

Information for Replacement of FR Series Controllers and Setters

Target controllers and setters

Manual controller	FR-AX
DC tach. follower	FR-AL
Three speed selector	FR-AT
Remote speed setter	FR-FK
Ratio setter	FR-FH
Speed detector	FR-FP
Master controller	FR-FG
Soft starter	FR-FC
Preamplifier	FR-FA

The replacement is stated on the following pages.

1. Controllers and Setters for Replacement

We provide the method of replacement with the succeeding controllers and setters using the functions of the general-purpose inverters. Consider the replacement by referring to the information.

2. Proposal for Replacement

2-1 FR-AX manual controller

Equipped with the frequency setting potentiometer, frequency meter, and start/stop switches, the FR-AX manual controller has been used in general applications where independent operation is performed manually.

Replacement

1. Required devices

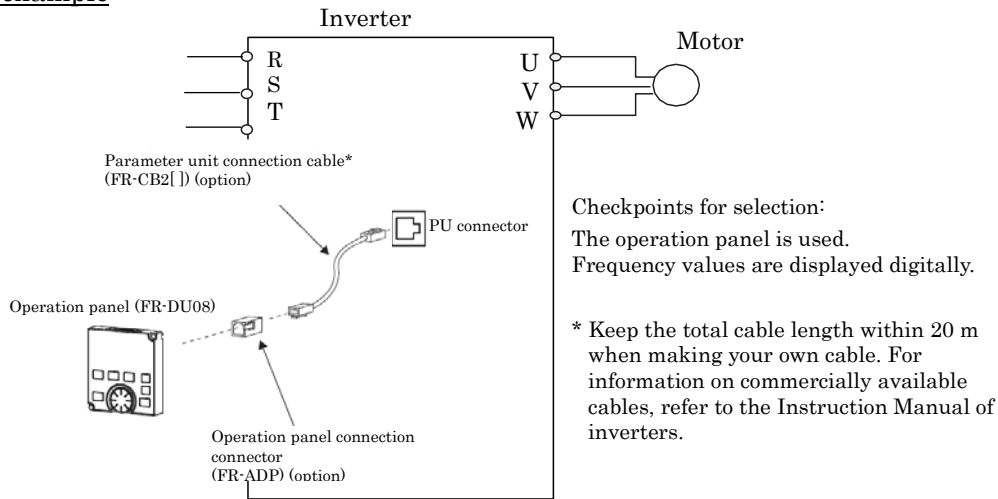
To install the operation panel on the enclosure surface:

Operation panel connection connector (FR-ADP): 1 pc., parameter unit connection cable (FR-CB2[]; 1, 3, or 5 m): 1 pc.

2. Connection

1) Refer to the following diagram to install the operation panel on the enclosure surface.

Wiring example



3. Checkpoints for operation settings

- 1) Frequency setting potentiometer: Setting dial on the operation panel. By changing the setting of Pr.161 Frequency setting/key lock operation selection, easy frequency setting (using the setting dial like a volume knob) is enabled.
- 2) Forward rotation switch / reverse rotation switch: FWD/REV keys on the operation panel.
- 3) Frequency meter: Digitally monitored on the operation panel.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
52	Operation panel main monitor selection	Output frequency. Pr.52 = "0"
79	Operation mode selection	PU operation mode. Set Pr.79 = "1".
161	Frequency setting / key lock operation selection	Set "1 or 11" in Pr.161 to use the setting dial like a volume knob.

For details, refer to the Instruction Manual of the inverter.

2-2 FR-AL DC tach. follower

This follower is designed to enable joint operation under the control of the frequency setting output to the inverter from other equipment in the "AUTO" position of the select switch or independent manual operation with the knob provided on the controller in the "MANUAL" position.

This is used for selection between AUTO and MANUAL.

Replacement

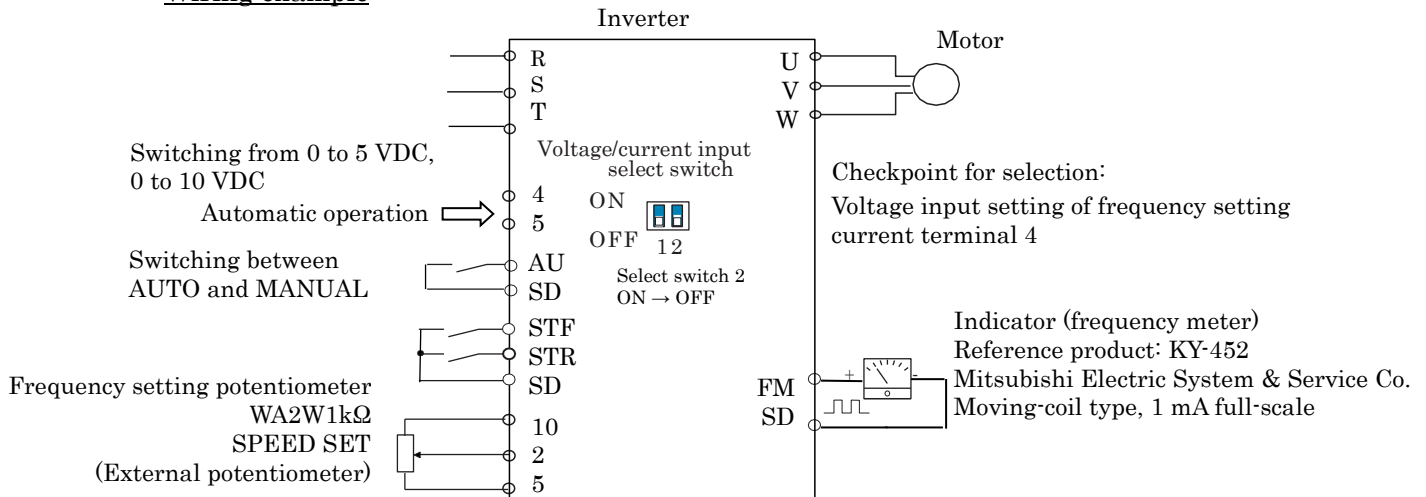
1. Required devices

External switch (for micro-currents): 3 pcs., external potentiometer (option WA2W1k Ω): 1 pc, frequency meter (reference product: KY-452 manufactured by Mitsubishi Electric System & Service Co.): 1 pc.

2. Connection

- 1) External switch: Forward rotation start switch across input terminals STF and SD
Reverse rotation start switch across input terminals STR and SD
Terminal 4 input selection switch across input terminals AU and SD
- 2) External potentiometer (SPEED SET): Across the frequency setting voltage terminals 10, 2 and 5
- 3) Automatic operation signal (signal from other devices): Across the frequency setting current terminals 4 and 5
Wiring length should be 30 m or less.
- 4) Frequency meter: Across terminals FM and SD for indicator

Wiring example



3. Checkpoints for operation settings

- 1) Frequency setting current terminal 4 selection: Set voltage/current input switch 2 to voltage input.
- 2) Selection between AUTO and MANUAL: Use the terminal 4 input selection (AU signal).
Turning ON the AU signal activates the automatic operation signal and enables automatic operation.
Turning OFF the AU signal activates SPEED SET and enables manual operation.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
55	Frequency monitoring reference	Set the full-scale value of terminal FM. Default value: 60 Hz
73	Analog input selection	Terminal 2 input selection. Set Pr.73 = "1, 3, or 5". Default value: 1
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
184	AU terminal function selection	Set Pr.184 = "4" to assign the AU signal.
267	Terminal 4 input selection	Set Pr.267 = "1 or 2" to select 0-5 V or 0-10 V. Set voltage/current input switch 2 to voltage input (OFF).
C0 (900)	FM/CA terminal calibration	For frequency meter calibration.
C2 (902)	Terminal 2 frequency setting bias frequency	Calibrate terminal 2 as required. Default value: 0 to 60 Hz is set for 0 to 5 V.
C3 (902)	Terminal 2 frequency setting bias	
125	Terminal 2 frequency setting gain frequency	
C4 (903)	Terminal 2 frequency setting gain	
C5 (904)	Terminal 4 frequency setting bias frequency	Calibrate terminal 4 frequency setting bias/gain. Calibrate the setting bias from 1 to 0 V. Default value: 0 to 60 Hz is set for 1 to 5 V (4 to 20 mA).
C6 (904)	Terminal 4 frequency setting bias	
126	Terminal 4 frequency setting gain frequency	
C7 (905)	Terminal 4 frequency setting gain	

For details, refer to the Instruction Manual of the inverter.

2-3 FR-AT three speed selector

This selector can be used with the inverters to start/stop a motor, and enables operation at three different preset frequencies using the setting select switch, frequency selecting limit switch etc.

Replacement

1. Required devices

External switch (for micro-currents): 5 pcs.

2. Connection

1) External switch: Forward rotation start switch across input terminals STF and SD

Reverse rotation start switch across input terminals STR and SD

High speed setting switch across input terminals RH and SD

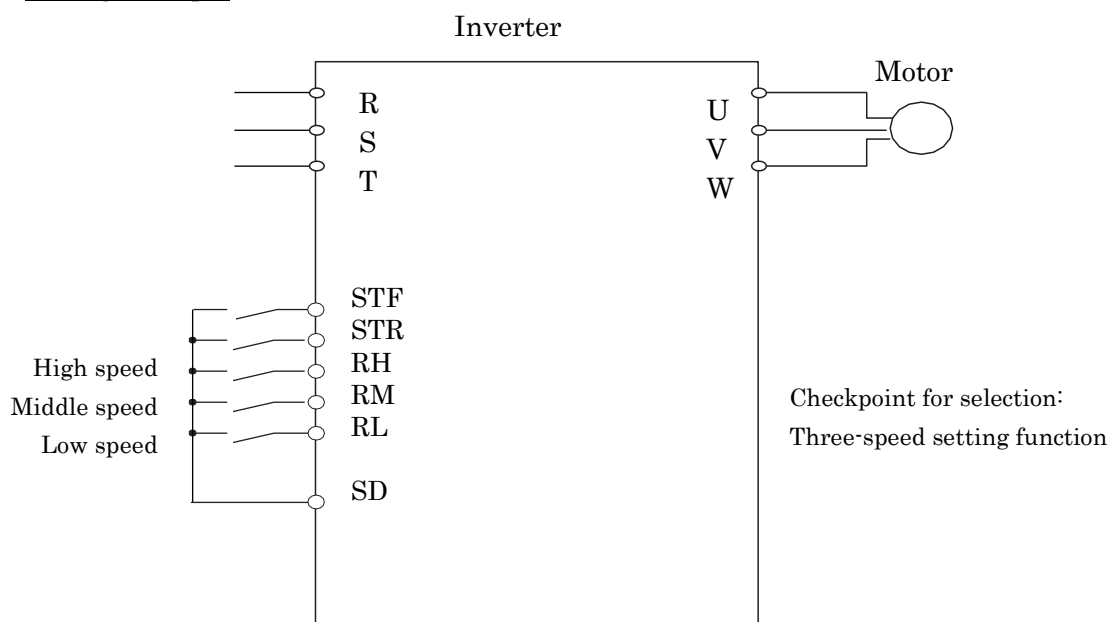
Middle speed setting switch across input terminals RM and SD

Low-speed setting switch across input terminals RL and SD

*The same connection applies when high-speed LS·H, middle-speed LS·M, or low-speed LS·L is selected.

Wiring length should be 30 m or less.

Wiring example



3. Checkpoints for operation settings

1) Three-speed setting: Use Pr.4 to Pr.6 high-speed RH, middle-speed RM, and low-speed RL function

In the initial setting, when two or more of multi-speed settings are simultaneously selected, priority is given to the set frequency of the lower-speed signal.

For example, when RH and RM signals turn ON, RM signal (Pr.5) has a higher priority.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
4	Three speed setting (high speed)	Set the higher-speed frequency. * Default value: 60 Hz
5	Three speed setting (middle speed)	Set the middle-speed frequency. * Default value: 30 Hz
6	Three speed setting (low speed)	Set the lower-speed frequency. * Default value: 10 Hz
79	Operation mode selection	External operation mode. Set Pr.79 = "2".

*The function is set in the parameter and cannot be adjusted externally like a potentiometer.

For details, refer to the Instruction Manual of the inverter.

2-4 FR-FK remote speed setter

You can make the speed change and start/stop a motor at two or more remote locations.

Besides, the frequency setting value is stored even after power OFF. When the power is restored, the operation continues at the previous frequency.

Replacement

1. Required devices

External switch (for micro-currents): 5 pcs., frequency meter (reference product: KY-452 manufactured by Mitsubishi Electric System & Service Co.): 1 pc.

2. Connection

1) External switch: Forward rotation start switch across input terminals STF and PC

Reverse rotation start switch across terminals STR and PC

Acceleration signal switch across terminals RH and PC

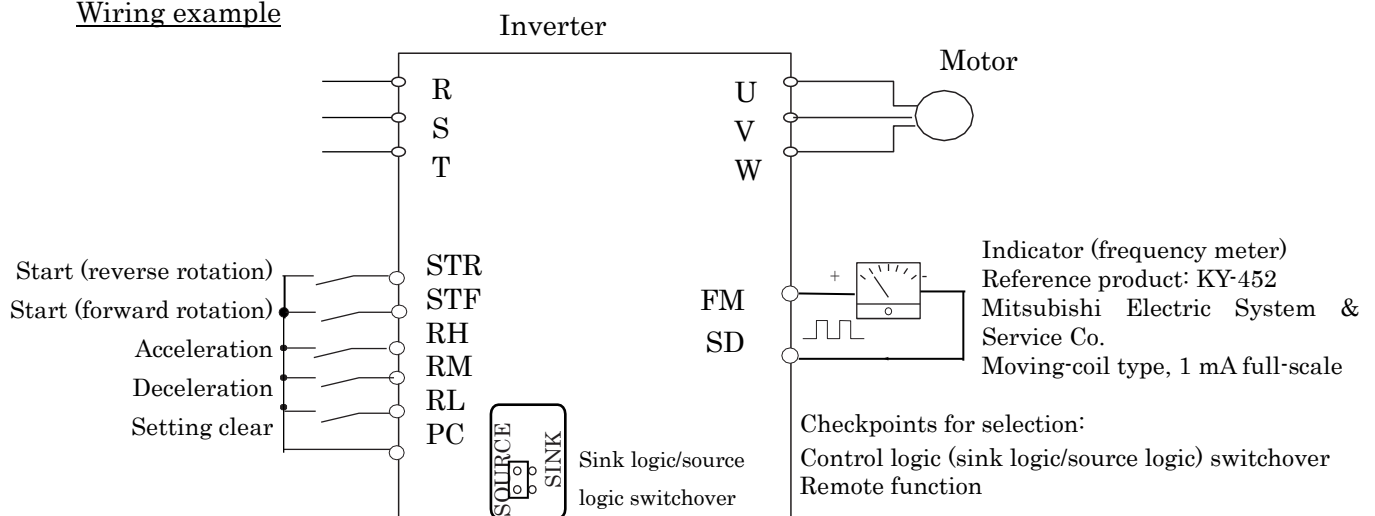
Deceleration signal switch across terminals RM and PC

Setting clear signal switch across terminals RL and PC

Wiring length should be 30 m or less.

2) Frequency meter: Across terminals FM and SD for indicator

Wiring example



3. Checkpoints for operation settings

1) Remote setting: Use Pr.59 Remote function selection.

2) Input terminal control logic: Change to the source logic (SOURCE).

3) Maximum frequency setting: The frequency at the point where the change of the output frequency is stopped when entering the start terminal ST and acceleration terminal ACC is kept during use of the FR-FK.

4) Slope of the setting frequency: Adjust the value using Pr.44 Second acceleration/deceleration time referring to the setting of time adjustment potentiometer (TIME). However, when the value is lower than the acceleration/deceleration time set in Pr.7 or Pr.8, the setting in Pr.7 or Pr.8 is prioritized.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
1	Maximum frequency	Set the maximum frequency. Default value: 120 Hz for the 55K or lower / 60 Hz for the 75K or higher
44	Second acceleration/deceleration time	Set the acceleration/deceleration time. Pr.20 Acceleration/deceleration reference frequency is set as maximum frequency. Adjust
45	Second deceleration time	Acceleration/deceleration time parameters (Pr.7, Pr.8) as required. Default value: Pr.7, 8 = 5 s for the 7.5K or lower / 15 s for the 11K or higher, Pr.44 = 5 s, Pr.20 = 60 Hz
54	FM/CA terminal function selection	Frequency setting value. Set Pr.54 = 5.
55	Frequency monitoring reference	Set the full-scale value of the terminal FM. Default value: 60 Hz
59	Remote function selection	Remote location. Set Pr.59 = "1 or 11". *
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
C0 (900)	FM/CA terminal calibration	Used to calibrate the scale of the indicator (frequency meter).

*The same signal is used for start and forward (reverse) rotation.

For details, refer to the Instruction Manual of the inverter.

2-5 FR-FH ratio setter

The FR-FH ratio setter has been used to operate up to five inverters at different ratios.

Replacement

1. Required devices

External switch (for micro-currents): Same numbers of inverter quantities

WA2W1k Ω external potentiometer (option): 1 pc.

2. Connection

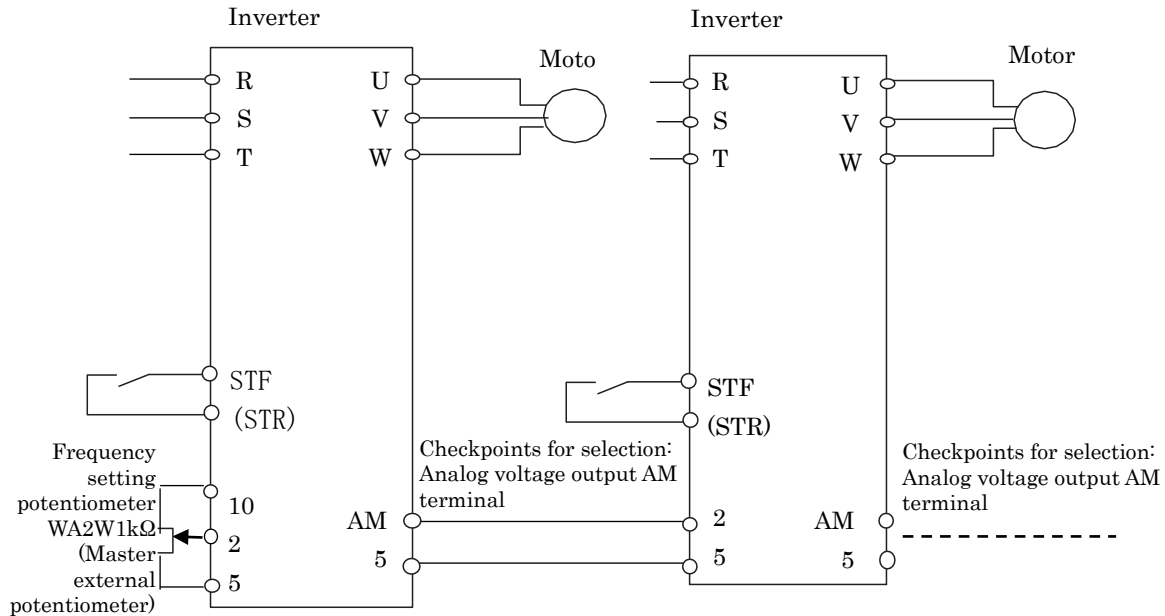
1) External switch: Forward rotation start switch across input terminals STF and SD

Reverse rotation start switch across input terminals STR and SD

2) External potentiometer: Across frequency setting voltage terminals 10, 2 and 5

3) Analog voltage output terminals AM-5: Frequency setting voltage terminals 2-5 on the next inverter

Wiring example



3. Checkpoints for operation settings

1) External potentiometer: Enter the command into the frequency setting voltage terminal 2.

Based on the frequency commanded from the master external potentiometer, a frequency command is entered into each inverter.

Pr.C2 (902), Pr.C3 (902), Pr.125, and Pr.C4 (903) are used for adjusting the frequency setting bias/gain input via terminal 2 of each inverter.

Analog voltage output AM selection: Set Pr.158 = "5" (frequency setting value).

Perform the wiring repeatedly in the similar way by entering the master motor frequency command into frequency setting voltage terminal 2 of the next inverter.

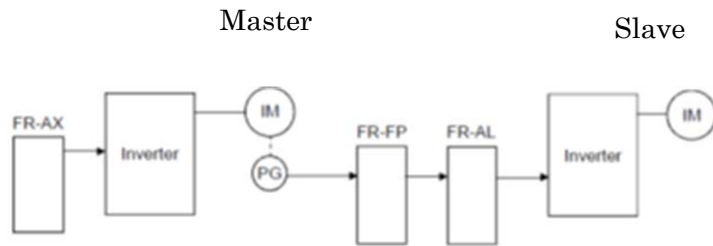
4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
7	Acceleration time	Change the settings as required. Default value: Pr.7,8 = 5 s for the 7.5K or lower / 15 s for the 11K or higher
8	Deceleration time	
20	Acceleration/deceleration reference frequency	Default value: 60 Hz
55	Frequency monitoring reference	Set the full-scale value of terminal AM. Default value: 60 Hz
73	Analog input selection	Terminal 2 input selection. Set Pr.73 = "1, 3, or 5". Default value: 1
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
158	AM terminal function selection	Frequency setting value. Set Pr.158 = "5".
C1 (901)	AM terminal calibration	To be used for calibration of terminal AM. Calibrate terminal AM of each inverter.
C2 (902)	Terminal 2 frequency setting bias frequency	Calibrate terminal 2 of each inverter. Default value: 0 to 60 Hz is set for 0 to 5 V.
C3 (902)	Terminal 2 frequency setting bias	
125	Terminal 2 frequency setting gain frequency	
C4 (903)	Terminal 2 frequency setting gain	

For details, refer to the Instruction Manual of the inverter.

2-6 FR-FP speed detector

When speed, mechanical displacement etc. of other equipment is converted into an electrical signal using a pulse generator, the signal is then entered into this setter. The setter converts it into the frequency setting signal and sends it to the inverter.



Replacement

PG (pilot generator) AC three-phase / single-phase 40 to 110 VAC and 25 to 100 VDC cannot be connected.

Vector control operation is performed using the main motor with encoder and the actual motor speed is used.

Replacement

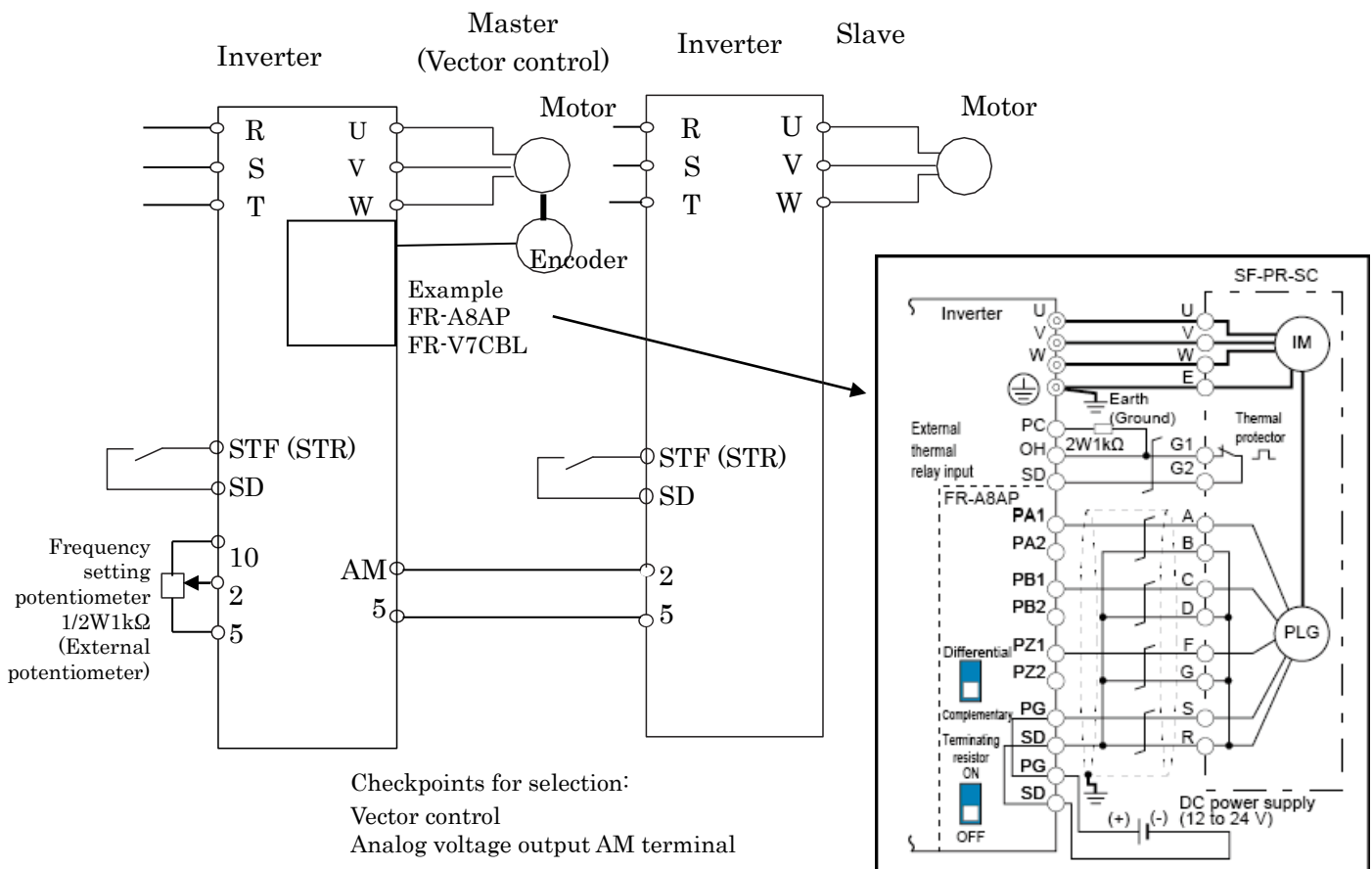
1. Required devices

External switch (for micro-currents): 4 pcs., external potentiometer only for the master motor (1/2W1kΩ(option WA2W1kΩ is frequently used.)): 1 pc., master motor with encoder (SF-PR-SC (complementary 2048 Pulse)): 1 pc., master inverter for which Vector control is enabled (FR-A800, FR-A8AP): 1 pc., encoder cable (FR-V7CBL): 1 pc., control power supply for encoder (12/24 VDC): 1 pc., external thermal resistance (MOS2C102J2W1kΩ manufactured by KOA): 1 pc., slave inverter: 1 pc., slave motor: 1 pc.

2. Connection

- 1) External switch: Forward rotation start switch across input terminals STF and SD
Reverse rotation start switch across input terminals STR and SD
 - 2) External potentiometer: Across the frequency setting voltage terminals 10, 2 and 5
 - 3) Analog voltage output terminals AM-5 of the master inverter: Frequency setting voltage terminals 2-5 of the slave inverter
- Wiring length should be 30 m or less.
- 4) Encoder: Refer to the following diagram.

Wiring example



3. Checkpoints for operation settings

- 1) Setting of the FR-A8AP: For the complementary, set the terminating resistor selection switch to OFF position.
- 2) External potentiometer on the master side: Set the frequency command of the master motor.
- 3) Control of the master side: Select vector control
The motor speed can be sent back by detecting the master motor actual speed with the encoder.
- 4) Analog voltage output AM selection of the master: Set rotation speed (Pr.158 = "6").
The following operation is performed by entering the master motor speed into frequency setting voltage terminal 2 of the slave motor. In that case, acceleration/deceleration time on the slave motor is 0 s.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
7	Acceleration time	Slave side: Set the time to 0 s.
8	Deceleration time	Master side: Set the time so that overload does not occur. Default value: Pr.7, 8 = 5 s for the 7.5K or lower / 15 s for the 11K or higher, Pr.20 = 60 Hz
20	Acceleration/deceleration reference frequency	Default value: 60 Hz
9	Electronic thermal O/L relay	Set the rated motor current.
22	Stall prevention operation (torque limit level)	Master side: Set the torque limit as required. Default value: 150%
55	Frequency monitoring reference	Master side: Set the full-scale value of terminal AM. Default value: 60 Hz Rotations per minute are displayed according to the Pr.37 and Pr.144 settings. Example: When Pr.37 = 0, Pr.144 = 4 or 104, 1800 r/min at 60 Hz is displayed.
71	Applied motor	Master side: When the SF-PR motor is selected, set Pr.71 = "70 or 73".
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
80	Motor capacity	Master side: Set the motor capacity and the number of motor poles. Default value: Pr.80 = 9999 Pr.81 = 9999 V/F control
81	Number of motor poles	
96	Auto tuning setting/status*	Master side: Motor constant tuning After tuning completion, Pr.96 setting is changed from "1" to "3".
158	AM terminal function selection	Master side: Rotation speed. Set Pr.158 = "6".
182	RH terminal function selection (example)	Master side: OH function assignment. Set Pr.182 = "7".
369	Number of encoder pulses	Master side: Number of encoder pulses. Set Pr.369 = "2048".

*For the motor constant tuning start, press FWD/REV key on the operation panel in the PU operation mode.

For External operation, turn ON the start command (STF signal or STR signal).

For details, refer to the Instruction Manual of the inverter.

Number	Name	Remarks
800	Control method selection	Master side: Vector control (speed control). Set Pr.800 = "0".
C1 (901)	AM terminal calibration	Master side: Used for calibration of terminal AM
C2 (902)	Terminal 2 frequency setting bias frequency	Calibrate terminal 2 as required. Default value: 0 to 60 Hz is set for 0 to 5 V.
C3 (902)	Terminal 2 frequency setting bias	
125	Terminal 2 frequency setting gain frequency	
C4 (903)	Terminal 2 frequency setting gain	

2-7 FR-FG master controller

This controller is a variable constant-voltage power supply unit, and used to deliver frequency signal to the inverter.

Replacement

1. Required devices

External switch (for micro-currents): Same numbers of inverter quantities, external potentiometer (option WA2W1k Ω): 1 pc.

2. Connection

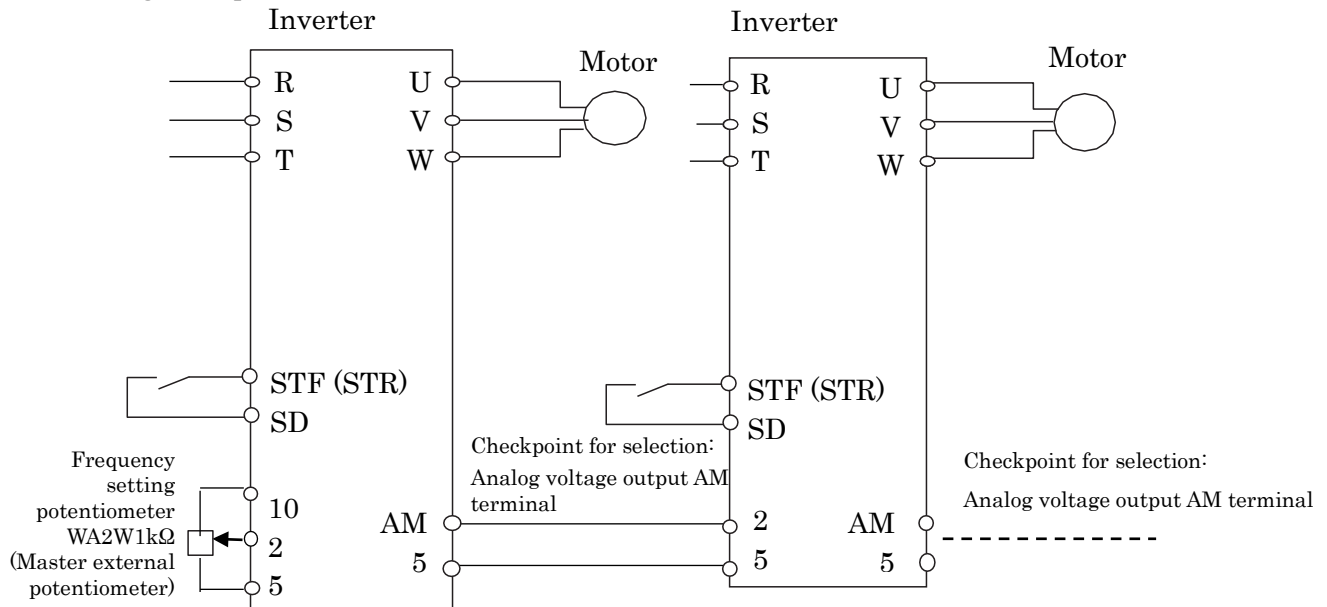
1) External switch: Forward rotation start switch across input terminals STF and SD

Reverse rotation start switch across input terminals STR and SD

2) External potentiometer: Across the frequency setting voltage terminals 10, 2 and 5

3) Analog voltage output terminals AM-5: Frequency setting voltage terminals 2-5 of the next inverter

Wiring example



3. Checkpoints for operation settings

1) External potentiometer: Enter the command into the frequency setting voltage terminal 2.

Parallel operation is performed by entering the frequency command for each inverter based on the frequency command by master external potentiometer.

2) Analog voltage output AM selection: Set frequency setting value (Pr.158 = "5").

Perform the wiring repeatedly in the similar way by entering the master motor frequency command into frequency setting voltage terminal 2 of the next inverter.

3) Terminals BP3-BN3: Use commercial ± 5 V 35 mA power supply if applicable.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
7	Acceleration time	Change the settings as required. Default value: Pr.7,8 = 5 s for the 7.5K or lower / 15 s for the 11K or higher
8	Deceleration time	
20	Acceleration/deceleration reference frequency	Default value: 60 Hz
55	Frequency monitoring reference	Set the full-scale value of terminal AM. Default value: 60Hz
73	Analog input selection	Terminal 2 input selection. Set Pr.73 = "1, 3, or 5". Default value: 1
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
158	AM terminal function selection	Frequency setting value. Set Pr.158 = 5.
C1 (901)	AM terminal calibration	To be used for calibration of terminal AM. Calibrate terminal AM of each inverter.
C2 (902)	Terminal 2 frequency setting bias frequency	Calibrate terminal 2 as required. Default value: 0 to 60 Hz is set for 0 to 5 V.
C3 (902)	Terminal 2 frequency setting bias	
125	Terminal 2 frequency setting gain frequency	
C4 (903)	Terminal 2 frequency setting gain	

For details, refer to the Instruction Manual of the inverter.

2-8 FR-FC soft starter

This starter is used with the inverter to gradually increase or decrease the speed control signal level at starting and stopping the system, or changing the speeds, in order to eliminate a shock that otherwise will be given to the machine, or to synchronize starting or stopping of two or more motors when inertia force of the motors differs from motor to motor because of individual load difference.

Replacement

1. Required devices

External switch (for micro-currents): Same numbers of inverter quantities, external potentiometer (option WA2W1k Ω): 1 pc.

2. Connection

1) External switch: Forward rotation start switch across terminals STF and SD

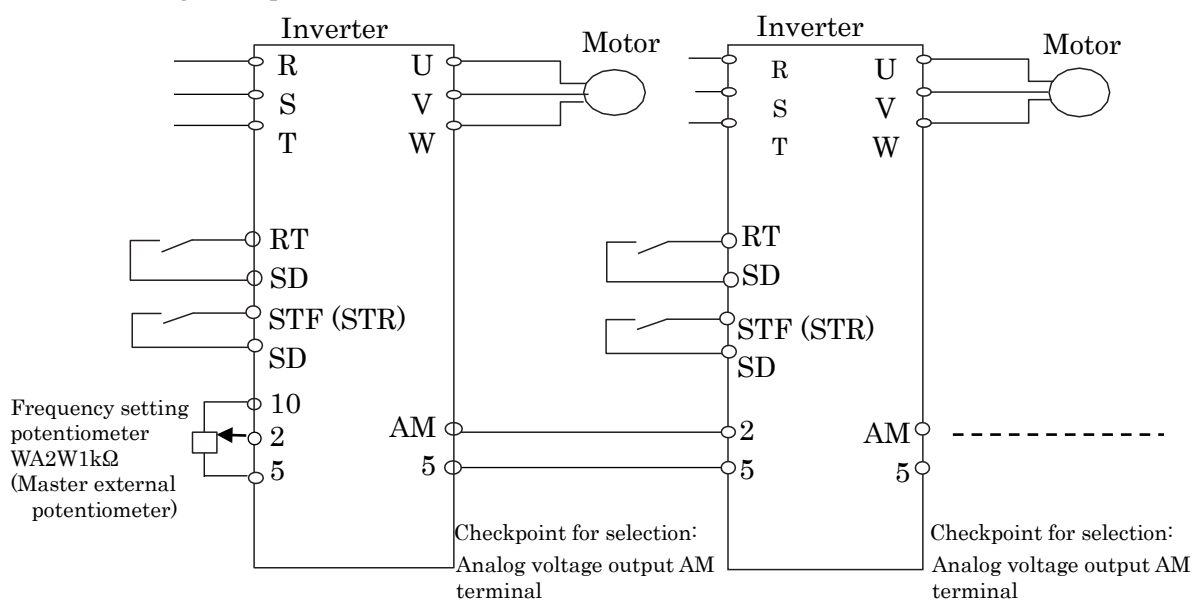
Reverse rotation start switch across input terminals STR and SD

Second function selection switch (for use of sudden stop) across input terminals RT and SD

2) External potentiometer: Across the frequency setting voltage terminals 10, 2 and 5

3) Analog voltage output terminals AM-5: Frequency setting voltage terminals 2-5 of the next inverter

Wiring example



3. Checkpoints for operation settings

1) External potentiometer: Enter the command into the frequency setting voltage terminal 2.

Parallel operation is performed by entering the frequency command of each inverter based on the frequency command by master external potentiometer.

2) Analog voltage output AM selection: Set frequency setting value (Pr.158 = "5").

Enter the master motor frequency command into frequency setting voltage terminal 2 of the next inverter.

3) Soft start and stop: Use Pr.7 Acceleration time and Pr.8 Deceleration time. Set the acceleration/deceleration times that take to reach Pr.20 Acceleration/deceleration reference frequency setting.

(The status is not displayed during acceleration/deceleration for adjustment.)

Set the acceleration/deceleration times for each inverter.

For using the sudden stop, set Pr.45 Second deceleration time for each inverter. The function is immediately enabled when the RT signal is turned ON.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
7	Acceleration time	Pr.7: Set the same time as that for soft start for each inverter. Pr.8: Set the same time as that for soft stop for each inverter. Default value: 5 s for the 7.5K or lower / 15 s for the 11K or higher
8	Deceleration time	
20	Acceleration/deceleration reference frequency	Default value: 60 Hz
45	Second deceleration time	Set the deceleration time at quick stop for each inverter. The function is immediately enabled when the RT signal is turned ON. Default value: 9999 (same as Pr.44 setting)
55	Frequency monitoring reference	Set the full-scale value of terminal AM. Default value: 60Hz
73	Analog input selection	Terminal 2 input selection. Set Pr.73 = "1, 3, or 5". Default value: 1
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
158	AM terminal function selection	Frequency setting value. Set Pr.158 = "5".
183	RT terminal function selection	RT function assignment. Set Pr.183 = "3".
C1 (901)	AM terminal calibration	To be used for calibration of terminal AM. Calibrate terminal AM of each inverter.
C2 (902)	Terminal 2 frequency setting bias frequency	Calibrate terminal 2 as required. Default value: 0 to 60 Hz is set for 0 to 5V.
C3 (902)	Terminal 2 frequency setting bias	
125	Terminal 2 frequency setting gain frequency	
C4 (903)	Terminal 2 frequency setting gain	

For details, refer to the Instruction Manual of the inverter.

2-9 FR-FA preamplifier

The preamplifier is mainly used to convert or amplify the output signal from a regulator to make the output signal application as the frequency setting signal for the inverter.

Replacement

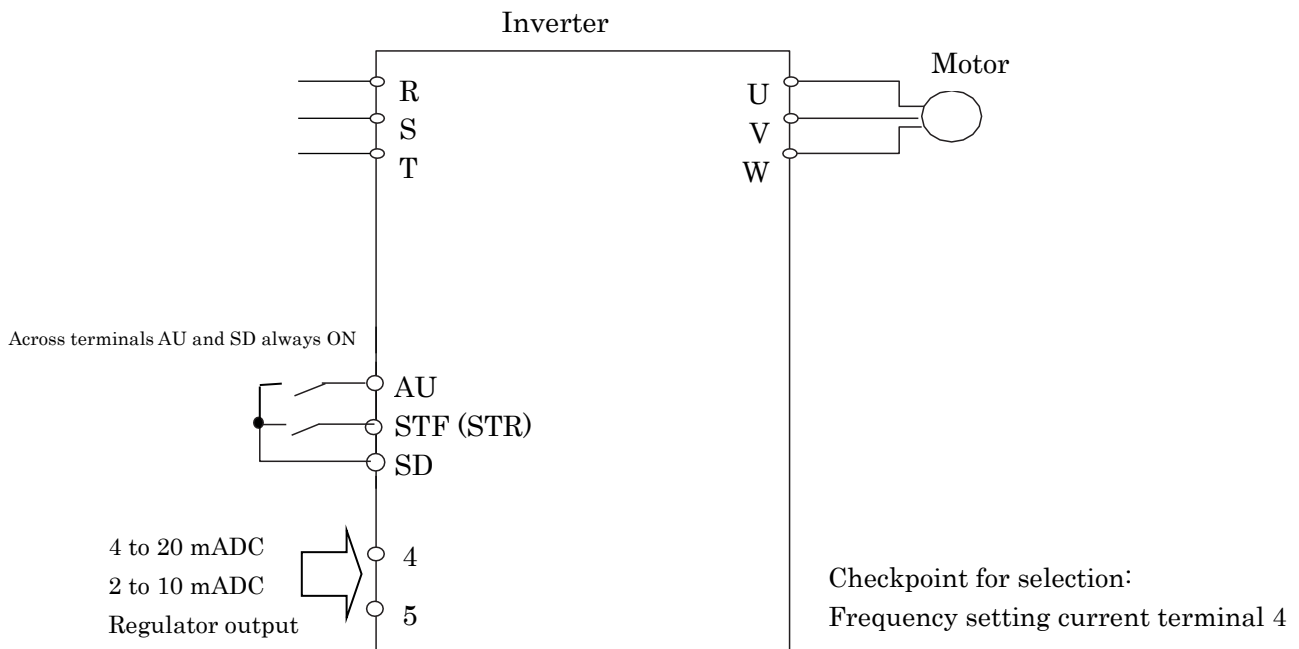
1. Required devices

External switch (for micro-currents): 3 pcs.

2. Connection

- 1) External switch: Forward rotation start switch across input terminals STF and SD
Reverse rotation start switch across input terminals STR and SD
Terminal 4 input selection switch (Always ON) across input terminals AU and SD
- 2) Regulator output (4 to 20 / 2 to 10 mADC): Across the frequency setting current terminals 4 and 5

Wiring example



3. Checkpoints for operation settings

- 1) Frequency setting current terminal 4: Input the regulator output (4 to 20 / 2 to 10 mADC current) directly. A frequency command can be entered.
- 2) Upper/lower limit: Set Pr.1 Maximum frequency and Pr.2 Minimum frequency as required.
Minimum frequency setting: Set the frequency at the point where the regulator is removed during use of the FR-FA.
Maximum frequency setting: Set the frequency at the point where 20 mADC (10 mADC) current is input during use of the FR-FA.
- 3) Arithmetic amplifier alone: Consider using an operational amplifier.

4. Related parameters of the inverter (Example: FR-A800)

Number	Name	Remarks
1	Maximum frequency	Set the items as required. Default value: Pr.1 = 120 Hz for the 55K or lower / 60 Hz for the 75K or higher Pr.2 = 0 Hz
2	Minimum frequency	
79	Operation mode selection	External operation mode. Set Pr.79 = "2".
184	AU terminal function selection	Set Pr.184 = "4" to assign the AU signal.
C5 (904)	Terminal 4 frequency setting bias frequency	Calibrate terminal 4 as required. Default value: 0 to 60 Hz is set for 4 to 20 mA.
C6 (904)	Terminal 4 frequency setting bias	
126	Terminal 4 frequency setting gain frequency	
C7 (905)	Terminal 4 frequency setting gain	

For details, refer to the Instruction Manual of the inverter.