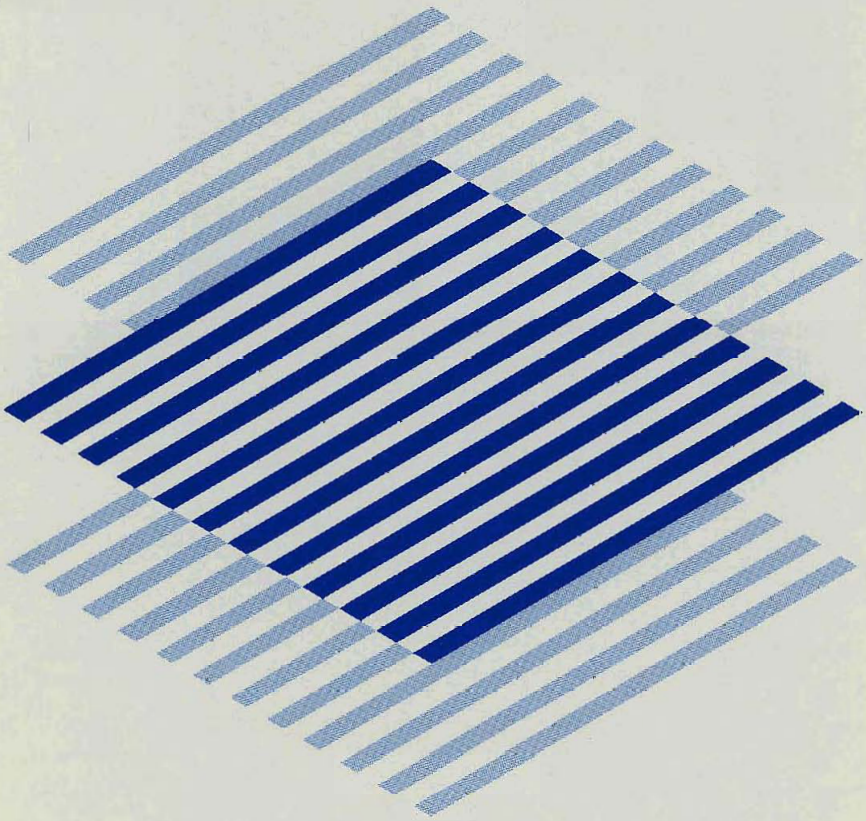
MITSUBISHI
TRANSISTORIZED INVERTER

FREQROL-Z

COMMERCIAL POWER SUPPLY-INVERTER
SWITCH-OVER/AUTOMATIC RESTART
AFTER INSTANTANEOUS POWER FAILURE UNIT

TYPE FR-ZNS

Instruction Manual



MITSUBISHI ELECTRIC

Thank you for choosing the option unit for the Mitsubishi FREQROL-Z200 series transistorized frequency inverters.

Please read this manual carefully to use the equipment to its optimum.
The FR-ZNS commercial power supply-inverter switch-over/automatic restart after instantaneous power failure unit allows the motor to keep operating without a stop when switching from the commercial power source to the inverter or if an instantaneous power failure occurs

CONTENTS

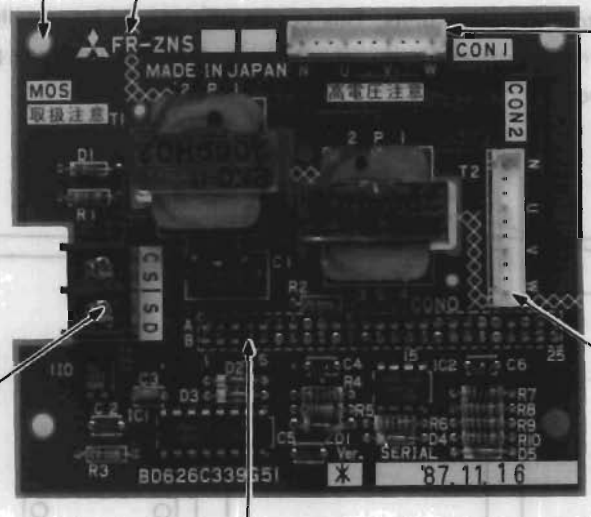
1. STRUCTURE

Installation hole (4 places)

Install onto the printed circuit board of the inverter.
For installation, see page 2.

Type

Check that the type received is correct.



Detection connector

To input the motor residual voltage.
For wiring, see page 4.

Terminal block

To reset the inverter.
For wiring, see page 5.

Connector (Rear surface)

Allows signals to be transferred between this unit and inverter.

For installation, see page 3.

Option-to-option connector
Used when this unit is used with the FR-ZTS.
For wiring, see page 4.

Accessories: Check that the following parts are supplied with the unit:

8 - Installation pins
1 - Connection cable

2. INSTALLATION

Remove the inverter cover and install the option unit in the following procedure:

2.1 Pre-Installation Checks

(1) Check the inverter type

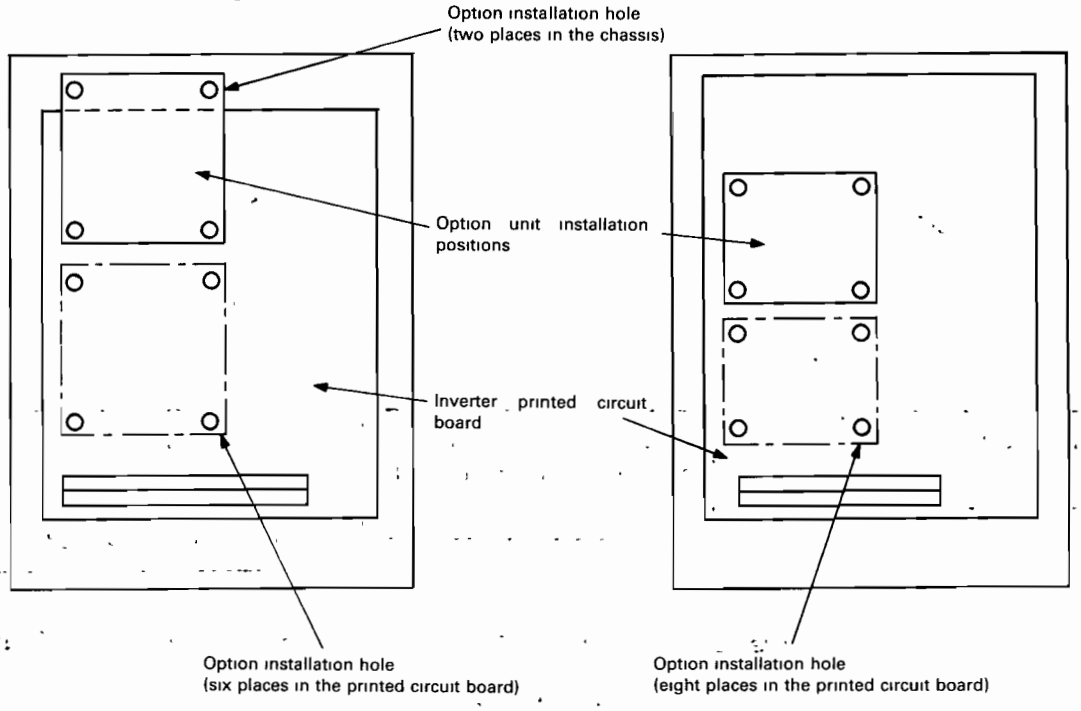
This option unit may only be used with the FREQROL-Z200 series inverters and must not be used with the other series (e.g. Z100, K400).

(2) Check that the inverter input power is off.

The inverter may become faulty if the option unit is installed with the input power on.

2.2 Installation Position

The Z200 series can accommodate up to two option units. This option unit should be installed at the upper position on the printed-circuit board as shown below with the exception that it may be installed at the lower position when the torque smoothing unit (FR-ZTS) exists at the upper position.



FR-Z220-0.4K to 1.5K

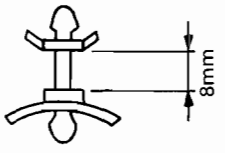
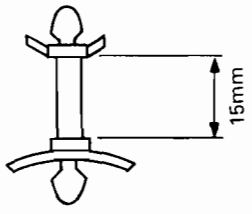
FR-Z220-2.2K to 11K
FR-Z240-2.2K to 7.5K

2.3 Installation Procedure

(1) Insert the supplied installation pins into the four installation holes in the inverter printed circuit board.

- Selecting the installation pin size

Two pin types (long and short) are supplied with the unit Determine the size in accordance with the inverter model (type) used

Inverter Model	Other Models FR-Z220-2.2K to 11K	FR-Z240-2.2K to 7.5K
Installation pin size	Short (4 pieces) 	Long (4 pieces) 

- Direction of pin installation

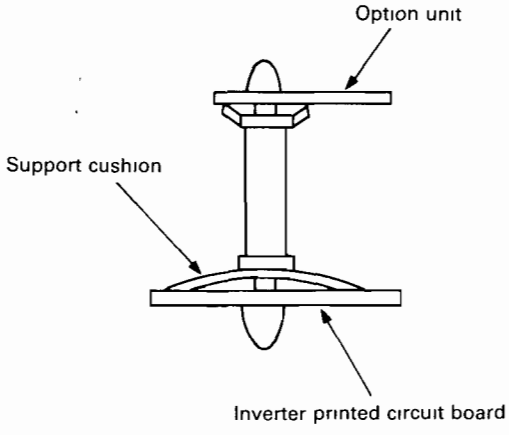
Insert the longer support cushion end of the installation pin into the installation hole in the inverter printed circuit board.

(2) Securely fit the option unit into the installation pins
At this time, the connector of the option unit is fitted into the connector pins on the inverter printed circuit board

Check point

- Check that the unit connector has been fitted into the inverter connector at the correct position

- Check that there is no clearance between the connectors.



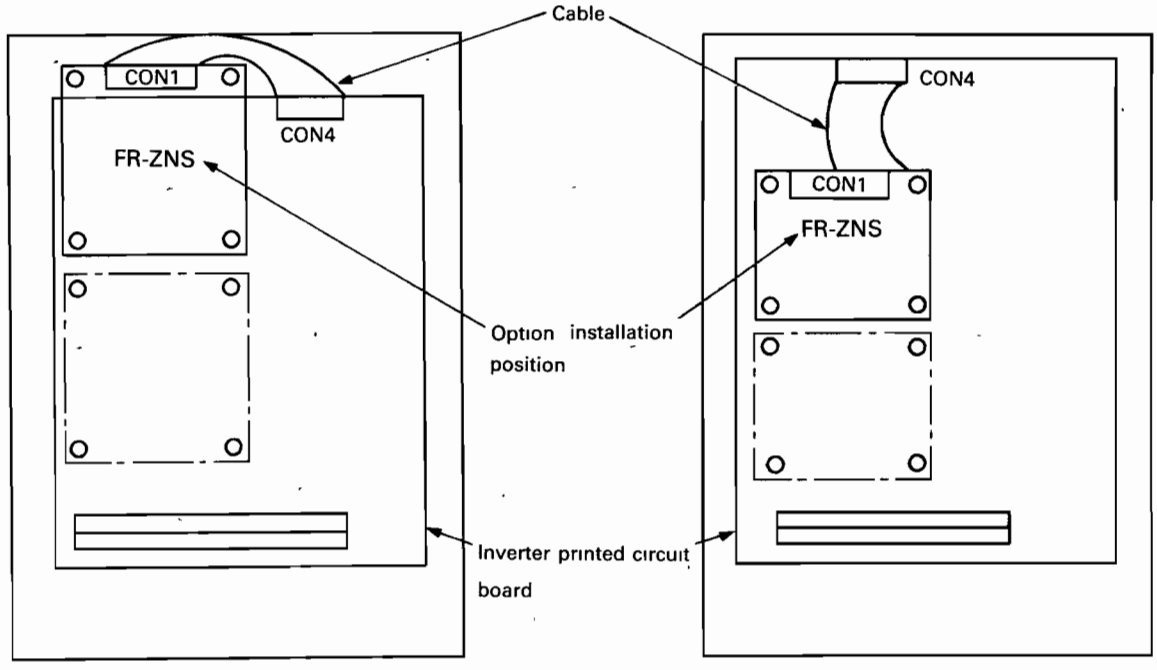
3. WIRING

3.1 Terminal Block and Connectors

	Symbol	Description	
Terminal	CS	Commercial power supply-inverter switch-over signal input terminal	Screw size: M3
	SD	Common terminal	
Connector	CON1	Motor residual voltage input connector (CON1 and CON2 are of the same specifications.)	
	CON2		

3.2 Connection of Option Unit and Inverter Printed Circuit Board

The connector (CON1) of the option unit and the connector (CON4) of the inverter printed circuit board must be connected by the supplied cable to operate the option unit.



FR-Z220-0.4K to 1.5K

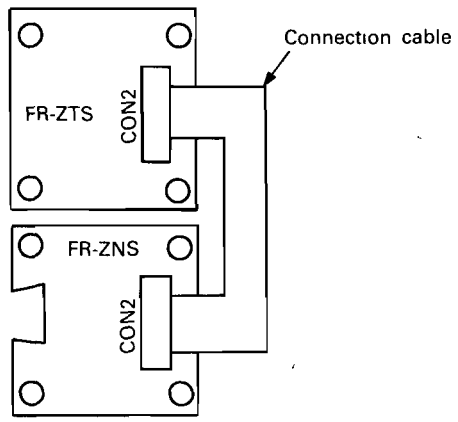
FR-Z220-2.2K to 11K
FR-Z240-2.2K to 7.5K

3.3 For Use with the FR-ZTS Option Unit

If the FR-ZTS (torque smoothing unit) already exists at the upper position of the printed circuit board, install the FR-ZNS to the lower position and connect it with the FR-ZTS by the supplied cable as shown on the right.

Connection cable

Note: When both the FR-ZTS and FR-ZNS are used in the inverter, either the FR-ZTS or the FR-ZNS may be installed at the upper position on condition that the connectors (CON2) of these option units should be connected each other by the supplied cable.



3.4 Connection of the CS and SD Terminals

(1) For commercial power supply-inverter switch-over

Wire the inverter as shown in Fig. 1 (see page 7) so that the signal across CS and SD may be switched in accordance with the switching of the magnetic contactor MC2 in the inverter output circuit

(2) For automatic restart after instantaneous power failure

CS and SD should always be connected

4. OPERATION PRINCIPLES

4.1 Commercial Power Supply-Inverter Switch-Over Operation

To operate the motor by the commercial power supply, disconnect the U, V, W output terminals of the inverter from the motor by using the magnetic contactor MC2 and stop the inverter by disconnecting the CS and SD terminals of the FR-ZNS option unit.

To switch from the commercial power supply to the inverter, switch off the commercial power supply operation magnetic contactor MC1 to coast the motor. At this time, the residual voltage of the frequency proportional to the coasting speed of the motor is induced in the motor terminals. (Switch-over to the inverter may fail if the residual voltage is lost.)

Then connect the CS terminal of the option unit and the SD terminal of the inverter, and switch on the inverter operation magnetic contactor MC2. This causes the reset signal (which can be set between 0.1 and 5 seconds by the parameter unit) to enter the inverter and the inverter to stand by for start for the set period of time. During this period, a frequency equivalent to the motor speed is detected in the option unit in accordance with the motor residual voltage and is output to the inverter. If the start signal of the inverter is on, the inverter output frequency is immediately risen up to the value corresponding to the coasting speed of the motor as soon as the above reset signal is switched off. This rise time is adjustable between 0.1 and 5 seconds using the cushion voltage time function (parameter 66). The commercial power supply operation is then switched to the inverter operation by gradually raising the output voltage of the inverter, with the starting current of the motor kept within the inverter rating. Approximately 1 second is required between the reset signal switched off and the operation switched over. After the switch-over to the inverter operation is complete, speed is increased or decreased up to the specified frequency in the acceleration/deceleration time set to the inverter.

To stop the motor from the inverter, switch off the start signal (STF or STR). The motor then decelerates to a stop in the defined deceleration time. At this time, the inverter operation magnetic contactor MC2 must be kept on. If switched off, the motor coasts to a stop.

> *Caution: The CS terminal of the option unit and the SD terminal of the inverter must be kept disconnected during the commercial power supply operation. Otherwise the reset signal will be given to the inverter on the leading edge of the signal across the above terminals.*

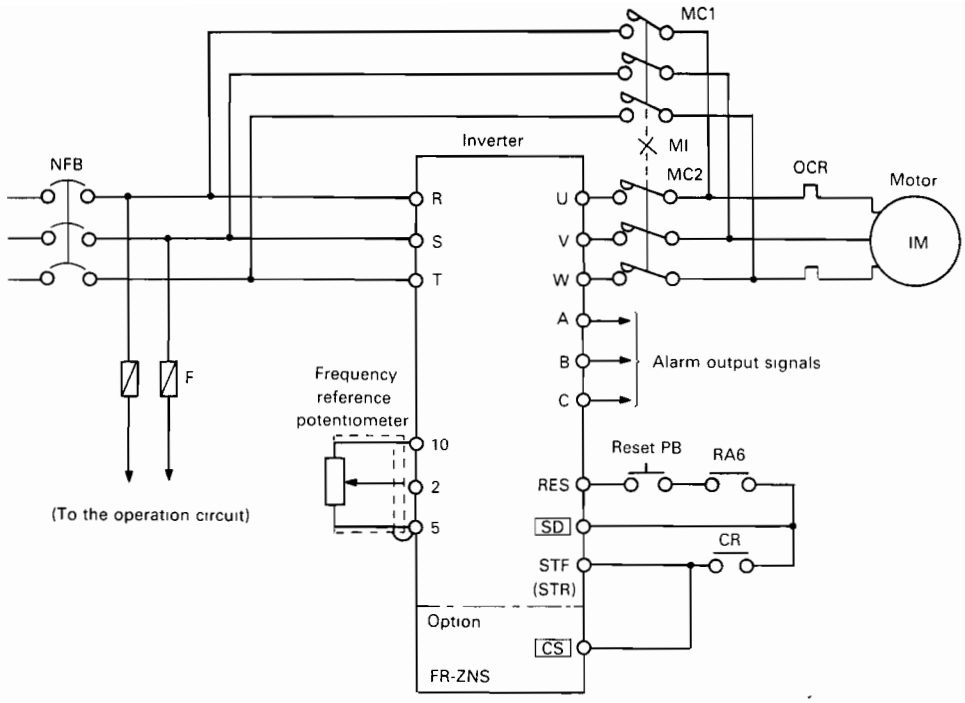


Fig. 1 Wiring Example for Commercial Power Supply-Inverter Switch-Over

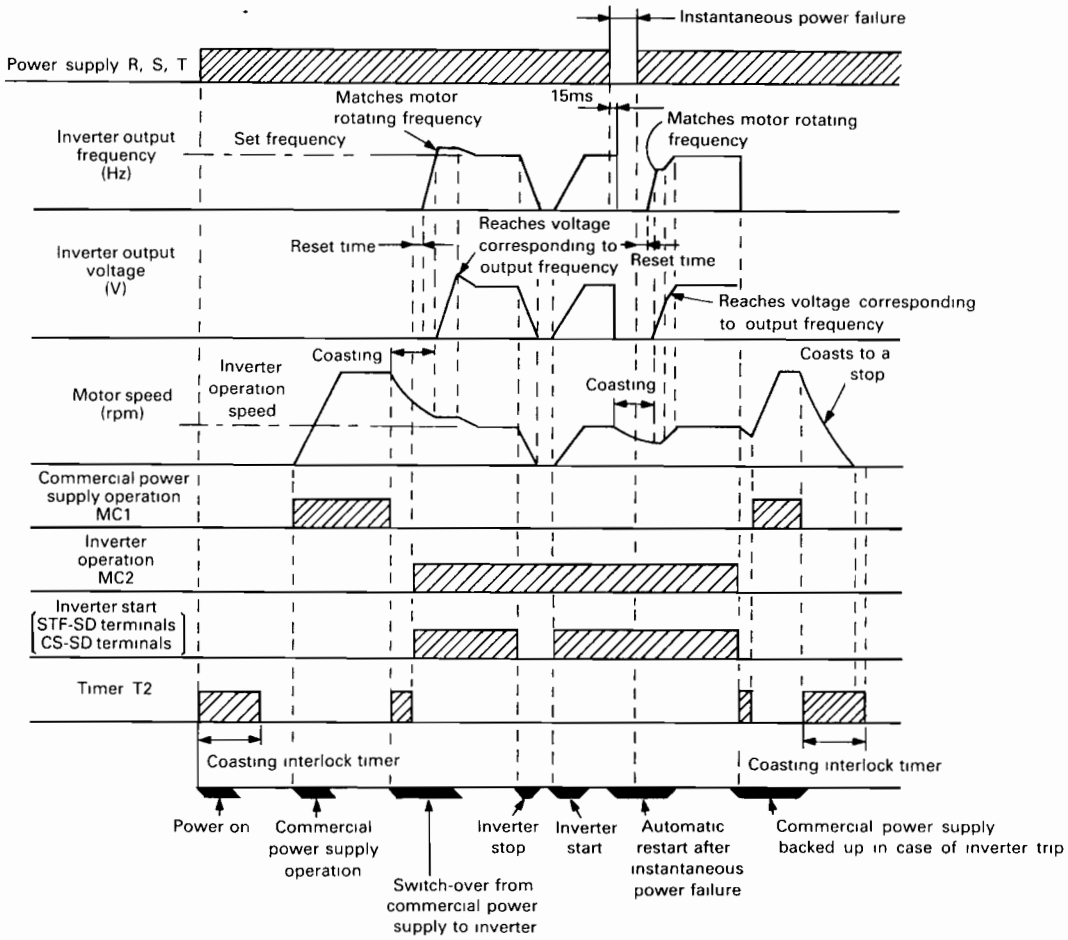


Fig. 2 FR-ZNS Operation Timing Chart

4.2 Automatic Restart After Instantaneous Power Failure

The fundamental operation principle is the same as that of the commercial power supply-inverter switch-over.
If instantaneous power failure has occurred longer than 15ms, or if power undervoltage protection is switched on and the power is then restored during the inverter operation, the reset signal is input from the inverter to the option unit.
If the signal across the CS terminal and the SD terminal of the option unit is on at this time, a frequency corresponding to the motor speed is detected in accordance with the motor residual voltage. When the start signal of the inverter is on, the inverter output frequency is risen smoothly up to the frequency equivalent to the coasting speed of the motor as soon as the reset signal (reset time: adjustable between 0.1 and 5 seconds by parameter 67) is switched off. The output voltage of the inverter is then risen in accordance with the cushion voltage time (adjustable between 0.1 and 5 seconds by parameter 66). The process of switching to the inverter operation is as described in Section 4.1. Fig. 3 shows the basic wiring diagram.

(1) Instantaneous power failure within 15ms

Normal operation is performed. Both the main and control circuits perform continuous operation without fault.

(2) Power failure longer than 15ms

As the inverter power is lost, the smoothing capacitor in the main circuit runs short of power and cannot continue operation any more. Hence, the inverter stops output (shuts off the transistor base) and the motor is coasted to a stop.
When the power is restored, the inverter outputs the reset signal to the option unit. If the signal across the CS and SD terminals is on, automatic restart after instantaneous power failure control is switched on.
The alarm output signal is not switched on between power failure occurrence and power restored.

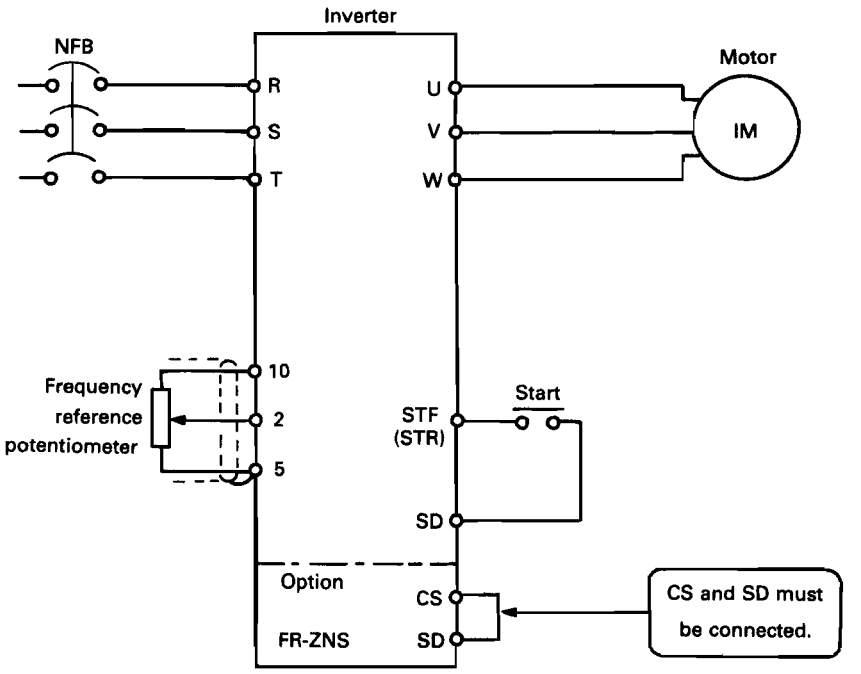


Fig. 3 Wiring Diagram for Use of Only Automatic Restart After Instantaneous Power Failure

CAUTION

(1) When only the "automatic restart after instantaneous power failure" facility is used, the CS terminal and the SD terminal of the option unit should be connected.

(2) When both the "commercial power supply-inverter switch-over" and "automatic restart after instantaneous power failure" facilities are used, the CS and SD terminals must be disconnected for the commercial power supply operation and connected for the inverter operation. See the wiring diagram example on page 16.

5. ADJUSTMENTS

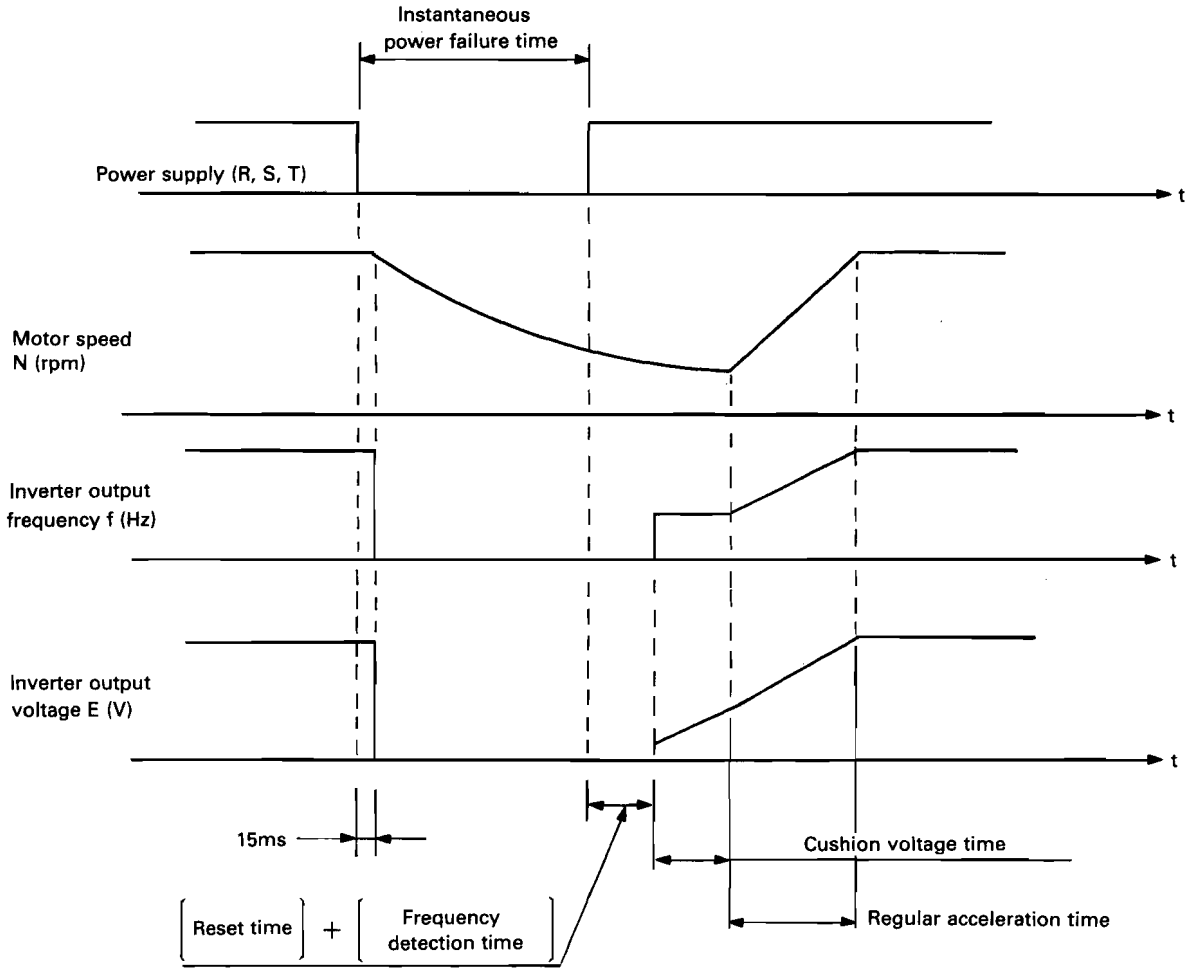
Restart control is automatic and requires no adjustment. The start-up time may be adjusted if it is necessary to make a restart earlier when the stop period is short during coasting of the motor due to small GD2 and large torque of the load.

- Time adjustable··· ● Cushion voltage time, and Reset time
- Adjustment method···Set by the parameter unit

Time Adjustable	Parameter Number	Setting Range	Factory setting
Cushion voltage time	66	0.1 to 5 seconds	0.5 seconds
Reset time	67	0.1 to 5 seconds	Depends on inverter capacity*

*Reset time···FR-Z220-0.4K to 1.5K: 0.2 seconds
FR-Z220/Z240-2.2K, 3.7K: 0.4 seconds
FR-Z220/Z240-11K: 1.0 second

Frequency detection time···6 to 500ms (automatically determined by the frequency detected)



6. INSTRUCTIONS

6.1 Application

(1) This option unit is designed for use in the FR-Z200 series inverters and cannot be used with the other series of inverters. This facility is mounted as standard in the inverters of 15kW (15K) and up.

(2) This option unit must not be used outside the inverter.

(3) This option unit cannot be used with any inverter which drives two or more motors.

6.2 Operation Sequence

● Commercial power supply-inverter switch-over

(1) When the motor is switched to the inverter from the commercial power supply, the inverter operation contactor (MC2) should be switched on before the signal across the CS and SD terminals is switched on. (Both may be switched on at the same time.) The signal across the CS and SD terminals must be off during the commercial power supply operation.

(2) The inverter will be damaged if the commercial power supply is applied to the inverter output circuit. Hence, electrical and mechanical interlocks must be provided so that the commercial power supply operation contactor and inverter operation contactor are not closed at the same time.

(3) If the load causes the motor to coast to a stop within the "'time between the commercial power supply operation contactor open and the inverter operation contactor closed' + 'inverter reset time'" (because of the large torque or small GD^2), the motor automatically restarts in the set acceleration time.

(4) The phase rotation at the motor terminals must be the same in the commercial power supply operation and inverter operation.

(5) When the power supply is input (connected) to the inverter, the instantaneous power failure indication (IPF lamp lit) and alarm output signal are not given if instantaneous power failure occurs during the commercial power supply operation.

● Automatic restart after instantaneous power failure

(1) If the load causes the motor to coast to a stop within the "'instantaneous power failure time' + 'reset time'" (because of the large torque or small GD^2), the motor automatically restarts in regular acceleration time after the reset time has elapsed.

(2) When only the "automatic restart after instantaneous power failure" facility is used, the CS terminal of the option unit and the SD terminal of the inverter (or of the option) must be connected.

6.3 Alarm Display

The inverter comes to a stop if any connection fault (e.g. loose connection of the option unit and inverter) occurs during operation.
At this time, E.OPT (E.OPT) is indicated by the parameter unit display and the ALARM lamp lit. Check the connector.

6.4 Relation between Operation Mode and Automatic Restart after Instantaneous Power Failure

● Instantaneous power failure shorter than 50ms to 100ms *

Operation Mode	Normal Operation	Alarm (except IPF, UVT)
External operation	○	×
3-wire control operation	○	×
Parameter unit operation	○	×
Data link operation	○	×

● Instantaneous power failure of 50ms to 100ms * or longer

Operation Mode	Normal Operation	Alarm (except IPF, UVT)
External operation	○	○
3-wire control operation	×	×
Parameter unit operation	×	×
Data link operation	×	×

Note:

** : Depends on the motor load.*

○: Restarted

×: Not restarted

7. SPECIFICATIONS

(1) Restartable motor speed

The motor may be automatically restarted if it is running at a speed equivalent to 6Hz or higher 0.5 seconds after the power is restored. If the speed is less than 6Hz, the motor is started at the same starting frequency as in a regular start.

Note: The motor cannot be restarted if it is run in the reverse direction by any external force (e.g. wind).

(2) Restartable instantaneous power failure time

There is no restriction on the time if the condition in (1) is met.

(3) Number of motors controlled

Only one. This option unit cannot be used with any inverter which drives two or more motors.

(4) Line voltage

This option unit may be used with any inverter of the 200V and 400V line voltage series.

(5) Control time

- Reset time: 0.2 to 1.0 s (depending on inverter capacity)
- Frequency detection time: 6 to 500ms (automatically controlled in accordance with the frequency detected)
- Cushion voltage time: 0.1 to 5s (set by the parameter unit)

(6) Inverter used

FR-Z200 series
FR-Z220-0.4K to 11K and FR-Z240-2.2K to 7.5K
(This facility is supplied as standard with the —15K and up)

8. OPERATION SEQUENCE DIAGRAMS

(1) Press the inverter operation pushbutton to switch from the commercial power supply to inverter operation without stopping the motor.

(2) The inverter operation is automatically switched to the commercial power supply operation if the inverter is tripped by its protection circuit.

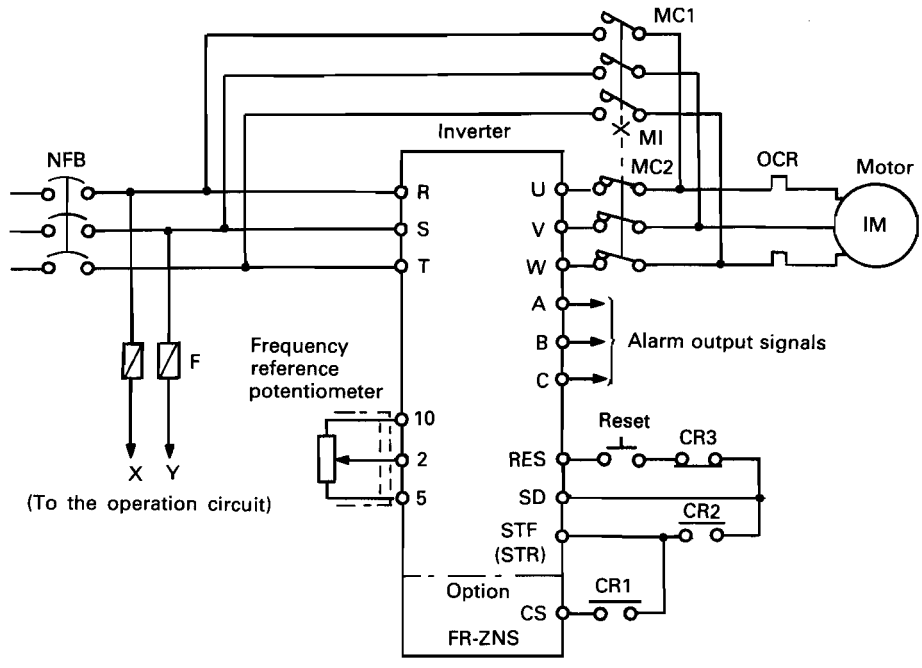
(3) When the stop pushbutton is pressed during the inverter operation, the motor is controlled by the inverter until it decelerates to a stop. (Modify the circuit as shown at the bottom of page 15 to coast the motor to a stop.)

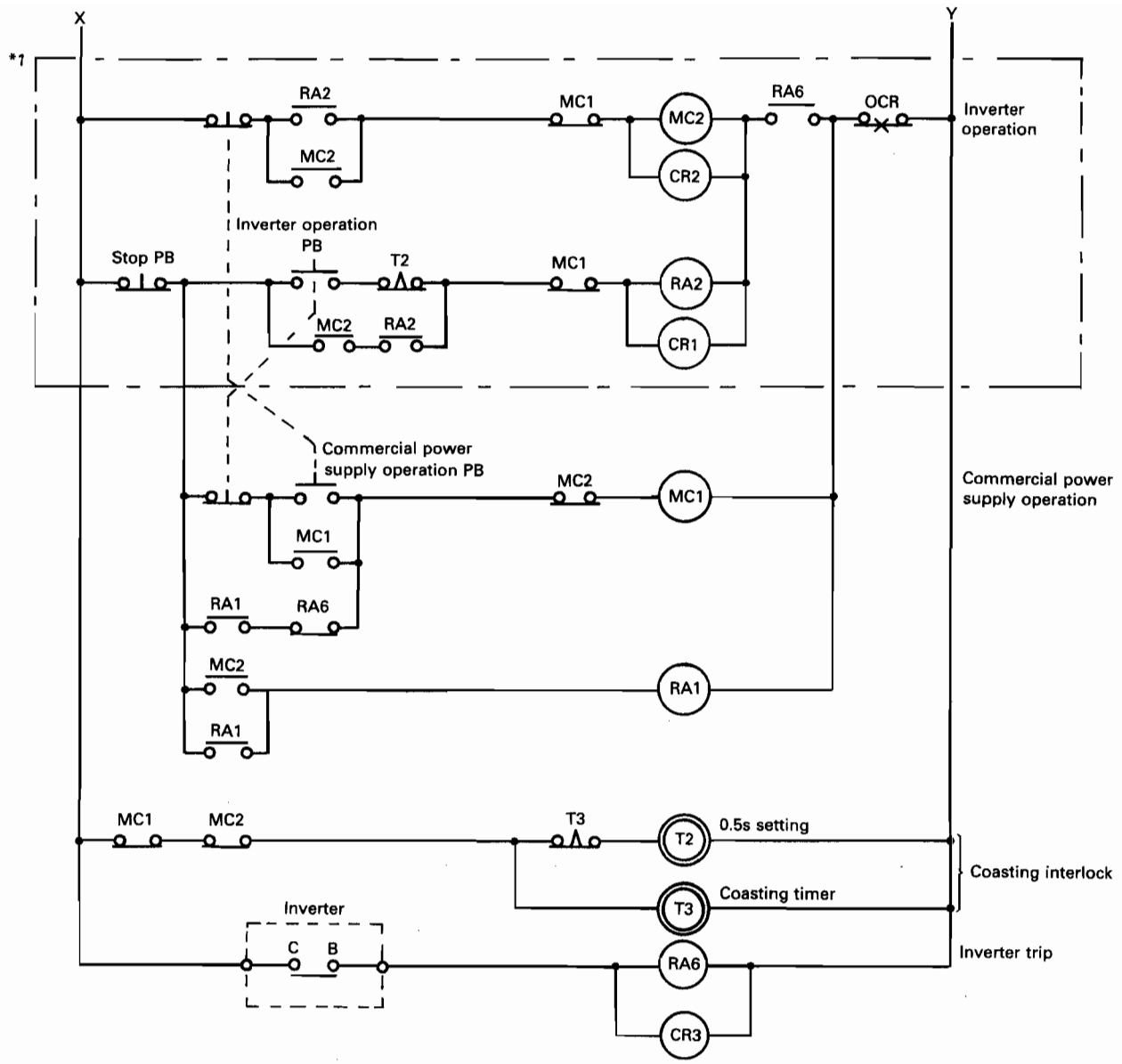
CAUTION

(1) Timer T3 should be set to the "motor coasting-to-stop" time or longer because the inverter starting circuit is provided with a coasting interlock.

(2) When the power is switched on during the inverter operation, the motor may be started after the time set to timer T3 has elapsed and with a delay of the option unit reset time.

(To operation circuit)
Frequency reference potentiometer





Change the area marked *1 as shown below to coast the motor to a stop during the inverter operation by pressing the stop pushbutton.

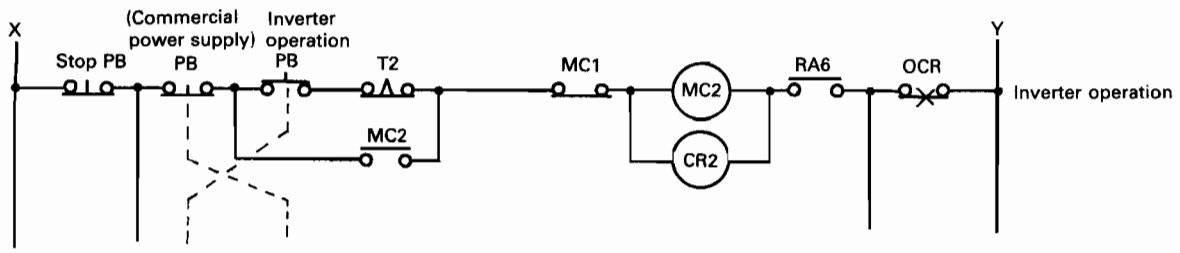
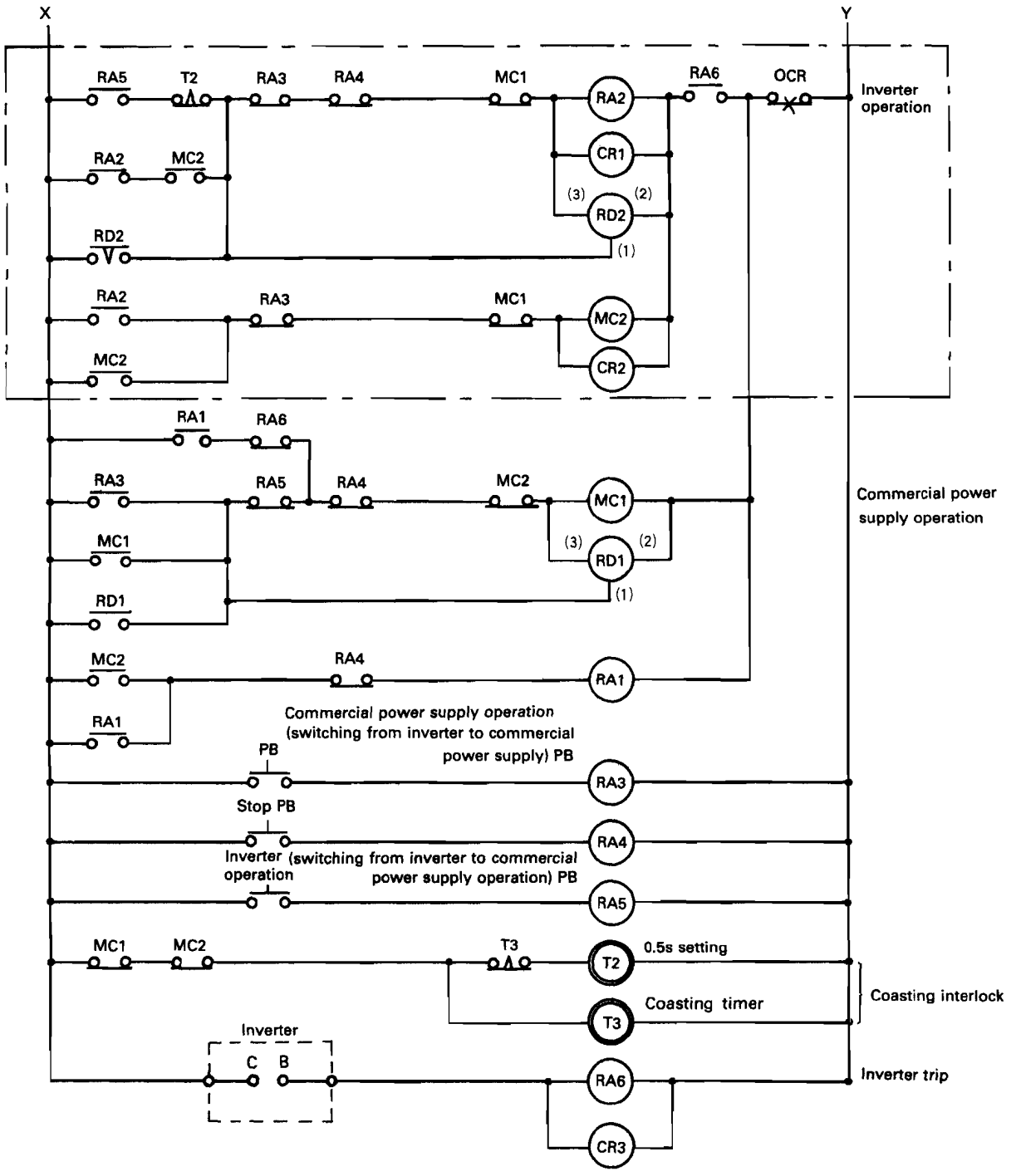


Fig. 6 Sequence Diagram for Commercial Power Supply-Inverter Switch-Over



Change the area marked *2 as shown below to coast the motor to a stop during the inverter operation by pressing the stop pushbutton.

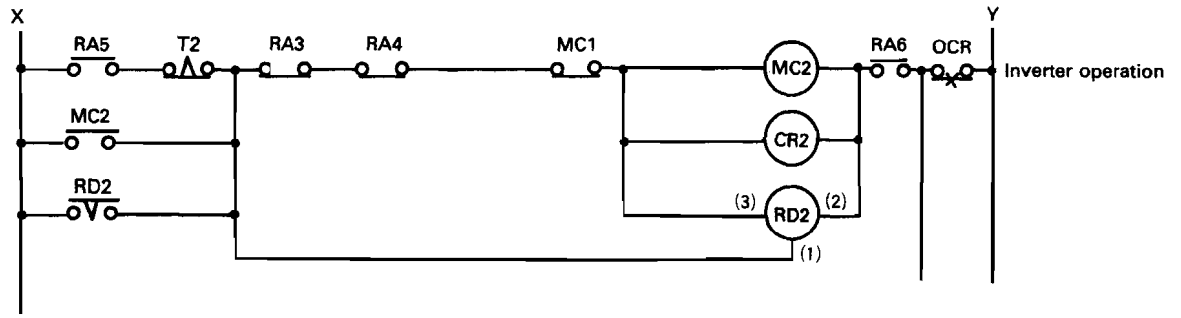


Fig. 7 Sequence Diagram for Commercial Power Supply-Inverter Switch-Over and Automatic Restart after Instantaneous Power Failure

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