS-505WII	· Adhesion of dirt or dust on the enclosure · Smooth hand rotation of thyristor cooling fan * · Check items in "Cautions in Operation" on the back of the control board door · Correct connection of the shunt connector to the voltage selecting tap (Fig. 6) · Correct setting of the frequency selector switch (Fig. 7) · Correct adjustment of potentiometers on the control board (1PCB) Refer to red paint
Supply Voltage at Input Terminals of VS-505WII	· Voltages of any two of phases U, V, W are within the values on Table 3. Check with a tester. · Terminals U_0 and U_1, and W_0 and W_1 are connected. · Rotating direction of the motor blower meets with the arrow marked on the blower.

* VS-505WII of larger capacity than 230 V, 45 A or 460 V, 90 A are provided with a thyristor cooling fan.

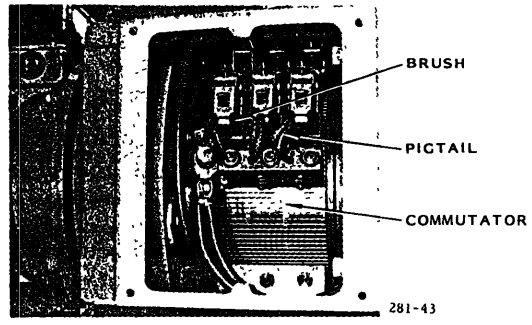


Fig. 5 Inspection Window of DC Motor

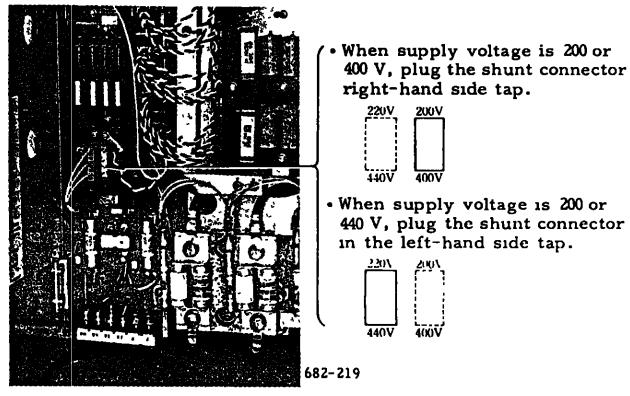


Fig. 6 Tap Selection of Control Supply Voltage

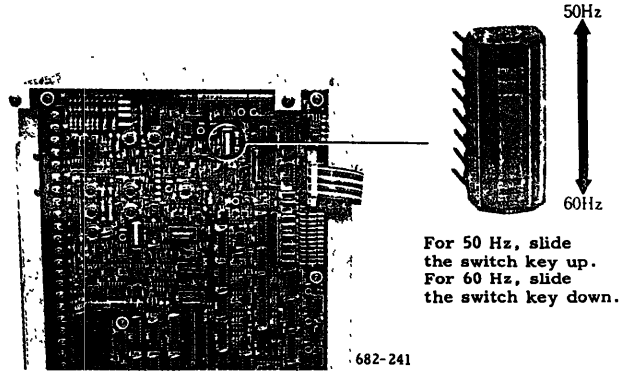


Fig. 7 Power Frequency Selector Switch

Table 3 Supply Voltage Allowable Range

Nominal Supply Voltage	Supply Frequency	Permissible Voltage Variation	Voltage Selector Tap
200 V	50/60 Hz	170 - 220 V	200 V
220 V	50/60 Hz	187 - 242 V	220 V
400 V	50/60 Hz	340 - 440 V	400 V
440 V	50/60 Hz	374 - 484 V	440 V

TEST RUN (Cont'd)

NO-LOAD OPERATION

After making the checks specified before test run, thoroughly check the environment of the system for safety.

Check the polarity of DC tachometer generator feedback voltage. When the motor is running forward, the polarity of VS-505WII signal terminal 2 (3 : 0 V) is minus and it is plus during reverse running of the motor.

Then, run the motor without load according to Table 4.

FULL-LOAD OPERATION

Before starting full-load operation, stop the power supply, couple the DC motor to the driven machine, and check the motor and the driven machine for safe and obstruction-free conditions. Table 5 gives full-load operation procedure.

Table 4 No-load Operation

Order	Operation	Check Items
1	Set the speed reference at zero.	——
2	Turn on main circuit power suppy.	Smooth rotation of the thyristor cooling fan.*
		Smooth rotation of the blower for DC motor.
		Rotating direction of the blower meets with the marking on the blower.
3	Make an operational sequence and check to be sure that operation is ready. (Turn on ready signal, motor cooling fan ON/OFF signal.)	Indication light "PREP" on the control board (1PCB) turns on.
4	Turn-on the operation signal.	——
5	Gradually, increase the speed setting value.	Smooth acceleration of DC motor.
		No abnormal odor, smoke, vibration and noise on DC motor.
6	Remove the hand-hole cover and check the commutator.	No brush chattering and sparking at the brushes.
	To avoid excessive temperature rise of DC motor winding in frame 112, 132, reclose the window within 5 minutes.	
7	Gradually, turn the speed setting potentiometer clockwise.	Smooth acceleration of DC motor.
8	Increase the speed setting value to the maximum.	DC motor rotates at the maximum speed. Check with a speedometer.
9	Change the speed to various values.	DC motor speed corresponds with the set values.
10	Turn off the operation signal.	DC motor suddenly stops.
11	Turn off the main circuit power supply.	——

* VS-505WII, rated 220 V, 45 A and above and 460 V, 90 A and above are provided with a thyristor cooling fan.

ADJUSTMENT

Do not tamper unnecessarily with the potentiometers on the control circuit board since they have been adjusted at the factory before shipped.

Adjuster Locations and Functions

Adjuster locations on the control circuit board and functions are shown in Fig. 8 and Table 6. The characteristics of control circuit board check terminals are shown in Fig. 9 and Table 7.

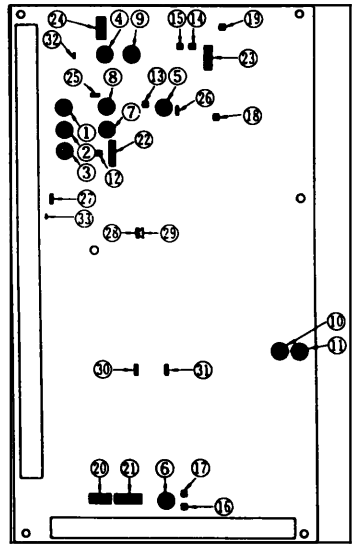


Fig. 8 Adjuster Locations on Control Circuit Board

Table 5 Full-load Operation

Order	Operation
1	Set the speed at zero.
2	Turn on the main circuit power supply.
3	Turn on operation signal and gradually increase the speed. Check to be sure that the motor and driven machine are correctly running.
4	Turn off the operation signal.
5	Turn off main circuit power supply.

Table 6 Control Circuit Board Adjuster Locations and Functions

Type of Adjusters	Adjuster Location	Adjuster Name	Adjuster Function	Adjusting Method	Specifications
Potentiometers	1	⊕ RATE	Accel time adjustment at fwd run. (Decel time adjustment at rvs run.)	Clockwise rotation increases accel time.	3 - 75 sec
	2	⊖ RATE	Decel time adjustment at fwd run (Accel time adjustment at rvs run.)	Clockwise rotation increases decel time.	3 - 75 sec
	3	NGAIN	ASR Gain adjustment.	Clockwise rotation increases GAIN	——
	4	NMAX	Speed feedback adjustment.	Clockwise rotation decreases speed.	±6 V/100% speed
	5	IGAIN	ACR Gain adjustment.	Clockwise rotation increases gain.	——
	6	IFB	Main circuit current feedback adjustment.	Clockwise rotation decreases current.	+3 V/100% current
	7	F LIMIT	Speed and current limit value at forward run.	Clockwise rotation increases limit value.	150% (Standard)
	8	R LIMIT	Speed and current limit value at reverse run.	Clockwise rotation increases limit value.	150% (Standard)
	9	CEMF	Counter electromotive force compensation.	Clockwise rotation increases gain.	0.17 - 0.84 times
	10	SM	Speedometer adjustment.	Clockwise rotation increases pointer swing.	1 mADC max
	11	AM	Ammeter adjustment.	Clockwise rotation increases pointer swing.	1 mADC max
	12	NOFS	ASR offset adjustment.	⊖voltage ⟷ ⊕voltage	——
	13	IOFS	ACR offset adjustment.	⊖voltage ⟷ ⊕voltage	——
	14	KIPP	Phase shift lag limit adjustment	Clockwise rotation advances shift lag limit.	155°eℓ (Standard)
	15	PSB	Adjustment of phase shifter operation point.	Clockwise rotation advances phase.	90°eℓ - 160°eℓ (Adjustable)
	16	OL%	Setting overload detection start point.	Clockwise rotation increases overload detection start point.	110% (Standard)
	17	OLT	Setting overload detection time.	Clockwise rotation increases operation time.	150%, 60 sec (Standard)
	18	ZCD	Setting zero current detection level.	Clockwise rotation increases detection level.	0% - 10% (Adjustable) 7% (Standard)
	19	IREF	Setting field current.	Clockwise rotation increases field current.	——
Resistor Selection (Open)	20	1FBR - 4FBR	Rough adjustment of field current detection voltage level.	Open the resistor according to specifications.	Refer to motor specifications.
	21	5FBR - 9FBR	Rough adjustment of main circuit current detection voltage level.		
Slide Switch	22	1SW	Control Method selector	(Speed control) N ⟷ 1 (Current control)	——
	23	2SW	Supply frequency selector.	50 Hz ⟷ 60 Hz	——
Plug Selection	24	A - D	Rough adjustment of speed detection voltage level.	Selection of the voltage level according to type of tach-gen and motor rated speed.	——
	25	E	Selection of soft start operation	E1 ——	——
				E2 Soft start	——
	26	F	Selection of PI or P control by ACR control method	F1 PI control	——
				F2 P control	——
	27	H	Selection of PI or P control by ASR control method	H1 P control	——
				H2 PI control	——
	28	J	Selection of zero-speed condition at motor overheat.	J1 Gate block after motor reached zero speed by stop operation.	——
				J2 Immediate gate block.	——
	29	K	Selection of start interlock zero-speed condition.	K1 With	——
				K2 Without	——
	30	L	Selection of zero-speed condition at motor blower stop.	L1 Field half-reduced after motor zero-speed by stop operation. (Gate block)	——
				L2 Field half-reduced immediately. (Gate block)	——
	31	M	Selection of exciter according to type of motor field.	M1 Exciter used.	——
				M2 Exciter not used.	——
Short-circuit Jumper	32	OPN	——	Open: • Speed control by voltage detection. • Speed control by AC tach-gen.	——
				Short-circuited: Other than the above.	——
	33	OPS	——	Open: Special application.	——
				Short-circuited: Other than the above.	——

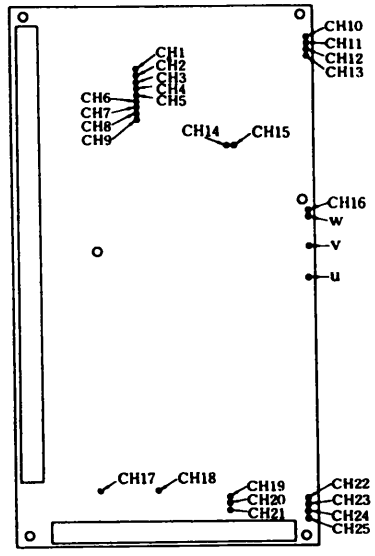


Fig. 9 Control Circuit Check Terminals

Adjustment Procedure

NMAX (Speed feedback adjustment)

To adjust the DC motor speed exactly to the reference speed, proceed as follows.

1. Prepare the tachometer having the required accuracy.

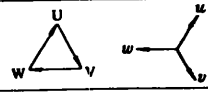
2. Operate the DC motor at no load (or less variation).

3. Measure the speed reference voltage with a voltmeter. Correct the voltage to that of desired motor speed.

4. Measure the motor speed with a tachometer.

5. If the speed does not reach the desired speed, turn NMAX counterclockwise to increase the speed.

Table 7 Control Board Check Terminals

	Signal Name		Check Terminals	Normal Value	
Main Circuit Power	Stable power supply		CH22	0V (SG)	
			CH24	+15 V	
			CH25	-15 V	
	Unstable power supply		CH19	+24 V	Allowable voltage function range: ±20%
			CH20	-24 V	
			CH23	+24 V (Pulse amplifier supply)	
	Speed reference		CH4	∓6 V/100% command (⊖ Forward, ⊕ Reverse)	
			CH5	±6 V/100% command (⊕ Forward, ⊖ Reverse)	
	Speed feedback		CH3	∓6 V/100% speed (⊖ Forward, ⊕ Reverse)	
	Current command	Forward	CH9	-3 V/100% command	
		Reverse	CH8		
	Current limit (Speed limit)	Forward	CH7	+3 V/100% current limit (+6 V/100% speed limit)	
		Reverse	CH6		
	Current feedback		CH18	+3 V/100% current	
	Current limiter output		CH2	Approx. -1 V at gate block	0 to +6 V when controlling
	Phase shifter input		CH16	Approx. +5.5 V at 60 Hz, +6.5 V at 50 Hz at gate block.	+1 to +5.5 V at 60 Hz, +1 to +6.5 V at 50 Hz when controlling.
	Counter electromotive force input		CH1	0 - ±5 V	
	Overload detection start point		CH21	110% (Approx. -1.65 V)	
	Zero-current detection		CH15	0 V at load current conduction, approx. +12 V at 0 A of load current.	
	Pulse amplifier power supply	Forward	CH12	0 V at reverse operation.	Approx. +24 V at forward operation.
		Reverse	CH13	0 V at forward operation.	Approx. +24 V at reverse operation.
	Gate block (at failure)		CH14	0 V normal, approx. -12 V at gate block.	
	Phase shifter synchronization power supply		u		U, V, W: Main circuit input power supply.
			v		
			w		
Field Power	Current command		CH11	Voltage according to field current.	Ex. -6 V/5 A
	Current feedback		CH17		+3 V/5 A
	Phase shifter input		CH10	Approx. +5 V at 60 Hz, +6 V at 50 Hz at field block.	+1 to +5 V at 60 Hz, +1 to +6 V at 50 Hz when controlling.

6. If the speed exceeds the desired speed, turn NMAX clockwise to decrease the speed.

FLIMIT (Forward limit value adjustment)
RLIMIT (Reverse limit value adjustment)

1. Current limitation (Speed control)

Slide the control method selector switch (1SW) on the control circuit board to N. When the voltages at CH7 (forward) and CH6 (reverse) are +3 V, 100% current limit value is obtained. Current limit value can be set within the range of 0% to 250% by F LIMIT and R LIMIT.

2. Speed limitation (Current control)

Slide the control method selector switch (1SW) on the control circuit board to I. When the voltages at CH7 (forward) and CH6 (reverse) are +6 V, 100% speed limit value is obtained. Speed limit value can be set within the range of 0% to 250% by F LIMIT and R LIMIT.

PSB (Phase shifter operating point adjustment)

PSB sets the phase shifter operating point.

1. When the current controller (ACR) is integral-controlled

Connect the plug selector F on the control circuit board at F1. Turn PSB fully counterclockwise.

2. When the current controller (ACR) is ratio-controlled

Connect the plug selector F on the control circuit board at F2. Turn PSB clockwise gradually with reference current at 0 V (0 V at CH2), and set at the position where main circuit current is ready to start.

CEMF (Counter electromotive force compensation)

Current loop is vulnerable to counter electromotive force. In order to obtain optimum performance, a compensating electromotive force has to be biased on the phase shifter, depending on the control mode.

1. When the current controller (ACR) is ratio-controlled

Adjust CEMF, observing the motor acceleration current with a synchroscope. Turn CEMF fully counterclockwise, and turn CEMF clockwise gradually until optimum value shown in Fig. 10 is obtained.

2. When the current controller (ACR) is integral-controlled

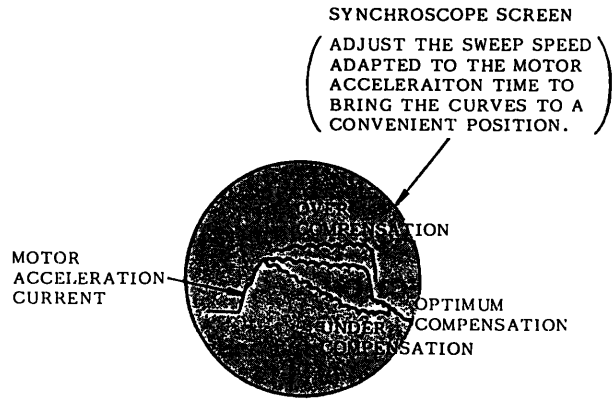


Fig. 10 CEMF Adjustment

CEMF compensation reduces the loss time due to Forward/Reverse selection to as the same level as the integral control of ACR. Turn CEMF fully counterclockwise, and during motor acceleration by current limit gradually turn it clockwise until the voltage at CH2 on the control circuit board stabilizes.

Field Current Adjustment

Field current adjustment is required for checking the setting at the factory or for fine adjustment. To change the setting, selection of resistors (1FBR to 4FBR) on the control circuit board is required.

1. For constant field current

a. Connect a DC ammeter to the field circuit.

b. Adjust so that the ammeter indicates the rated field current with IREF on the control circuit board. (Refer to the test report or nameplate data.)

2. For field weakening control

Field weakening control is made for the VS-505WII combined with field weakening control unit type JGSM-51-□ .

a. Connect DC ammeter to the field circuit and DC voltmeter to output terminals P, N.

b. Turn IREF on the control circuit board and FORCE FLD and V LIMIT of field controller fully counterclockwise.

c. Set the minimum field weakening current by IREF. In this case, set the current at 80% field weakening current at maximum speed. (See the test report.)

d. Set the rated field current (field intensifying by FORCE FLD. (See the test report or nameplate data.)

e. After the motor starts, gradual increasing the speed reference increases the voltage across P and N and governs it at some value. Turn V LIMIT clockwise gradually so that the governed value is the rated voltage.

MAINTENANCE

VS-505WII requires almost no daily inspection. To keep the correct and successful operation, periodic maintenance operations should be performed. The users should prepare their own maintenance programs based on the following guidelines.

PERIODIC INSPECTION

Table 8 shows the minimum inspection items and the procedures.

Table 8 Periodic Inspection

Inspection Part	Inspection Item	Inspection Procedure	What to do	Remarks
Thyristor cooling fan	· Noise · Vibration	· Check for any intermittent or unusual noise. · Feel by hand.	Replace.	Rule of thumb for cooling fan replacement: 15,000 hours of operation.
General	· Dust or dirt · Loose terminal screws or nuts	· Check for dust clogging or dirt adhesion. · Check for loose screws or nuts.	· Clean with an electrical cleaner. · Tighten.	——

PARTS REPLACEMENT

· Replace the parts required after checking the trouble and correcting it according to TROUBLE-SHOOTING GUIDE.

· Turn off the power before part removal or mounting.

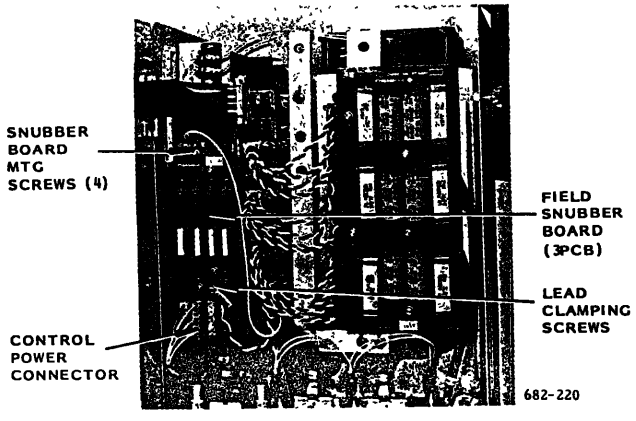


Fig. 11 Field Thyrsitor Assembly

Field Thyristor Replacement

With all the Models, thyristor modules consisting of a thyristor and a diode are used as the field thyristor. Replace them as follows.

1. Remove the four mounting screws of field snubber board (3PCB), lead clamping screws, control power connector. Then, remove snubber board. See Fig. 11.

2. Remove lead clamping screws connecting to thyristor, and remove the leads from thyristor. In this case, mark all terminals for identification. See Fig. 12.

3. Remove thyristor mounting screws (2) and remove thyristor module.

4. Check the type and capacity of new thyristor module against the requirements. Install it by reversing the removal procedure, making connections to the terminals identified by the marks made before removing the old thyristor module. Coat the thyristor mounting surface with joint compound, JOINTAL Z made by Nippon Light Metal Co., Ltd.

Main Circuit Thyristor Replacement
VS-505W II, 230 V at 25 A

The unit uses a thyristor module consisting of two thyristors. Replace it as follows.

1. Remove snubber board (4PCB) mounting screws (5) and lead clamping screws. Remove snubber board. (Fig. 13)

2. Remove bus bar mounting screws and lead clamping screws connected to thyristor. Remove bus bar and leads. (Fig. 14) In this case, mark the terminals for identification.

3. Remove two thyristor clamping screws and thyristor.

4. Check the replacement module for type and capacity, and reinstall it by reversing the disassembly procedure, identifying the terminals by means of the marks made prior to disassembling.

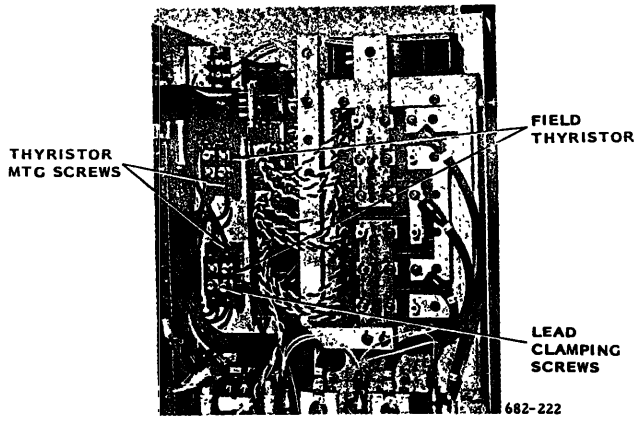


Fig. 12 With Snubber Board Removed

Main Circuit Thyristor Replacement

VS-505WII, 230 V at 35 to 105 A, 460 V at 50 to 105 A

The unit uses a thyristor module consisting of two thyristors. Replace it as follows.

1. Remove snubber board (4PCB) mounting screws (5) and remove snubber board. (Fig. 15)

2. Remove bus bar mounting screws and lead clamping screws connected to thyristor. Remove bus bar and leads. (Fig. 16). In this case, mark the terminals for identification.

3. Remove two thyristor clamping screws and thyristor.

4. Check the replacement module for type and capacity, and reinstall it by reversing the disassembly procedure, identifying the terminals by means of the marks made prior to disassembling. Coat the thyristor mounting surface with joint compound, JOINTAL Z made by Nippon Light Metal Co., Ltd.

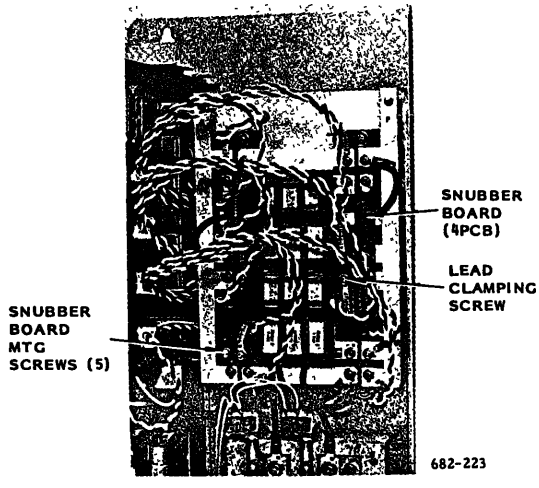


Fig. 13 Field Thyristor Assembly (230 V, 25 A)

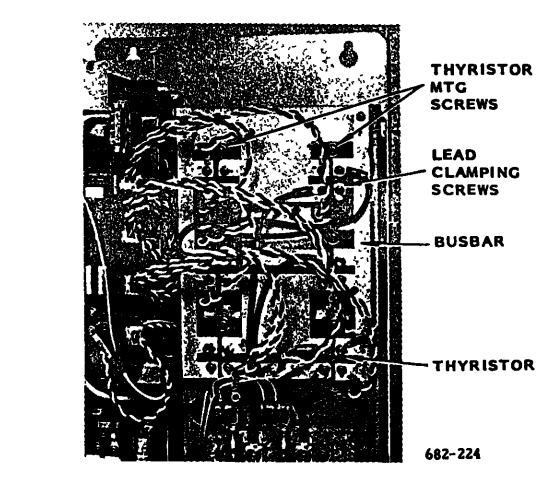


Fig. 14 With Snubber Board Removed

Main Circuit Thyristor Replacement

VS-505WII, 230 V at 180 to 550 A, 460 V at 180 to 550 A

The VS-505WII uses a flat thyristor module as a power module. For 180 A and 260 A, one power module is employed, and for 420 A, and 550 A, three power modules are employed. Proceed as follows.

1. Remove the clamping screws for thyristor gate (G) and cathode (K) terminals (24 for 260 A or below, and 8 for 420 A or more), and free the leads. Remove fuse mounting bolt(s) (3 for 260 A or below and 1 for 420 A or more). (Fig. 17)

2. Loosen power module mounting bolts (7 for 260 A or below, 8 for 420 A or more), and remove the power module.

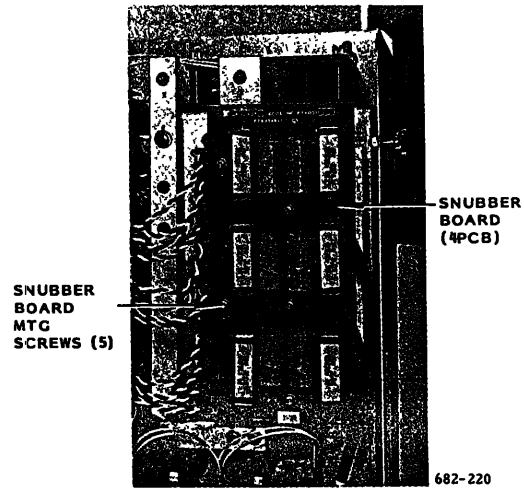


Fig. 15 Main Circuit Thyristor Assembly (460 V, 105 A)

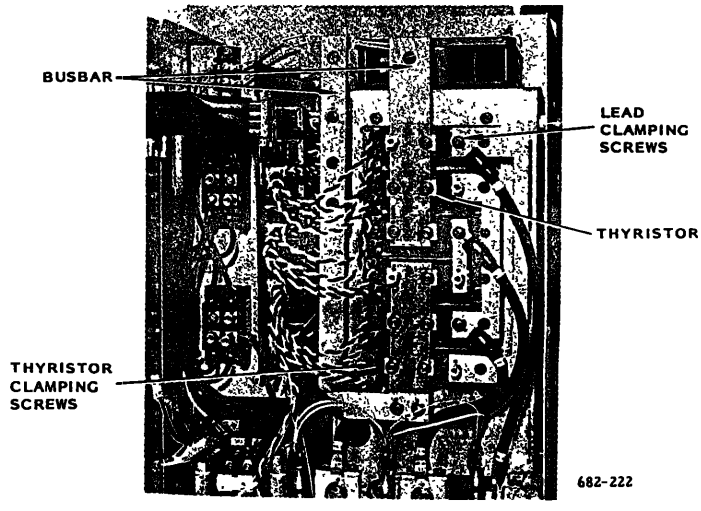


Fig. 16 With Snubber Board Removed

3. Place the main circuit thyristor module on a work bench. Remove the snubber board (4PCB-U, V, W) mounting screws (3 for 260 A or below, 4 for 420 A or more), and take out the snubber board. (Fig. 18)

4. Loosen the fin mounting nuts alternately, turning 1/4 turn at a time. Then, remove the leaf spring.

5. Remove the fin and take out the leaf spring.

6. Clean the contact surfaces of the new thyristor and the fin, and thinly coat these surfaces with joint compound, JOINTAL Z made by Nippon Light Metal Co., Ltd.

7. Align the fin locating pin and the thyristor locating hole, after making sure that the polarity of the thyristor is correct.

8. Keeping the leaf spring and the fin in parallel, finger-tighten the clamping nuts. Then, tighten them alternately through 1/4 turn at a time, three times each with a socket wrench. Now, the thyristor fin has been installed.

9. Tighten the snubber board mounting screws. Then, mount the thyristor module by reversing the disassembling procedure, tightening the screws firmly.

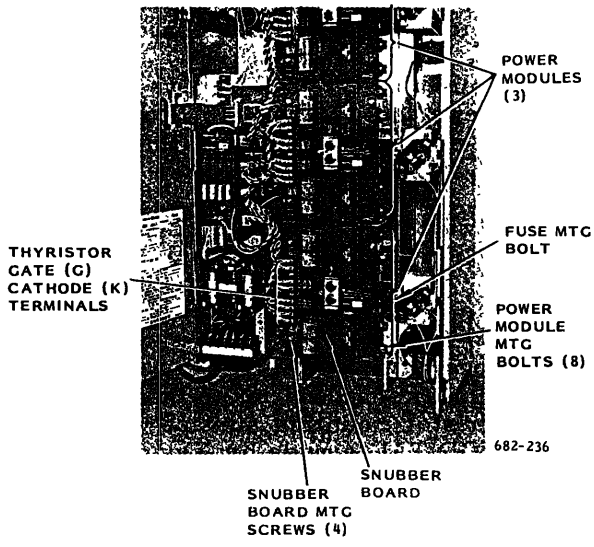
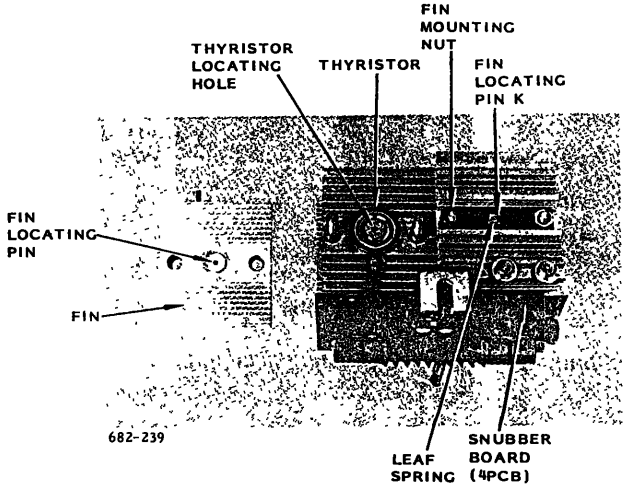
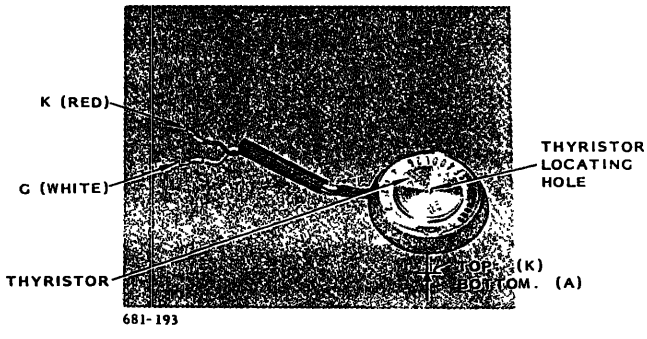


Fig. 17 Main Circuit Thyristor (460 V, 420 A)



(a) With Thyristor Removed



(b) Thyristor

Fig. 18 Thyristor Replacement

Thyristor Protective Fuse Replacement

VS-505W II, 230 V at 25 to 105 A, 460 V at 50 to 105 A

1. Pull up the fuse blown indicating microswitch with the leads connected. (Fig. 19)

2. Remove the two fuse mounting bolts.

3. Mount the replacement fuse by reversing the removing procedure, after checking it for model and capacity.

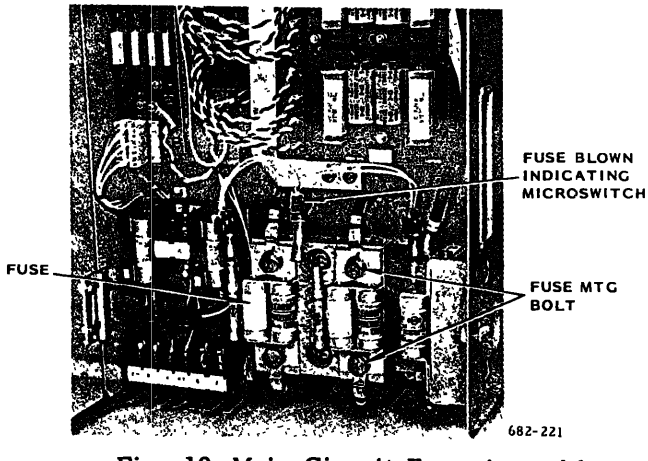


Fig. 19 Main Circuit Fuse Assembly (460 V, 105 A)

Thyristor Protective Fuse Replacement

VS-505WII, 230 V at 180 to 550 A, 460 V at 180 to 550 A

1. Remove the two lead clamping screws of the fuse-blown indicating mocroswitch and free the leads. (Fig. 20)

2. Remove the two fuse mounting bolts, and remove the fuse together with the fuse-blown indicating microswitch.

3. Check the replacement fuse for model and capacity, and install it by reversing the disassembling procedure.

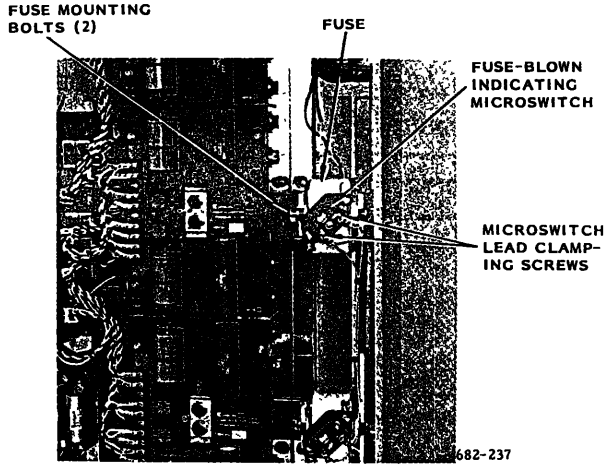


Fig. 20 Main Circuit Fuse Assembly (460 V, 420 A)

Surge Absorber Fuse Replacement

1. Pull the fuse element and remove it. (Fig. 21)

2. Mount the replacement fuse, after checking its model and capacity.

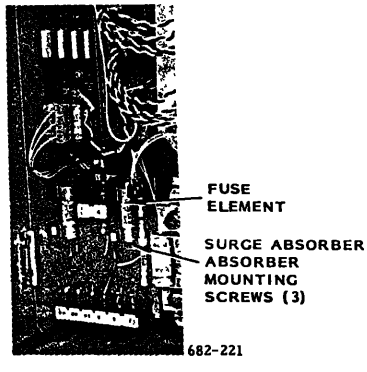


Fig. 21 Surge Absorber Fuse

Surge Absorber Replacement

1. Remove three surge absorber mounting screws and remove surge absorber.

2. Check the replacement surge absorber for model and capacity. Mount three surge absorbers after connecting M4 pressure terminals to their leads as shown in Fig. 22.

Fig. 22 Surge Absorber with Pressure Terminals Connected to Leads

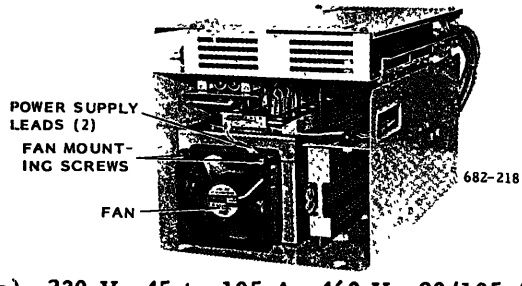
Thyristor Cooling Fan Replacement

To replace a thyristor cooling fan with a new one, proceed as follows. (Fig. 23) The VS-505WII units rated 230 V, 25 A; 460 V, 50 A are self-cooled type.

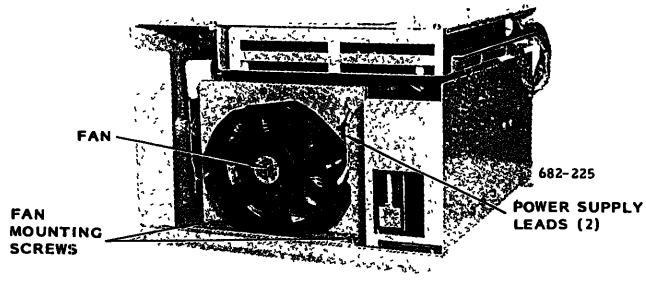
1. Remove the cooling fan power lead.

2. Unscrew the two fan mounting screws and dismount the fan.

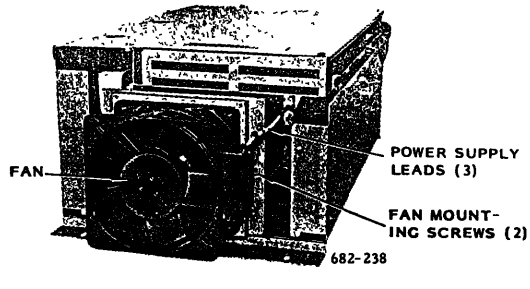
3. Remove the fan by reversing the disassembling procedure.



(a) 230 V, 45 to 105 A; 460 V, 90/105 A



(b) 230 V, 180/260 A; 460 V, 180/260 A



(c) 230 V, 420/550 A; 460 V, 420/550 A

Fig. 23 Thyristor Cooling Fan

MAINTENANCE (Cont'd)

Control Circuit Board Replacement

Disconnect all the leads from the terminals.
Then, unplug the connectors shown in Fig. 24, and remove the 6 control circuit board mounting screws.

Mount the new board by reversing the disassembling procedure. Plug-in the connectors firmly.

CAUTIONS IN REPLACING CONTROL CIRCUIT BOARD

Make sure that the type of the new control circuit board agrees with the nameplate and potentiometer settings of new control circuit board are the same as the old one. Refer to the nameplate "Cautions in Operation" posted on the inside of the control circuit board door of VS-505WII. See Table 6 "Adjuster Locations on the Control Circuit Board and Functions".

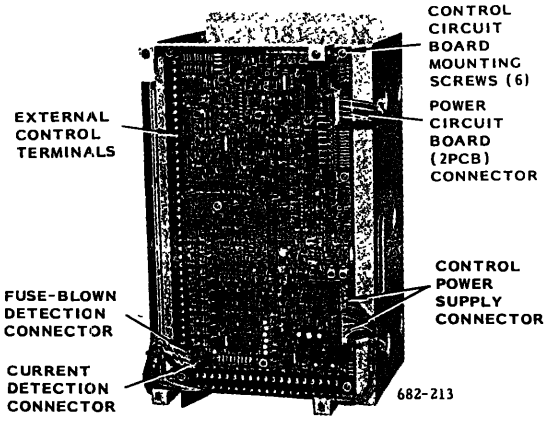


Fig. 24 Control Board

TROUBLESHOOTING GUIDE

Table 9 Troubleshooting Guide

	Trouble	Possible cause		Check method	What to do	
Motor does not run.	PREP lamp OFF	Control printed board	Failure indicating lamp ON.	——	——	
			Operation sequence failure.	Check the external operation sequence.	Replace the control board. See Replacement of Control Board.	
	OCL lamp ON	Control printed board	Too low setting of "OL1," "OLT".	Is setting dial at the positions indicated by lock paint?	Set the setting dial to the position of lock paint.	Reset.
			Too high setting of "FLIMIT," "RLIMIT" Incorrect setting of "IFB".	Refer to Tables 6 and 7.	Readjust.	
		Thyristor	Defective (deteriorated).	Check thyristor (Fig. 25).	Replace thyristor. (See Main Circuit Thyristor on page 9.)	
		Motor and driven machine	Overloaded.	Check load current.	Adjust load.	
			Locking.	Run motor without load, and see if it locks.	Repair motor.	
				Check load for locking.	Repair driven machine.	
			Layer shorting in motor.	Run motor with terminals (P) and (N) disconnected. If OCL lamp does not light, the motor and its circuit are defective.	Repair motor.	
			Grounding of motor circuit.	Measure resistance between terminal (P) (or N) and ground (E) with a multitester. If the reading is nearly ∞ on the largest scale of the tester, the circuit is normal.	· Repair motor. · Correct wiring.	
	FU lamp ON	Thyristor	Defective (deteriorated).	Check thyristor (Fig. 25)	Replace thyristor. (See Main Circuit Thyristor on page 9.	
		Motor	Layer shorting in motor.	Operate only board with (P) and (N) disconnected. If fuse is not blown, motor circuit is defective.	Repair motor.	To replace fuses (1FU, 2FU, 5FU), refer to Replacement of Thyristor Protection Fuse.
			Grounding of motor circuit.	Measure resistance across terminal (P) (or N) and ground (E) with a multitester, and if the reading is nearly ∞ on the largest scale of the tester, the circuit is normal. (See Note.)	· Repair motor. · Correct wiring.	
		Control circuit board	Defective (phase control circuit).	——	If the motor is normal, replace control circuit board. Refer to Replacement of Control Circuit Board on page 13.	
		Fuse	Defective (deteriorated).	——	——	
	FL lamp ON	Motor	Layer shorting in field winding.	Measure resistance across terminal J and K with converter terminal J and K disconnected with a tester. If it indicates ∞, it means field circuit is disconnected.	· Repair motor. · Replace fuse. (3FU or 4FU).	
			Grounding of field circuit.	Measure resistance across terminal (J or K) and ground (E) with a multitester, and if the reading is nearly ∞ on the largest scale of the tester, the circuit is normal.		
		Control circuit board	Defective.	——	If the motor is normal, replace control board. See Replacement of Control Board on page 13.	
	THG lamp ON	Motor	Over loading. Main circuit	Check load current.	Adjust load.	
			Over loading. Field circuit	Check field current.	Readjust. See Adjustment on page 7.	
			Locking.	Run motor without load, and see if it locks.	Repair motor.	
				Check load for locking.	Adjust load.	
			Blocked air filter.	——	Refer to the instructions for Industrial DC Motors (TOE-C435-3).	
			Insufficient cooling with blower.	Check the blower for correct running direction.	Correct wiring.	
	MCF lamp ON	Motor	Cooling blower stop.	Check fan for locking or overloading. Check thermal relay for tripping.	Repair or replace fan.	
	TCF lamp ON	Thyristor cooling fan stop. Where the fan is provided with failure sensor		Check fan for locking or overloading.	Replace the thyristor cooling fan. See Replacement of Thyristor Cooling Fan, on page 12.	
	Surge absorber fuse blown	Main CKT	Excessive surge.	Check fuses (3FU, 4FU).	Eliminate cause of surge. Replace surge and fuse. See Replacement of Surge of Absorber Fuse and Replacement of Surge Absorber.	

Note: If the reading is not ∞, accurate measurement with a 500 V megger is required. Reading must be 3 megohms or above.

SPARE PARTS

Table 9 lists the recommended spare parts for one VS-505WII, keep always minimum insurance spare parts on hand to protect the unit against costly downtime. When ordering spare parts, specify complete nameplate rating and description (type, code no., etc.) of the parts required, and quantity desired.

Table 10 Spare Parts for Control Panel

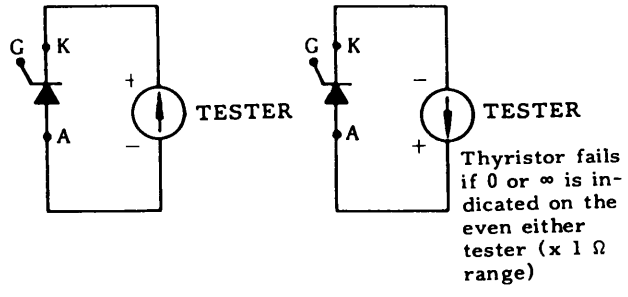
Thyristor Converter Unit Type CDMR-WII		Main circuit Thyristor		Thyristor Protective fuse		Surge Absorber Fuse		Fan		Field Thyristor Diode		Surge Absorber		Control Circuit Board	
		Type (Code No)	Q'ty	Type (Code No)	Q'ty	Type (Code No)	Q'ty	Type (Code No.)	Q'ty	Type (Code No)	Q'ty	Type (Code No.)	Q'ty	Type (Code No)	Q'ty
Type SS	230 V 25 A	TM20DA-II (SCR195)	6	60FHS-55 (FU642)	2	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G471K (XX110)	3	JPDC-C041 (ETC5472)	1
Type S	230 V 35 A	TM25DZ-H (SCR196)													
	230 V 45 A							4715PC-22T -B30-B00 (FAN130)							
	230 V 90 A	TM55DZ-H (SCR197)		60FHS-110 (FU644)											
	230 V 105 A	TM90DZ-H (SCR198)		60FHS-150 (FU645)											
Type M	230 V 180 A	N105CH08 (SCR259)	12	CS5F-200 (FU609)		FCF2-30 (FU600)		5915PC-22T -B30-B00 (FAN131)							
	230 V 260 A	N195CH08 (SCR261)		CS5F-350 (FU612)											
Type L	230 V 420 A			CS5F-450 (FU614)				MRW18-DTA (FAN107)							
	230 V 550 A	553PA80 (SCR263)		CS5F-600 (FU616)											
Type S	460 V 50 A	PK55HB-160 (SCR244)	6	60FHS-110 (FU644)	3	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G102K (XX167)	3	JPDC-C041 (ETC5472)	1
	460 V 90 A	(TM55DZ-2H) (SCR201)						HN4556MV (FAN110)							
	460 V 105 A	PK90HB-160 (SCR245) (TM90DZ-2II) (SCR202)		60FHS-150 (FU645)											
Type M	460 V 180 A	N105CH16 (SCR260)	12	CS5F-200 (FU609)		FCF2-30 (FU600)		7556MXV (FAN111)							
	460 V 260 A	N195CH16 (SCR262)		CS5F-350 (FU612)											
Type L	460 V 420 A			CS5F-450 (FU614)				MRW18-DTA (FAN107)							
	460 V 550 A	553PA160 (SCR264)		CS5F-600 (FU616)											

〈REFERENCE〉

ROUGH CHECK OF THYRISTORS

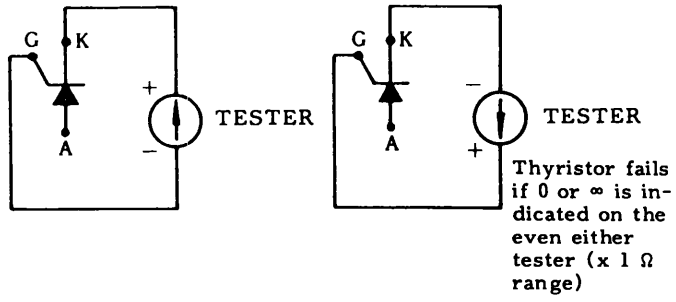
Where thyristors normally function, the following values are obtained.

More than several hundreds of kiloohms across (A) and (K).



(a) Resistance across thyristor terminals (A) and (K)

Several ohms to several hundreds of ohms across (G) and (K).



(b) Resistance across thyristor terminals (G) and (K)

Fig. 25 Rough Check of Thyristors

ELEMENTARY DIAGRAM OF THYRISTOR CONVERTER UNIT (TYPE CDMR-W Ⅱ, 230 V, 90 A)

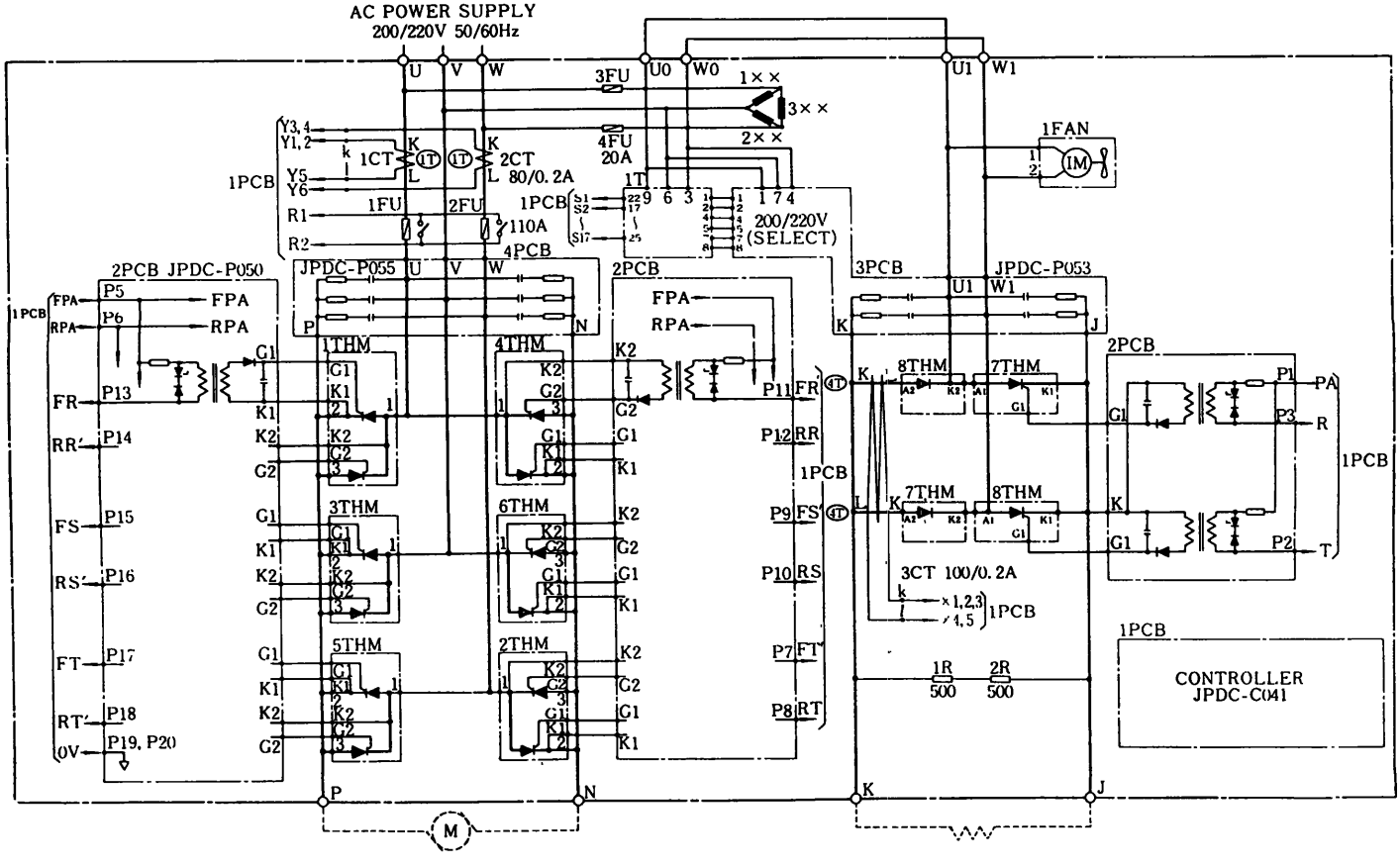


Fig. 26 Main Circuit

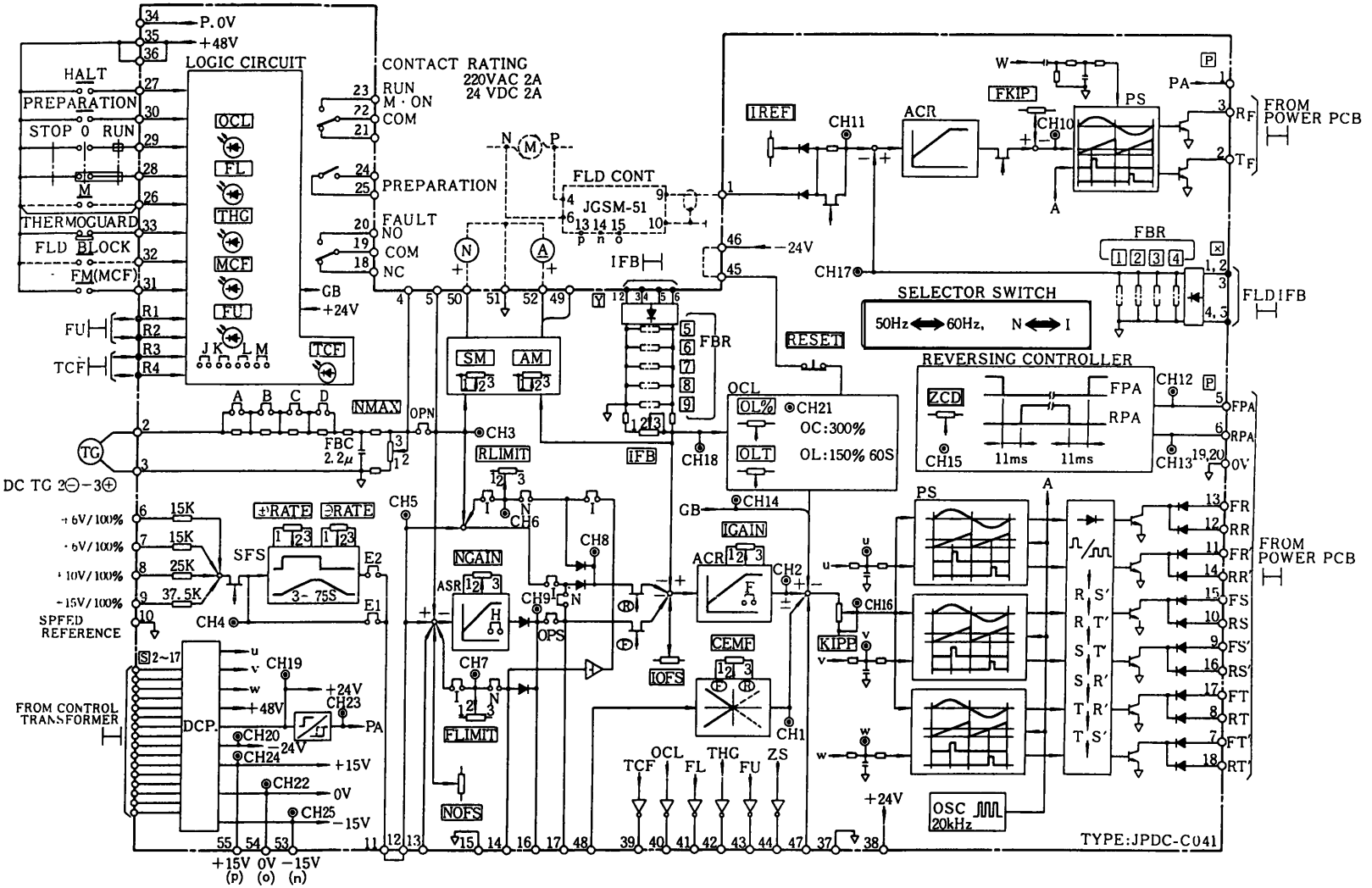
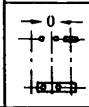


Fig. 27 Control Circuit

FUNCTIONS OF EXTERNAL CONTROL TERMINALS

Table 11 Functions of External Control Terminals for Input

	Signal Name		Terminal No.	Function	
1	Ready signal		30	"Close" --- Field intensifying. "Open" --- Gate block → Field half-reduced.	
2	Operation signal		29	"Close" --- Speed reference "ON" → Acceleration to speed reference value. "Open" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
			29 28	"RUN" --- Speed reference "ON" → Acceleration to speed reference value. "STOP" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
3	Quick stop signal		27	Quick stop at "Close" in case of soft start operation. "Close" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
4	Main circuit M input answer back signal		26	"Close" --- Gate block released.	Terminals 26 and 35 (or 36) short-circuited unless used.
5	Motor overheat signal		33	"Open" --- Gate block. "Close" --- Normally.	
6	Field block signal		32	"Close" --- Field block. (Field circuit clipped at KIPP phase.)	
7	Motor blower ON/OFF signal		31	"Close" --- Field intensifying. "Open" --- Gate block → Field current half-reduced.	
8	External gate block signal		46 - 47	"Close" --- Gate block.	
9	External (OCL) failure reset		45 - 46	"Close" --- Normally. "Open" --- Reset.	Terminals 45 and 46 short-circuited when reset button in the unit is used.
10	Fuse blown detection signal (inside)		R1 - R2	"Open" --- Normally. "Close" --- Gate block.	
11	Thyristor cooling fan stop signal (inside)		R3 - R4	With failure detection cooling fan (option). "Open" --- Normally. "Close" --- Gate block.	
12	Speed reference (⊕ Forward, ⊖ Reverse)		6	±6 V/100%N	· Soft start command possible. · 3 to 75 sec. (Variable) · Accel. time, decel. time adjustable independently.
			7	±6 V/100%N	
			8	±10 V/100%N	
			9	±15 V/100%N	
			10	0 V (SG)	
			12	±6 V/100%N	Terminals 11 and 12 short-circuited.
			13	±6 V/100% N	
13	External current reference (⊕ Forward torque, ⊖ Reverse torque)		14	±3 V/100% Ia	
			15	0 V (SG)	
14	Speed feedback signal		2 - 3	DCTG 2 (-), 3 (+)	
15	CEMF compensation		48	Forward: -6 V/100% Va Reverse: +6 V/100% Va	
16	Automatic field weakening current command		1	Output received from field controller Type JGSM-51.	
17	Speed feedback (Voltage feedback)		5	· Output from Type JGSM-55 When reversible operation by ACTG. (OPN: Open) · Output from type JGSM-53 When speed controlled by voltage detection. (OPN: Open)	

Notes:
1. Use highly reliable contact for input interface signal considering that the load is 48 VDC, 10 mA.
2. Provide a noise killer at both ends of coil when relays, contactors, etc. are used.

Table 12 Functions of External Control Terminals for Output

	Signal Name		Terminal No.	Function	
1	Ready signal		24 - 25	Contact signal closed when operation is ready. (PREP light ON.)	Allowable contact capacity: 220 VAC, 2 A 24 VDC, 2 A
2	Operation signal		21-22-23	NO contact --- For M input command.	
3	Failure signal		18-19-20	Contact signal closed (or opened) when failure occurs.	
4	Zero-speed detection signal	 *	44	"ON" at motor speed 1% or below (±6 V/100% N_{PB}).	
5	Main circuit current detection signal		49	±6 V/100% Ia (Allowable load impedance: 3 kΩ) ±12 V Max	
6	Speed reference signal		11	±6 V/100% N	Terminals 11 and 12 short-circuited.
7	Speed feedback signal		4	Input from Type JGSM-55 when reversible operation by ACTG. (OPN: Open)	
8	Individual failure detection signal	Thyristor cooling fan stop	39	"ON" by thyristor cooling fan stop.	 *
		Thyristor overcurrent and overload	40	"ON" by thyristor overcurrent overload.	
		Field lost	41	"ON" by field loss.	
		Motor overheat	42	"ON" by motor overheat.	
		Fuse blown	43	"ON" by fuse-blown.	
9	Speedometer		50 - 51	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at maximum speed)	
10	Main circuit ammeter		52 - 51	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at 150% load)	
11	Control power supply		53	-15 V	
			54	0 V (SG)	
			55	+15 V	
			38	+24 V	
			37	0 V (POWER 0 V)	
			35, 36	+48 V	Isolated from other control power supply.
			34	0 V (POWER 0 V)	

*Allowable rating 24 VDC, 50 mA. (24 VDC power supply required externally.)

Varispeed-505WII

INDUSTRIAL USE THYRISTOR CONVERTER UNITS

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