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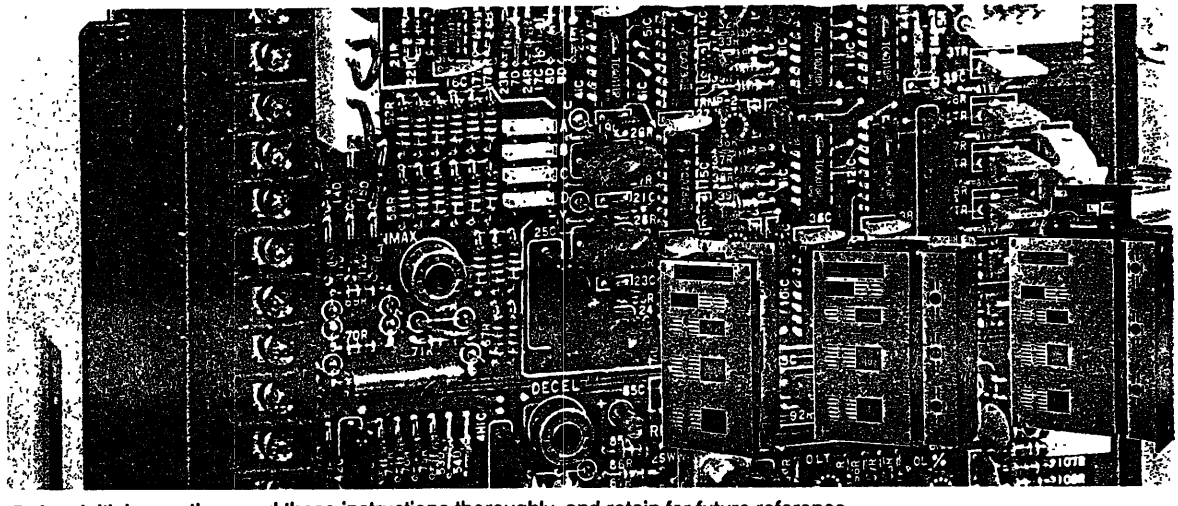
INDUSTRIAL USE THYRISTOR CONVERTER UNIT

Varispeed-505 ZII Drive

INSTRUCTIONS

MODEL CDMR-ZII



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

YASKAWA

TOE-S505-30B

When properly installed, operated and maintained, this equipment will provide a lifetime of optimum operation. It is mandatory that the person who operates, inspects, and maintains this equipment thoroughly read and understand this manual.

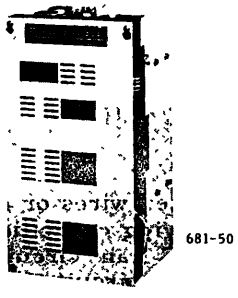
IMPORTANT

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

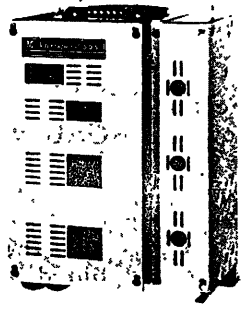
Varispeed-505ZII (VS-505ZII) is a thyristor converter unit for varispeed non-reversing operation of industrial DC motors.

For correct operation of VS-505ZII, users must throughly read these instructions. This manual is also necessary for maintenance and troubleshooting, and therefore should be kept field for ready reference.

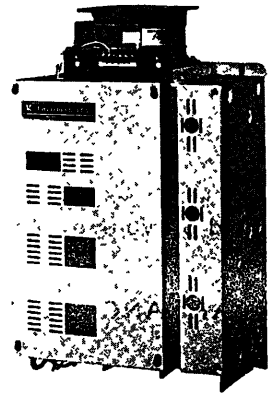
For details on DC motors, refer to "Instructions for Industrial DC Motors" (TOE-C435-3).



Type CDMR-ZII
(Type S)
230V, 105A



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



Type CDMR-ZII
(Type L)
230V, 550A

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: -10°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 connections in reference to the interconnection diagram furnished on your order and the following.

COMPONENT ARRANGEMENT IN VS-505ZII

Figs. 2 to 4 show component arrangement in the VS-505ZII

TERMINAL SIZES AND CARRYING CURRENTS

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

Table 1 Terminal Size and Current Capacity

CDMR-ZII		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	M6	21	M5	25	M4	12
	35	M6	29	M8	35		
	45	M6	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		

Note:

1. Terminal size other than listed above is M4 and current capacity is 2A or below.
2. Rule of thumb of AC main circuit power capacity
   $12 \times \sqrt{3} \times E \times I$ (VA)
   E: Supply voltage
   I: AC main circuit current

INTERCONNECTIONS

Make connections of VS-505ZII 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 mm² 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 (11 to 16), speed feedback terminals (3 to 5), tachometer circuit terminals (38 to 40).

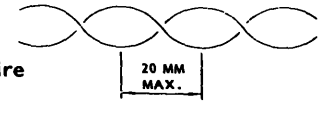
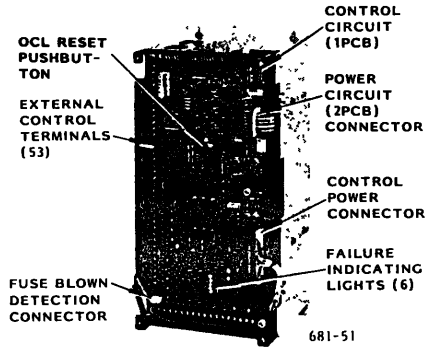
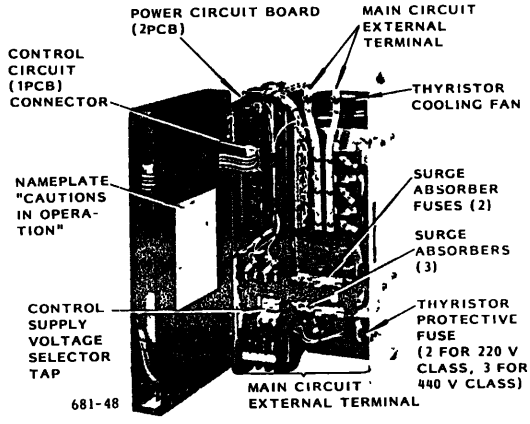


Fig. 1 Pitch of Twisted Wire

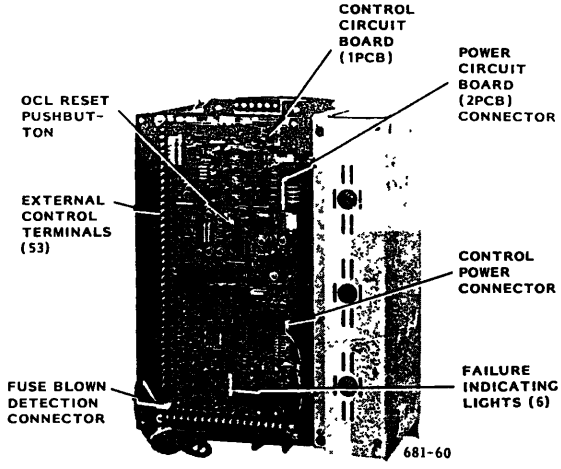


(a) Control Circuit

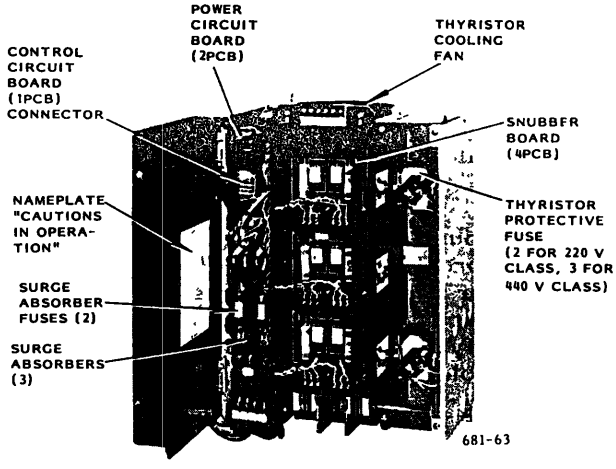


(b) Power Circuit

Fig. 2 Type CDMR-ZII, -S (230V, 150A)

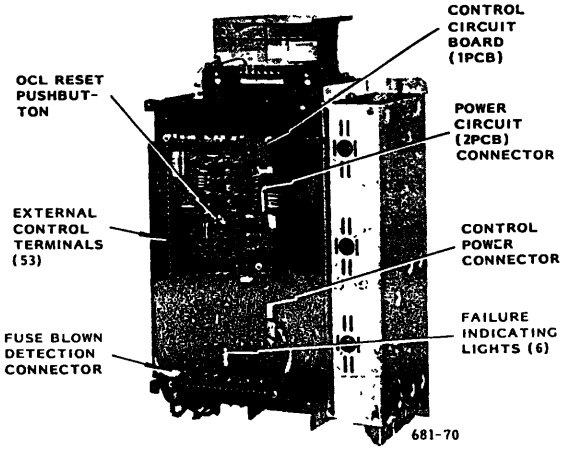


(a) Control Circuit

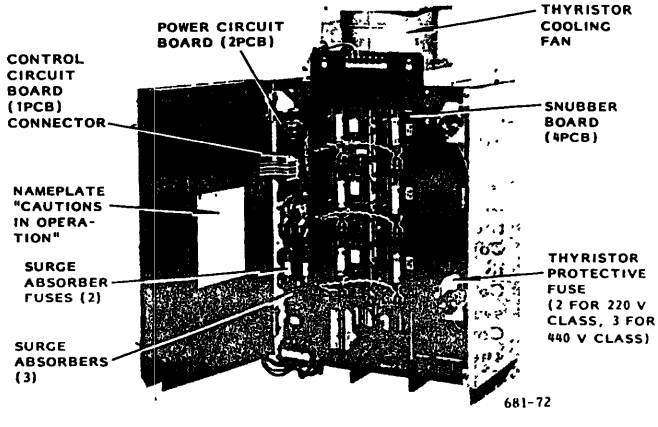


(b) Power Circuit

Fig. 3 Type CDMR-ZII, -M (230V, 260A)



(a) Control Circuit



(b) Power Circuit

Fig. 4 Type CDMR-ZII, -L (230V, 550A)

WIRING (Cont'd)

Separation of Signal Cables from Main Circuit Cables

To avoid inductive interference from other cables, run the shielded or twisted wires (1 to 53) 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 500V megger. Connect VS-505ZII 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 successful.

TEST RUN

When the VS-505ZII 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 "Troubleshooting 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-505ZII 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-505ZII	· 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) · Corrent 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-505ZII	· Voltages of any two of phases U, V, W are within the values on Table 3. Check with a tester. · Terminals (U0) and (U1) and (W0) and (W1) are connected. · Rotating direction of the motor blower meets with the arrow marked on the blower.

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

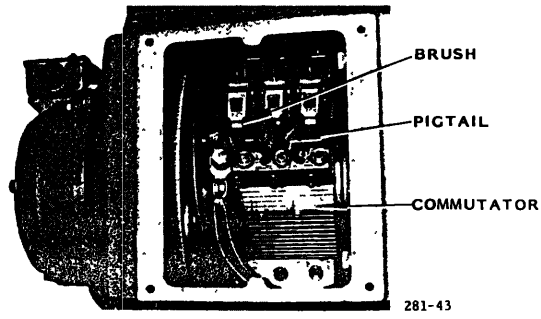
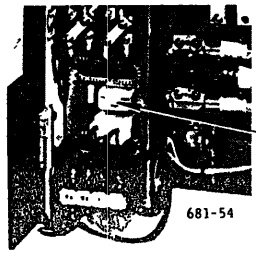
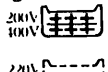


Fig. 5 Inspection Window of DC Motor

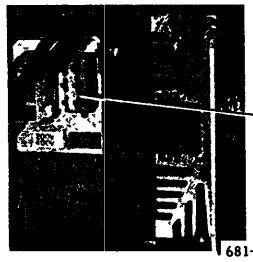


Either 230V or 460V at 105A or below

· When supply voltage is 200 or 400 V, plug the housing in the upper tap.

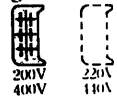


· When supply voltage is 220 or 440 V, plug the housing in the lower tap.



Either 230V or 460V at 180A or below

· When supply voltage is 200 or 400 V, plug the housing in the left tap.



· When supply voltage is 220 or 440 V, plug the housing in the right tap.

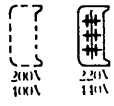
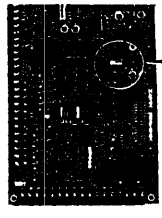


Fig. 6 Tap Selection of Control Supply Voltage



60Hz ⟷ 50Hz

· When supply frequency is 50Hz, slide the switch key down.
· When supply frequency is 60Hz, slide the switch key up.

Fig. 7 Selection of Supply Frequency

Table 3 Supply Voltage Allowable Range

Nominal Supply Voltage	Supply Frequency	Permissible Voltage Variation	Voltage Selectoer Tap
220 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

NO-LOAD OPERATION

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

Check the polarity of DC tachometer generator feedback voltage. When the motor is running forward, the polarity of VS-505ZII signal terminal 3 (4: 0V) is minus and it is plus during reverse running of the motor.

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

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 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 4 No-load Operation

Order	Operation	Check Items
1	Set the speed reference at zero.	-
2	Turn on main circuit power supply.	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.)	-
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.	Turning speed setting potentiometer rapidly during acceleration or deceleration changes motor speed smoothly.
10	Turn off the operation signal.	DC motor stops. (It stops suddenly by VS-505ZII with a dynamic braking function.)
11	Turn off the main circuit power supply.	-

*VS-505ZII, rated 230V, 45A and above and 460V, 90A and above are provided with a thyristor cooling fan.

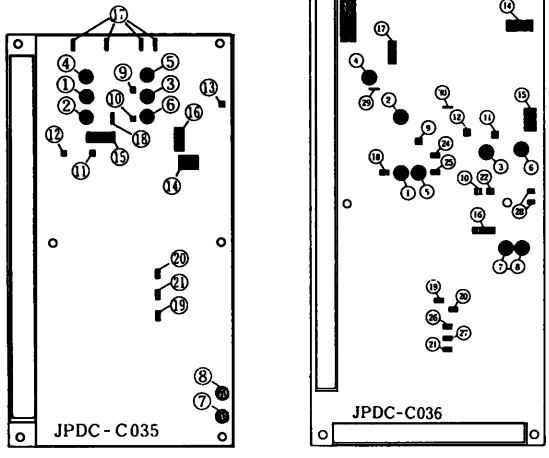
TEST RUN (Cont'd)

ADJUSTMENT

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

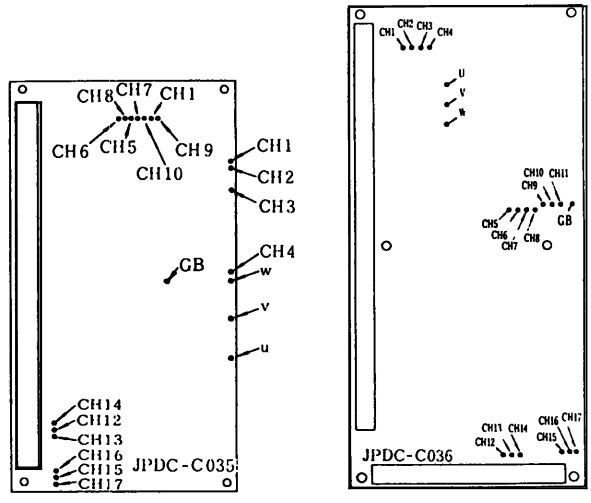
Adjuster Locations and Functions

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



(a) Type JPDC-C035 (b) Type JPDC-C036

Fig. 8 Adjuster Locations on Control Circuit Board



(a) Type JPDC-C035 (b) Type JPDC-C036

Fig. 9 Control Circuit Board Check Terminals

Table 6 Control Circuit Board Check Terminals

	Signal Names	Check Terminals	Normal Values	
Main circuit power	Phase shifter input	CH4	Approx. +5.5 V at 60 Hz, approx. +6.5 V at 50 Hz when gate blocked	+1 to +5.5 V at 60 Hz, +1 to +6.5 V at 50 Hz when controlling
	Current limit	CH5	+3 V/100% current limit	
	Speed feedback	CH6	-6 V/100% speed	
	Current command	CH7	-3 V/100% command	
	Speed command	CH8	+6 V/100% command	
	Gate block	CH9	(Gateblock by OCL) 0 V normal, -24 V at gateblock	
		GB	0 V normal, +12 V at gateblock	
	Current controller output	CH10	Approx. -1 V at gateblock	0 to +6 V when controlling
	Current feedback	CH11	+3 V/100% current	
	Stable power supply	CH12	0 V (SG)	
		CH13	+15 V	
		CH14	-15 V	
	Unstable power supply	CH15	+24 V	Allowable variation range: ±20%
		CH16	-24 V	
		CH17	+24 V (pulse amplifier power supply)	
Field power	Current command	CH1	Voltage value according to field current.	Ex. -6 V/5 A
	Current feedback	CH2		+3 V/5 A
	Phase shifter input	CH3	Approx. +5 V at 60 Hz, approx. +6 V at 50 Hz when field blocked	+1 to +5 V at 60 Hz, +1 to +6 V at 50 Hz when controlling

Table 7 Control Circuit Board Adjuster Locations and Functions

Type of Adjusters	Adjuster Location	Adjuster Names	Adjuster Functions	Adjusting Method		Specifications
Potentiometers	1	ACCEL	Acceleration time adjustment.	Clockwise rotation increases acceleration time.		3 - 75 sec
	2	DECEL	Deceleration time adjustment.	Clockwise rotation increases deceleration time.		3 - 75 sec
	3	GAIN	ASR Gain adjustment.	Clockwise rotation increases gain.		—
	4	NMAX	Speed feedback adjustment.	Clockwise rotation decreases speed.		-6/100% speed
	5	LIMIT	Current limitation	Clockwise rotation increases limit value.		0 - 250%
			Speed limitation			0 - 125%
	6	IFB	Main circuit current feedback adjustment.	Clockwise rotation decreases current.		+3V/100% current
	7	SM	Speedometer adjustment.	Clockwise rotation increases pointer swing.		1 mADC max
	8	AM	Ammeter adjustment.	Clockwise rotation decreases pointer swing.		1 mADC max
	9	BIAS	ASR offset adjustment.	⊖ voltage ⊕ voltage		—
	10	KIPP	Phase shift lag limit adjustment	Clockwise rotation advances shift lag.		155°el (Standard)
	11	OL%	Setting overload detection start point.	Clockwise rotation increases overload detection start point.		110% (Standard)
	12	OLT	Setting overload.	Clockwise rotation increases operation time.		150%, 60 sec (Standard)
	13	I REF	Setting field current	Clockwise rotation increases the current.		—
	㉒	PSB	Phase shifter operating point adjustment	Clockwise rotation advances phase.		Adjustable between 90 and 160°el
Potentiometers selection (Open)	14	1FBR-4FBR	Rough adjustment of field current detection voltage level.	Open the resistor according to specifications.		Refer to motor specifications.
	15	5FBR-9FBR	Routh adjustment of main circuit detection voltage level.			
Slide switch	16	1SW	Supply frequency selector.	Selection of 50 Hz or 60 Hz.		—
Plug selection	㉓	ACTG/DCTG	Selection of ACTG and DCTG according to Type of TG.	For AC tach-gen, select ACTG, and for DC tach-gen, select DCTG.		—
	17	A - D	Rough adjustment of speed detection voltage level.	Selection of the voltage level according to type of tach-gen and motor rated speed.		—
	18	E	Selection of soft start operation	E_1	—	—
				E_2	Soft start	—
	㉔	F	Selection of BIAS	F_1	ASR BIAS Adjustment	—
				F_2	ACR BIAS Adjustment	—
	㉕	H	Selection of LIMIT	H_1	Current limitation	—
				H_2	Speed limitation	—
	19	J	Selection of start interlock zero-speed condition	J_1	Possible	—
				J_2	—	—
	20	K	Selection of motor stopping method	K_1	Gate block at zero speed when decelerating to stop.	—
				K_2	Gate block at stop command.	—
	㉖	L	Selection of use of exciter according to motor field.	L_1	Exciter used.	—
				L_2	Exciter not used.	—
	㉗	M	Selection of field block due to motor overheat.	M_1	Field blocked.	—
				M_2	Field not blocked.	—
	21	N	Selection of zero-speed condition at motor cooling fan stopping.	N_1	Field half-reduced after motor zero-speeds by stop operation.	—
				N_2	Field half-reduced. (Gate block)	—
	28	P	Selection of PI and P of ACR control	P_1	PI control	—
				P_2	P control	—
Short-circuit jumper	29	OPN	—	Open	·Speed control by voltage detection. ·Speed control by AC tach-gen.	—
				Short	Except for the above	—
	30	OPS	—	Open	Special application	—
				Short	Except for the above	—

Note: The adjusters of the circled numbers are provided with the control circuit board Type JPDC-C036 (ETC00491X) only.

TEST RUN (Cont'd)

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 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.

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

LIMIT (Limit value adjustment)

1. Current limitation (Speed control)

Connect the plug-connectors F and H to F1 and H1 on the control circuit board, respectively. When the voltage at CH5 is +3V, 100% current limit value is obtained. Current limit value can be set within the range of 0% to 250% by LIMIT.

2. Speed limitation (Current control)

Connect the plug-connectors F and H to F2 and H2 on the control circuit board, respectively. When the voltage at CH5 is +6V, 100% current limit value is obtained. Current limit value can be set within the range of 0% to 125% by 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 P on the control circuit board at P1. Turn PSB fully counterclockwise.

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

Connect the plug selector P on the control board at P2. Turn PSB clockwise gradually with reference current at 0V (0V at CH10), and set at the position where main circuit current is ready to start.

Adjustment of Field Current

The manner of adjusting field current when field current is constant differs from that when field weakening control is made.

Constant Field Current

1. Connect DC ammeter to field circuit.

2. Adjust the potentiometers (1FBR to 4FBR) and IREF on the control circuit board so that ammeter indicates rated field current.

Field Weakening Control

Proceed as follows to adjust field current in combination with field adjuster type JGSM-51-[ ].

1. Connect DC ammeter to field circuit and DC voltmeter to output terminals (P) and (N).

2. Select the potentiometer (from 1FBR to 4FBR) which corresponds to the desired voltage level of field current detection. Remove those potentiometers not being used.

3. Turn the potentiometer 1REF on the control board and FORCE FLD and V LIMIT of the field adjuster fully counterclockwise.

4. Set the minimum field weakening current using I REF. Set-value should be 80% field weakening current at maximum speed.

5. Set the rated field current (field intensifying) using FORCE FLD of field adjuster.

6. Increase speed reference gradually after motor starts.

The voltage across terminals (P) and (N) increases as speed rises and reaches the limited value.

Turn V LIMIT clockwise gradually so that the limited value is motor rated voltage (220V or 440V).

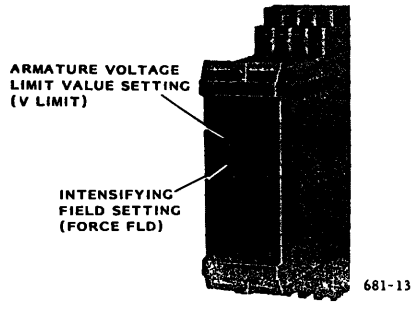


Fig. 10 Field Adjuster Type JGSM-51-[ ]

MAINTENANCE

VS-505ZII 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 Item	Inspection Item	Inspection Procedure	What to do
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.	· Check for dust clogging or dirt adhesion. · Check for loosening of screws or nuts.	· Clean with an electrical cleaner. · Tighten.

PARTS REPLACEMENT

Field Thyristor

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

The same replacement procedure applies to all the models.

1. Loosen the bus bar screws and the lead clamping screws, and unclamp the leads. In this case, mark all the terminals for identification. (Fig. 11)

2. Loosen the two clamping screws, and remove the thyristor module.

3. Check the replacement thyristor module for type and capacity, and install it by reversing the removal procedure, making connections to the terminals identified by the marks made before removing the old thyristor module.

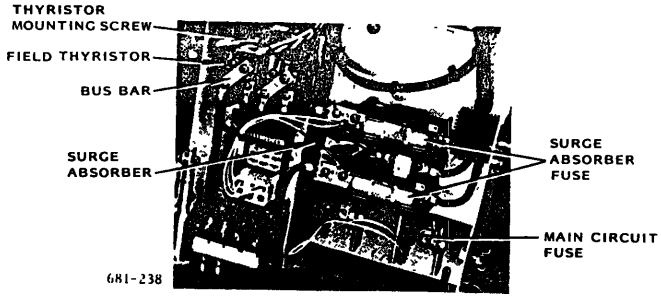


Fig. 11 Field Thyristor (230V, 25A)

Main Circuit Thyristor

230V, 25A System (Fig. 12)

The system uses a thyristor module comprising two thyristors. Replace it as follows.

1. Remove the 6 bus bar clamping screws, and remove the bus bar.

2. Loosen all the thyristor lead screws, and unclamp all the leads. In this case, mark the terminals for identification.

3. Remove the two thyristor clamping screws.

4. Check the replacement thyristor 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.

NOTE

When installing the thyristor module, apply thermal compound JOINTAL Z (made by Nippon Light Metal Co., Ltd.) to the thyristor mounting surface (reverse side).

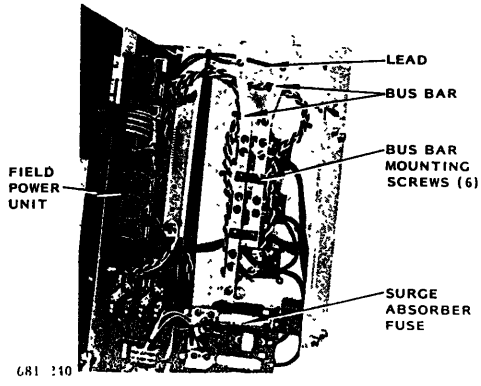


Fig. 12 Main Circuit Thyristor

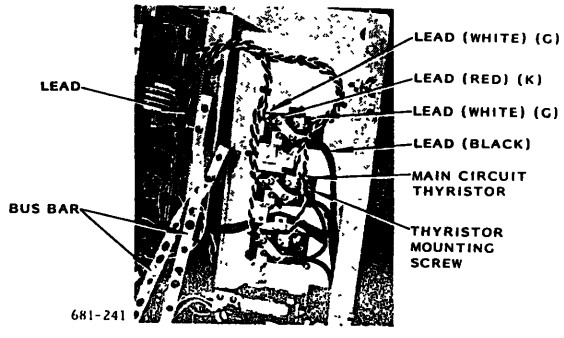


Fig. 13 Bus Bar Removal

MAINTENANCE (Cont'd)

230V, 35 to 105A System, 460V, 50 to 105A System

1. Remove the 6 bus bar mounting screws, and remove the bus bar. The leads connected to the bus bar need not be removed. (Fig. 14)

2. Loosen the thyristor connecting screws, and unclamp the leads. In this case, mark the terminals for identification.

3. Remove the two thyristor clamping screws.

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

NOTE

When installing the thyristor, apply thermal compound JOINTAL Z (made by Nippon Light Metal Co., Ltd.) to the thyristor mounting surface (reverse side).

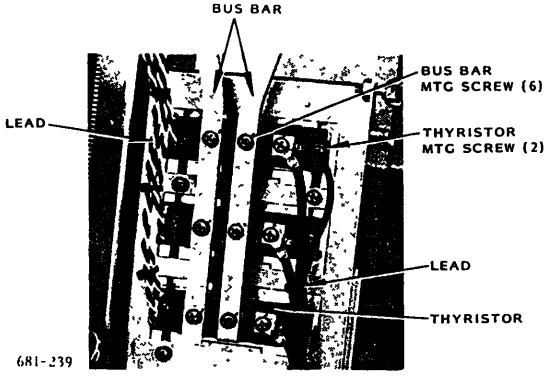


Fig. 14 Main Circuit Thyristor (230V, 105A)

230V, 180 to 550A, 460V, 180 to 550A System

In these systems, flat thyristors are used. The thyristor modules differ in shape depending upon capacity, but their replacement procedure is the same, as given below.

1. Remove the 6 clamping screws for thyristor gate cathode terminal, and free the leads. In this case, mark the terminals for identification. (Fig. 15)

2. Remove the mounting bolts (5 for 260A and below and 7 for 420A and larger systems) for the thyrisotr module, and remove the main circuit thyristor.

3. Place the main circuit thyristor module on a work bench, and loosen the control circuit board mounting screws (Fig. 16) for the thyristor assembly to be replaced, and then, loosen the gate wiring screws.

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 thyristor.

6. Clean the contact surfaces of the new thyristor and the fin, and thinly coat these surfaces with thermal 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 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 control circuit board mounting screws. Then, mount the thyristor module by reversing the disassembling procedure, tightening the screws firmly.

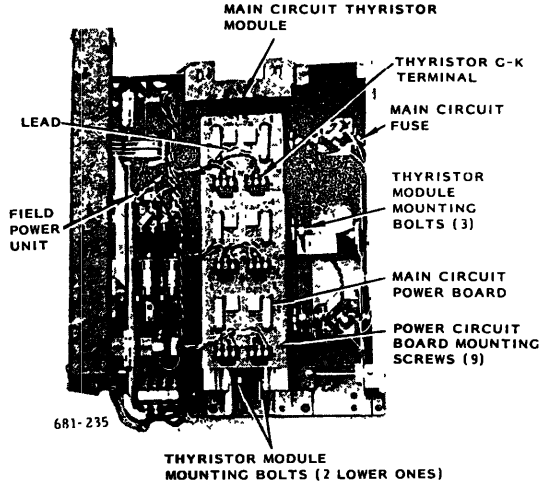
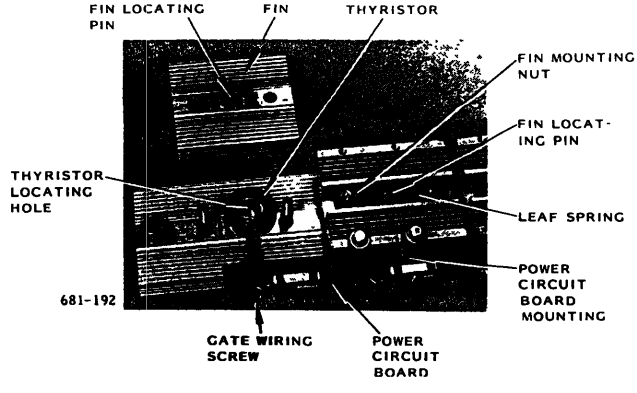
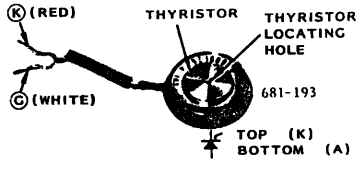


Fig. 15 Main Circuit Thyristor Assembly (230V, 260A System)



(a) With Thyristor Removed



(b) Thyristor

Fig. 16 Thyristor Replacement

Replacement of Main Circuit Fuse

230V, 25 to 105A, 460V, 50 to 105A System

1. Remove the fuse blown indicating microswitch with the leads by pulling upward. (Fig. 17)

2. Remove the two fuse mounting bolts.

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

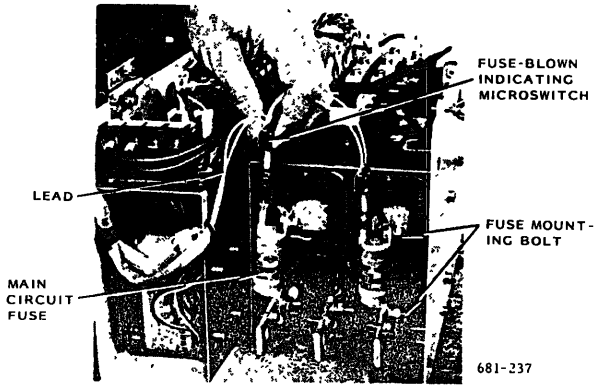


Fig. 17 Main Circuit Fuse (230V, 25A)

230V, 180 to 550A, 460V, 180 to 550A systems (Fig. 15)

1. Loosen the two lead clamping screws, and free the four leads of the fuse-blown indicating microswitch. (Fig. 18)

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.

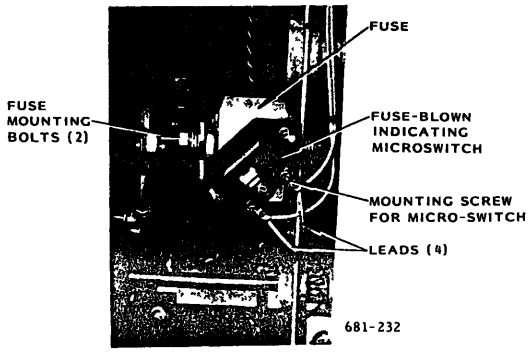


Fig. 18 Main Circuit Fuse Assembly

Surge Absorber Fuse Replacment

1. Pull the fuse element and remove it. (Fig. 19)

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

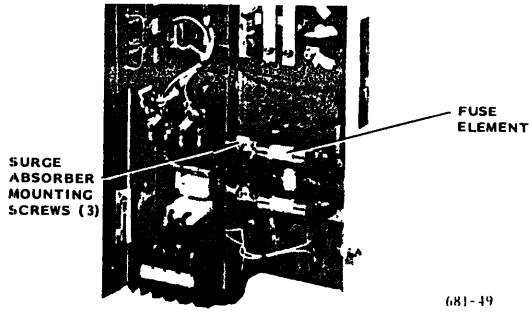


Fig. 19 Surge Absorber Fuse

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. 20.

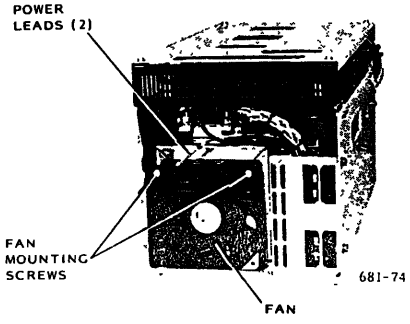
Fig. 20 Surge Absorber with Pressure Terminals Connected to Leads

MAINTENANCE (Cont'd)

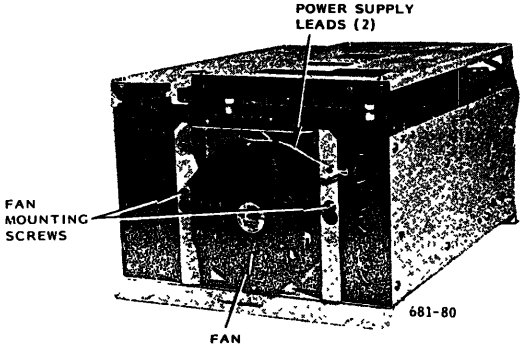
Thyristor Cooling Fan

Using for 230V, 25A and 460V, 50A ratings are self-cooled. Replace the fans as follows. (Fig. 21)

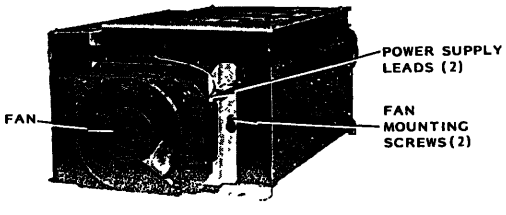
1. Disconnect the power leads.
2. Unscrew the two fan mounting screws, and dismount the fan.
3. Remove the fan by reversing the disassembling procedure.



(a) 230V, 45 - 105A
460V, 90 - 105A



(b) 230V, 180 - 260A
460V, 180 - 260A



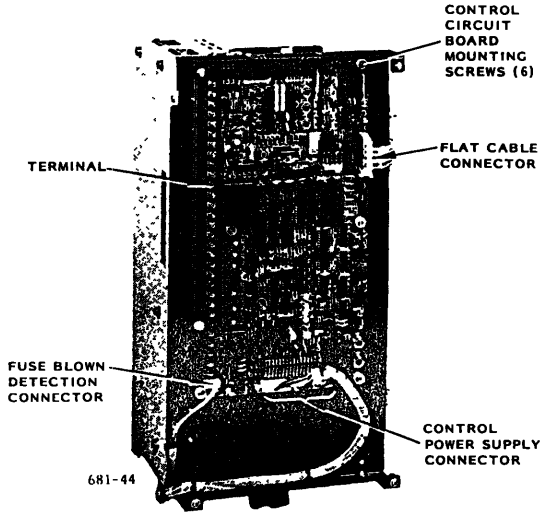
(c) 230V, 420/550A; 460V, 420/550A

Fig. 21 Thyristor Cooling Fan

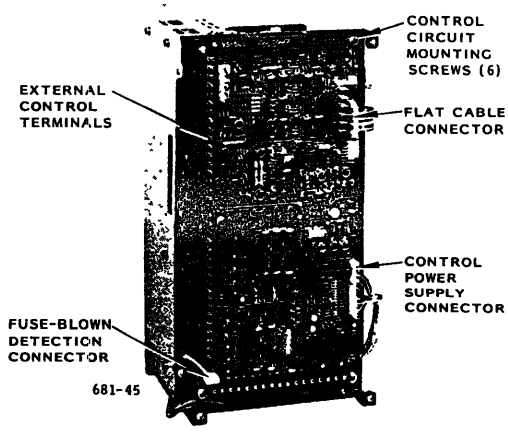
Control Circuit Board Replacement

Disconnect all the leads from the terminals. In this case mark the terminals for identification. Then, unplug the connectors shown in Fig. 22, and loosen the 6 control circuit board mounting screws.

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



(a) Type JPDC-C035



(b) Type JPDC-C036

Fig. 22 Control Circuit Board

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 board door of VS 505Z II. See Table 7 Adjuster Locations on the Control Circuit Board and Functions.

TROUBLESHOOTING GUIDE

Table 9 Troubleshooting Guide

	Trouble	Possible Cause		Check Methoc	What to do	
Motor does not run	OCL lamp ON	Control circuit board	Too low setting of "OL₂," "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 "LIMIT."	Refer to Table 6 and 7.	Readjust.	
			Incorrect setting of "IFB".			
		Thyristor	Defective (deteriorated)	Check thyristor (Fig. 25).	Replace thyristor. (See Main Circuit Thyristor on page 10.)	
		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 10.)	
		Motor	Layer shorting in motor.	Operate only board with (P) and (N) disconnected. If fuse is not blown, motor circuit is defective.	· Repair motor. · Correct wiring.	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 11.	
		Fuse	Defective (deteriorated).	——	——	
	FL lamp ON	Motor	Layer shorting in field winding.	Disconnect terminals (J) and (K), and measure resistance between terminal (J) and (K) of motor with a multitester. If the reading is ∞, 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 Circuit Board on page 11.	
	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 6.	
			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 senser.		Check fan for locking or overloading.	Replace the thyristor cooling fan. See Replacement of Thyristor Cooling Fan, on page 11.	
	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 10 lists the recommended spare parts for one VS-505ZII, 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-ZII		Main Circuit Thyristor		Thyristor Protective Fuse		Surge Absorber Fuse		Fan		Field Thyristor Diodo		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-H (SCR195)	3	60FHS-55 (FU642)	2	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G-471K (XX140)	3	JPDC-C035 (ETC490X) or JPDC-C036 (ETC491X)	1
Type S	230 V 35 A	TM25DZ-H (SCR196)						4715PS-22T-B30-B00 (FAN130)							
	230 V 45 A														
	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)	6	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	N280CH08 (SCR265)		CS5F-600 (FU616)											
Type S	460 V 50 A	PK55HB-160 (SCR244)	3	60FHS-110 (FU644)	3	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G-102K (XX167)	3	JPDC-C035 (ETC490X) or JPDC-C036 (ETC491X)	1
	460 V 90 A	TM55DZ-2H (SCR201)						HN4556MV (FAN110)							
	460 V 105 A	PK90HB-160 (SCR245) TM90DZ-2H (SCR202)		60FHS-150 (FU645)											
Type M	460 V 180 A	N105CH16 (SCR260)	6	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	N280CH16 (SCR266)		CS5F-600 (FU616)											

〈REFERENCE〉

ROUGH CHECK OF THYRISTORS

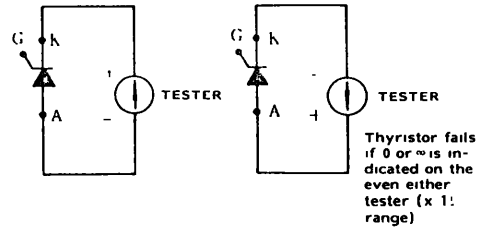
Where thyristors normally function, the following values are obtained.

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

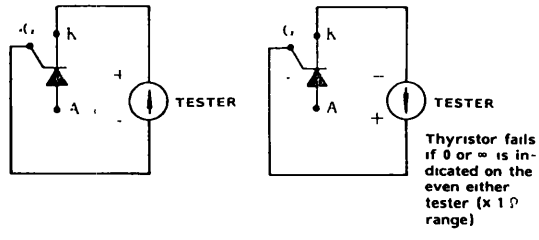
Several ohms to several hundreds of ohms across (G) and (K).

CAUTION IN CHECKING FLAT THYRISTORS

Apply pressure 5 to 10 kg across thyristor polarities A and K so as to insure positive thyristor internal connections. Measure the resistance using a tester as shown in Fig. 23 (a) and (b).



(a) Resistance across Thyristor Terminals (A) and (K)



(b) Resistance across Thyristor Terminals (G) and (K)

Fig. 23 Rough Check of Thyristors

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

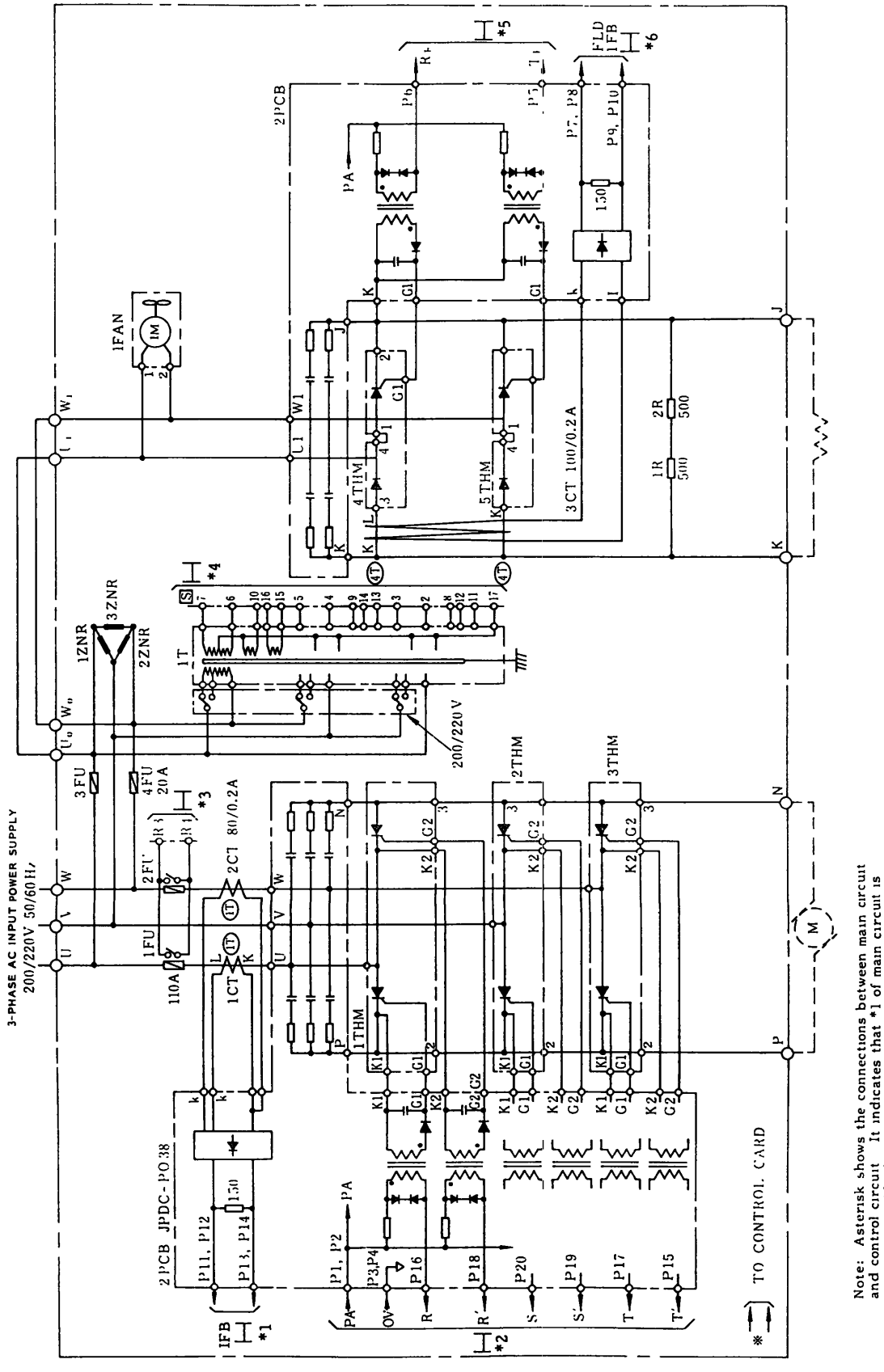
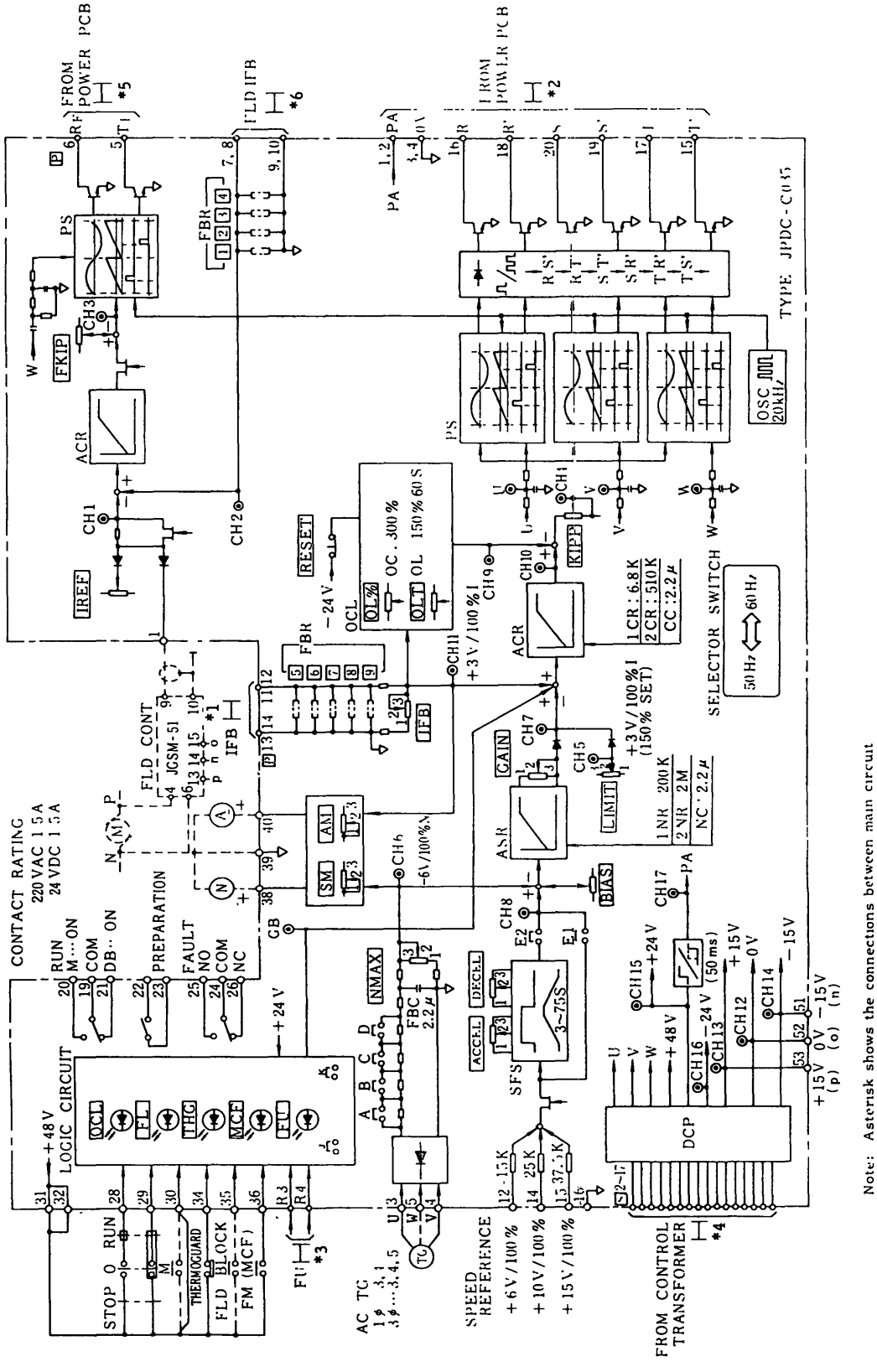


Fig. 24 Main Circuit

ELEMENTARY DIAGRAM OF THYRISTOR CONVERTER UNIT (TYPE CDMR-ZII, 230V, 90A) (CONT'D)



Note: Asterisk shows the connections between main circuit and control circuit. It indicates that *1 of main circuit is connected to *1 of control circuit.

Fig. 25 Control Circuit Type JPDC-C035

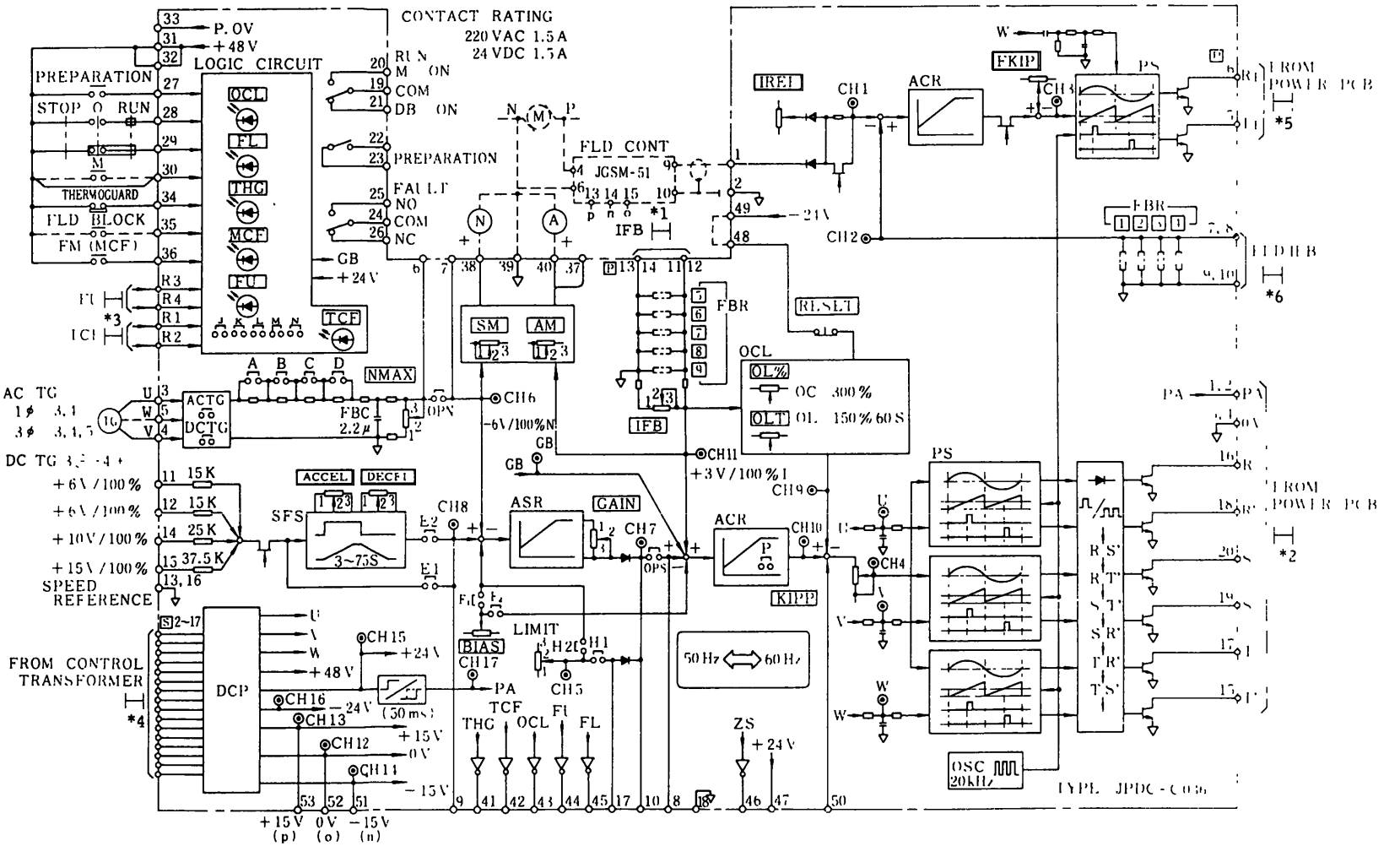
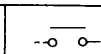
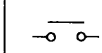
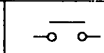
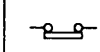
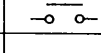
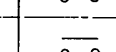
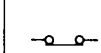
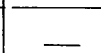
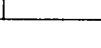


Fig. 26 Control Circuit
Type JPDC-C036

Note: Asterisk shows the connections between main circuit and control circuit. It indicates that *1 of main circuit is connected to *1 of control circuit

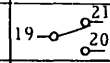
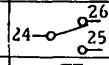
Table 11 Functions of External Control Terminals for Input

	Signal Name		Terminal No.	Function	
1	Ready signal		㉗	"Close" --- Field intensifying. "Open" --- Gate block → Field half-reduced.	
2	Operation signal		28	"Close" --- Speed reference "ON" → Acceleration to speed reference value. "Open" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
			28 29	"RUN" --- Speed reference "ON" → Acceleration to speed reference value. "STOP" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
3	Main circuit M input answer back signal		30	"Close" --- Gate block released.	Terminals 30 and 31 (or 32) short-circuited unless used.
4	Motor overheat signal		34	"Open" --- Gate block. "Close" --- Normally.	
5	Field block signal		35	"Close" --- Field block. (Field circuit clipped at KIPP phase.)	
6	Motor blower ON/OFF signal		36	"Close" --- Field intersifying. "Open" --- Gate block → Field current half-reduced.	
7	External gate block signal		㊾ - ㊿	"Close" --- Gate block.	
8	External (OCL) failure reset		㊽ - ㊾	"Close --- Normally. "Open" --- Reset.	Terminals 48 and 49 short-circuited when reset button in the unit is used.
9	Fuse blown detection signal (inside)		(R1) - (R2)	With failure detection cooling fan (option). "Open" --- Normally. "Close" --- Gate block.	
10	Thyristor cooling fan stop signal (inside)		R3 - R4	"Open" --- Normally. "Close" --- Gate block.	
11	Speed reference		⑪	+6V/100%N	· Soft start command possible. · 3 to 75 sec. (Variable) · Accel. time, decel. time adjustable independently.
			12	+6V/100%N	
			14	+10V/100%N	
			15	+15V/100%N	
			⑬, 16	0V (SG)	
12	External current reference (+ Forward torque. - Reverse torque)		⑰	±3V/100% Ia	
			⑱	0V (SG)	
13	Speed feedback signal		3 - 4 - 5	ACTG 3, 4 --- 1φ, 3, 4, 5 --- 3φ DCTG 3(-), 4(+)	
14	Automatic field weakening current command		1	Output received from field controller Type JGSM-51.	
			②	0 V (SG)	

Note:

1. Use highly reliable contact for input interface signal considering that the load is 48VDC, 10mA.
2. Provide a noise killer at both ends of coil when relay, contactors, etc. are used.
3. The terminals of the circled numbers are provided with the control circuit board Type JPDC-C036 (ETC00491X) only.

Table 12 Functions of External Control Terminals for Output

	Signal Name		Terminal No.	Function	
1	Ready signal		22-23	Contact signal closed when operation is ready. (PREP light ON.)	Allowable contact capacity: 220VAC, 1.5A 24VDC, 1.5A
2	Operation signal		19-20-21	NO contact --- For M input command. NC contact --- For DB input command	
3	Failure signal		24-25-26	Contact signal closed (or opened) when failure occurs.	
4	Zero-speed detection signal	 *	㊻	"ON" at motor speed 1% or below (-6V/100% N_{FB})	
5	Main circuit current detection signal		㊲	+6V/100% Ia (Allowable load impedance: 3 kΩ)	
6	Individual failure detection signal	Motor overheat	㊶	"ON" by motor overheat.	
		Thyristor cooling fan stop	㊷	"ON" by thyristor cooling fan stop.	
		Thyristor overcurrent and overload	㊸	"ON" by thyristor overcurrent overload.	
		Fuse blown	㊹	"ON" by fuse-blown.	
		Field lost	㊺	"ON" by field loss.	
7	Speedometer		38-39	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at maximum speed)	
8	Main circuit ammeter		40-39	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at 150% load)	
9	Control power supply		51	-15V	
			52	0V (SG)	
			53	+15V	
			㊼	+24V	
			31,32	+48V	Isolated from other control power supply.
			㉝	0V (POWER 0V)	

*Allowable rating 24VDC, 50mA.

Note: The terminals of the circled numbers are provided with the control circuit board Type JPDC-C036 (ETC00491X).

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