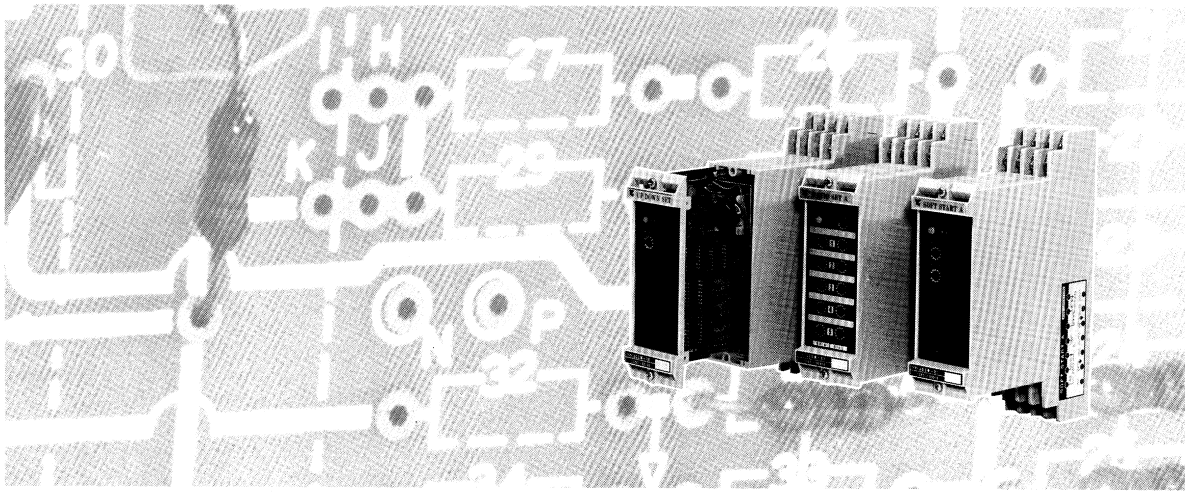
# VS SYSTEM MODULES
# USER'S MANUAL

## TYPE JGSM

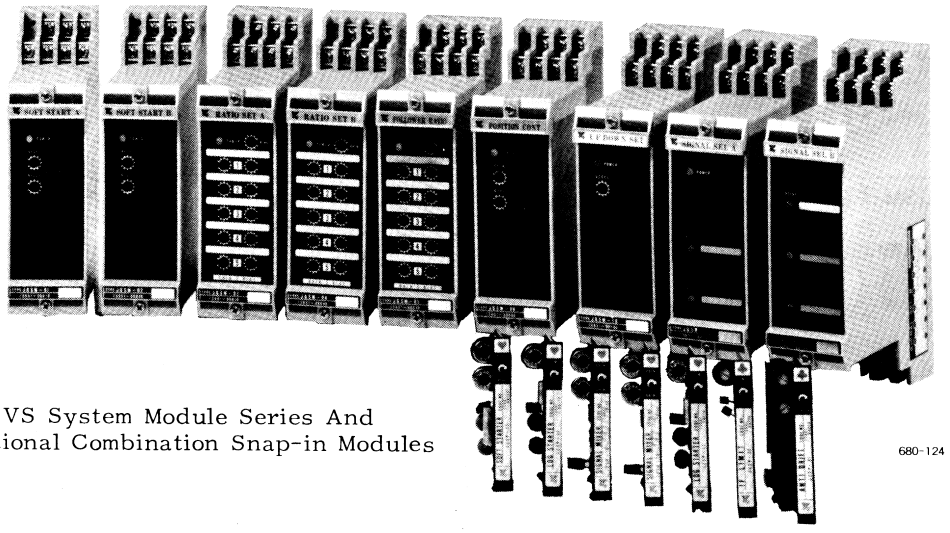


YASKAWA

MANUAL NO. TSE-C730-30H

The YASKAWA VS system module has been developed as the system controller for AC-operated, eddy-current coupling, adjustable speed system, called YASKAWA VS motor drive. In combination with VS controller, the main control unit of the drive, the module can form an automatic control system to meet precisely any requirements of various types of industrial machines such as pump, blower, conveyor, extruder, etc.

It is available in 17 types (depending upon specific function), which can be assembled in flexible combinations much in the manner of building blocks. Plug-in connections permit mounting, wiring, and operation from the front. Since a single function is incorporated in a single module, any trouble can be rapidly and easily located and corrected by changing the defective module, keeping down time to an absolute minimum.



VS System Module Series And
Optional Combination Snap-in Modules

680-124

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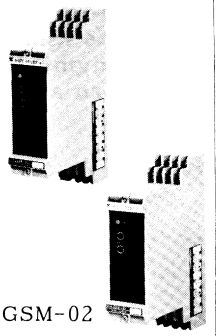
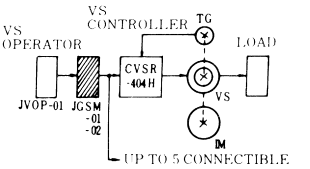
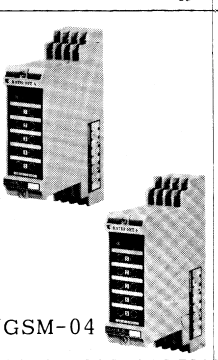
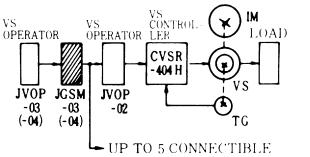
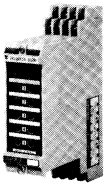
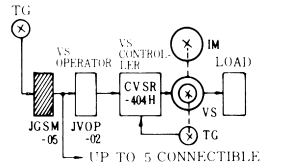
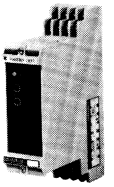
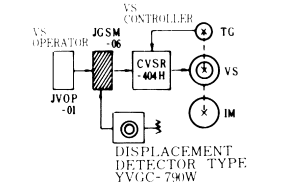
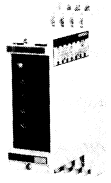
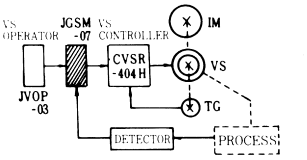
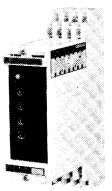
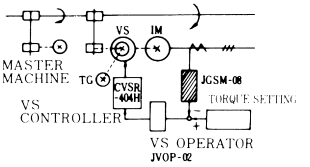
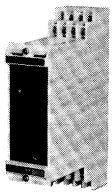
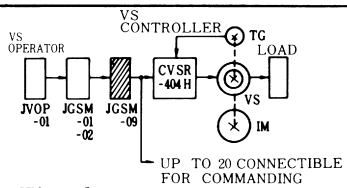
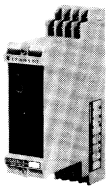
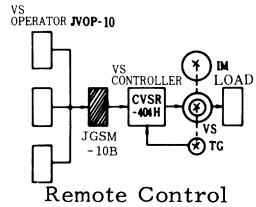
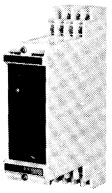
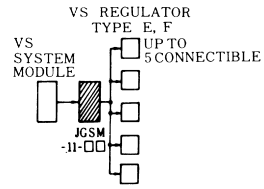
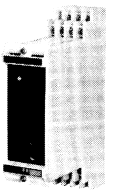
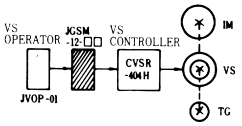
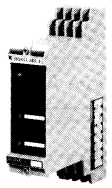
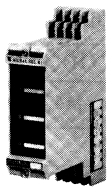
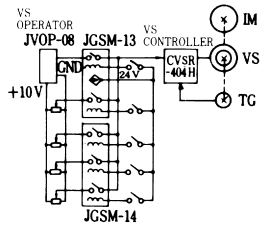
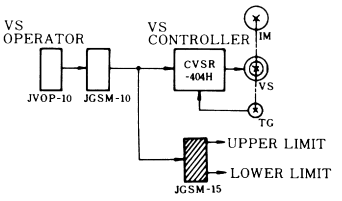
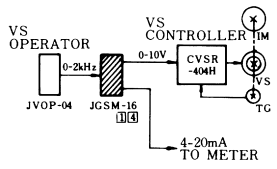
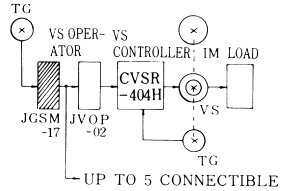
# LIST OF VS SYSTEM MODULES

Table 1 List of VS System Modules

| Module Name | Configuration and Type Name | Description | Drive Arrangement |
|---|---|---|---|
| Soft Starter A<br>Soft Starter B |  <br>JGSM-01<br>JGSM-02 | Linear acceleration/deceleration control provides smooth, uniform speed changed at starting and stopping and during speed increase and decrease. Accel/decel time adjustable in 1.5 to 30 sec with A and 5 to 90 sec with B. |  <br>Timed Start |
| Ratio Setter A<br>Ratio Setter B |  <br>JGSM-03<br>JGSM-04 | Ratio setter A converts signal of 4 to 20 mA to voltage signal and B transforms frequency signal of 0 to 2 kHz to isolated voltage signal. Both setters A and B set five types of ratios and biases. |  <br>Ratio Drive |
| Follower Ratio Setter |  <br>JGSM-05 | Transforms frequency signal from AC tach-gen to voltage signal and sets five types of ratios and biases. |  <br>Follower Ratio Drive |
| Position Controller |  <br>JGSM-06 | Transforms AC voltage signal from displacement detector in proportion to rotating angle to DC voltage signal. |  <br>Displacement Detector Control |
| PID Controller |  <br>JGSM-07 | Independently sets proportional gain, integral and differential time. |  |
| Torque Controller |  <br>JGSM-08 | Input power of VS motor prime mover is determined so that VS motor equivalent torque can be calculated. |  <br>Torque Controller Helper Drive |

Note: YASKAWA recommends that Extension type JGSM-99 should be used to check for internal circuit operation of system modules.

Table 1 List of VS System Modules (Cont'd)

| Module Name | Configuration and Type Name | Description | Drive Arrangement |
|---|---|---|---|
| Preamplifier |  JGSM-09-□□* | Amplifies both the power of DC input signal and output of snap-in function module when inserted. |   Timed Start and Parallel Operation |
| UP/DOWN Setter |  JGSM-10B | Executes "UP" or "DOWN" command from remote control type VS operator type JVOP-10 by lowering or raising reference voltage. |   Remote Control |
| Power Amplifier |  JGSM-11-□□* | Allows use of old VS motor regulators by using an interface that functions as operational amplifier of VS system module. |   |
| Operational Amplifier |  JGSM-12-□□† | Required operational circuits are provided through a range of values of operational impedances. |   |
| Signal Selector A<br>Signal Selector B |  JGSM-13  JGSM-14 | Signal selector A consists of power supply circuit and two relay circuits. Signal selector B contains three relay circuits and is powered from selector A. Both selectors A and B are used as selector circuits of control signals. |   Multi-Stage Drive |
| Comparator |  JGSM-15-□□* | Compares DC voltage, current, AC tach-gen, frequency, or reference signals with two preset levels. It drives relays and output contact signal (1NONC contact). |   |
| V/I Converter |  JGSM-16-□□* | Converts DC voltage input signal to current signal of 4 to 20 mA which can be connected to instrument. Insertion of snap-in module can determine input signals such as frequency or tach-gen. |   |
| Ratio Setter C |  JGSM-17 | Transforms master speed signals such as AC voltage signal (200 VAC), AC tach-gen signal (30 VAC) or DC voltage signal (10 VDC) to DC voltage. It can set five types of ratios and biases. |   Follower Ratio Drive |

* □□ Shows type of VS snap-in function modules. † □□ Indicates type of impedance.

# COMMON RATINGS AND SPECIFICATIONS

Table 2 Ratings and Specifications Common to All Types of VS System Modules

| | | |
|---|---|---|
| Electrical | Power supply | 200 VAC at 50/60 Hz, 220 VAC at 50/60 Hz |
| | Allowable voltage variation (1) | +10 to -15% or ±10% |
| | Power supply capacity | 6 VA Max |
| | Standard signal level | Voltage signal level: ±10 V<br>Current signal level: 4 to 20 mA (1 to 5 V)<br>Frequency signal level: 0 to 2 kHz<br>Sequence voltage level: 24 V (non-stabilized) |
| | Standard input impedance | Voltage signal: 20 kΩ (10 V/20 kΩ = 0.5 mA)<br>Current signal: 250 Ω |
| | Standard output characteristics | Output voltage: ±10 V<br>Output current: ±2.5 mA<br>Max rated load: 4 kΩ |
| | Standard command setting resistance | 2 kΩ (10 V/2 kΩ = 5 mA) |
| | Standard AC tach-gen signal | Voltage signal: 35 V/1800 r/min<br>Frequency signal: 540 Hz/1800 r/min |
| | Dielectric strength (7) | 2000 VAC for a minute in power circuit |
| Environmental | Storage temperature (2) | -40 to 185°F (-40 to +85°C) (for a short period) |
| | Operating temperature range | 14 to 131°F (-10 to +55°C) |
| | Operating humidity (3) | 95% R.H. (No condensation) at 104°F (40°C) ambient |
| | Vibration (4) | 10 to 55Hz, 0.3 mm full amplitude in any one of X, Y, and Z directions for 24 hours. |
| | Harmful gas (5) | $H_2S$ 0.5 ppm max, average 0.1 ppm max |
| | Dust (6) + | No harmful dust present |
| Physical | Dimensions mm | 49 (W) × 200 (H) × 140 (D) |
| | Mounting space mm | 35 × 185, Two M4 tapped holes (upper left and lower right) |
| | Mounting screws | 2-M4, 30 long |
| | External terminals | 14-pole |
| | Terminal numbers | 2 to 15 |
| | Mass | 800 g Max |

Notes:

1. Allowable voltage variation is within range of +10% and -15% when power of 220 V is applied to terminals ② and ④ or 200 V to terminals ③ and ④.

   Voltage varies ±10% when power of 200 V is connected across terminals ② and ④.

2. Storage temperature should be from -40°C to 85°C, taking into consideration the environmental condition during transit. For long periods of storage of spare parts, etc., keep them at a temperature of 25°C ±10°C and protect from high humidity (95% or more) and direct sunlight for more than short periods.

3. If used under conditions of sustained high temperature and high humidity, special precautions are required. For details, contact your YASKAWA representative.

4. Inspection standards for variation during transit. Special precautions are required when it is installed in a location where constant vibration is prevalent. For details, contact your YASKAWA representative.

5. Special precautions are required when it is installed where harmful gases are highly concentrated, such as the place directly adjacent to furnace of a steel mill, ammoniac fertilizer factory, synthetic fiber factory, coking mill, paper/pulp mill, etc. For details, contact your YASKAWA representative.

6. If installed in an area of excessively dusty locations, special precautions must be taken (e.g. the whole control panel must be of dust-proof construction). For details, contact your YASKAWA representative.

7. Megger test or withstand voltage test must not be performed on the module. When these tests are made on the module cables, plug-in printed board must be removed. It is not necessary to disconnect the external wiring.

# VS SYSTEM MODULE INDIVIDUAL SPECIFICATIONS AND CHARACTERISTICS

## SOFT STARTERS A/B TYPE JGSM-01/02

Soft starter gives linear acceleration/deceleration control to the command signal within a limited time range so that no harmful shock will result from motor starting/stopping operation or abrupt change of speed. Two types of starters (A and B) are available according to adjustable range of acceleration/deceleration time: 1.5 to 30 seconds with A and 5 to 90 seconds with B.

They incorporate function of quick stopping, zero command detection, polarity inversion output, and signal output during acceleration/deceleration.

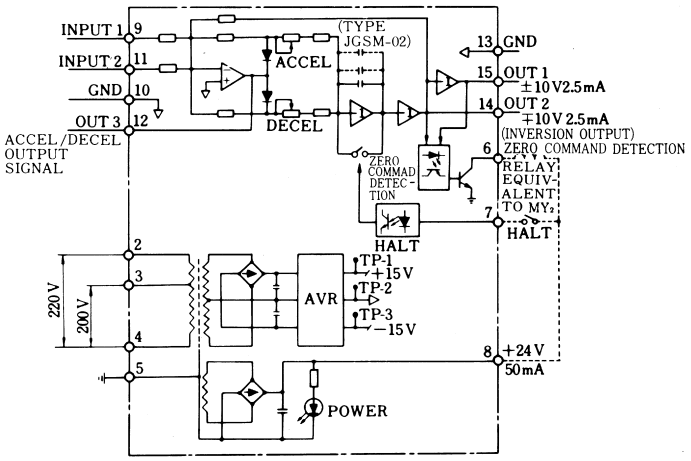



Fig. 1 Block Diagram of Soft Starters A and B, Type JGSM-01 and -02

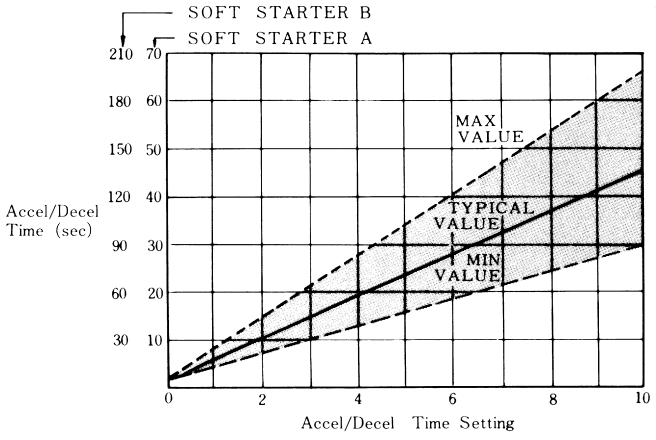



Fig. 2 Accel/Decel Time and Setting

Table 3 Specifications and Characteristics of Soft Starter

| Item | Soft Starter A Type JGSM-01 | Soft Starter B Type JGSM-02 |
|---|---|---|
| Rated input signal voltage | ±10V (Terms. ⑨, ⑪) | |
| Rated input resistance | 20kΩ (Terms. ⑨, ⑪) | |
| Rated input current | 0.5mA (Terms. ⑨, ⑪) | |
| Rated output signal voltage | ±10V at OUT1 ⑮, ∓10V at OUT2 ⑭ | |
| Rated output current | 2.5mA (Terms. ⑮, ⑭) | |
| Rated min load resistance | 4kΩ (Terms. ⑮, ⑭) | |
| Quick stop input voltage | 24V, non-stabilized (Term. ⑦) | |
| Quick stop input current | 10mA (Term. ⑦) | |
| Quick stop input resistance | 2.4kΩ (Term. ⑦) | |
| Accel/Decel time adjustable range | 1.5 to 30sec | 5 to 90sec |
| Accel/Decel time variation (temperature) | ±5%/35℃ | |
| Zero command detection voltage | ±0.5V (Typical value) | |
| Zero output detection sink current | 40mA at term ⑥ (Type MY2 relay made by OMRON) | |
| Quick stop time | 100ms | 300ms |
| Input/output transmission ratio | 1 : 1 at term. ⑮, 1 : −1 at term. ⑭ | |
| Input/output transmission ratio error | ±4% Max | |
| Zero-point offset voltage | ±20mV at −10 to +60℃ | |
| Output voltage at quick stopping | 0.2V Max | |

Note: For AC power supply, environmental and physical specifications, refer to Table 2.

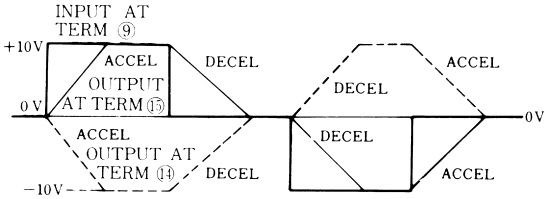



Fig. 3 Acceleration and Deceleration

## APPLICATIONS

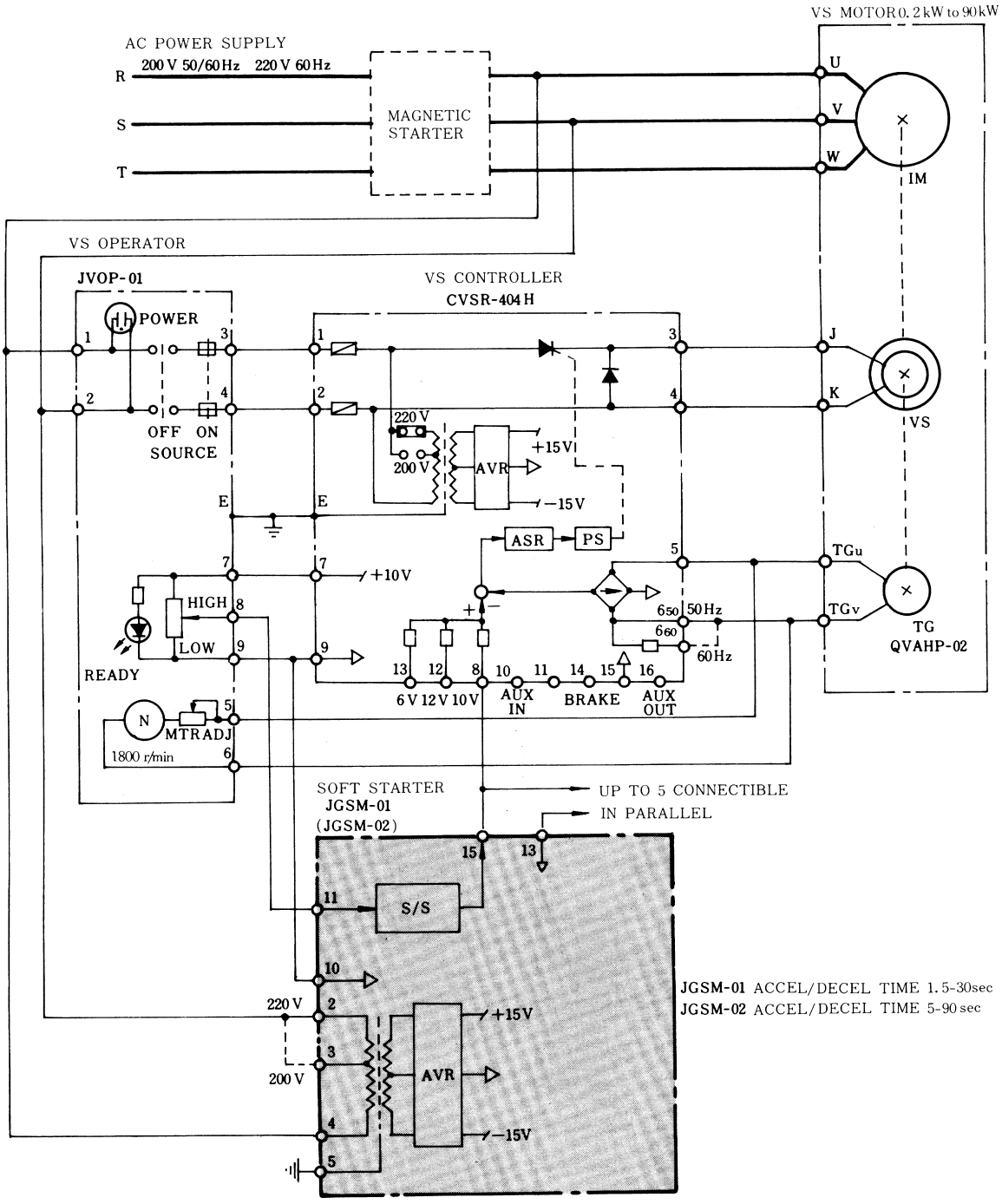



Fig. 4 Cushioned Start, Timed Accel/Decel Drive Circuit of VS Motor

## RATIO SETTERS A/B TYPE JGSM-03/04

Ratio setter A, type JGSM-03, converts current signal to DC voltage and ratio setter B, type JGSM-04, converts frequency signal to DC voltage. Current signal of 4 to 20 mA is given from master speed setter, type JVOP-03, as speed reference signal. Frequency signal of 0 to 2 kHz is supplied from master speed setter, type JVOP-04.

Type JGSM-03 (current input signal) is non-isolation type and type JGSM-04 (frequency input signal) is isolation type. Both types can set five types of ratios and bias voltages of ±30%.

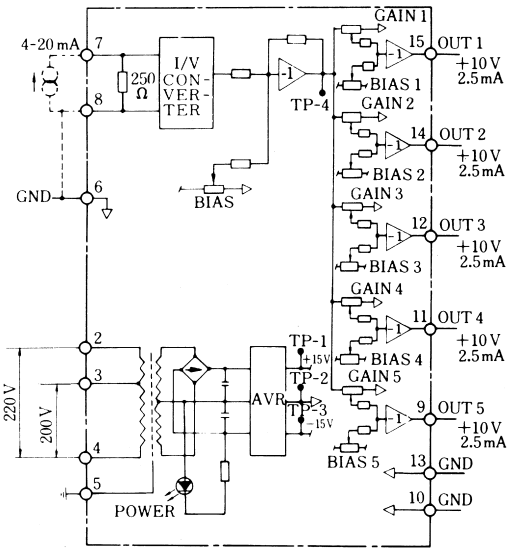



Fig. 5 Block Diagram of Ratio Setter A, Type JGSM-03

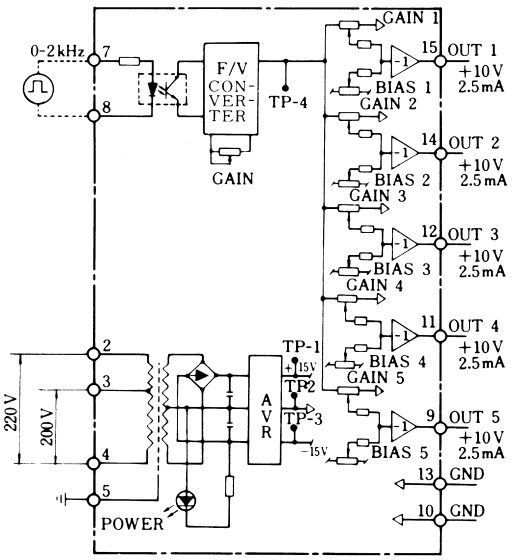



Fig. 6 Block Diagram of Ratio Setter B, Type JGSM-04

Table 4 Specifications and Characteristics of Ratio Setters A and B

| Item | Ratio Setter A Type JGSM-03 | Ratio Setter B Type JGSM-04 |
|---|---|---|
| Rated input signal | 4-20mA (Terms. ⑦-⑧) | 0-2kHz (Terms. ⑦-⑧) |
| Rated input resistance | 250 Ω | 1.2kΩ |
| Signal voltage level | — | H: 8.4VMin L: 1.4VMax |
| Rated output signal voltage | +10V (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) | |
| Rated output current | 2.5mA (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) | |
| Rated min load resistance | 4kΩ (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) | |
| No. of ratios to be set | 5 | |
| Ratio setting range* | 0 to 100% (0 to 170%) | |
| Bias setting range* | ±30% (±50%) | |
| Common mode input voltage range | ±10V | — |
| Common mode rejection ratio | 40dB | — |
| Input/output transmission ratio error | ±2% Max | ±2% Max |
| Input/output linearity | 0.2% Max | 0.2% Max |
| Input/output voltage variation (temperature) | 0.5%/95°F (35℃) | |
| Zero-point offset voltage | ±30mV Max | |
| Zero-point temperature drift | 1mV/℃ Max | |

* For ratings with asterisk, refer to Fig. 7.

Note : For AC power supply, environmental and physical specifications, refer to Table 2.

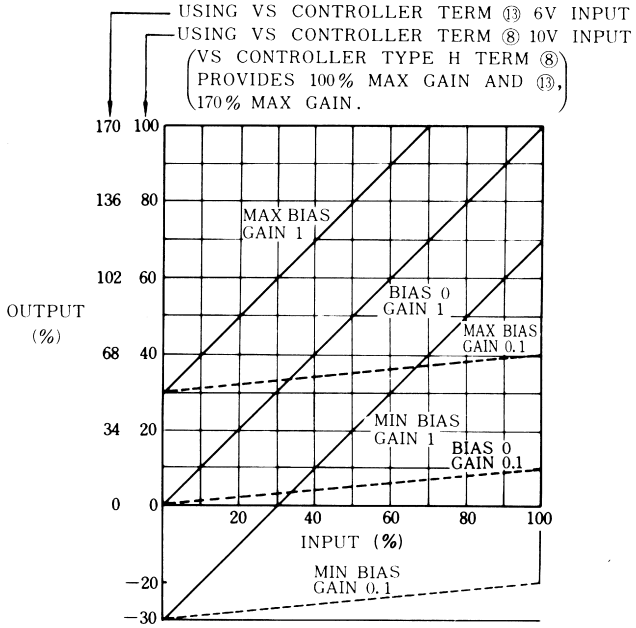



Fig. 7 Characteristics of Ratio and Bias Setting

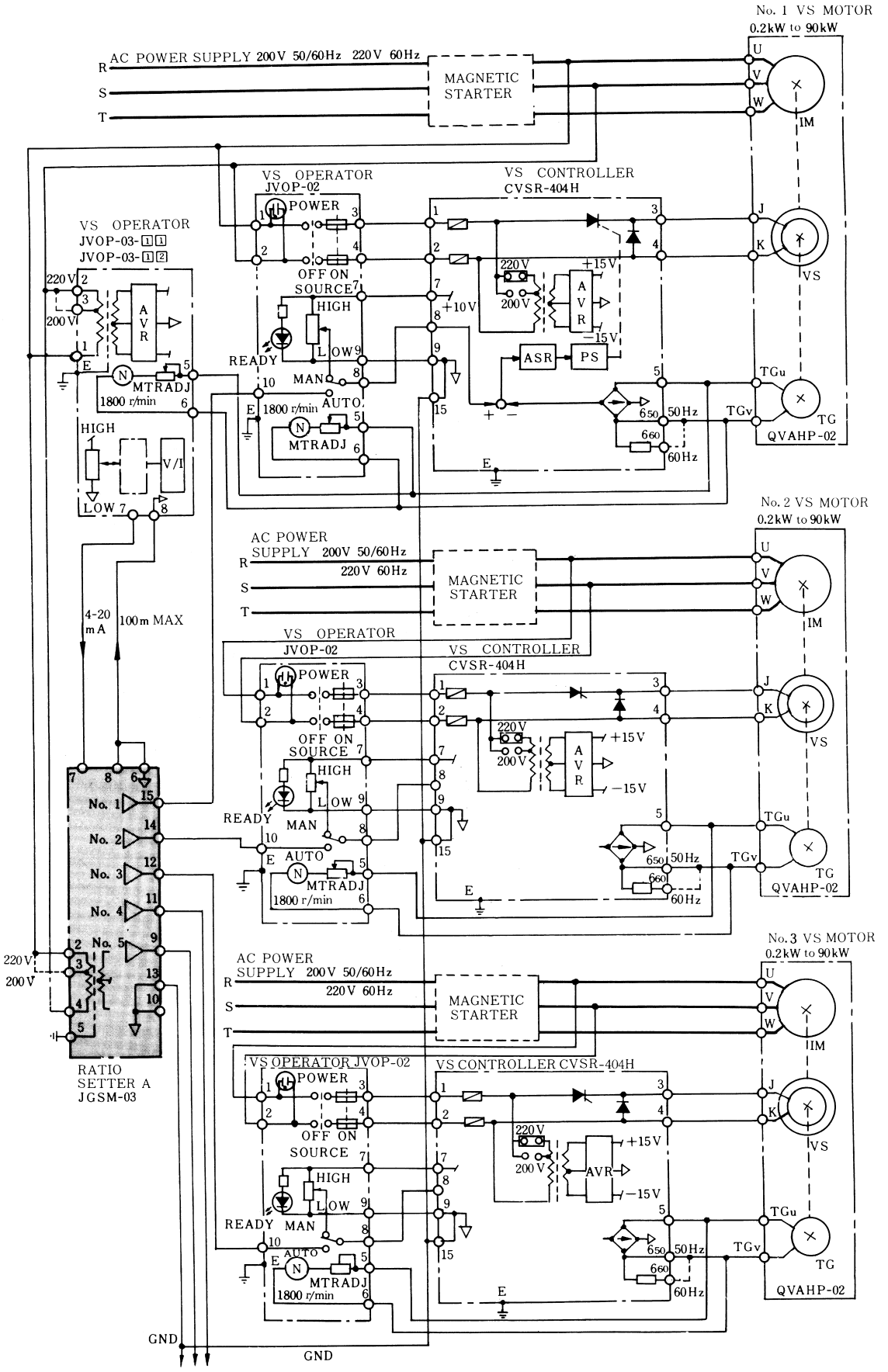



Fig. 8 Ratio Drive Circuit of VS Motor by Use of Ratio Setter A

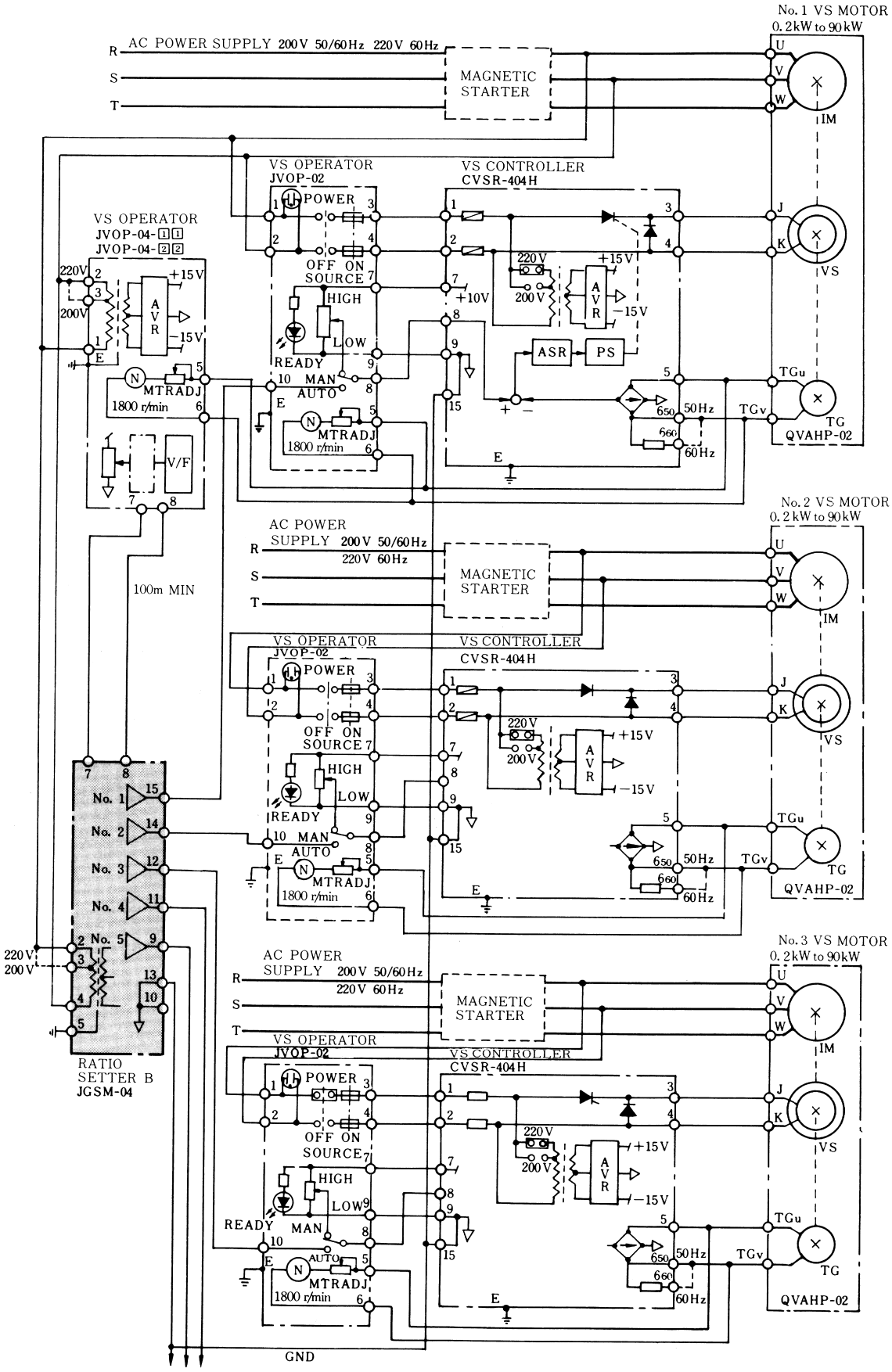



Fig. 9 Ratio Drive Circuit of VS Motor by Use of Ratio Setter B

## FOLLOWER RATIO SETTERS TYPE JGSM-05

Follower ratio setter, type JGSM-05, detects and transforms the frequency signal from AC tach-gen to DC voltage signal. (AC tach-gen is connected to the master machine.) The frequency signal detected eliminates speed fluctuation due to tach-gen output voltage. The follower ratio setter can set five types of ratios and the bias voltage independently within the range of ±30%.

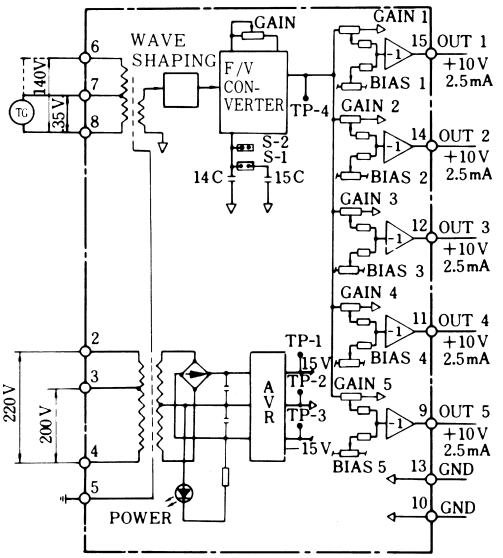



Fig. 10 Block Diagram of Follower Ratio Setter Type JGSM-05

### Types of AC Tachometer Generators and Speed of Master Machine

Selection of the input terminal and the internal short-circuit shunt selector, and GAIN adjustment is made according to the type of AC tach-gen and the speed of master machine.

Table 6 shows types of tach-gen according to VS motor speed and selection of the input terminals.

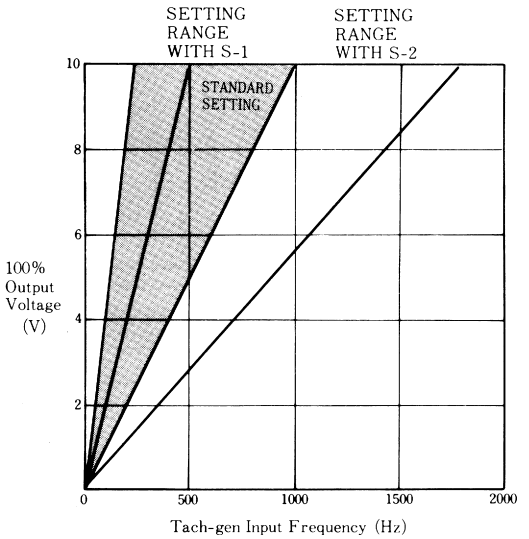



Fig. 11 Gain Setting Range of Follower Ratio Setter

Table 5 Specifications and Characteristics of Follower Ratio Setter

| Item | JGSM-05 |
|---|---|
| Tach-gen rated input voltage | 35VAC (Terms.⑦-⑧), 140VAC (Terms.⑥-⑧) |
| Rated input frequency | 540Hz/1800r/min |
| Applicable tach-gen | See Table 6. |
| Frequency adjustable range | 240Hz to 1800Hz |
| Rated output voltage | +10V (Terms.⑮, ⑭, ⑫, ⑪, ⑨) |
| Rated output current | 2.5mA (Terms.⑮, ⑭, ⑫, ⑪, ⑨) |
| Rated min load resistance | 4 kΩ |
| No. of ratios to be set | 5 |
| Ratio setting range* | 0 to 100% (0 to 170%) |
| Bias setting range* | ±30% (±50%) |
| Input/output transmission range | 10V/240Hz to 10V/1800Hz |
| Input/output linearity | 0.2%Max |
| Input/output voltage variation (temperature) | ±0.5%/95°F (35℃) |
| Zero-point offset voltage | ±30mV Max |
| Zero-point temperature drift | 1mV/℃ Max |

* For ratings with asterisk, refer to Fig. 7.
Note : For AC power supply, environmental and physical specifications, refer to Table 2.

Table 6 Tach-gen for Follower Ratio Setter and Master Motor Speed

| Tach-gen Type QVAH | Tach-gen rated output / Master motor rated speed r/min | VS Motor 60Hz 1650 | VS Motor 60Hz 1500 | VS Motor 50Hz 1350 | VS Motor 50Hz 1200 |
|---|---|---|---|---|---|
| -2B 10-3B -4B | 35V 720Hz 1800r/min | 32V 660Hz | 29V 600Hz | 26V 540Hz | 23V 480Hz |
| 02-2B -3B | 35V 720Hz 1800r/min | | | | |
| 02-1B | 35V 540Hz 1800r/min | 32V 495Hz | 29V 450Hz | 26V 405Hz | 23V 360Hz |
| QVAHP 02-1B | 35V 540Hz 1800r/min | | | | |
| 10 | 35V (70V) 500Hz 2500r/min | 23V 330Hz | 21V 300Hz | 19V 270Hz | 17V 240Hz |
| 10TB | 70V 1000Hz 2500r/min | 58V 825Hz | 53V 750Hz | 47V 675Hz | 42V 600Hz |
| 20 | 140V 1000Hz 2000r/min | 116V 825Hz | 105V 750Hz | 95V 675Hz | 84V 600Hz |

Note : For tach-gen listed in shaded area, follower ratio setter input terminals ⑦ and ⑧ are used and short-circuit shunt is set for S—1. For tach-gen in unshaded area, input terminals ⑥ and ⑧ are used and short-circuit shunt is changed to S—2.

## APPLICATIONS

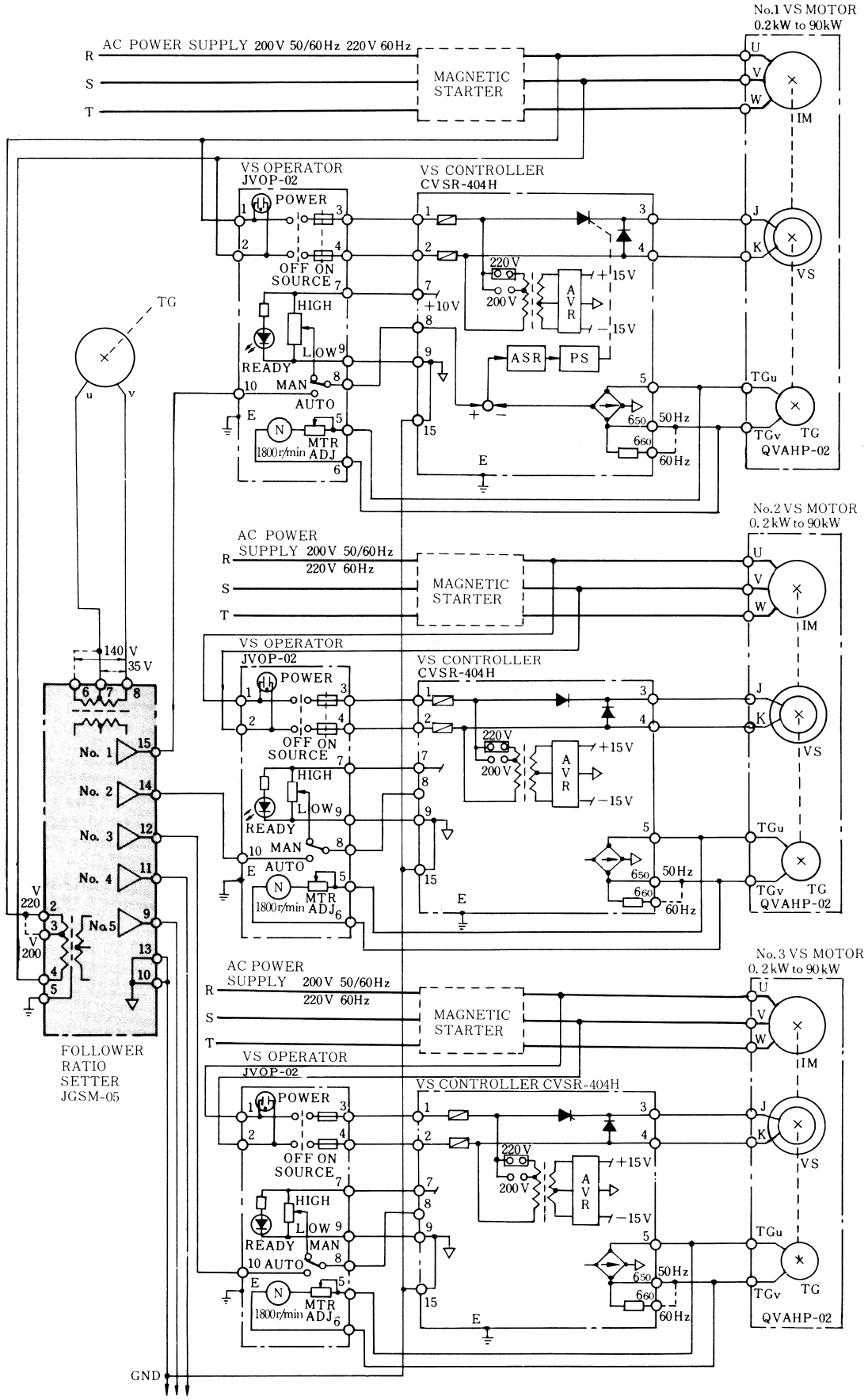



Fig. 12 Follower Ratio Drive Circuit of VS Motor

## POSITION CONTROLLERS TYPE JGSM-06

Position controller type JGSM-06 converts the mechanically rotating angle (±60°) to DC voltage signal. The angle is detected by the synchro transmitter (selsyn) built in the displacement detector type YVGC-500W.

It has functions of two arithmetic operations of addition and subtraction, such as adding bias voltage and taking out the signal which deviates from the position command signal.

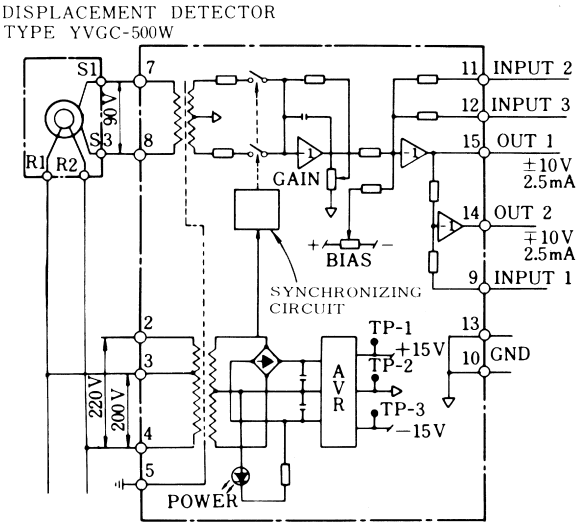



Fig. 13 Block Diagram of Position Controller Type JGSM-06

Table 7 Specifications and Characteristics of Position Controller

| Item | Type JGSM-06 |
|---|---|
| Applicable detector(2) | Type YVGC-500W |
| Rotation angle input voltage | 90VAC ±10%, 50/60Hz (Terms. ⑦-⑧) |
| Synchro rotating angle | ±60° |
| Rated output voltage(1) | ±10V at term. ⑮, ∓10V at term. ⑭ |
| Rated output current | 2.5mA (Terms. ⑮, ⑭) |
| Rated min load resistance | 4kΩ |
| Rated addition/subtraction input voltage (3) | ±10V (Terms. ⑨, ⑪, ⑫) |
| Rated addition/subtraction input resistance | 20kΩ |
| Rated input/output transmission ratio | 7.8V/60° |
| Input/output transmission ratio adjustable range | 7.8V/20° to 1.6V/60° |
| Bias voltage adjustable range | ±3.0V |
| Zero-point offset voltage | ±20mV Max |
| Zero-point temperature drift | ±10mV/95°F (35℃) |

Notes : 1. For AC power supply, environmental and physical specifications, refer to Table 2.
2. When synchro generator alone is used, refer to page 9.
3. When rotation is in the clockwise direction as shown in the block diagram, plus voltage appears at terminal ⑮ and minus voltage at terminal ⑭.

Apply the input voltage to terminal ⑪ or ⑫ when polarity of position command is positive and apply the input voltage to terminal ⑨ when the command polarity is negative.

For the command for VS controller, terminal ⑭ is used.

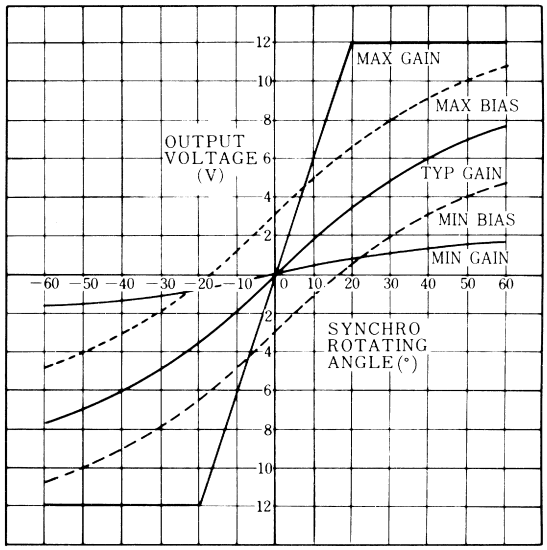



Fig. 14 Input/Output Characteristics

### Direction of Rotation and Polarity of Detected Voltage

Fig. 15 shows the example of connections between the position controller and displacement detector type YVGC-500W. It indicates that direction of detector rotation is clockwise. Plus voltage and minus voltage appear at terminal ⑮ and ⑭, respectively.

To reverse polarity, reverse the connections to terminals ⑦ and ⑧, or the connections to terminals ③ and ④. The direction of rotation of the drive system, polarities of command voltage and detected voltage should be fully checked before starting, so that the control system becomes a negative feedback system. The polarity of the signal should be checked when a synchro transmitter alone is connected to the machine.

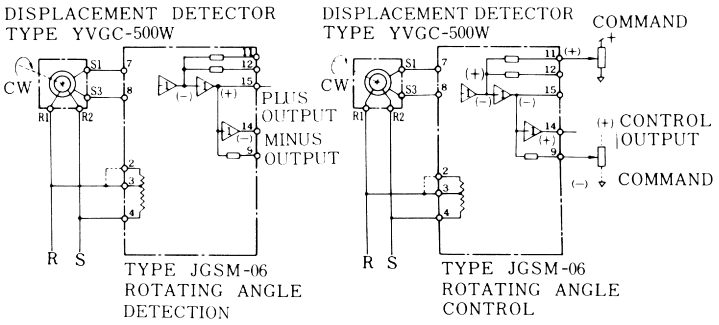



Fig. 15 Rotating Angle Control

## APPLICATIONS

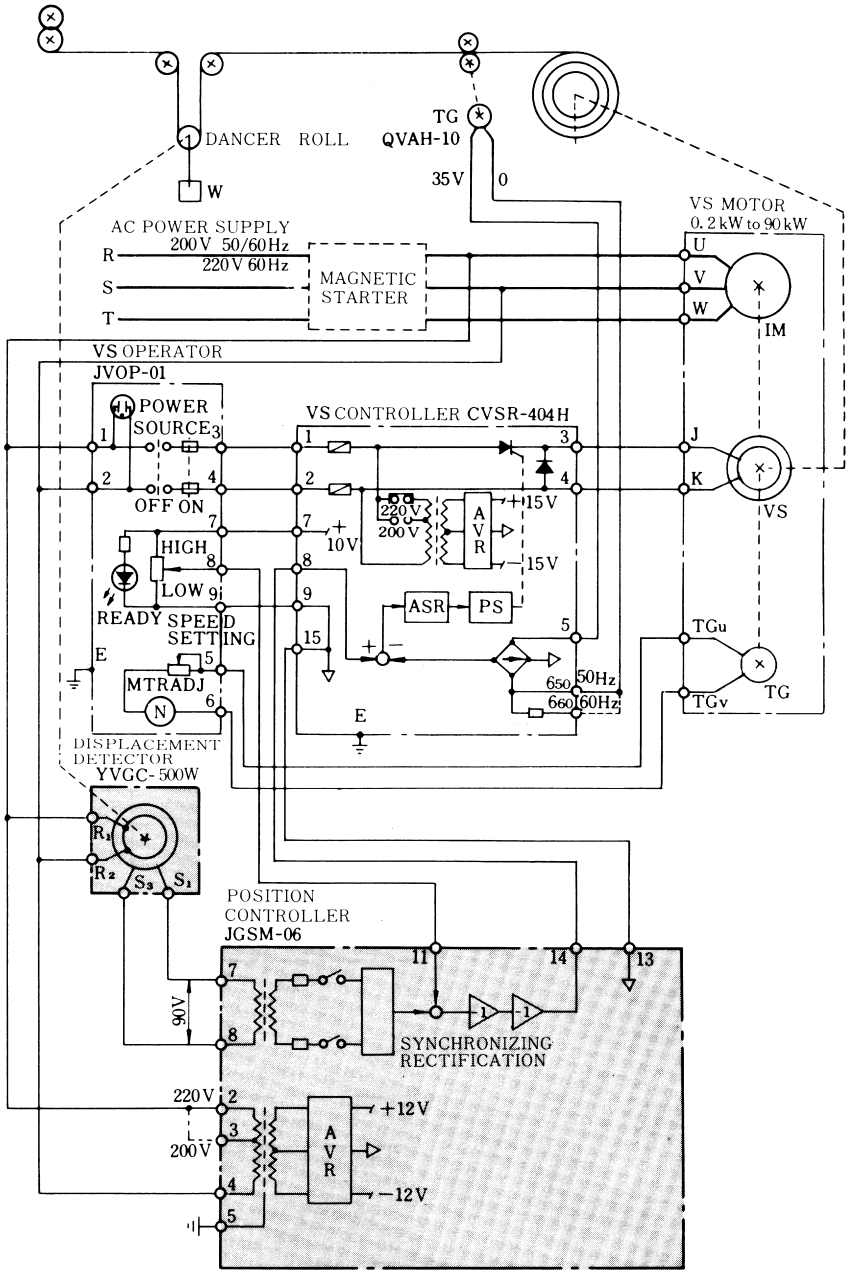



Fig. 16 Wind-up Control Circuit with Dancer Roll

## Displacement Detectors and Synchro Transmitters

### Displacement Detector Type YVGC-500W

Displacement detector type YVGC-500W houses a synchro transmitter type TS 5N2 and two limit switches for detecting upper and lower limits in a cast iron casing.

The detector input shaft is linked with synchro transmitter shaft with gear ratio of 1 : 1 inside the casing. It is directly connected to the machine through the input shaft. The detector is adjusted so that the output voltage across the secondary output terminals (S1) and (S3) is zero when the input shaft is positioned at zero on the dial scale.

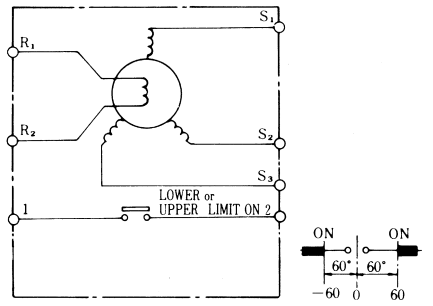



Fig. 17 Block Diagram of Displacement Detector Type YVGC-500W

### Synchro Trasmitters

When the synchro transmitter alone is used in place of the displacement detector, use the one listed in Table 10. The transmitter is available on order.

Table 8 Specifications and Characteristics of Displacement Detector

| Item | Type YVGC-500W |
|---|---|
| Enclosure | Dripproof, Dustproof type |
| Primary voltage | 200V at 50Hz, 220V at 60Hz |
| Secondary voltage | 90V±3V (with 90° displacement angle) |
| Operational displacement angle (1) | ±60° |
| Max displacement angle (2) | ±140° ±10° |
| Max output voltage | 90V/90° |
| Built-in Synchro generator | Type TS5N2E12TX(made by Tamagawa Seiki) |
| | Primariy rotor : Single phase connection |
| | Primary voltage : 200V, 50Hz ; 220V, 60Hz |
| | Secondary stator : Three phase connection |
| | Secondary voltage : 90V ±3V |
| Limit switch | 250VAC 10A (Resistive load) 6A (Inductive load)<br>125V DC 0.6A |

Notes : 1. Operational displacement angle shows the range where the rotating angle of type YVGC-500W and the output voltage of type JGSM-06 make linear change.
2. Maximum displacement angle shows mechanically rotating angle (up to the stopper) of the displacement detector.
3. Required torque is 0.078 N·m.

Table 9 Ratings and Specifications of Explosionproof Type Displacement Detector

| Item | Type YVGCM-500 |
|---|---|
| Enclosure | Explosionproof type |
| Explosion class and ignition group | 1 G3 |
| Location | Class 1 location |
| Electrical specifications | See Table 8. |
| Standard | JIS C 0903<br>Recommended practice for explosion-protected electrical installations in general industries |
| No. of Explosionproof test by Ministry of Labor | No. 10557 |

Table 10 Ratings and Specifications of Synchro Transmitter

| Item | Type TS5N2E12TX (Tamagawa Seiki) | Type 80TX-9002-A01 (Minebea Co., Ltd.) |
|---|---|---|
| Primary voltage and frequency | 200V at 50Hz<br>220V at 60Hz | 200V at 50Hz<br>220V at 60Hz |
| Secondary voltage | 90 ±3V | 90±3V |
| No-load excitation current | 0.17A | 0.13A |
| Torque rate | $0.81\times10^{-3}$N·m/deg min | $0.81\times10^{-3}$N·m/deg min |
| Max torque | — | 600g·cm min |
| Indication error | ±1.0deg max | ±1.0deg max |
| Temperature rise | 30℃ max | 30℃ max |
| Insulation resistance | 10MΩ min (with a 500V megger) | — |
| Dielectric strength | 1500V for a minute | 1500V for a minute |
| Approx Mass | 1.1kg | 1.3kg |

## PID CONTROLLERS TYPE JGSM-07

PID controller type JGSM-07 sets ratio gain, integral time, and differential time for simple process control. For the standard input signal and process feedback signal, current signal (4 - 20 mA) and voltage signal (1 - 5 V) can be used by setting or removing the internal shunt selectors.

The output signal of +10 VDC is used so that it can be connected with the VS system module and VS controller. In addition, PID controller has the following functions.

### Differential Operation

Setting off the differential operation by using the internal shortcircuit pin (S-3: short-circuited, S-4: opened).

### Resetting Integrator

Resetting the integrator output drift in uncontrolled operation.

### Smooth Operation

Providing smooth operation when the standard value makes a sudden change.

### Anti-reset Wind-up Operation

Preventing overshoot due to excessive integrator output by applying a limiter to the integrator output.

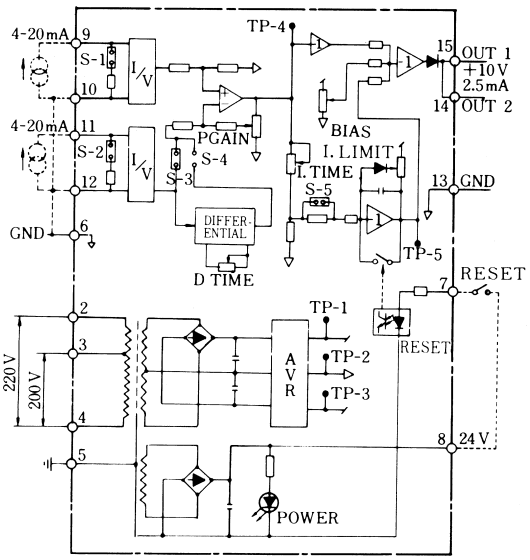



Fig. 18 Block Diagram of PID Controller Type JGSM-07

Table 11 Specifications and Characteristics of PID Controller

| Item | | Type JGSM-07 |
|---|---|---|
| Signal Input Characteristics | Rated current reference signal | 4-20mA across terms.⑨ and ⑩. +: Term.⑨; −: Term.⑩; S-1 short-circuited. |
| | Rated feedback current signal | 4-20mA across terms.⑪ and ⑫. +: Term.⑪; −: Term.⑫; S-2 short-circuited. |
| | Rated feedback input resistance | 250Ω (±1%) |
| | Rated input voltage reference signal | 1-5V across terms.⑨ and ⑩. +: Term.⑨; −: Term.⑩; S-1 opened. |
| | Rated feedback voltage signal | 1-5V across terms.⑪ and ⑫. +: Term.⑪; −: Term.⑫; S-2 opened. |
| | Differential input impedance | 1MΩ min at DC |
| | Common mode input impedance | 1MΩ min at DC |
| | Common mode input voltage | ±10V |
| Output Characteristics | Rated output voltage | +10V (Terms. ⑮ and ⑭.) |
| | Allowable output load current | 2.5mA (Terms.⑭ and ⑮ in common) |
| | Rated min load resistance | 4kΩ |
| | Zero-point offset voltage | ±50mV Max |
| | Zero-point temperature drift | 10mV/35℃ |
| PID Calculation Characteristics | Ratio gain setting range | 0.5 (200%) to 50 (2%) |
| | Integral time setting range | 1 to 10 sec with S-5 shortcircuited |
| | | 10 to 100 sec with S-5 opened |
| | Differential time setting range | 0.1 to 10 sec with S-3 opened, S-4 shortcircuited |
| | | No differential operation with S-3 shortcircuited, S-4 opened. |
| | Differential gain | Approx 10 times. |
| | Integral limitation range | 3V to 10V |
| | Bias voltage setting range | 0 to 7V |
| Reset Input | Reset supply voltage | 24V Non-stabilized (Term.⑧) |
| | Reset input current | 10mA (Term.⑦) |
| | Reset input resistance | 2.4kΩ |

Note : For AC power supply, environmental and physical conditions, refer to Table 2.

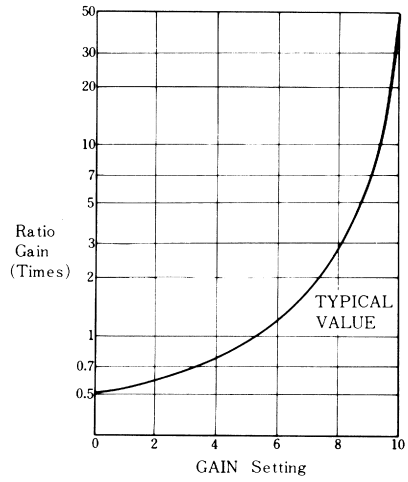



Fig. 19 Ratio Gain Setting Characteristics

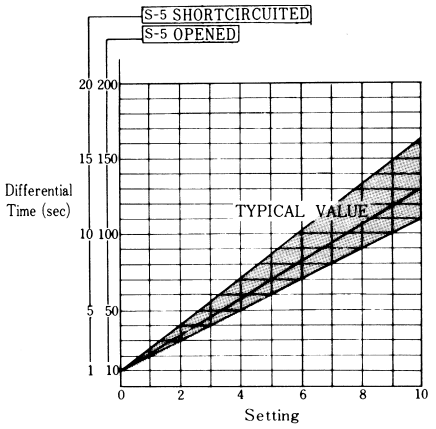



Fig. 20 Integral Time Setting Characteristics

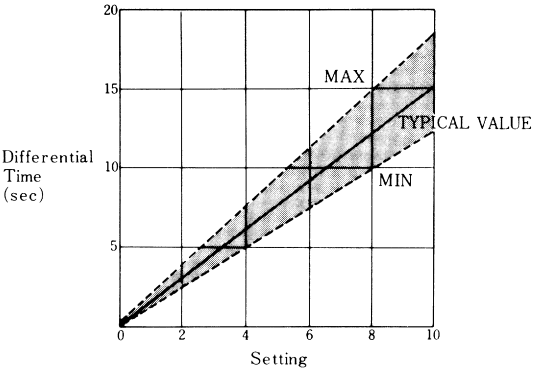



Fig. 21 Differential Time Setting Characteristics

## APPLICATIONS

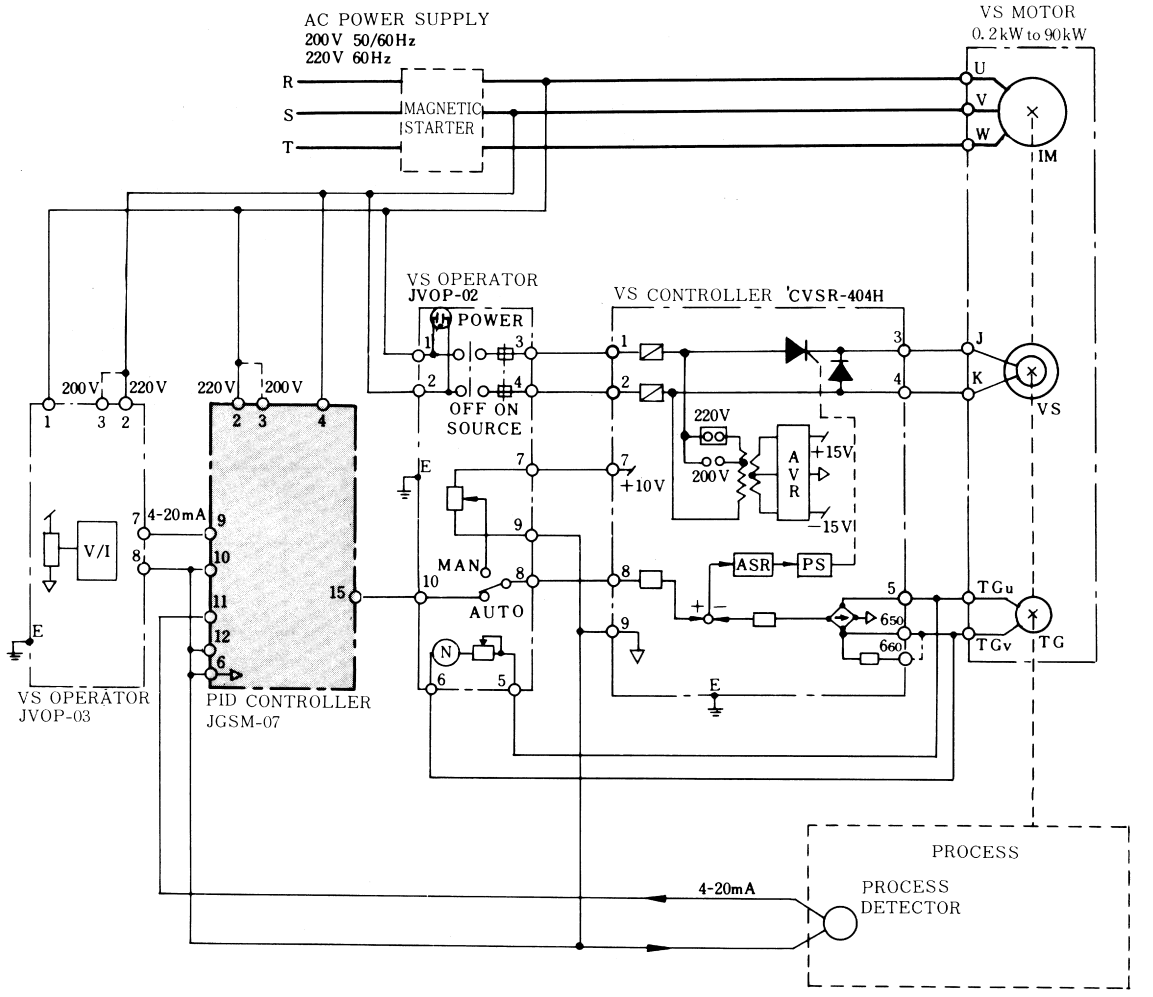



Fig. 22 Process Control Circuit by Use of PID Controller

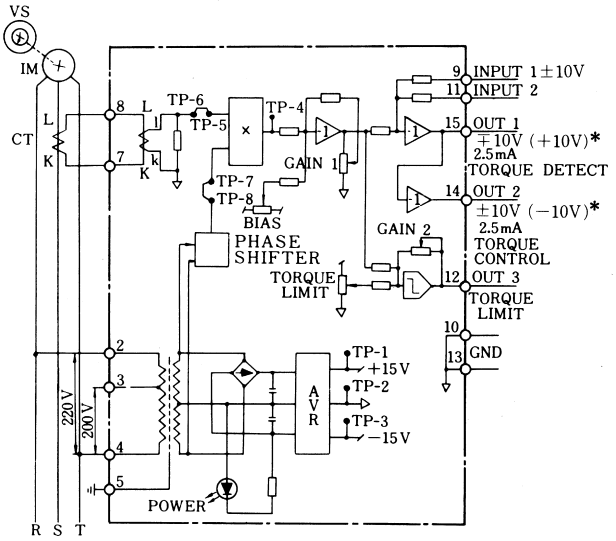
## TORQUE CONTROLLERS TYPE JGSM-08

Torque controller type JGSM-08 calculates VS motor equivalent output torque from input power of VS motor prime mover. The output torque is obtained from output power which is the result of deducting mechanical loss, iron loss and eddy current loss of the VS motor from input power calculated from the product of voltage and current applied to VS motor prime mover.

The torque controller contains an amplifier which detects the deviation from torque command and a comparator which detects the deviation from torque limit. Current transformer is selected according to the motor capacity for current detection.

### Current Transformer for the Primary Current Detection

Current transformer (CT) for the primary current detection is selected in accordance with motor output. Refer to Table 13. The current transformer should have a capacity of more than 5 VA and the ratings listed in Table 13 to meet motor output.




*Indicates the polarity of torque detection voltage.

Fig. 23 Block Diagram of Torque Controller Type JGSM-08

Table 12 Specifications and Characteristics of Torque Controller

| Item | | JGSM-08 |
|---|---|---|
| Current Transformer for the Primary Current Detection (CT) | Primary current | According to motor capacity. Refer to Table 13. |
| | Secondary current | 5A |
| | Capacity | 5VA |
| Rated addition/subtraction input voltage | | ±10V (Terms. ⑨, ⑪) |
| Rated addition/subtraction input resistance | | 20kΩ (Terms. ⑨, ⑪) |
| Rated torque detection voltage | | +10V at term. ⑮, −10V at term. ⑭ |
| Rated calculation output voltage | | ±10V (OUT2 ⑭), ∓10 (OUT1 ⑮)† |
| Torque limit output voltage | | +10V at term. ⑫ |
| Rated output current | | 2.5mA (Terms. ⑮, ⑭, ⑫) |
| Rated min load resistance | | 4kΩ (Terms. ⑮, ⑭, ⑫) |
| Torque limit setting range | | 0 to 100% |
| Zero-point offset voltage | | ±20mV Max (Terms. ⑮, ⑭, ⑫) |
| Zero-point temperature drift | | ±1mV/℃ Max |
| Torque calculation accuracy | | ±5% Max |

†When torque command voltage with plus polarity is applied at terminal ⑨ or ⑪, and plus deviation is detected, the output voltage with plus polarity is obtained at terminal ⑭, and the output voltage with negative polarity, at terminal ⑮.

Note :

For AC power supply, environmental and physical specifications, refer to Table 2.

Primary current transformer should be connected to AC power supply with the correct polarity of CT as shown in the block diagram. If it is connected with the reverse polarity, torque detected will be outputted in reversed polarity.

Table 13 Selection of Transformer for Primary Current Detection

| Motor Output kW | Transformer Type UNM-BT-5 Ratings | Motor Output kW | Transformer Type UTM-BT-5 Ratings |
|---|---|---|---|
| 0.2 | 5VA 5/5A | 7.5 | 5VA 40/5A |
| 0.4 | 5VA 5/5A | 11 | 5VA 50/5A |
| 0.75 | 5VA 5/5A | 15 | 5VA 75/5A |
| 1.5 | 5VA 10/5A | 19 | 5VA100/5A |
| 2.2 | 5VA 15/5A | 22 | 5VA100/5A |
| 3.7 | 5VA 20/5A | 30 | 5VA150/5A |
| 5.5 | 5VA 30/5A | 37 | 5VA200/5A |

## APPLICATIONS

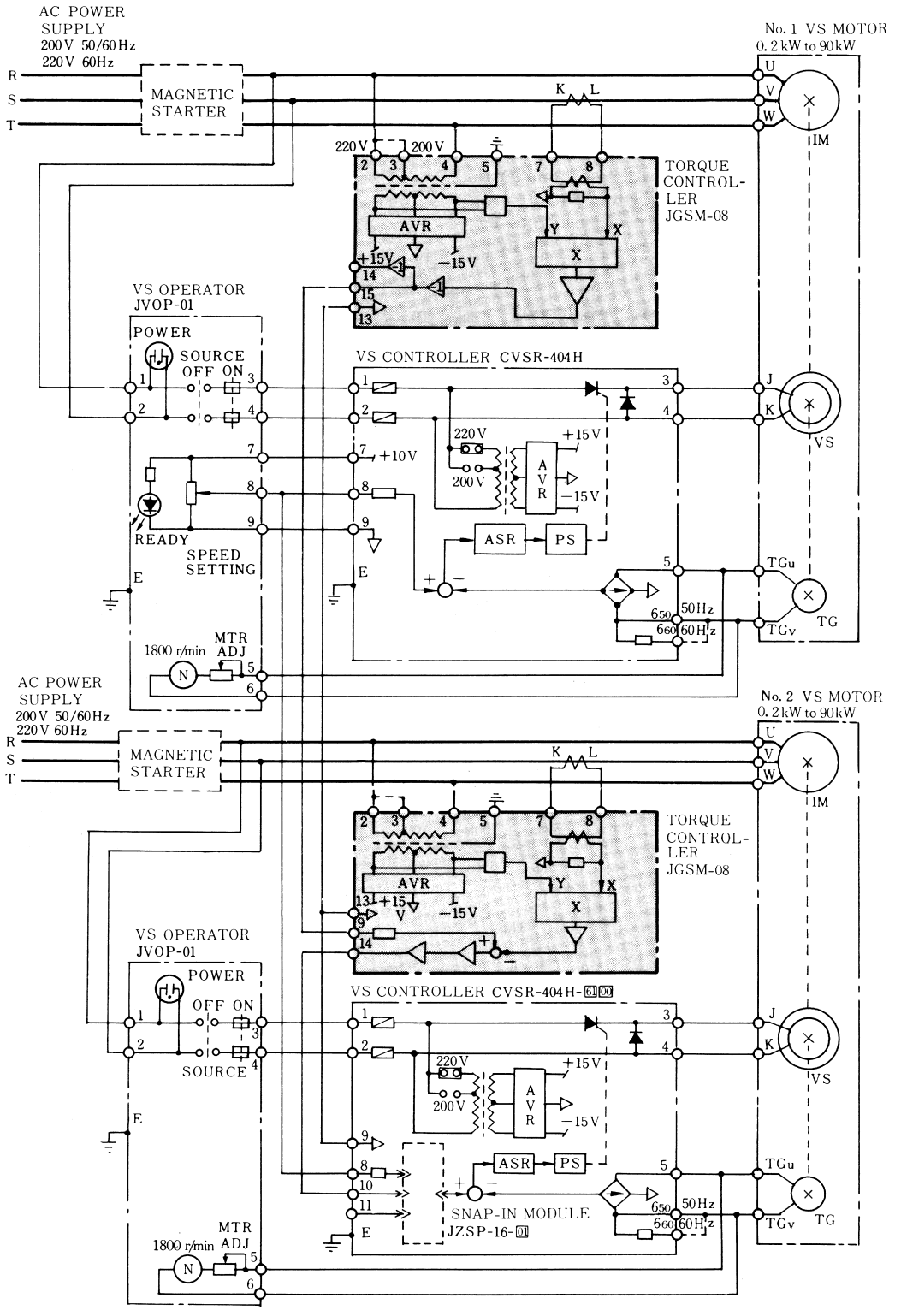
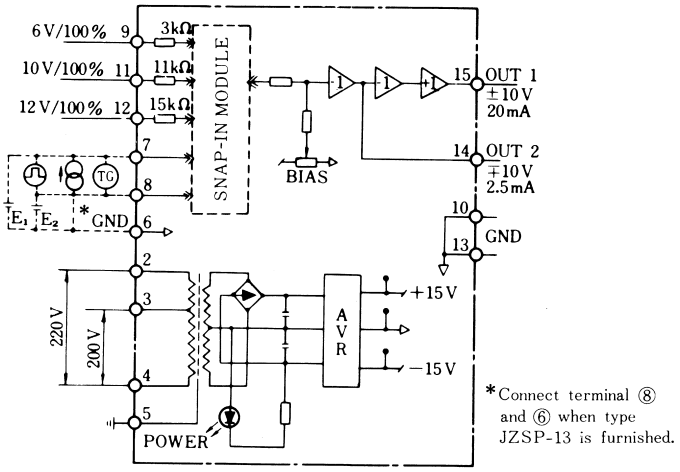



Fig. 24 Load Parallel Drive Circuit by Use of Torque Controller

## PREAMPLIFIERS TYPE JGSM-09-□□
## POWER AMPLIFIERS TYPE JGSM-11-□□

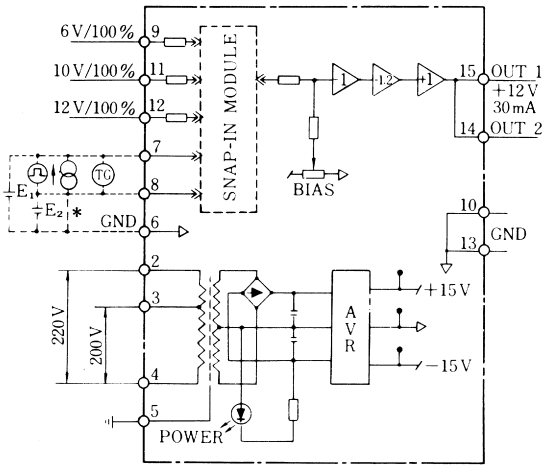
When preamplifier type JGSM-09 and power amplifier type JGSM-11 are combined with VS snap-in modules, they acquire the function of the module, and amplify its output power.

Type JGSM-11 serves as the interface when the conventional VS motor regulators type JRCV-E3B, -F3C are operated in the 10 VDC signal system.




Applicable Snap-in Modules
Type JZSP-00, -11, -12,
-13, -14, -15, -16-01, -16-02

Fig. 25 Block Diagram of
Preamplifier Type JGSM-09-□□




Applicable Snap-in Modules
Type JZSP-00, -11, -12,
-13, -14, -15, -16-01, -16-02

Fig. 26 Block Diagram of
Power Amplifier Type JGSM-11-□□

Table 14 Specifications and Characteristics of Preamplifier and Power Amplifier

| Item | | | Preamplifier Type JGSM-09-□□ | Power Amplifier Type JGSM-11-□□ |
|---|---|---|---|---|
| Rated output voltage | | | ±10V at term. ⑮, ∓10V at term. ⑭ | +12V (Terms. ⑮, ⑭) |
| Rated output current | | | ±20mA at term. ⑮, ∓2.5mA at term. ⑭ | +30mA (Terms. ⑮, ⑭) |
| Rated min load resistance | | | 500Ω at term. ⑮, 4kΩ at term. ⑭ | 400Ω (Terms. ⑮, ⑭) |
| Snap-in Module to be Combined | Functions·Specifications | Shortcircuit board Type JZSP-00 | Power amplifying of input voltage signal | |
| | | Log starter Type JZSP-11 | Log time adjustable in 0.1 to 3 sec. | |
| | | Soft starter Type JZSP-12 | Accel/decel time adjustable in 1.5 to 30 sec. | |
| | | I/V converter Type JZSP-13 | 0-10V/4-20mA | |
| | | F/V converter Type JZSP-14 | 0-10V/0-2kHz | |
| | | Tach-gen follower Type JZSP-15 | 10V at 495Hz (1650r/min) | |
| | | Signal mixer Type JZSP-16-□□ | Increasing/decreasing calculation of voltage signal at term. ⑪ | |
| | Rated input Signal | Shortcircuit board | 6V at term. ⑨, 10V at term. ⑪, 12V at term. ⑫ | |
| | | Log starter | | |
| | | Soft starter | | |
| | | I/V converter | 4-20mA (Terms. ⑦-⑧) | |
| | | F/V converter | 0-2kHz (Terms. ⑦-⑧) | |
| | | Tach-gen follower | 35V, 540Hz/1800r/min (Terms. ⑦-⑧) | |
| | | Signal mixer | 6V at term. ⑨, 10V at term. ⑪, 12V at term. ⑫, 10V at terms. ⑦, ⑧ | |
| | Bias voltage adjustable range | | 0-7V | |
| AC power capacity | | | 4VA | |

Note : For AC power supply, environmental and physical specifications, refer to Table 2.

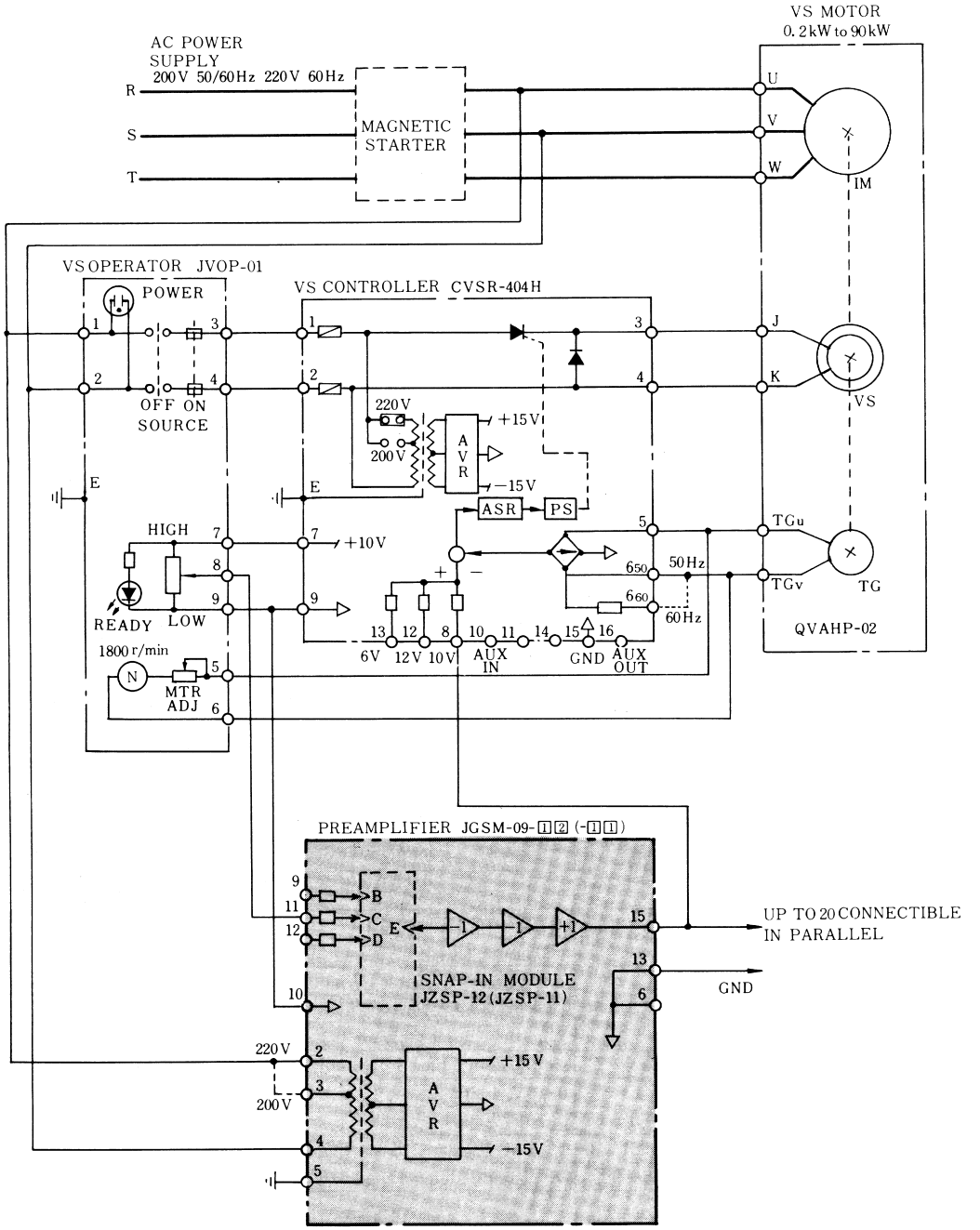



Fig. 27 Timed Start Drive Circuit by Use of Preamplifier Type JGSM-09-□□

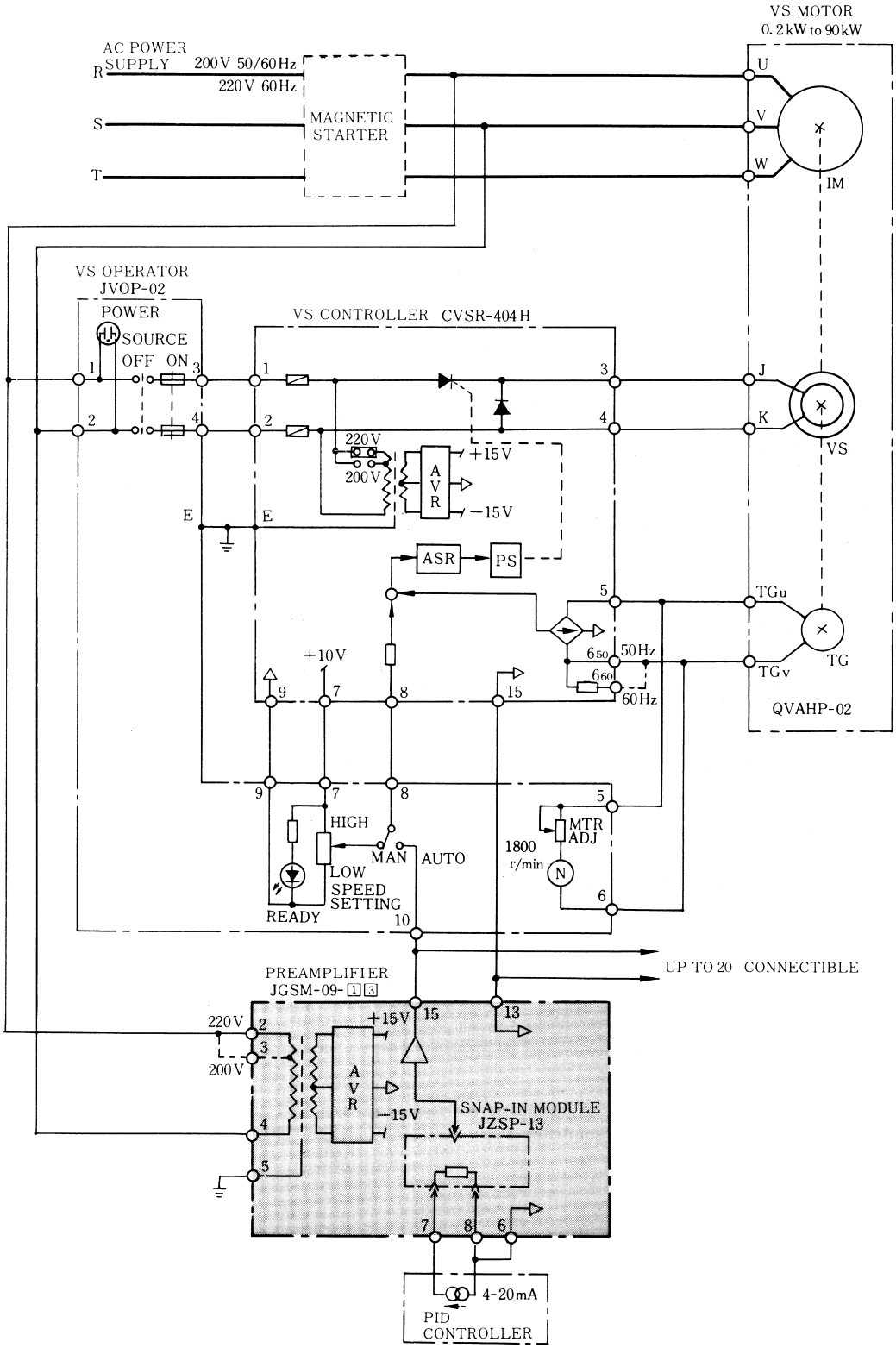



Fig. 28 Example of Interface with Current Signal by Use of Preamplifier Type JGSM-09-[1][3]

## APPLICATIONS (Cont'd)

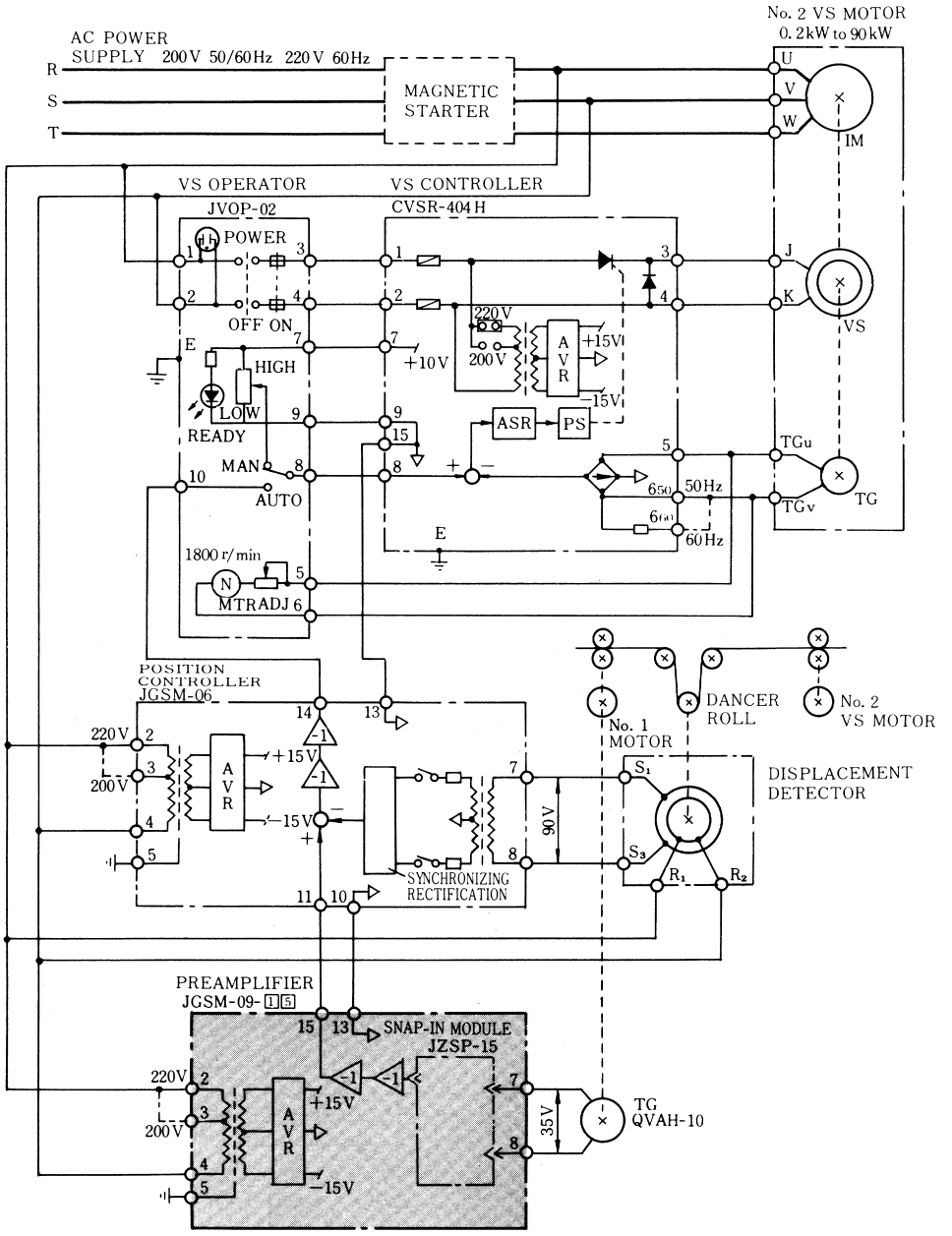



Fig. 29 Follower Drive Circuit by Use of Preamplifier Type JGSM-09-[1][5]

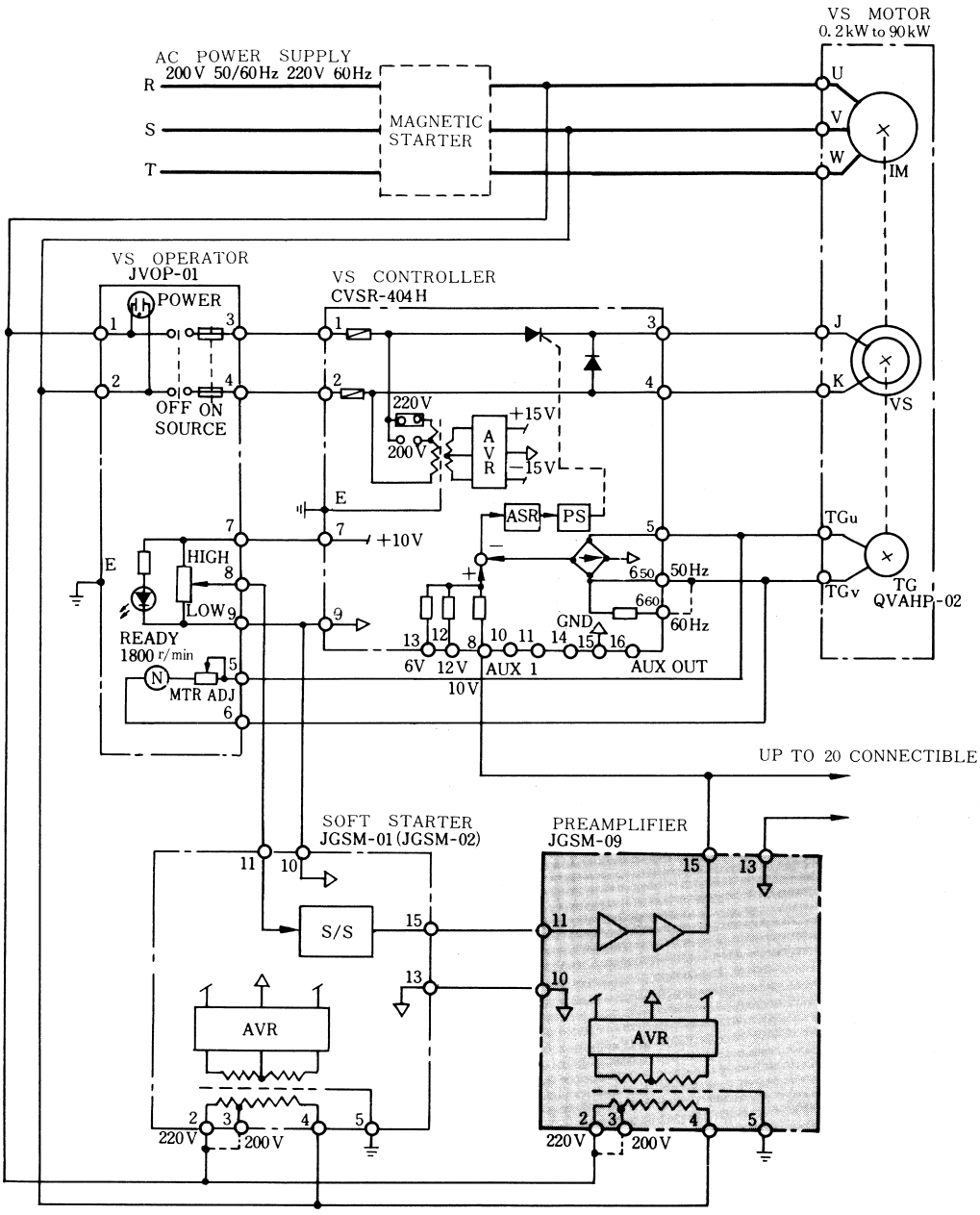



Fig. 30 Where Output Power of Soft Starter Amplified by Use of Preamplifier Type JGSM-09

## APPLICATIONS (Cont'd)

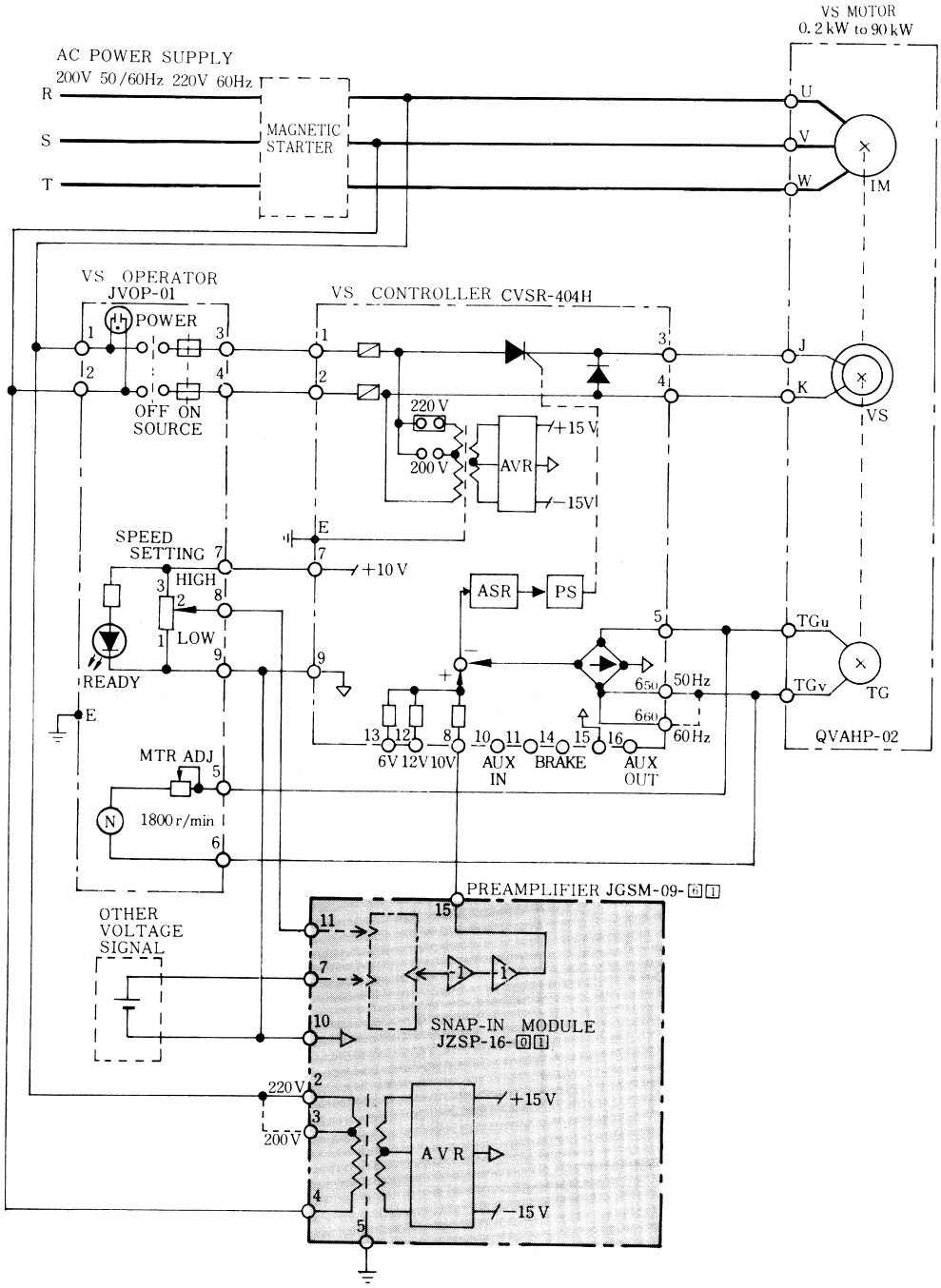



Fig. 31 Increasing Calculation of Voltage Signal by Use of Preamplifier Type JGSM-09-□□

## UP/DOWN SETTERS TYPE JGSM-10B

UP/DOWN setter type JGSM-10B is used in combination with the remote control type VS operator type JVOP-10 to set the motor speed by using UP/DOWN/HALT command of the VS operators from remote or several places.

Acceleration/deceleration time range of 3 to 30 seconds, 12 to 120 seconds, 35 to 350 seconds or 45 to 450 seconds can be selected by switching over the shortcircuit shunt selector in the module. Time range of 3 to 30 seconds (connected to (S1)) is selected as standard.

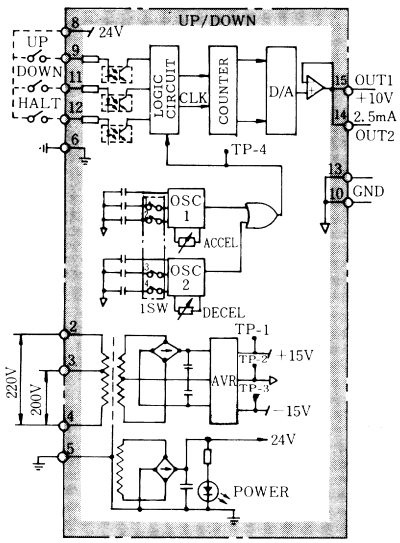



Fig. 32 Block Diagram of UP/DOWN Setter Type JGSM-10B

Table 15 Type Name of Amplifiers When Snap-in Modules Combined

| Snap-in Module to be inserted Type JZSP | Suffix Letter to be added to Type Name of Amplifier | | Function |
|---|---|---|---|
| | Type JGSM-09 | Type JGSM-11 | |
| -00 | -□□ | -□□ | Power amplifier (Shortcircuit board) |
| -11 | -11 | -11 | Log starter |
| -12 | -12 | -12 | Soft starter |
| -13 | -13 | -13 | I/V converter |
| -14 | -14 | -14 | F/V converter |
| -15 | -15 | -15 | Tach-gen follower |
| -16-01 | -61 | -61 | Adder |
| -16-02 | -62 | -62 | Adder/Subtractor |

Note: The last two letters of the type name of the snap-in module to be combined should be recorded in the suffix blanks □□ of amplifier type name as shown listed above. This provides quick reference for correct module for replacement.

### Priority Sequence of Command Signal

HALT, DOWN, and UP are arranged in priority sequence of the input command signal. Accordingly, priority is given to DOWN operation, when UP command and DOWN command are given from two different locations simultaneously.

Table 16 Specifications and Characteristics of UP/DOWN Setter

| Item | JGSM-10 | |
|---|---|---|
| Input command | UP:Term.(9), DOWN:Term.(11), HALT:Term.(12) | |
| Input command voltage | 24V±30% (Terms.(9), (11), (12)) | |
| Rated input current | 10mA (Terms.(9), (10), (12)) | |
| Command supply voltage | 24V±30% at term.(8) | |
| Allowable command output current | 50mA max at term.(8) | |
| Rated output voltage | +10V (Terms.(14), (15)) | |
| Rated output current | 2.5mA (Terms.(14), (15) in common) | |
| Rated min load resistance | 4kΩ (Terms.(14), (15) in common) | |
| Accel/Decel time(1) | 1SW-1, 3:OFF 1SW-2, 4:OFF | 3 to 30 sec |
| | 1SW-1, 3:ON 1SW-2, 4:OFF | 12 to 120 sec |
| | 1SW-1, 3:OFF 1SW-2, 4:ON | 35 to 350 sec |
| | 1SW-1, 3:ON 1SW-2, 4:ON | 45 to 450 sec |
| Quick stop time (HALT) | 200 ms max | |
| Accel/decel time variation (temperature) | ±5%/35°C | |
| Output voltage resolution | 0.1% | |
| Zero-point offset voltage | ±10mV max | |
| Zero-point temperature drift | ±5mV/35°C | |
| Operation during instantaneous power failure | UP/DOWN counter holds the status existing before power failure for up to 80ms. For 150 ms or above, UP/DOWN counter is reset and the output voltage becomes 0V. | |
| AC power capacity | 7VA (Typical value) | |

Notes: 1. Accel/Decel time can be adjusted respectively. Slide switches Nos. 1 to 4 of 1SW are preset to OFF at the factory.

2. For AC power supply, environmental and physical specifications, refer to Table 2.

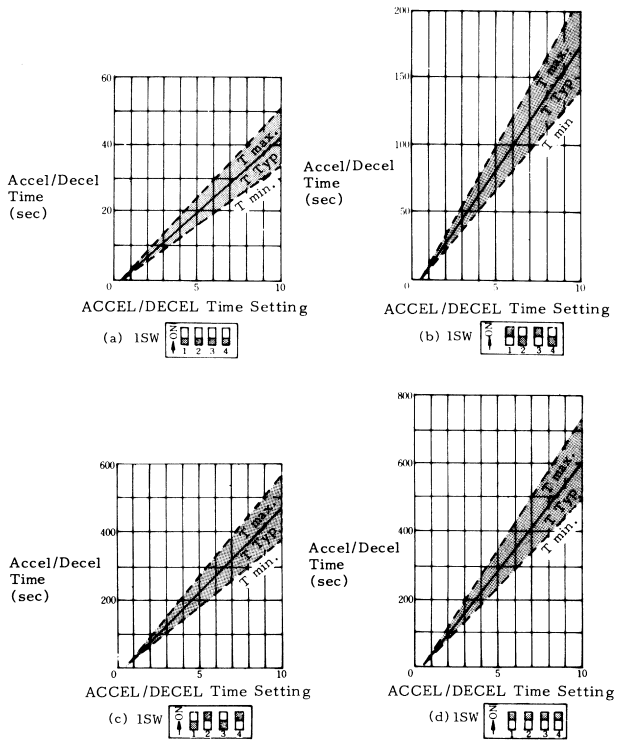



Fig. 33 Accel/Decel Time Characteristics

## APPLICATIONS

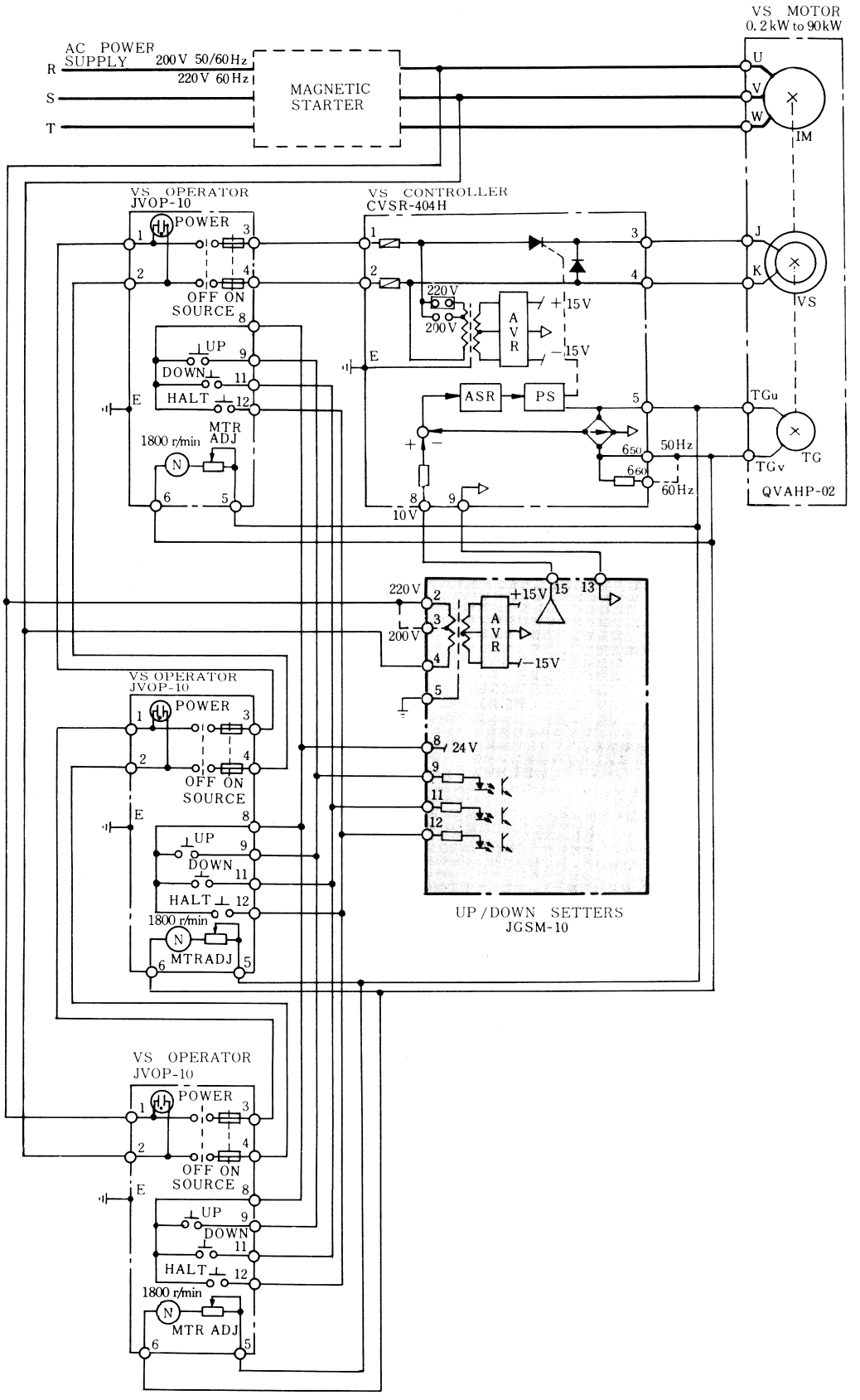



Fig. 34 Multiple Point Control Circuit by Use of UP/DOWN Setters

## OPERATIONAL AMPLIFIERS TYPE JGSM-12-□□

Operational amplifier type JGSM-12-□□ contains two IC circuits of the operational amplifier. Required operational circuits can be composed through various values of operational impedances. Fixed circuits such as power supply and operational amplifier are installed in the basic printed circuit board and the changeable parts of operational impedances are on the plug-in type optional board.

The operational impedance circuit for general purpose use can be supplied by YASKAWA. For other special circuits, contact YASKAWA.

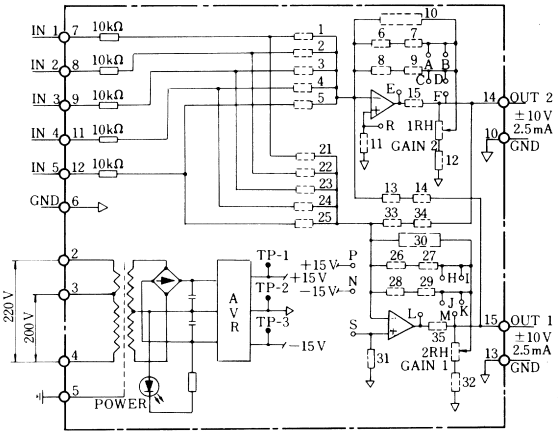



Fig. 35 Block Diagram of Operational Amplifier Type JGSM-12

Table 17 Specifications and Characteristics of Operational Amplifier

| Item | Type JGSM-12-□□ |
|---|---|
| Function | Two circuits of operational amplifier + (operational impedance) |
| Required AC power capacity | 2VA Max |
| Rated input voltage | ±10V (Terms. ⑦, ⑧, ⑨, ⑪, ⑫) |
| Rated input current | ±0.5mA |
| Rated standard input resistance | 20kΩ |
| Rated output voltage | ±10V (Terms. ⑭, ⑮) |
| Rated output current | 2.5mA |
| Rated min load resistance | 4kΩ |

Characteristics of Operational Amplifier

| Item | Symbol | Min. | Typ | Max. |
|---|---|---|---|---|
| Input offset voltage | VIO | — | 1.0mV | 6.0mV |
| VIO temperature characteristic | △VIO/△T | — | 3μV/℃ | — |
| Input offset current | IIO | — | 20mA | 200mA |
| Input bias current | IB | — | 80mA | 500mA |
| Open loop gain | AV | — | 20,000 | 160,000 |
| Two circuit separation | | — | 120dB | — |
| Circuit current (Two circuits) | ICC | — | 3.0mA | 5.6mA |
| Power consumption (Two circuits) | Pα | — | 90mW | 170mW |
| Common mode voltage rejection ratio | CMR | 70dB | 90dB | |
| Power supply voltage rejection ratio | SVR | — | 30μV/V | 150μV/V |
| Max output voltage | Vom | ±10V | ±13V | |
| Input resistance | Ri | 0.3MΩ | 1.0MΩ | |
| Output shortcircuit current | Ishort | 5mA | 20mA | |

Note : For AC power supply, environmental and physical conditions, refer to Table 2.

### Operational Impedances

Yaskawa standard operational impedance circuit is composed of the parts as shown in Table 18.

Table 18 Components for Operational Impedance

| Component Name | Mounting Pitch mm | Type name & Specifications |
|---|---|---|
| Carbon film resistor | 12.5 | ERD-25TJ 1/4W 5% |
| Mettallized film resistor | 12.5 | RN14EK2EF 1/4W 1% |
| Tantalum capacitor | 15, 22.5 27.5 | CS2H1D 0.1-47μF |
| Silicon diode | 12.5 | 1S・953 |
| Metallized film capacitor | 10, 15 22.5, 27.5 | 954M 0.1-10μF |
| Cermet variable resistor | (1RH 2RH) | GFP-122 2 - 20kΩ |
| Jumper wire | | S-IRV 7/0.18 (TA-SC) |
| Polyester carbon capacitor | 12.5 | 501N5002 0.001 - 0.1μF |
| | 0.8 Max of lead hole | |

## Operational Impedance Board

Printed circuits are pre-patterned as shown in Fig. 37. Each impedance board is mounted and soldered at the corresponding address in accordance with the circuit being used.

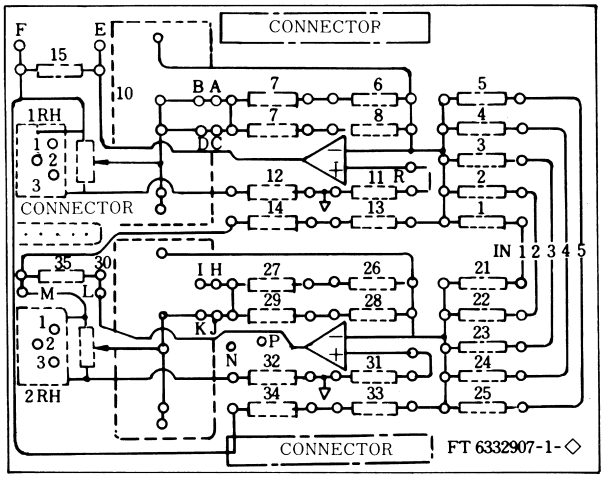


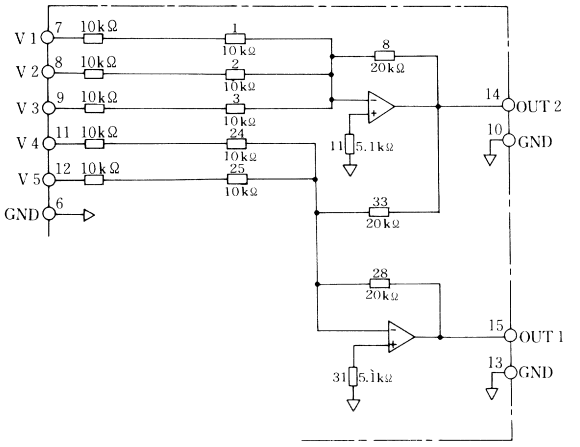

Fig. 36 Functional Block Diagram of Operational Impedance Board

## Standard Circuit

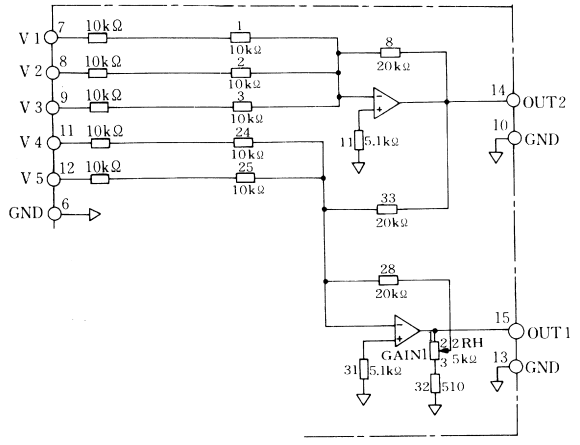
Table 19 Standard Circuit of Operational Amplifier

| Type JGSM-12 | Operational Function |
|---|---|
| -[0][1] | Addition/Subtraction circuit GAIN1<br>Addition input (Terms. ⑦ ⑧ ⑨),<br>Subtraction input (Terms. ⑪ ⑫), output (Term. ⑮) |
| -[0][2] | Addition/Subtraction amplification circuit<br>GAIN1-10<br>Addition input (Terms. ⑦ ⑧ ⑨),<br>Subtraction input (Terms. ⑪ ⑫),<br>output (Term. ⑮) |
| -[0][3] | Positive output absolute value circuit GAIN1<br>Input (Terms. ⑪ ⑫), output (Term. ⑮) |
| -[0][4] | Negative output absolute value circuit<br>Input (Terms. ⑪ ⑫), output (Term. ⑮) |
| -[0][5] | High voltage priority circuit<br>$V_0$ = max ($-V_1$, $-V_2$)<br>Input (Terms. ⑪ ⑫), output (Terms. ⑭ ⑮) |
| -[0][6] | Low voltage priority circuit<br>$V_0$ = min ($-V_1$, $-V_2$)<br>Input (Terms. ⑪ ⑫), output (Terms. ⑭ ⑮) |
| -[0][7] | Voltage selector (begins to work more than normal voltage.)<br>Input (Term. ⑪), normal input (Term. ⑫),<br>output (Term. ⑮) |
| -[0][8] | Voltage selector (begins to work less than normal voltage.)<br>Input (Term. ⑪), normal input (Term. ⑫),<br>output (Term. ⑮) |

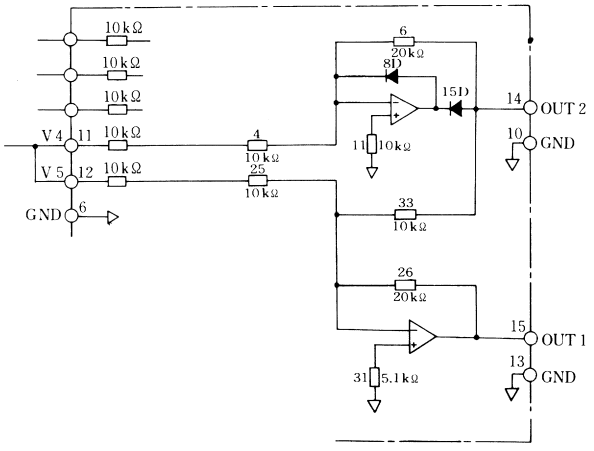
Note : Operational impedance is not mounted in Type JGSM-12-□□.




(a) Addition/Subtraction Circuit (Type JGSM-12-[0][1])

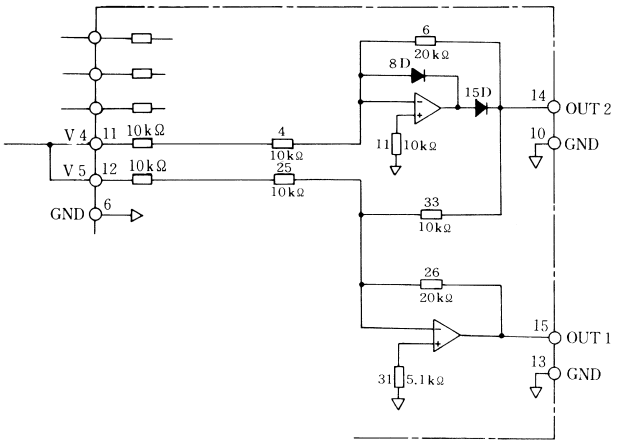



(b) Addition/Subtraction Amplification Circuit (Type JGSM-12-[0][2])

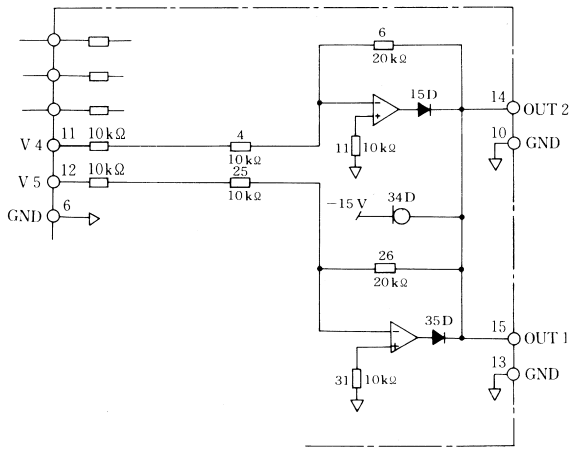



(c) Positive Output Absolute Value Circuit (Type JGSM-12-[0][3])

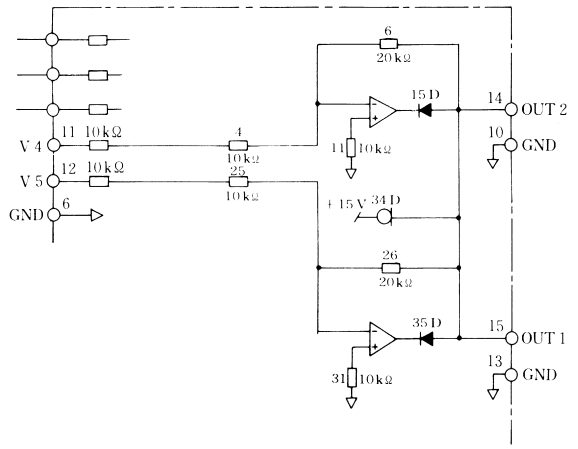
Fig. 37 Standard Circuit of Operational Amplifier



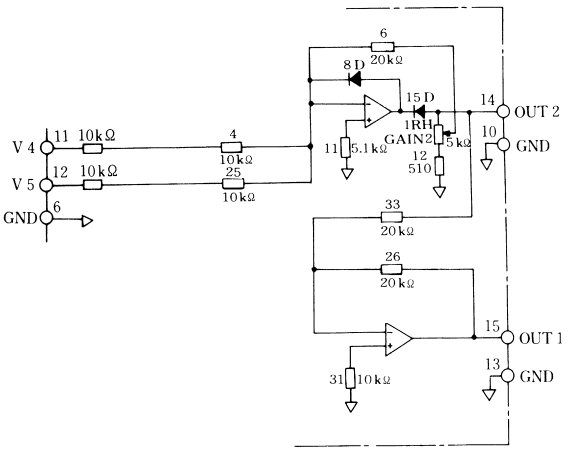

(d) Negative Output Absolute Value Circuit (Type JGSM-12- 0 4)



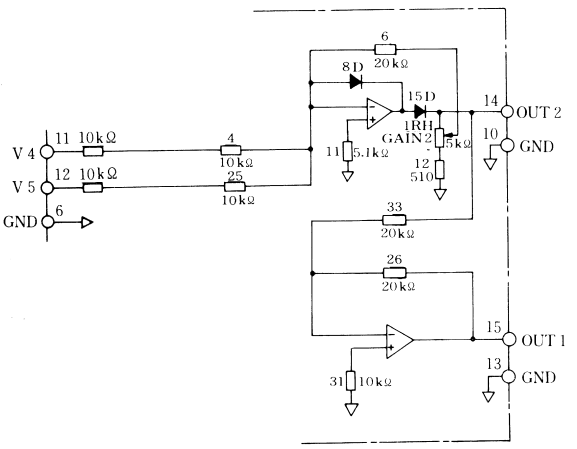

(e) High-Voltage Priority Circuit (Type JGSM-12- 0 5)




(f) Low-Voltage Priority Circuit (Type JGSM-12- 0 6)




(g) Voltage Selector A (Type JGSM-12- 0 7)




(h) Voltage Selector B (Type JGSM-12- 0 8)

Fig. 37 Standard Circuit of Operational Amplifier (Cont'd)

## APPLICATIONS

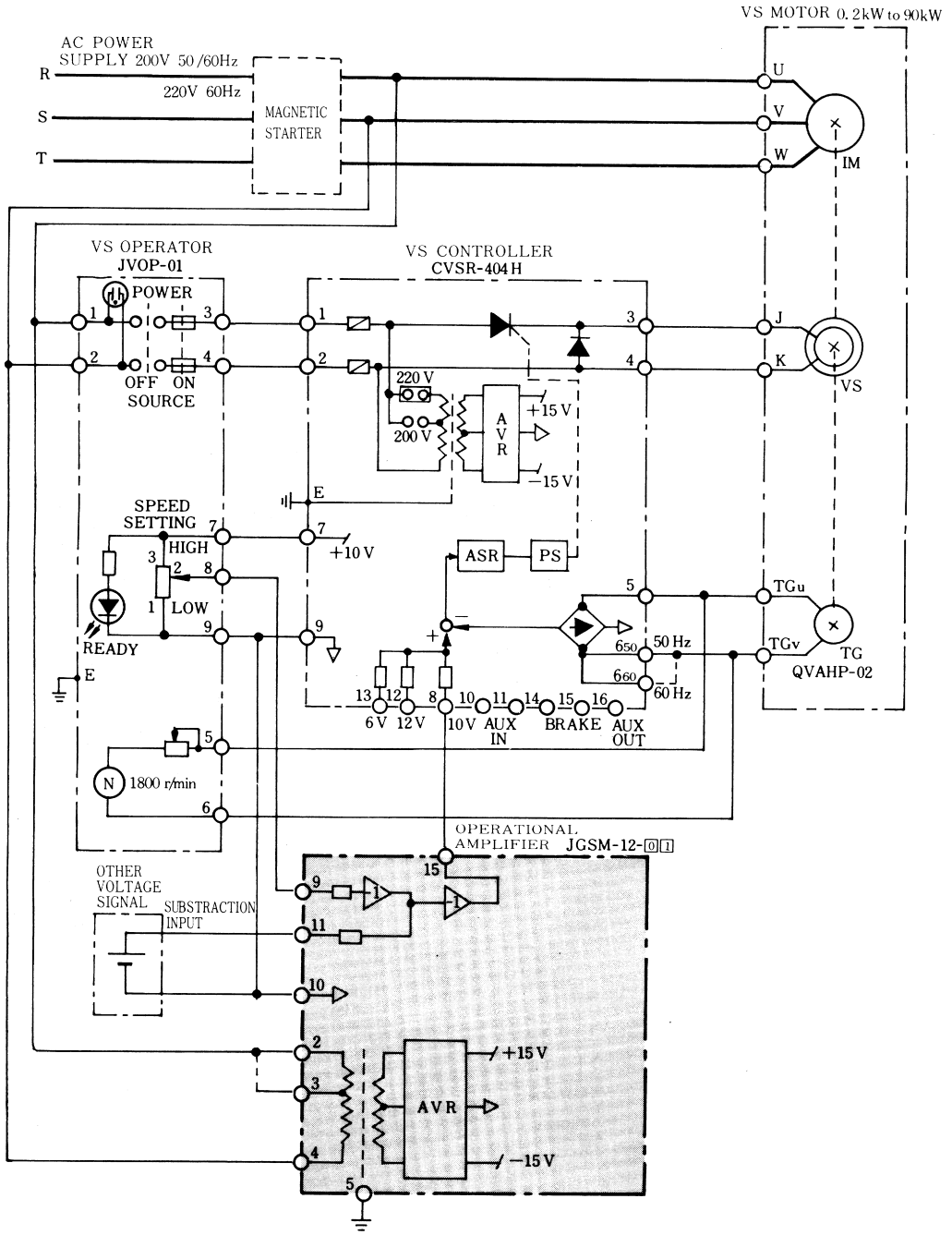



Fig. 38 Decreasing Calculation of Voltage Signal by Use of Operational Amplifier Type JGSM-12-[0] [1]

## SIGNAL SELECTORS A/B TYPE JGSM-13/14

Signal selectors A/B are used as control signal selector circuits. Typical usage is to select automatic operation to manual operation.

Signal selector A, type JGSM-13 consists of power supply for driving relays and two NCNO contact relay circuits. Signal selector B, type JGSM-14 contains three NCNO contact relay circuits and is powered by type JGSM-13. Relay operation is indicated by LED.

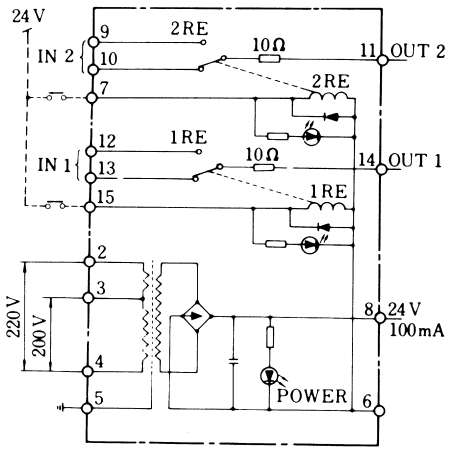



Fig. 39 Block Diagram of Signal Selector A, Type JGSM-13

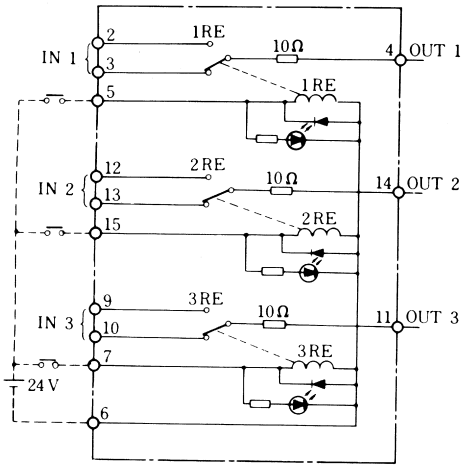



Fig. 40 Block Diagram of Signal Selector B, Type JGSM-14

### Guide to Operation

#### Grounding

Signal selector A, type JGSM-13 should be grounded by use of ground terminal ⑤.

#### Withstand Voltage Test on Relay Contacts

Withstand voltage across relay contacts should be 300 VAC for a minute. The withstand voltage test can be applied to signal lead and sequence circuit of 48 VDC or below.

#### Voltage Applied to Contacts

The same voltage should be applied to NC and NO contacts of the relay. When two signals isolated from each other by a transformer are fed to the NC and NO contacts, both signals should be grounded.

Table 20 Specifications and Characteristics

| Item | Signal Selector A<br>Type JGSM-13 | Signal Selector B<br>Type JGSM-14 |
|---|---|---|
| AC power supply | 7VA Max | — |
| DC output supply voltage | 24V ±30%<br>(Term. ⑧) | — |
| Rated output current | 100mA (Term. ⑧) | — |
| Relay driving capability | 5 circuits | — |
| Relay coil input current | 17mA/1 circuit<br>(Terms. ⑦, ⑮) | 17mA/1 circuit<br>(Terms. ⑤, ⑦, ⑮) |
| Operation indicator | LED ON | LED ON |
| 〈Relays〉 | | |
| Coil rated voltage | 24VDC | |
| Working voltage | 16VDC | |
| Open voltage | 2.4VDC | |
| Max continuous voltage to be applied | 42VDC | |
| Coil resistance | 2kΩ | |
| Contact bounce | 0.5ms | |
| Contact resistance | 60mΩ. Max | |
| Insulation resistance | 100MΩ Min with a 500 VDC megger for a minute or more | |
| Withstand voltage | 300VAC across contacts and coil for a minute | |
| | 1000VAC across coil and contact for a minute | |
| Operation time | Approx 1ms | |
| Reset time | Approx 2ms | |

## APPLICATIONS

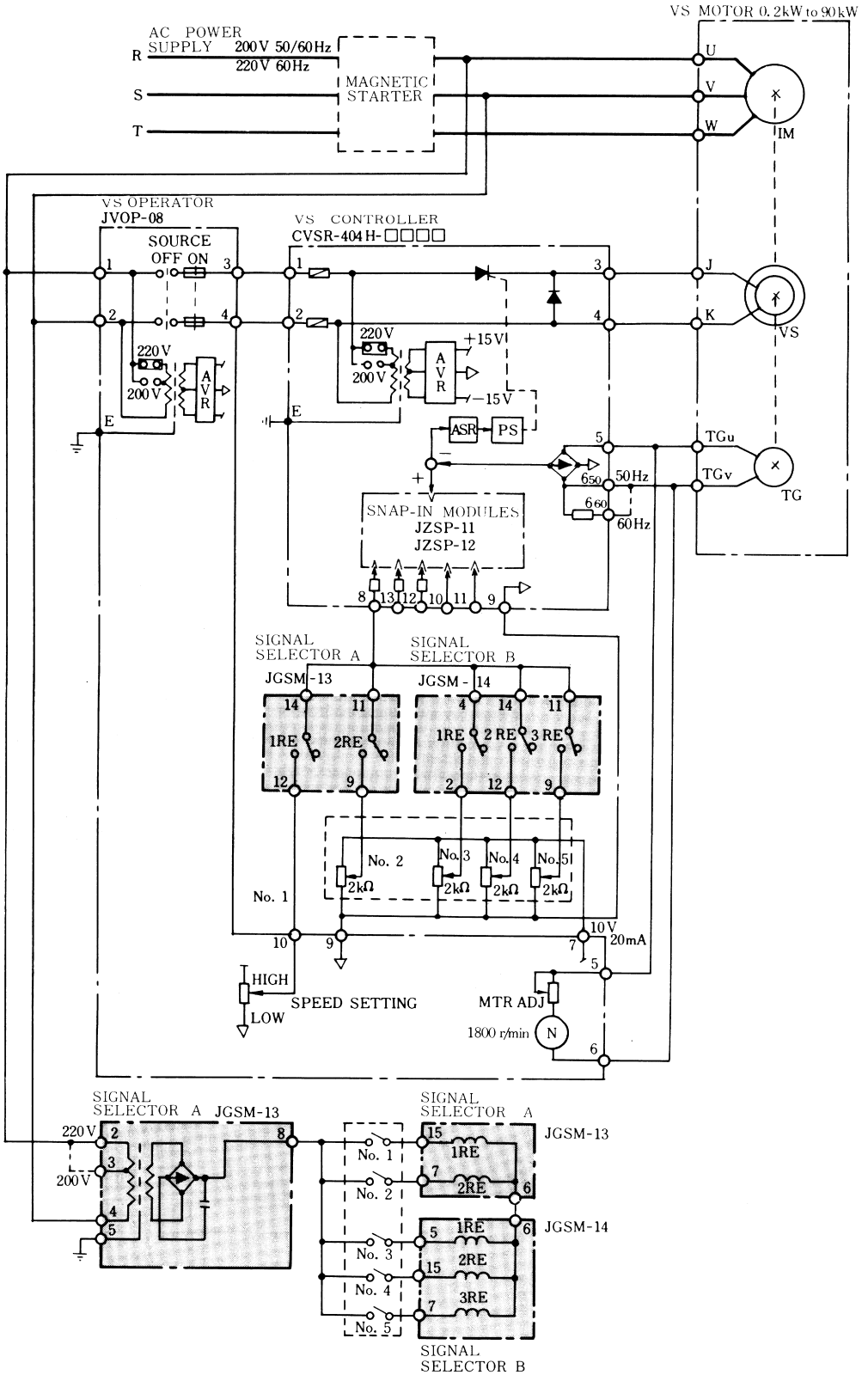



Fig. 41 Selector Circuits of Control Signals Using Signal Selectors

## COMPARATORS TYPE JGSM-15-□□

Comparators type JGSM-15-□□ detect signal levels and compare with two preset signal levels. Results of comparisons drive relays and output in the form of contact signals. Relay contact output has a driving capacity of 220 VAC at 5 A. It is directly connected to an operational sequence circuit of 220 V.

Signal levels to be detected are determined by the snap-in modules combined with the comparator as follows:

DC voltage signal: Type JZSP-00

Addition/Subtraction of DC voltage signal: Type JZSP-16-02

DC current signal: Type JZSP-13

Frequency signal: Type JZSP-14

AC tach-gen signal: Type JZSP-15

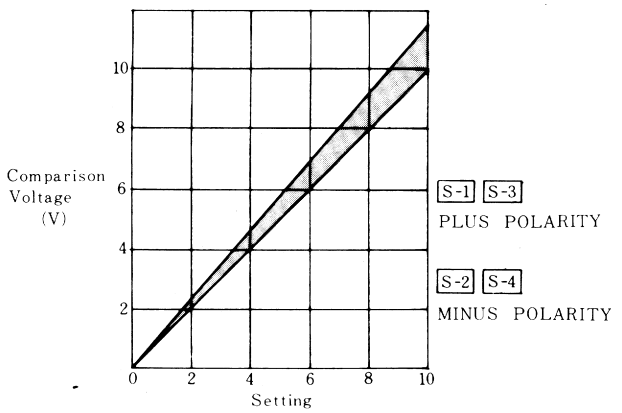
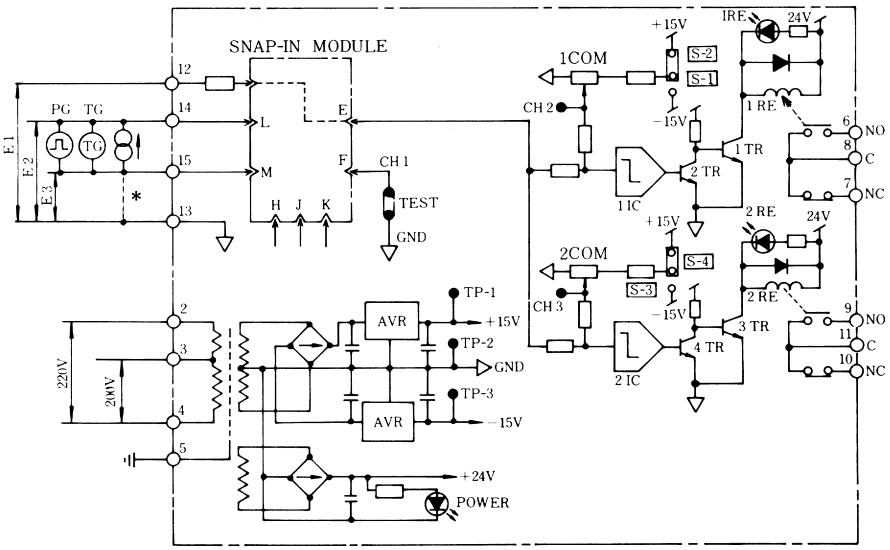



Fig. 42 Setting Characteristics of 1COM, 2COM

Table 21 Specifications and Characteristics of Comparator

| Item | | | Comparator Type JGSM-15-□□ |
|---|---|---|---|
| Input Signals | DC voltage signal | | ±10 V (Terms. ⑫—⑬), with Type JZSP-00 |
| | Addition/subtraction of DC voltage | | ±10 V (Terms. ⑫, ⑭, ⑮—⑬), with Type JZSP-16-02 |
| | Current signal | | 4 To 20 mA (Terms. ⑭—⑮), with Type JZSP-13 |
| | Frequency signal | | 0 To 2 kHz (Terms. ⑭—⑮), with Type JZSP-14 |
| | AC tach-gen signal | | 35V/1800r/min, 540Hz (Terms. ⑭—⑮), with Type JZSP-15 |
| Comparison voltage setting | 1 COM | S-1 | 0 To 10 V (when shipped) |
| | | S-2 | 0 To -10 V |
| | 2 COM | S-3 | 0 To 10 V (when shipped) |
| | | S-4 | 0 To -10 V |
| Voltage detecting hysterisis range | | | Approx. 0.1 V |
| Relay operation indicator | | | LED (red) |
| Relay Contacts | Rated load | | Resistive load : 220VAC or 24VDC at 8A |
| | | | Induction load : 220VAC or 24VDC at 5A |
| | Rated conduction current | | 8 A |
| | Max operational temperature | | 250 VAC, 250 VDC |
| | Max operational current | | Resistive load : 8 A |
| | | | Induction load : 5 A |
| | Max contact capacity | | Resistive load : 1800 VA (AC), 200 W (DC) |
| | | | Induction load : 1100 VA (AC), 120 W (DC) |
| | Min applicable load | | 5 VDC, 1 mA |
| | Contact resistance | | 30 mΩ Max. |
| AC power supply | | | Approx. 6 VA |

Note : For AC power supply, environmental and physical specifications, refer to Table 2.




Applicable module types
JZSP-00, -13, -14, -15, -16-02

* Connect terminals ⑬ and ⑮ when type JZSP-13 is furnished.

Fig. 43 Block Diagram of Comparator Type JGSM-15

## APPLICATIONS

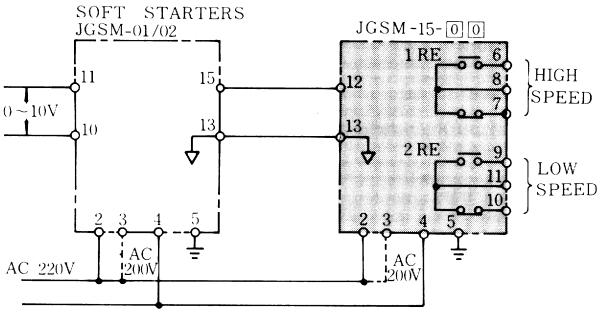



Fig. 44 Where Detecting Reference Voltage

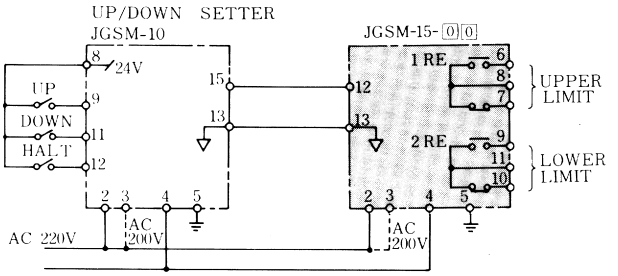



Fig. 45 Where Detecting Reference Level of UP/DOWN Setter

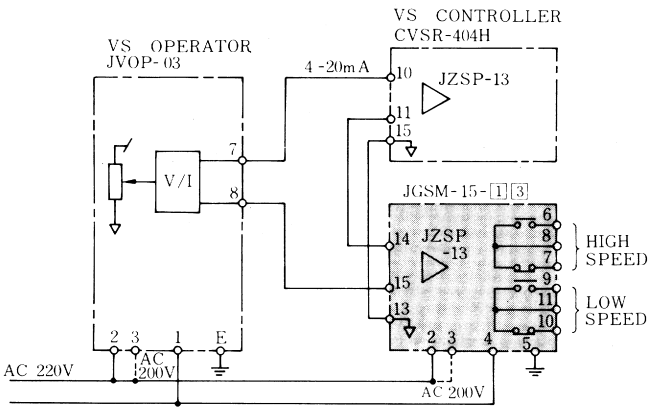



Fig. 46 Where Detecting Current Reference Level

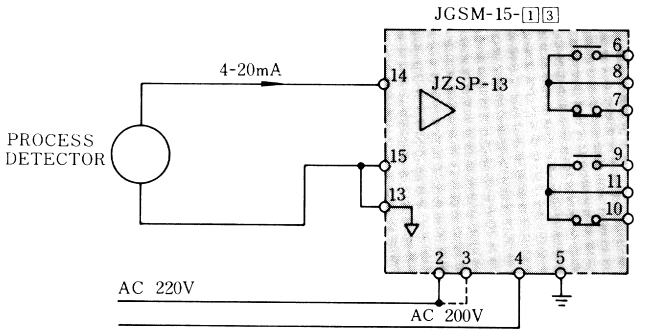



Fig. 47 Where Detecting Signal Level of Process Detector

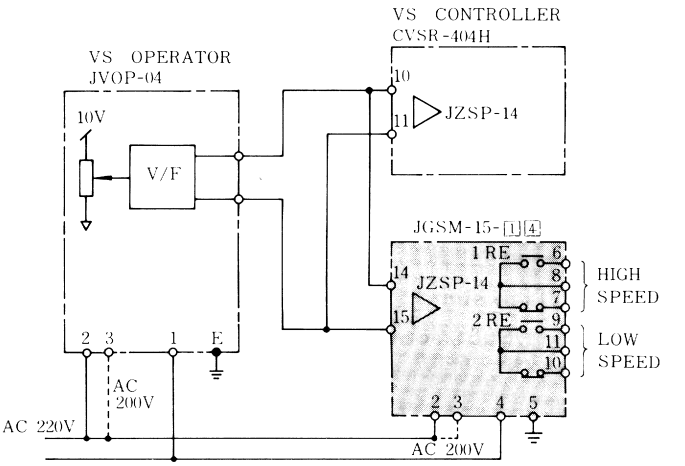



Fig. 48 Where Detecting Frequency Reference Level

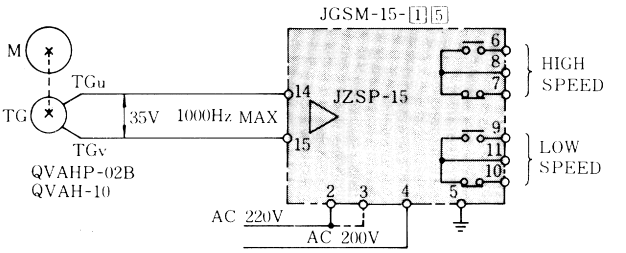



Fig. 49 Where Detecting Speed Level

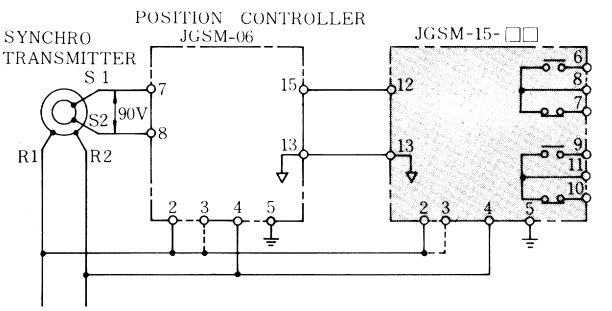



Fig. 50 Where Detecting Displacement Level

## V/I CONVERTERS TYPE JGSM-16-□□

V/I converters type JGSM-16-□□ convert various types of input signals to current signals of 4 to 20 mA which are fed to instruments.

Types of input signals are determined by the snap-in modules combined with the V/I converter as follows:

DC voltage signal: Type JZSP-00

Addition/Subtraction of DC voltage signal: Type JZSP-16-02

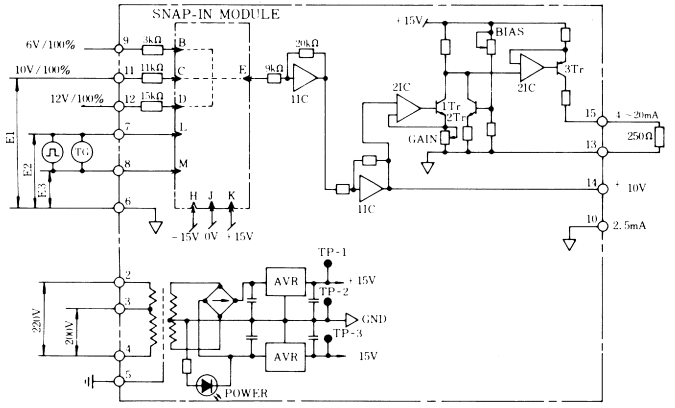
Frequency signal: Type JZSP-14

AC tach-gen signal: Type JZSP-15

Table 22 Specifications and Characteristics of V/I Converter

| | Item | V/I Converter Type JGSM-16-□□ | |
|---|---|---|---|
| Input Signal Characteristics | DC voltage signal | 6V/100% (Terms. ⑨—⑥) | with type JZSP-00 |
| | | 10V/100% (Terms. ⑪—⑥) | |
| | | 12V/100% (Terms. ⑫—⑥) | |
| | Addition/subtraction of DC voltage signal | Same for DC voltage signal | with type JZSP-16-02 |
| | | ±10V (Terms. ⑦-⑥, ⑧-⑥) | |
| | Frequency signal | 0-2kHz (12V, 10mA) (Terms. ⑦—⑧) | with type JZSP-14 |
| | AC tach-gen signal | 35V/1800r/min, 540Hz/ 1800r/min (Terms. ⑦—⑧) | with type JZSP-15 |
| Output characteristics | Output current signal | 4-20mA (Terms. ⑮—⑬) | |
| | Max output current | 30mA max | |
| | Max output voltage | 12V (Term. ⑮) | |
| | Output voltage signal | ±10V, 2.5mA (Terms. ⑭—⑩) | |
| Input/output linearity | | 1% Max | |
| Zero-point temperature drift | | 1%/35℃ Max | |
| AC power supply | | Approx. 4VA | |

Note : For AC power supply, environmental and physical specifications, refer to Table 2.




Applicable module types
JZSP-00, -14, -15, -16-02

Fig. 51 Block Diagram of V/I Converter Type JGSM-16

## APPLICATIONS

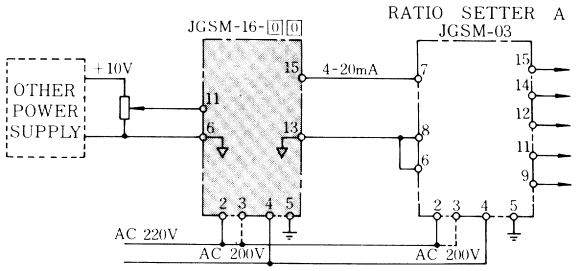



Fig. 52 Where Converting DC Voltage Signal to Current Signal and Setting Ratios

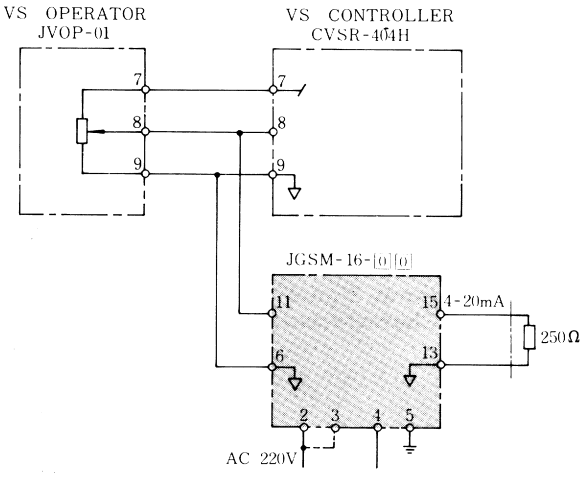



Fig. 53 Where Converting Speed Reference to Instrument Signal

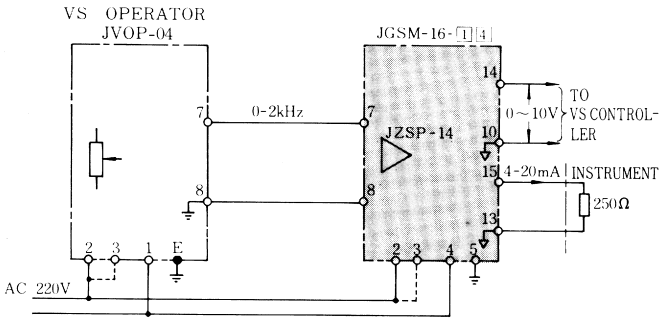



Fig. 54 Where Converting Insulated Speed Reference to Instrument Signal

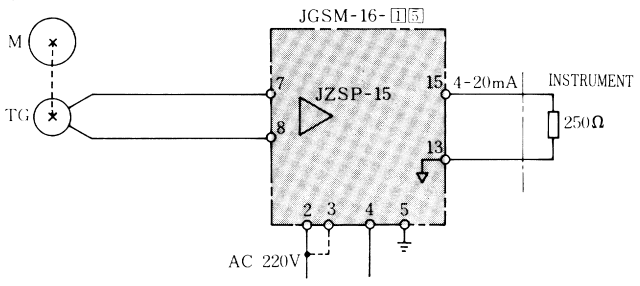



Fig. 55 Where Converting Motor Speed to Instrument Signal

## RATIO SETTER C TYPE JGSM-17

Ratio setter C, type JGSM-17, detects and converts master speed signals such as AC voltage signal (200 VAC), AC tach-gen signal (30 VAC) or DC voltage signal (10 VDC) to DC voltage. It can set five types of ratios and the bias voltage independently within the range of ± 30%.

AC voltage signal is insulated by a transformer. DC voltage signal is non-insulated type. AC voltage signal type is standard. DC voltage signal type can be selected by switching over the shunt slelector in the module.

Table 23 Specifications and Characteristics of Ratio Setter C

| Item | | Ratio Setter C Type JGSM-17 |
|---|---|---|
| AC power supply | | Approx. 6 VA |
| Input Signal Characteristics | AC input signal | Shunt selectors: S-1, S-3, S-5 (when shipped) |
| | AC input voltage | 242 VAC/60 Hz, 220 VAC/ 50 Hz Max (Terms. ⑥ - ⑧) |
| | AC input V/A | Approx. 0.3 VA (220 V, 60 Hz) |
| | AC tach-gen input siganl | Shunt selectors: S-1, S-3, S-5 (when shipped) |
| | Applicable AC tach-gen | Refer to Fig. 30. |
| | AC input voltage | 50 VAC Max (Terms. ⑦ - ⑧), (V/F) < (35 V/50 Hz) |
| | AC input VA | Approx. 0.1 VA (35 V, 540 Hz) |
| | DC voltage signal | Shunt selectors: S-2, S-4, S-6 |
| | Input voltage | ± 10 VDC, 2.5 mA |
| | Input resistance | Approx. 4 kΩ |
| Output Characteristics | Rated output voltage | +10 V (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) |
| | Rated max output current | 2.5 mA (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) |
| | Rated min load resistance | 4 kΩ (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) |
| | Zero-point offset voltage | ± 30 mV Max (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) |
| | Zero-point temperature drift | 1 mV/°C (Terms. ⑮, ⑭, ⑫, ⑪, ⑨) |
| Transmission Characteristics | No. of ratios to be set | 5 |
| | Ratio setting range* | 0 to 100% (0 to 170%) |
| | Bias setting range* | ± 30% (± 50%) |
| | Input/output transmission ratio | 10 V/200 VAC (Terms. ⑥-⑧)<br>10 V/30 VAC (Terms. ⑦-⑧) |
| | Input/output linearity | 1% Max |
| | Input/output voltage variation (temperature) | ± 0.5%/35°C Max |

* For ratings with asterisk refer to Fig. 7
Note: For AC power supply, environmental and physical specifications, refer to Table 2.

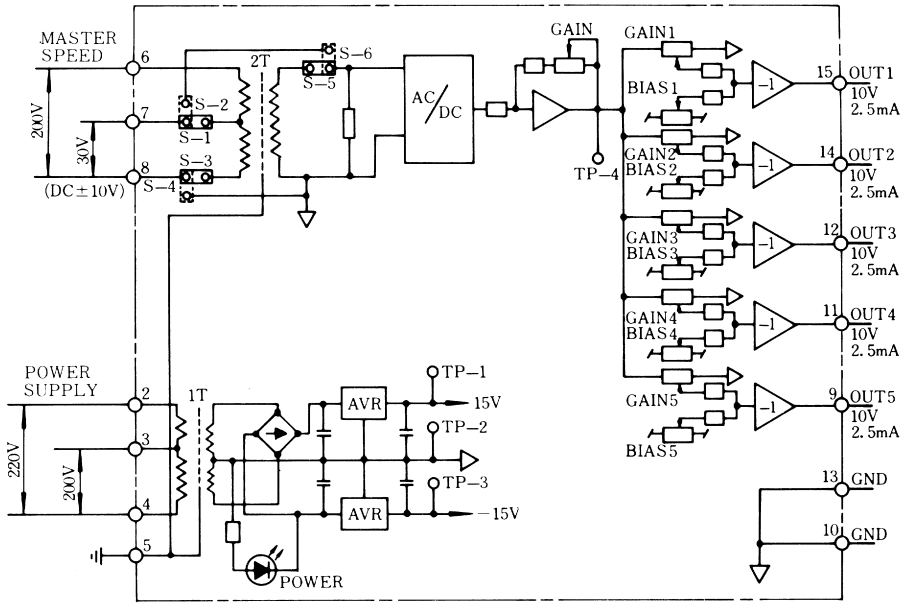
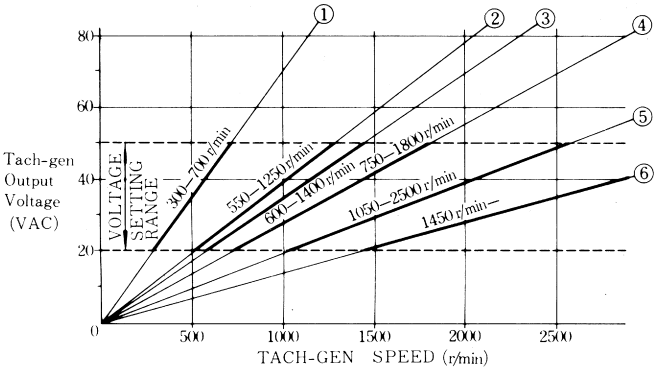



Fig. 56 Block Diagram of Ratio Setter C
Type JGSM-17




① QVAH-20T, -20TB
② QVAH-10-2B, -3B, -4B 70V/1800 r/min OUTPUT
QVAH-02-2B, -3B 70V/1800 r/min OUTPUT
③ QVAH-10TB
④ QVAH-10 70V/2500 r/min OUTPUT
⑤ QVAH-10-2B, -3B, -4B 35V/1800 r/min OUTPUT
QVAH-02-2B, -3B 35V/1800 r/min OUTPUT
QVAH-02-1B
QVAHP-02-1B
⑥ QVAH-10 35V/2500 r/min OUTPUT

Fig. 57 Applicable Tachometer-generator and Adjustment Speed Range

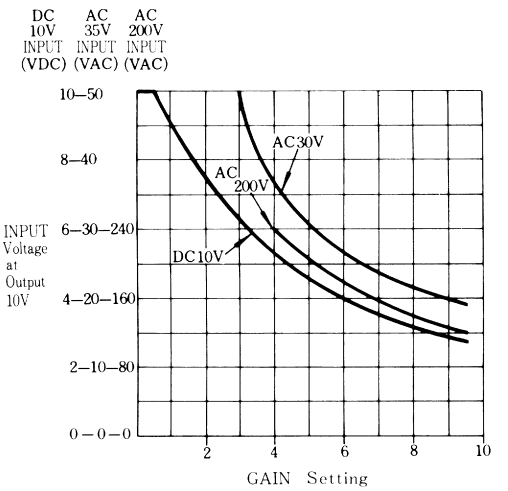



Fig. 58 Gain Adjustment Range

## APPLICATIONS

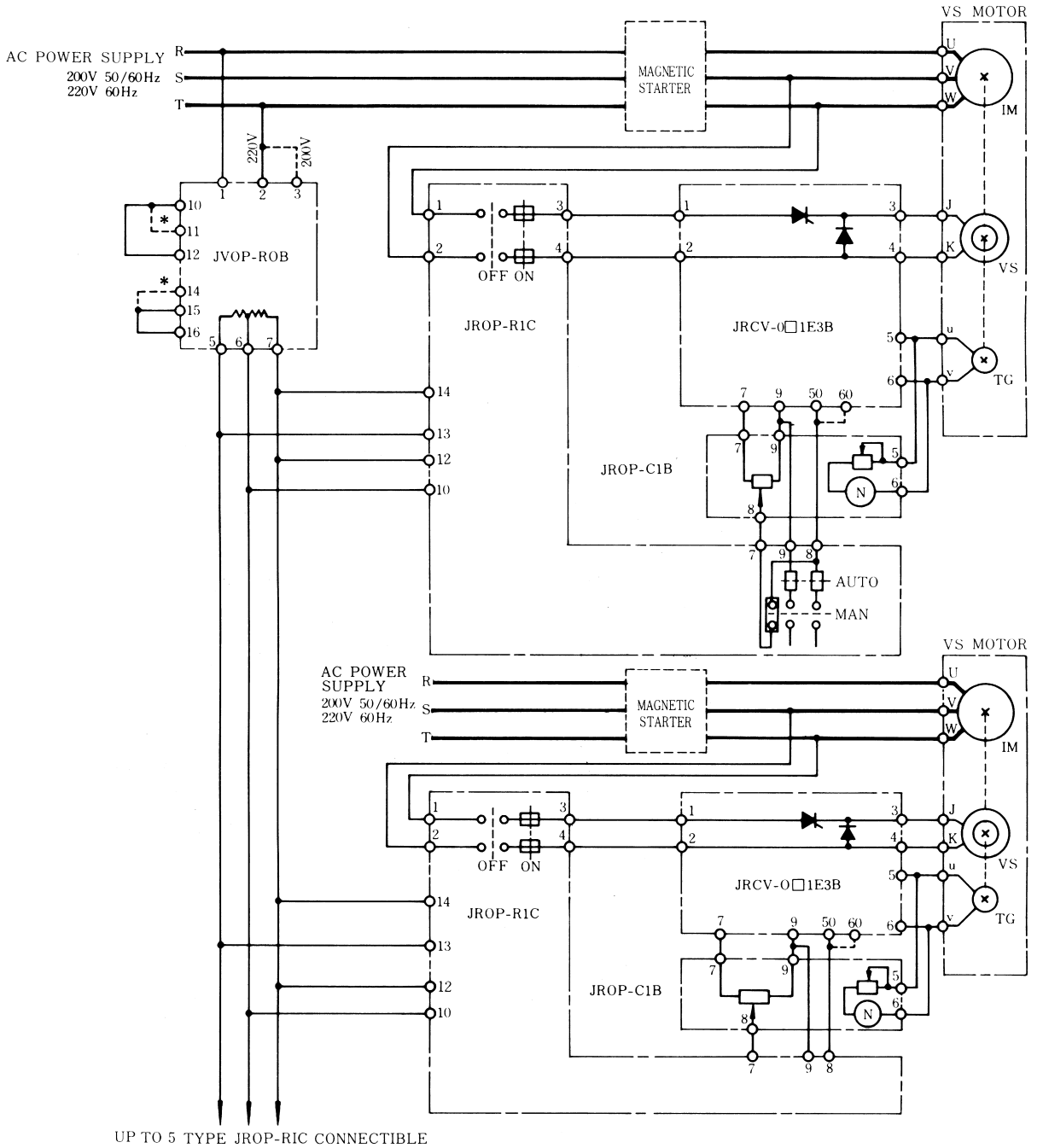



Fig. 59 For Autopack Series Ratio Controller — Ratio Setter C can be used as spare parts of old type Ratio controller JROP-R1C.

Note: Dotted lines with * indicate connection at 60 Hz.

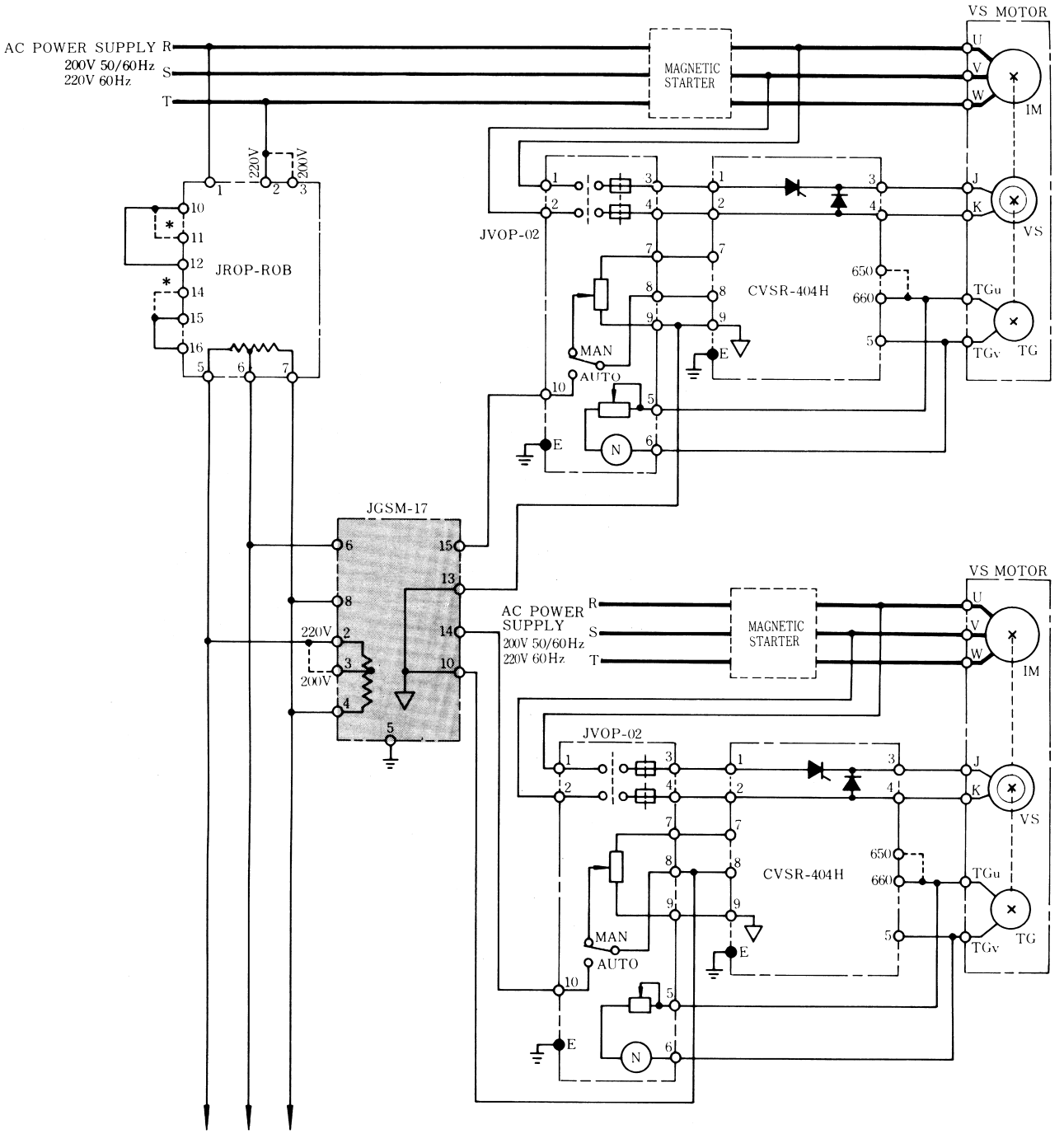



Fig. 60 Ratio Drive Circuit Using Ratio Setter C Type JGSM-17

Note: Dotted lines with * indicate connection at 60 Hz.

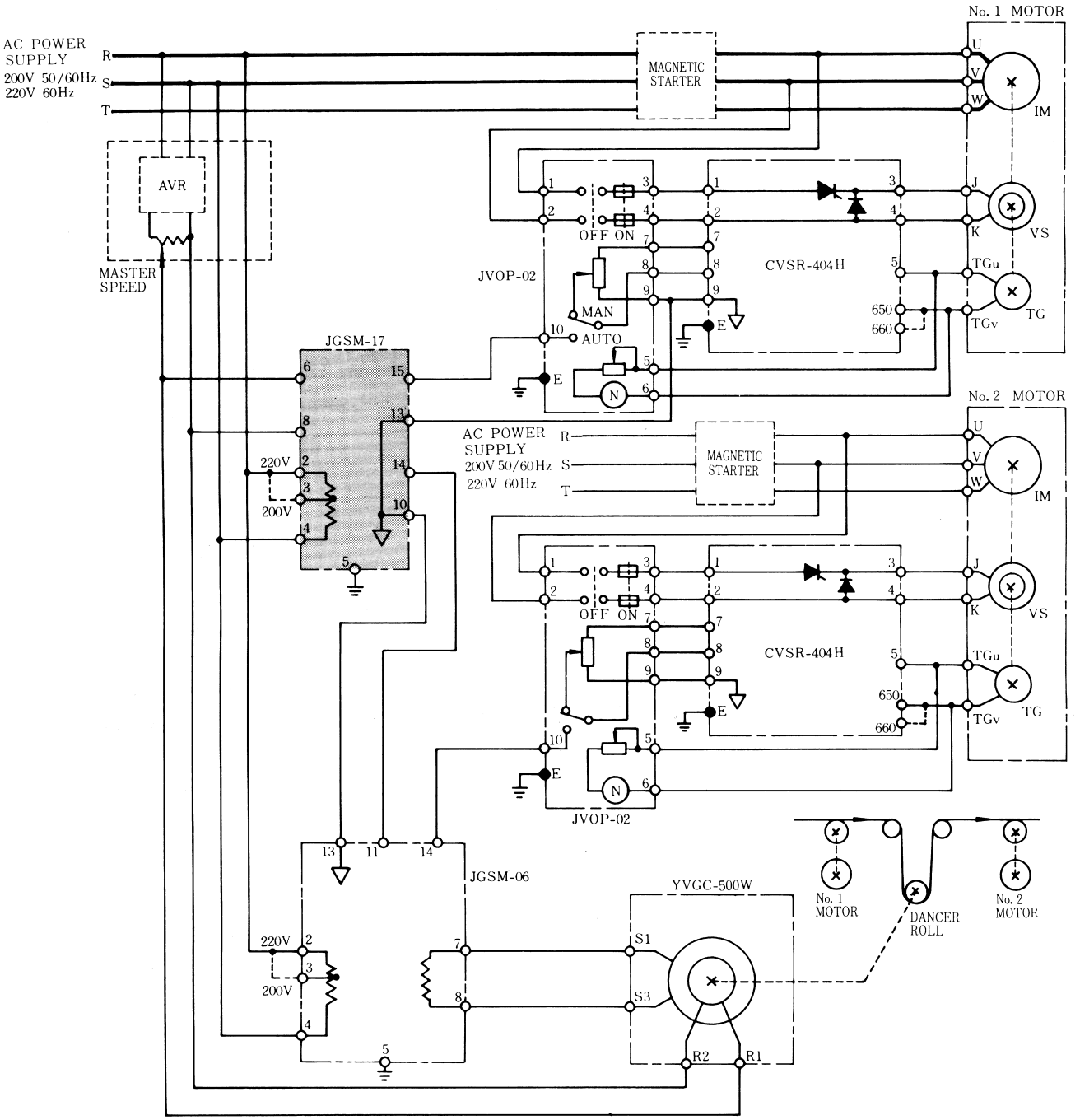



Fig. 61 Control System Diagram with Dancer Roll

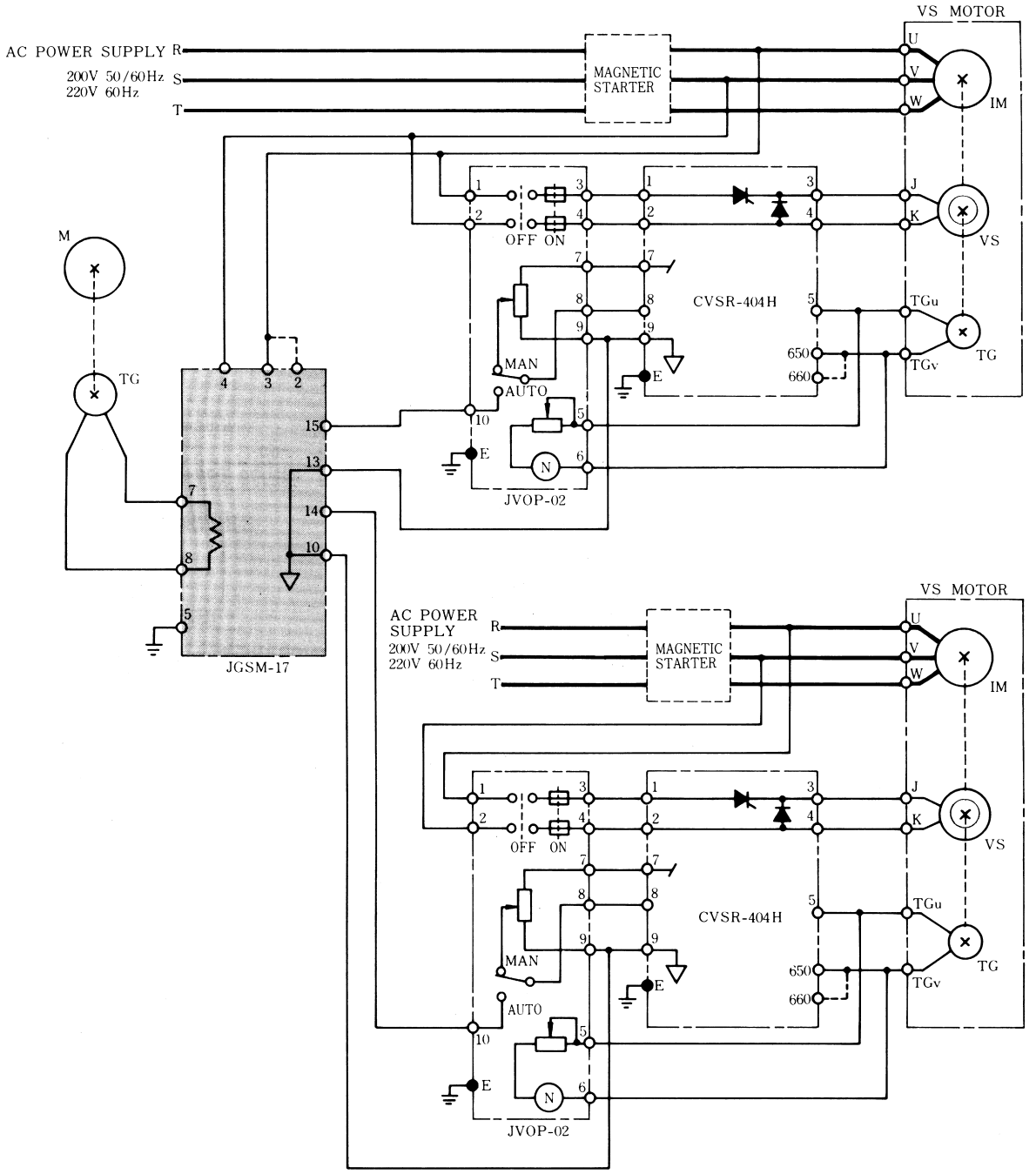



Fig. 62 Follower Ratio Drive System

# WIRING

## LEADS

### Lead Size

Power cable: 2 mm²

Signal cable: 0.75 - 2 mm²

Lead Termination

Pressure terminals are used.
For calking of the cables and the pressure terminal, use the specified tools.

### Signal Level and Standard Specifications of Connections

The signal level of YASKAWA electronic controllers are different depending on each series. Standard specifications of connections with the VS system module and the other series should be as follows:

Signal level

Autopack series controller: ±12 V
Standard electronic controller
(YE Module B): ±6 V
Varispeed drive series controller
(VS system module): ±10 V

Connections to VS Controller

VS controller type CVSR-404H is provided with input terminals for 6 V, 10 V, and 12 V signals so as to permit the connections with other controllers.

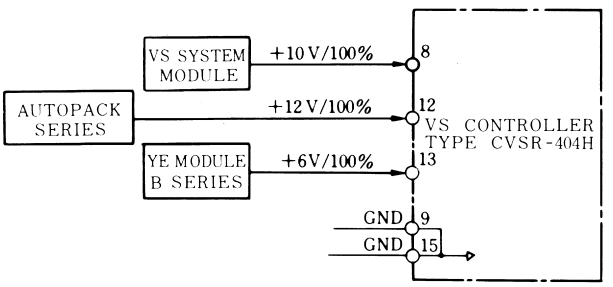



Fig. 63 Connection between VS Controller and Other Controllers

Interconnections of VS System Modules

Up to five VS system modules can be connected in parallel to one VS system module.

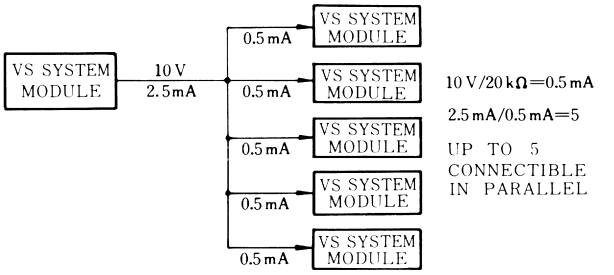



Fig. 64 Interconnections of VS System Modules

Connections between VS System Module and VS Controller

Up to five VS controllers can be connected in parallel to one VS system module.

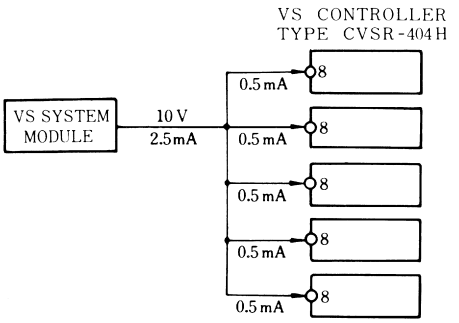



Fig. 65 Connections between VS System Module and VS Controller

Connections between VS System Module and VS Motor Regulator

When old type VS motor controller, VS motor regulator is combined with VS system module, power amplifier type JGSM-11 is used as an interface for both. Up to five VS motor regulators can be connected in parallel.

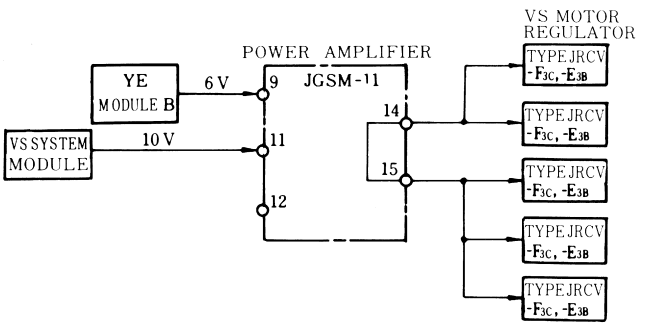



Fig. 66 Connections between VS System Module and VS Motor Regulator

### Master Speed Setting Signal (Non-isolation Type)

When distance of wiring between master speed setter and ratio setter is 100 m or below, current signal of 4 to 20 mA is used.

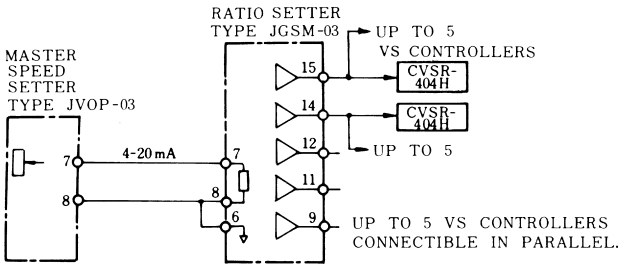



Fig. 67 Where Distance of Wiring between Master Speed Setter and Ratio Setter is 100 m or below

### Master Speed Setting Signal

When distance of wiring between master speed setter and ratio setter is 100 m or above, frequency signal of 0 to 2 kHz is used. The signal is isolated by a photo isolator.

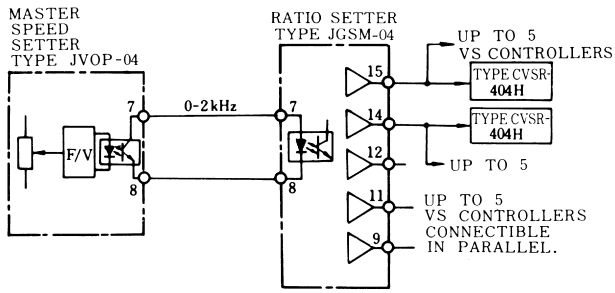



Fig. 68 Where Distance of Wiring between Master Speed Setter and Ratio Setter is 100 m or above

# DIMENSIONS in mm

## VS SYSTEM MODULES

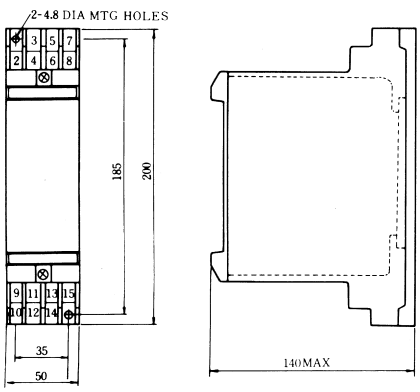



Fig. 69 VS System Module

## DEFLECTION DETECTORS

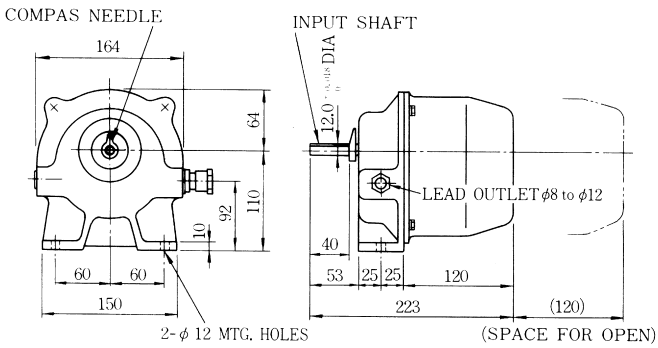
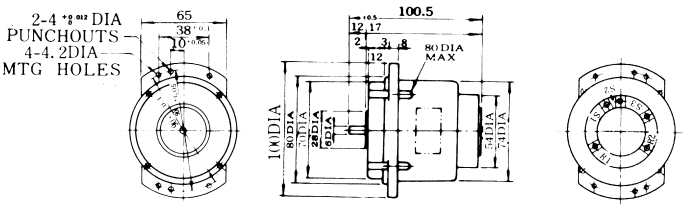
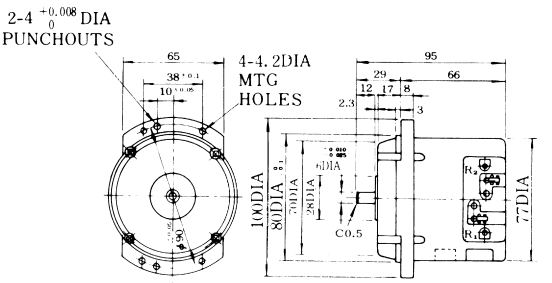



Fig. 70 Deflection Detector

## SYNCHRO TRANSMITTERS



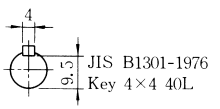

TYPE TS5N2E12TX




TYPE 80TX-9002-A01

Fig. 71 Synchro Transmitters

SHAFT EXTENSION



# MAINTENANCE

## DRAW-OUT OF PRINTED BOARD

Loosen the faceplate mounting screws and draw out the printed board. (See Fig. 72.)

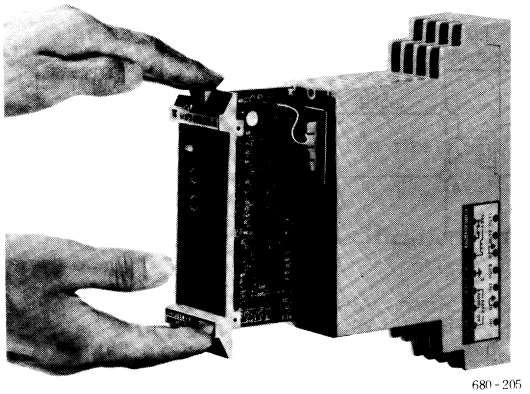



Fig. 72 Draw-out of Printed Board

## DRAW-OUT OF SNAP-IN MODULE

Rotating downward from the top, pull down the snap-in module faceplate, and the snap-in module can be removed from the system module. (See Fig. 73.)

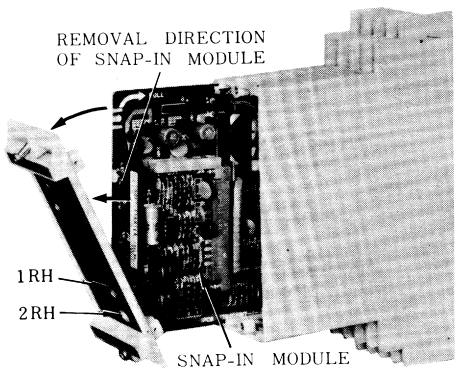



Fig. 73 Construction of Preamplifiers Type JGSM-09-□□ and Power Amplifiers Type JGSM-11-□□

## REMOVAL OF SUB-PRINTED BOARD

. Loosen the faceplate mounting screws and pull out the faceplate from casing.

. Take out the sub-printed board lock and remove the board from the basic printed board. (See Fig. 74.)

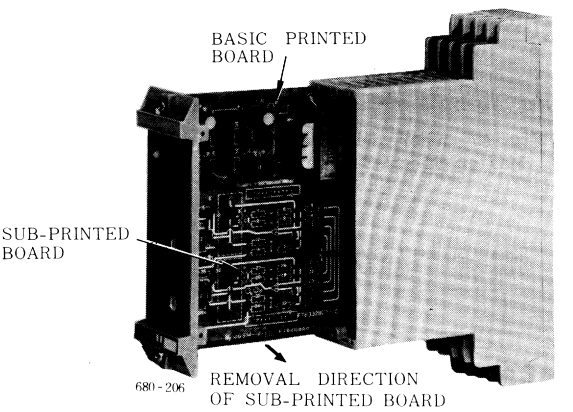



Fig. 74 Construction of Operational Amplifiers Type JGSM-12-□□

# VS SYSTEM MODULES
# USER'S MANUAL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