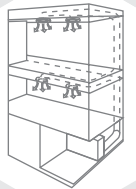
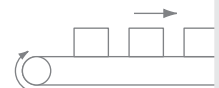
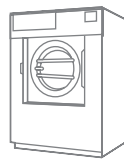


FRENIC Series Inverter Applications



FRENIC

Mini **APPLICATION GUIDE**



Application to Belt Conveyors

Advantages of using Fuji inverters

(1) Smooth start with a high starting torque of 150% or more

- Our original simplified torque-vector control makes it possible to generate a high starting torque of 150% or more (with automatic torque boost and slip compensation control ON at 0.5Hz).
- Even if conveyance load changes during operation, the current limit function and the slip compensation control function activate to ensure continuous operation without tripping.

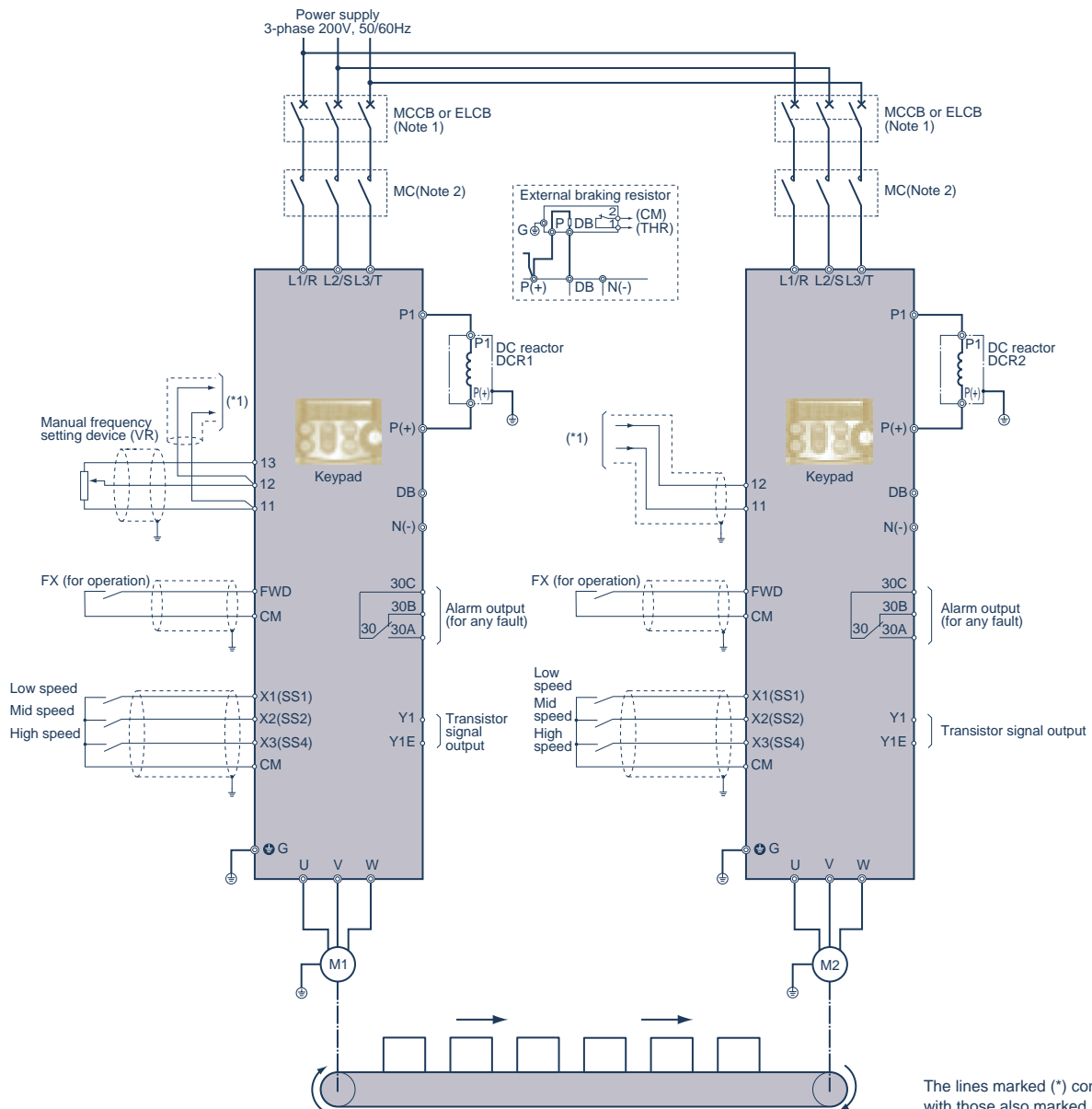
(2) More efficiency with multistep frequency operation

With the change of conveyance load, the multistep frequency function changes the motor operation frequency, enabling smooth operation without stopping the conveyor.

(3) Low noise eliminating the need to take special measures for noise reduction

Unpleasant noise from the inverter-driven motor has been nearly zeroed like the case where the motor gets its drive directly from the commercial power source. The inverter thus meets the strict requirement for noise reduction.

Wiring diagram and system configuration



Note 1 : Install a recommended molded-case circuit-breaker or an earth-leakage circuit-breaker (except one used only for protection against ground fault) in the primary circuit of the inverter to protect wiring. At this time, ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
 Note 2 : If there is a magnetic contactor or a solenoid close to the inverter, connect a surge suppressor to its coil. Keep the wiring length to a minimum.

Function code settings (recommended)

Func. code	Name	Factory setting	Recommended setting value	Remarks
F10	Electronic thermal relay (Select)	1: For motor with self-cooled fan, standard motor	1: For motor with self-cooled fan, standard motor	
F11	(for motor protection) (Level)	Nominal applied motor rated current	Nominal applied motor rated current	
F12	(Thermal time constant)	5.0: 5min	5.0: 5min	Set if necessary.
P02	Motor (Capacity)	Capacity of nominal applied motor	0.01 to 10.00kW 0.01 to 10.00HP	If "2" is set at the function code P99, HP unit is effective. If not, kW is effective.
P03	(Rated current)	Nominal applied motor rated current	0.00 to 99.99A	
P09	(Slip compensation gain)	0.0: 0%	0.0 to 200.0%	Set the value in accordance with the equipment to be combined.
E01	X1 terminal function (Select)	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	Input signal for reversing logic can be selected by setting a number in the order of 1000 shown in ().
E02	X2 terminal function	7: (1007) Coast-to-stop command [BX]	1: (1001) Multistep freq. selection (0 to 3 step) [SS2]	
E03	X3 terminal function	8: (1008) Alarm reset [RST]	2: (1002) Multistep freq. selection (0 to 7 step) [SS4]	
F31	FMA terminal (Select)	0: Output frequency (before slip compensation)	0: Output frequency (before slip compensation)	
H06	Fan stop operation	0: Inactive	1: Active (1.5kW or more)	
H07	ACC/DEC pattern	0: Inactive (linear)	1: S-curve (weak) 2: S-curve (strong)	Set the pattern according to the load conditions of machine to be combined.
F26	Motor sound (Carrier freq.)	2: 2kHz	15: 15kHz	
F14	Restart after momentary power failure (Select)	1: Inactive (Trips without restart when power recovers.)	4: Active (Restarts at frequency output at power failure, for general load.)	

In addition to the above codes, check if the parameter values set at the function codes F03 to F05, F07, F08, P02, P03, and P09 match the motor rated values and the machine design specifications.



Tips

(1) Setting the base frequency to 50Hz

Setting the base frequency to 50Hz gets the maximum performance out of the standard motor, thereby allowing you to reduce the required acceleration time.

(2) Installing a braking resistor

- If you select an inverter with a built-in braking resistor (1.5kW or larger capacity model), neither installing an external braking resistor nor securing its installation space is necessary.
- The 0.4 to 4.0kW models incorporate a braking transistor, to which an external braking resistor (DB□□-□) can be connected.
- When connecting an external braking resistor, be sure to remove the jumper bar form across the terminals P(+) and DB, and insulate the terminals.

(3) Reducing the radio noise

In an area where radio waves are weak, the radio may receive noise from the inverter. To prevent this, we recommend you install a ferrite ring (ACL-40B or ACL-74B).

(4) Suppressing harmonics with a DC reactor

The inverter is standard-equipped with the exclusive terminals P1 and P(+) to which a DC REACTOR can be connected. For suppressing harmonics, install the optional DC REACTOR (DCR□-□□□).

(5) Suppressing power-on inrush current

FRENIC-Mini series inverters incorporate the circuit for suppressing inrush current flowing when the power is turned on.

Application to Air Conditioning Fans

Advantages of using Fuji inverters

(1) Automatic energy-saving operation function for more energy saving

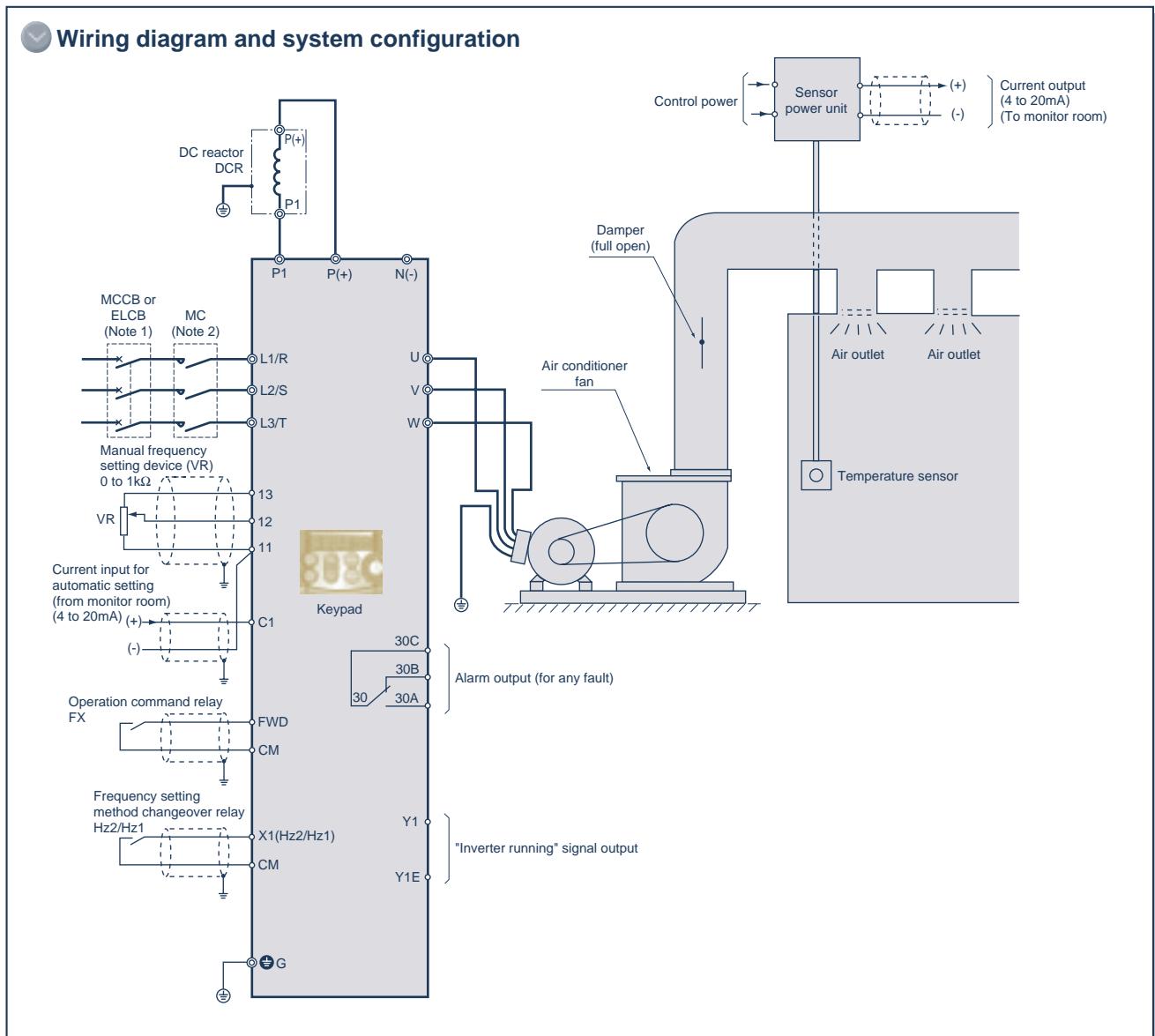
The inverter automatically sets the conditions that the motor can run with the highest efficiency according to the ever-changing fan's axial force. By minimizing the power consumption in this way, the inverter meets an increasing demand for energy saving.

(2) Inverter cooling fan ON/OFF control

- With activation of the inverter cooling fan ON/OFF control, the inverter automatically stops its fan when the inverter operation command is off and the heat sink temperature is low.
- The energy saving effect obtained from this function may be small when compared with the power required for air conditioner. However, it is significant when the energy is saved in the whole air conditioning system. Furthermore, this ON/OFF control is effective in eliminating the fan noise especially at night when such noise is a nuisance.

(3) Low noise for comfortable environment

Unpleasant noise from the inverter-driven motor has been nearly zeroed like the case where the motor gets its drive directly from the commercial power source.



Note 1 : Install a recommended molded-case circuit-breaker or an earth-leakage circuit-breaker (except one used only for protection against ground fault) in the primary circuit of the inverter to protect wiring. At this time, ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
 Note 2 : If there is a magnetic contactor or a solenoid close to the inverter, connect a surge suppressor to its coil. Keep the wiring length to a minimum.

Function code settings (recommended)

Func. code	Name	Factory setting	Recommended setting value	Remarks
F01	Frequency command 1	4: Potentiometer on the keypad	2: Current input (terminal C1) (4 to 20mA DC)	Normal operation
C30	Frequency command 2	2: Current input (terminal C1) (4 to 20mA DC)	0: Keypad operation (▲ or ● key) 1: Voltage input (terminal 12) (0 to 10V DC) 4: Potentiometer on the keypad	Manual operation
E01	X1 terminal function (Select)	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	11: (1011) Freq. set 2 / Freq. set 1 [Hz2/Hz1]	The function can be set at E02 or E03 (terminal X2 or X3).
F37	Load select/Auto torque boost/Energy-saving operation	1: Constant torque load	3: Energy-saving operation (Variable torque load during ACC/DEC.)	
H06	Fan stop operation	0: Inactive	1: Active (1.5kW or more)	
F14	Restart mode after (Select) momentary power failure	1: Inactive (Trips without restart when power recovers.)	5: Active (Restarts at starting frequency, for low-inertia load.)	
F26	Motor sound (Carrier freq.)	2: 2kHz	15: 15kHz	
E20	Y1 terminal function (Select)	0: (1000) Inverter running [RUN]	0: (1000) Inverter running [RUN]	
C01	Jump frequency 1	0.0: 0Hz	0.0 to 400.0: 0.0 to 400.0Hz	Set the value if this function is needed for the machine to be combined.
C02	2	0.0: 0Hz		
C03	3	0.0: 0Hz		
C04	(Hysteresis)	3.0: 3Hz	0.0 to 30.0: 0.0 to 30.0Hz	

In addition to the above codes, check if the parameter values set at the function codes F03 to F05, F07, F08, P02, P03, and P09 match the motor rated values and the machine design specifications.

Tips

(1) Automatic energy-saving operation: Ideal for fans

The automatic energy-saving operation exhibits the maximum effect when used for the fan's variable torque load.

(2) Possible to output "Inverter running" signal

By assigning the Y1 terminal function to "Inverter running" at the function code E20, the transistor signal can be output by establishing continuity between the terminals Y1 and Y1E during inverter operation.

(3) Easy switching between automatic and manual frequency setting methods

- Frequency setting method can be easily switched between remote frequency setting (4 to 20mA) and manual frequency setting (using ▲ or ● key or potentiometer). This function is useful when the operating condition needs to be confirmed on the site.
- Any of the terminals X1 to X3 is connected to a relay, and the setting method is switched by turning on and off of the relay contact.

Suppose this function is assigned to the terminal X1 by data setting at the function code E01. When the relay contact between the terminal X1 and the relay which is connected to CM is OFF, the frequency setting method specified by F01 becomes effective. When the contact is ON, the frequency setting method specified by the function code C30 becomes effective.

(4) Suppressing harmonics with a DC reactor

The inverter is standard-equipped with the exclusive terminals P1 and P(+) to which a DC REACTOR can be connected. For suppressing harmonics, use the optional DC REACTOR (DCR□-□□□).

(5) Suppressing power-on inrush current

FRENIC-Mini series inverters incorporate the circuit for suppressing inrush current flowing when the power is turned on.

Application to Air Conditioning Fans (with PID control)

Advantages of using Fuji inverters

(1) Built-in PID control function

The inverter incorporates the PID control function. By simply connecting a room temperature sensor (4 to 20mA) with the inverter, the inverter can control the air conditioner so that it keeps the room temperature at a constant level.

(2) Automatic energy-saving operation function for more energy saving

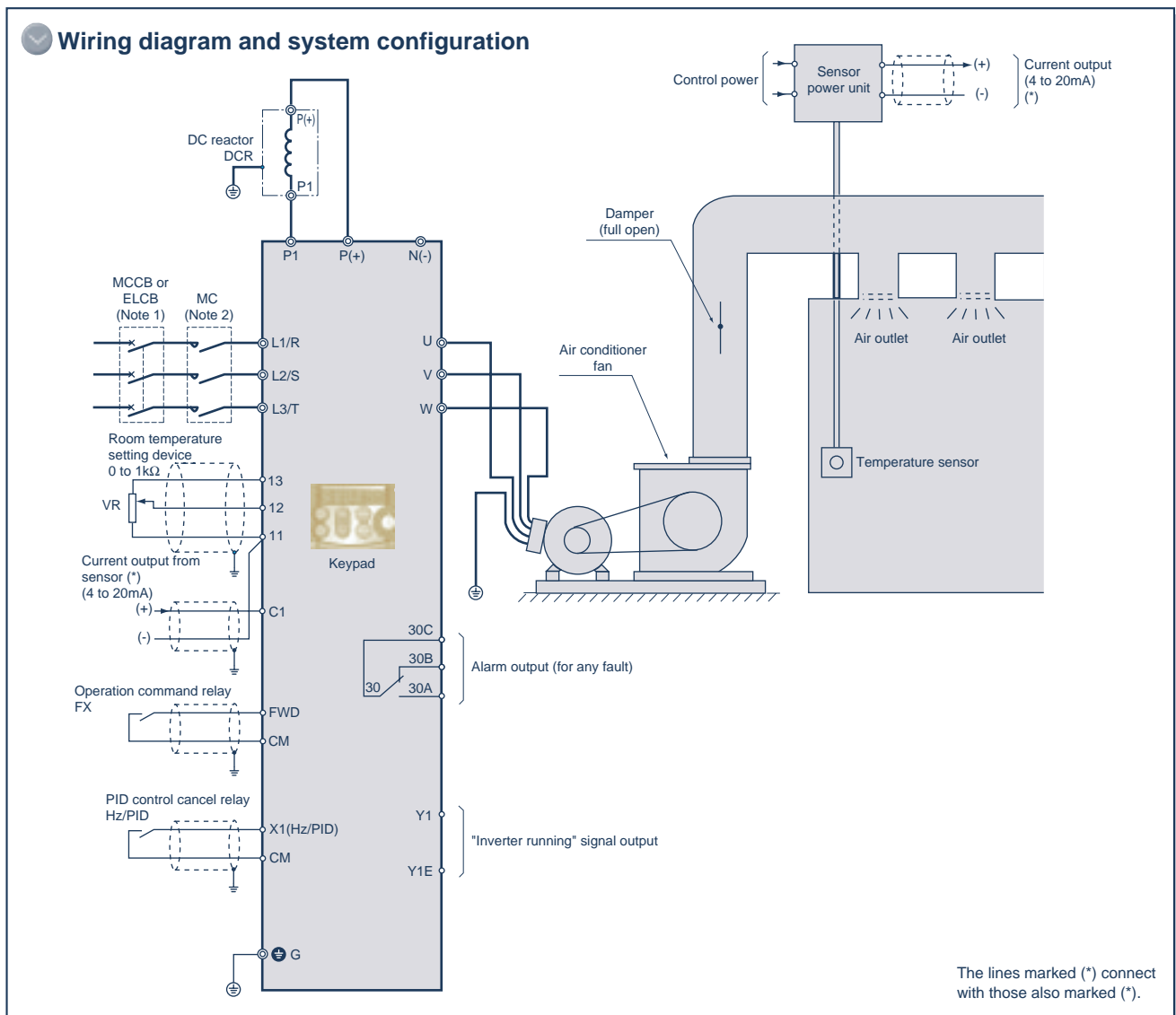
The inverter automatically sets the conditions that the motor can run with the highest efficiency according to the ever-changing fan's axial force. By minimizing the power consumption in this way, the inverter meets an increasing demand for energy saving.

(3) Inverter cooling fan ON/OFF control

- With activation of the inverter cooling fan ON/OFF control, the inverter automatically stops its fan when the inverter operation command is off and the heat sink temperature is low.
- The energy saving effect obtained from this function may be small when compared with the power required for air conditioner. However, it is significant when the energy is saved in the whole air conditioning system. Furthermore, this ON/OFF control is effective in eliminating the fan noise especially at night when such noise is a nuisance.

(4) Low noise for comfortable environment

Unpleasant noise from the inverter-driven motor has been nearly zeroed like the case where the motor gets its drive directly from the commercial power source.



Note 1 : Install a recommended molded-case circuit-breaker or an earth-leakage circuit-breaker (except one used only for protection against ground fault) in the primary circuit of the inverter to protect wiring. At this time, ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
 Note 2 : If there is a magnetic contactor or a solenoid close to the inverter, connect a surge suppresser to its coil. Keep the wiring length to a minimum.

Function code settings (recommended)

Func. code	Name	Factory setting	Recommended setting value	Remarks	
J01	PID control (Select)	0: Inactive	0: Inactive (4 to 20mA DC)	Operation without PID control	
			1: Process control use (Normal action) Set for heating.	Set for heating.	
			2: Process control use (Inverse action) Set for cooling.	Set for cooling.	
J03	P (gain)	0.100: 0.1 times	0.001 to 10.00: 0.001 to 10.00 times	Set the gain according to equipment design specifications.	
J04	I (Integration time)	0.0: 0s	0.1 to 3600: 0.1 to 3600s		
J05	D (Differentiation time)	0.0: 0s	0.1 to 600.0: 0.1 to 600.0s		
J06	(Feedback filter)	0.5: 0.5s	0.0: No filter		
E62	Terminal 13 (Function)	0: No function selection	5: PID feedback value		
E01	X1 terminal function (Select)	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	20: (1020) PID control cancel [Hz/PID]	With the terminal X1 ON, manual (keypad) operation is selected.	
F37	Load select/Auto torque boost/Energy-saving operation	1: Constant torque load	3: Energy-saving operation (Variable torque load during ACC/DEC.)		
H06	Fan stop operation	0: Inactive	1: Active (1.5kW or more)		
E20	Y1 terminal function (Select)	0: (1000) Inverter running [RUN]	0: (1000) Inverter running [RUN]		
F14	Restart mode after momentary power failure (Select)	1: Inactive (Trips without restart when power recovers.)	5: Active (Restarts at starting frequency, for low inertia load)		
F26	Motor sound (Carrier freq.)	2: 2kHz	15: 15kHz		
C01	Jump frequency 1	0.0: 0Hz	0.0 to 400.0: 0.0 to 400.0Hz	Set the value if this function is needed for the machine to be combined.	
C02		2			0.0: 0Hz
C03		3			0.0: 0Hz
C04		(Hysteresis)			3.0: 3Hz

In addition to the above codes, check if the parameter values set at the function codes F03 to F05, F07, F08, P02, P03, and P09 match the motor rated values and the machine design specifications.



Tips

(1) Possible to set PID control parameters

The optimum values for PID control function vary with the equipment and the conditions where the equipment is used. The factors for determining the optimum values include the area size to be air conditioned, adiabatic status, and the air conditioner capacity.

At first, set arbitrary values on the trial base, and then re-set the optimum values after test operation.

(2) Automatic energy-saving operation: Ideal for fans

The automatic energy-saving operation exhibits the maximum effect when used for the fan's variable torque load.

(3) Possible to output "Inverter running" signal

By assigning the Y1 terminal function to "Inverter running" at the function code E20, the transistor signal can be output by establishing continuity between the terminals Y1 and Y1E during inverter operation.

(4) Suppressing harmonics with a DC reactor

The inverter is standard-equipped with the exclusive terminals P1 and P(+) to which a DC REACTOR can be connected. For suppressing harmonics, use the optional DC REACTOR (DCR□-□□□).

Application to Centrifugal Separators

Advantages of using Fuji inverters

(1) Slip compensation control function for constant rotating speed

The inverter maintains the constant rotating speed according to the preset slip compensation amount.

(2) Smooth start with a high starting torque of 150% or more

Our original simplified torque-vector control makes it possible to generate a high starting torque of 150% or more (with automatic torque boost and slip compensation control ON at 0.5Hz).

(3) Frequency setting up to 400Hz

Since the frequency can be set to a maximum of 400Hz, the inverter can meet the demand for high-speed rotation of the motor.

(4) Low noise for comfortable environment

Unpleasant noise from the inverter-driven motor has been nearly zeroed like the case where the motor gets its drive directly from the commercial power source.

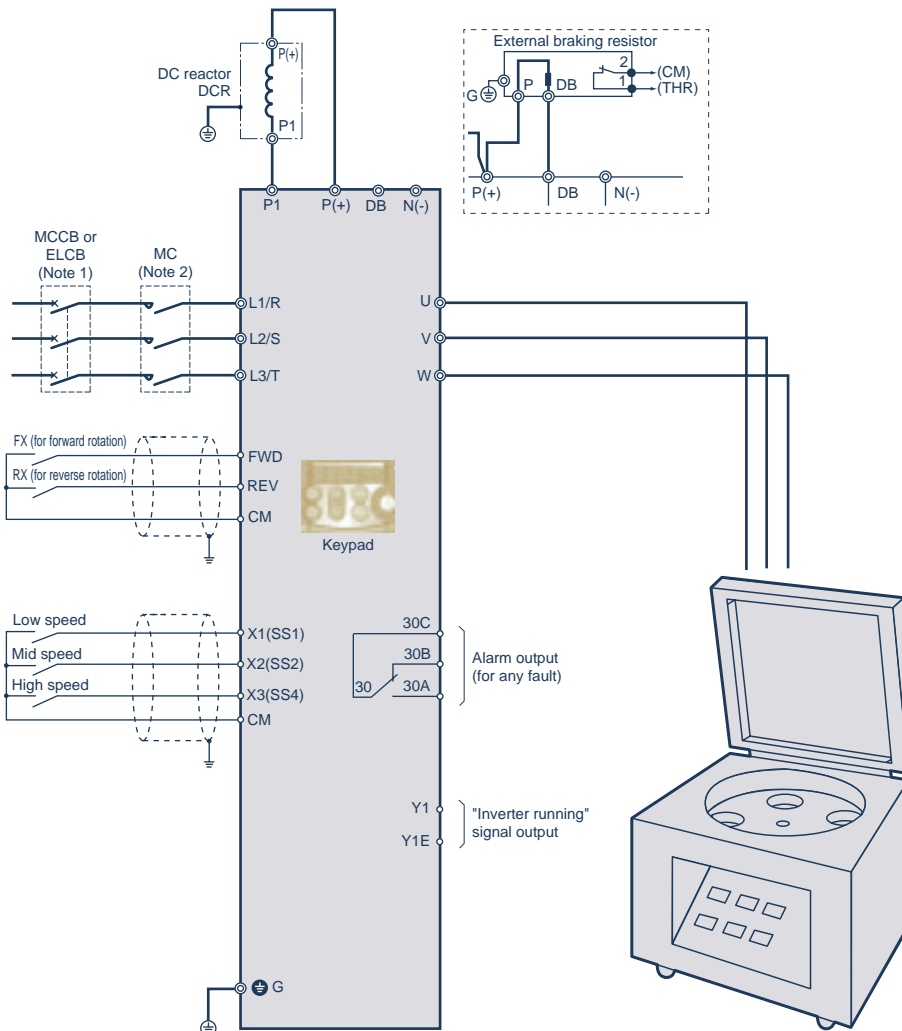
(5) Cost reduction by sharing 50Hz and 60Hz parts

The inverter can output a preset frequency whether the power source frequency is 50Hz or 60Hz, and permits sharing of the mechanical parts. Since the mechanical parts and completed systems are used for both 50Hz and 60Hz, their stock amount can be greatly reduced, allowing easy stock control.

(6) Acceleration/deceleration time setting up to 3600 seconds

The acceleration/deceleration time can be set within the range from 0.01 to 3600 seconds.

Wiring diagram and system configuration



Note 1 : Install a recommended molded-case circuit-breaker or an earth-leakage circuit-breaker (except one used only for protection against ground fault) in the primary circuit of the inverter to protect wiring. At this time, ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.

Note 2 : If there is a magnetic contactor or a solenoid close to the inverter, connect a surge suppresser to its coil. Keep the wiring length to a minimum.

Function code settings (recommended)

Func. code	Name	Factory setting	Recommended setting value	Remarks
F03	Maximum frequency	60.0: 60Hz	25.0 to 400.0: 25.0 to 400.0Hz	Set the value if this function is needed for the machine to be combined.
E01	X1 terminal function (Select)	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	Input signal for reversing logic can be selected by setting a number in the order of 1000 shown in ().
E02	X2 terminal function	7: (1007) Coast-to-stop command [BX]	1: (1001) Multistep freq. selection (0 to 3 step) [SS2]	
E03	X3 terminal function	8: (1008) Alarm reset [RST]	2: (1002) Multistep freq. selection (0 to 7 step) [SS4]	
F37	Load select/Auto torque boost/Energy-saving operation	1: Constant torque load	2: Auto torque boost	
H06	Fan stop operation	0: Inactive	1: Active (1.5kW or more)	
F14	Restart mode after momentary power failure (Select)	1: Inactive (Trips without restart when power recovers.)	1: Inactive (Trips without restart when power recovers.)	
F26	Motor sound (Carrier freq.)	2: 2kHz	15: 15kHz	
E20	Y1 terminal function (Select)	0: (1000) Inverter running [RUN]	0: (1000) Inverter running [RUN]	
H69	Automatic deceleration (Select)	0: Inactive	0: Inactive	
C01	Jump frequency 1	0.0: 0Hz	0.0 to 400.0: 0.0 to 400.0Hz	Set the value if this function is needed for the machine to be combined.
C02	2	0.0: 0Hz		
C03	3	0.0: 0Hz		
C04	(Hysteresis)	3.0: 3Hz		

In addition to the above codes, check if the parameter values set at the function codes F03 to F05, F07, F08, P02, P03, and P09 match the motor rated values and the machine design specifications.

When setting the maximum frequency to 120Hz or more, it is necessary to run the inverter in combination with the motor on a trial base to check for operation.



Tips

(1) Reducing the radio noise

In an area where radio waves are weak, the radio may receive noise from the inverter. To prevent this, we recommend you install a ferrite ring (ACL-40B or ACL-74B).

(2) Suppressing harmonics with a DC reactor

The inverter is standard-equipped with the exclusive terminals P1 and P(+) to which a DC REACTOR can be connected. For suppressing harmonics, install the optional DC REACTOR (DCR□-□□□).

(3) Suppressing power-on inrush current

FRENIC-Mini series inverters incorporate the circuit for suppressing inrush current flowing when the power is turned on.

(4) Installing a braking resistor

- If you select an inverter with a built-in braking resistor (1.5kW or larger capacity model), neither installing an external braking resistor nor securing its installation space is necessary.
- The 0.4 to 4.0kW models incorporate a braking transistor, to which an external braking resistor (DB□□-□) can be connected.
- When connecting an external braking resistor, be sure to remove the jumper bar form across the terminals P(+) and DB, and insulate the terminals.

Application to Washing Machines for Commercial-use

Advantages of using Fuji inverters

(1) Substantially reduced motor instability

Thanks to our unique motor control technology, unstable motor rotation in a low speed range has been reduced to about a half (compared with our previous model).

(2) Slip compensation control function for constant rotating speed

By setting a slip compensation amount, the inverter controls the washing machine so that the machine maintains the constant rotating speed, at which the cloth items always drop when they comes to the top of the tub regardless of the amount of washing load.

(3) Smooth start with a high starting torque of 150% or more

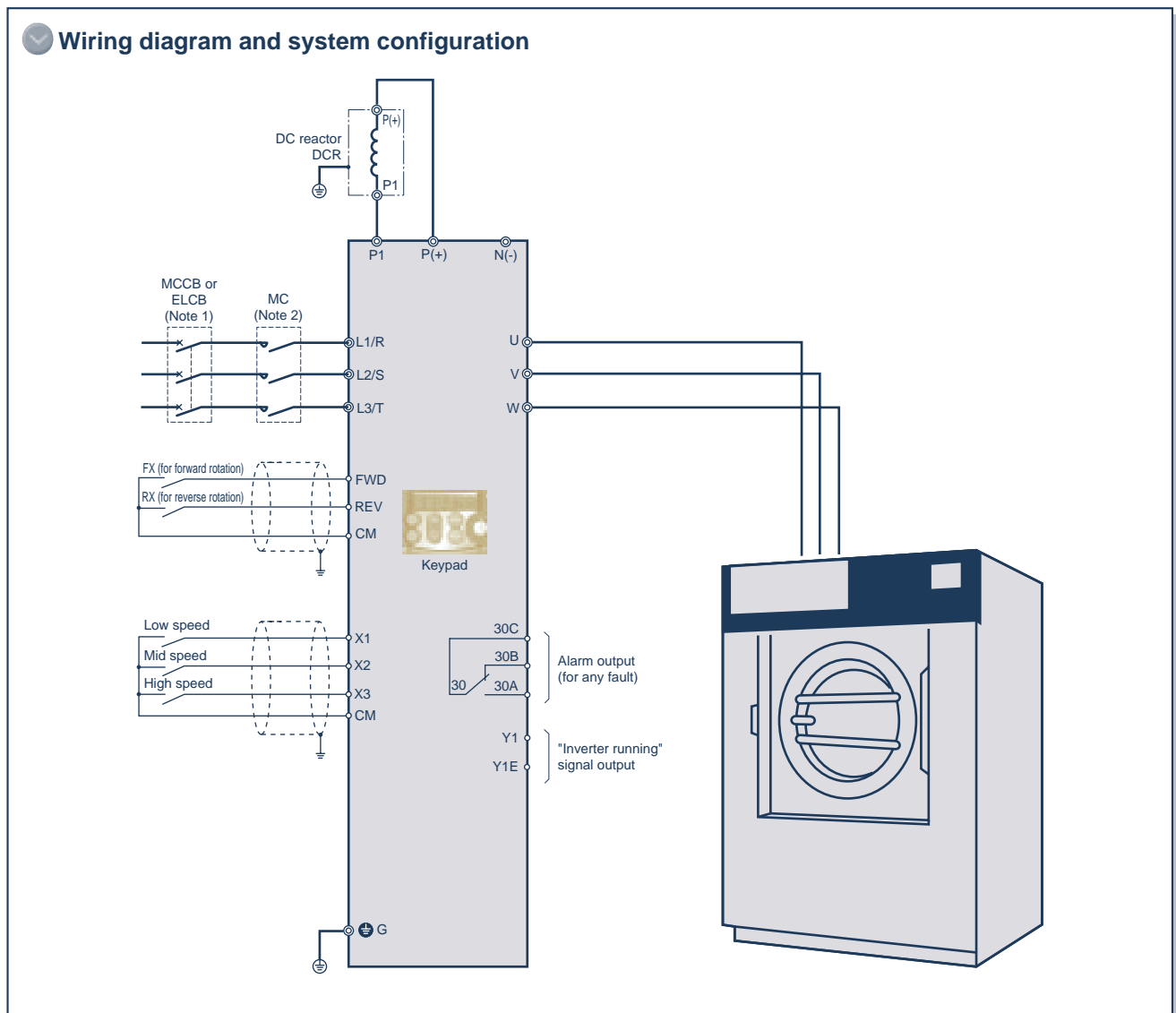
Our original simplified torque-vector control makes it possible to generate a high starting torque of 150% or more (with automatic torque boost and slip compensation control ON at 0.5Hz).

(4) Low noise eliminating the need to take special measures for noise reduction

Unpleasant noise from the inverter-driven motor has been nearly zeroed like the case where the motor gets its drive directly from the commercial power source. The inverter thus meets the strict requirement for noise reduction.

(5) Cost reduction by sharing 50Hz and 60Hz parts

The inverter can output a preset frequency whether the power source frequency is 50Hz or 60Hz, and permits sharing of the mechanical parts. Since the mechanical parts and completed systems are used for both 50Hz and 60Hz, their stock amount can be greatly reduced, allowing easy stock control.



Note 1 : Install a recommended molded-case circuit-breaker or an earth-leakage circuit-breaker (except one used only for protection against ground fault) in the primary circuit of the inverter to protect wiring. At this time, ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
 Note 2 : If there is a magnetic contactor or a solenoid close to the inverter, connect a surge suppresser to its coil. Keep the wiring length to a minimum.

Function code settings (recommended)

Func. code	Name	Factory setting	Recommended setting value	Remarks	
E01	X1 terminal function (Select)	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	0: (1000) Multistep freq. selection (0 to 1 step) [SS1]	Input signal for reversing logic can be selected by setting a number in the order of 1000 shown in ().	
E02	X2 terminal function	7: (1007) Coast-to-stop command [BX]	1: (1001) Multistep freq. selection (0 to 3 step) [SS2]		
E03	X3 terminal function	8: (1008) Alarm reset [RST]	2: (1002) Multistep freq. selection (0 to 7 step) [SS4]		
F37	Load select/Auto torque boost/Energy-saving operation	1: Constant torque load	2: Auto torque boost		
H06	Fan stop operation	0: Inactive	1: Active (1.5kW or more)		
F14	Restart mode after momentary power failure (Select)	1: Inactive (Trips without restart when power recovers.)	4: Active (Restarts at frequency output at power failure, for general load.)		
F26	Motor sound (Carrier freq.)	2: 2kHz	15: 15kHz		
E20	Y1 terminal function (Select)	0: (1000) Inverter running [RUN]	0: (1000) Inverter running [RUN]		
C01	Jump frequency 1	0.0: 0Hz	0.0 to 400.0: 0.0 to 400.0Hz	Set the value if this function is needed for the machine to be combined.	
C02		2			0.0: 0Hz
C03		3			0.0: 0Hz
C04		(Hysteresis)			3.0: 3Hz

In addition to the above codes, check if the parameter values set at the function codes F03 to F05, F07, F08, P02, P03, and P09 match the motor rated values and the machine design specifications.

Tips

(1) Reducing the radio noise

In an area where radio waves are weak, the radio may receive noise from the inverter. To prevent this, we recommend you install a ferrite ring (ACL-40B or ACL-74B).

(2) Suppressing harmonics with a DC reactor

The inverter is standard-equipped with the exclusive terminals P1 and P(+) to which a DC REACTOR can be connected. For suppressing harmonics, install the optional DC REACTOR (DCR□-□□).

(3) Suppressing power-on inrush current

FRENIC-Mini series inverters incorporate the circuit for suppressing inrush current flowing when the power is turned on.

(4) Easy to copy the function code data with keypad

By using the copy function of the optional remote keypad, the preset function codes can be easily copied to several inverters.

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Wood processing machine

Centrifugal separator

Washing machine

RELATED CATALOGS AND MANUALS

FRENIC-Mini Series Catalog

No. MEH441

FRENIC-Mini Series User's Manual

No. MEH446

Notes on Safety

- Before operating this product, be sure to read the Instruction Manual and User's Manual carefully to ensure safe and proper operation.
- Some of the products in this catalog must be used for limited applications, installed in a limited place, or inspected periodically. For details, consult with your local Fuji inverter distributor or Fuji Electric.
- These products should be wired only by the electrical engineer qualified for electric work or electrical wiring.

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