# *FVR-Micro*
# Product Specification

**(based on Specification Jde015-00004c)**

**Fuji Electric Systems Co.,Ltd.**
**Technical Second Gr., Engineering Dept. Ⅱ**
**Drive Systems and Solutions Div.**
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# 1．Standard specifications

## 1) 3 phase 400V

| Items | | Specifications | | | | |
|---|---|---|---|---|---|---|
| Power supply series | | 3 phase 400V | | | | |
| Type (FRN□□□S1S-□□) | | FVR0.4 S1S-4E | FVR 0.75 S1S-4E | FVR 1.5 S1S-4E | FVR 2.2 S1S-4E | FVR 3.7 S1S-4E |
| Nominal applied motor [kW] | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| Output ratings | Rated capacity[*1] [kVA] | 1.2 | 2.3 | 3.2 | 4.2 | 6.3 |
| | Rated Voltage[*2] [V] | Depends on input power supply | | | | |
| | Rated current[A] | 1.5 | 2.5 | 4.2 | 5.5 | 8.2 |
| | Overload capacity | 150%-1min. of Rated output current | | | | |
| Input ratings | Q'ty of phase, Voltage and Frequency | 3 phase 380 to 460V, 50/60Hz | | | | |
| | Voltage/Allowable Frequency Fluctuation | Voltage：+10 to -10%[*3] Frequency：+5 to -5% | | | | |
| | Rated current[A][*4] | 1.9 | 3.5 | 6.0 | 7.2 | 9.0 |
| | Required power supply capacity [kVA] | 1.3 | 2.3 | 4.0 | 4.8 | 6.0 |
| Braking | DC Braking | Breaking start frequency：0.0 to 60.0Hz，Breaking time：0.0 to 30.0s，Breaking operation level：0 to 100% | | | | |
| Enclosure(IEC 60529) | | IP20 Close type | | | | |
| Mass [kg] | | 1.3 | 1.3 | 1.3 | 1.6 | 1.7 |

*1) Rated capacity shows in a case of Rated 440V

*2) It is impossible to output over the power supply voltage

*3) interphase imbalance rate(%)= (Maximum voltage [V] - Minimum voltage [V])/3 phase average voltage[V]×67

　　(refer to IEC 61800-3)

　　　As for operation of interphase imbalance has become larger, please contact to us.

*4) The data was calculated under the condition that Fuji has decided.

2) Single phase 200V

| Items | | Specifications | | | | |
|---|---|---|---|---|---|---|
| Power supply series | | Single phase 200V | | | | |
| Type (FRN□□□S1S-□□) | | FVR0.2 S1S-7E | FVR 0.4 S1S-7E | FVR 0.75 S1S-7E | FVR 1.5 S1S-7E | FVR 2.2 S1S-7E |
| Nominal applied motor [kW] | | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| Output ratings | Rated capacity [*1] [kVA] | 0.6 | 1.0 | 1.9 | 2.5 | 4.2 |
| | Rated Voltage [*2] [V] | Depends on input power supply | | | | |
| | Rated current[A] | 1.6 | 2.5 | 4.2 | 7.5 | 11 |
| | Overload capacity | 150%-1min.of Rated output current | | | | |
| Input ratings | Q'ty of phase, Voltage and Frequency | Single phase 200 to 240V, 50/60Hz | | | | |
| | Voltage/Allowable Frequency Fluctuation | Voltage：+10 to -10%　　Frequency：+5 to -5% | | | | |
| | Rated current[A] [*4] | 4.9 | 6.5 | 10 | 17.5 | 27 |
| | Required power supply capacity [kVA] | 1.1 | 1.5 | 2.2 | 3.9 | 6.0 |
| Breaking | DC Breaking | Breaking start frequency：0.1 to 60.0Hz, Breaking operation level：0 to 100% Rated current<br>Starting time：0.0 to 60.0s, Stopping：0.0 to 60.0s, | | | | |
| Enclosure(IEC 60529) | | IP20 Close type | | | | |
| Mass [kg] | | 1.3 | 1.3 | 1.3 | 1.6 | 1.7 |

*1) Rated capacity shows in the case of Rated 220V

*2) It is impossible to out put over the power supply voltage

*4) The data was calculated under the condition that Fuji has decided

# 1. Common specifications

| Items | | | Specifications | | Remark |
|---|---|---|---|---|---|
| Output frequency | Adjustment | Maximum output frequency | ・variable setting 5.0 to 400Hz | | |
| | | Base Frequency | ・variable setting 10.0 to 400Hz | | |
| | | Starting frequency | ・variable setting 0.1 to 60.0Hz | | |
| | | Carrier frequency | ・2.0 to 12kHz | | |
| | Setting resolutions | | ・Keypad setting : 0.01Hz(under 99.99Hz), 0.1Hz(100.0 to 400.0Hz) | | |
| Control | Control method | | ・V/f control, Slip compensation control function | | |
| | Voltage/Frequency characteristics | | 200V | Able to setting 2.0 to 255V by both Base frequency and Maximum output frequency Able to select AVR Control ON/OFF | |
| | | | | Polygonal line V/f Arbitrary (1pont) : 2.0 to 255V, 0.1 to 400Hz: able to setting | |
| | | | 400V | Able to setting 2.0 to 255V by both Base frequency and Maximum output frequency Able to select AVR Control ON/OFF | |
| | | | | Polygonal line V/f Arbitrary (1 point) : 2.0 to 510V, 0.1 to 400Hz:able to setting | |
| | Torque boost | | ・Function code "1-05","1-06":set torque boost value | | |
| | Starting torque | | ・Over 150%(Setting frequency 5Hz, Automatic torque boost & Slip compensation) | | |
| | Start/Stop | | ・Key operation : Start and stop by RUN , STOP key(Touch panel) ・External signal : Forward( reverse) operation, stop order(able to 3 wired operation) (digital input) Free run order, external alarm, fault reset etc ・Pattern operation : Automatic operation / stop order by set pattern | | |
| | Setting frequency (analog input :12/C1 switching mode) | | ・Key operation : ⋀,⋁key ・Set by built in volume ・Set by rheostat(External resistor : 5kΩ 1/2W) ・0 to +10Vdc(+5Vdc):Able to set（+5V:analogue input gain ,for switching(200%)） ・+1 to +5Vdc(Bias・Able to adjust analogue input gain) ・Able to set by 4 to 20mAdc | | |
| | (Multi-step frequency) | | ・Multi-step frequency operation Able to select 3-bit external signal with set the 8kinds of frequencies. | | |
| | (Switching mode Of frequency) | | ・Able to switch 2kinds of set frequencies by external signal(digital input) | | |
| | Acceleration & deceleration | | ・Variable setting in the range of 0.1 to 600s(as for acceleration and deceleration , Both 2 types of time is able to set inside of unit ) | | |
| | DC Breaking | | Breaking start frequency : 0.1 to 60.0Hz, Breaking time : 0.0 to 60.0s, Breaking operation level : 0 to 100%variable setting(able to set each other ,Starting and Stopping ) . | | |

| Items | | Specifications | Remark |
|---|---|---|---|
| Control | Frequency limiter | ・Set the UP/DOWN frequencies by the ratio against to maximum frequency range:1 to 110%(Upper limited)、0 to 100%(Lower limited) | |
| | Bias | ・Able to set the bias value of analog inputted frequency in the range of maximum output frequencies (0.0 to 100% ) | |
| | Gain | ・able to set the gain of analog inputted frequency in the range of maximum output frequencies (0.0 to 100% ) | |
| | Jumping frequency | ・Jumping frequency 3 points and Jumping range (0.0 to 400Hz) are able to set | |
| | Jogging operation | ・Operate by RUN key or digital contact input (FWD, REV) (Exclusive frequency, Exclusive acceleration & deceleration time) | |
| | Restart in Instantaneous power failure | ・Restart the inverter without stop the motor in the case of power recovery | |
| | Slip compensation control | ・Compensate the deduction of speed for load and able to stable operation | |
| | Automatic deceleration | ・If the intermediate voltage in deceleration become overvoltage limited level, it will stop the deceleration and avoid the OV trip with constant speed | |
| | Cooling fan (ON-OFF control) | ・Able to select the mode of cooling fan in the case of operation is stopped. | |
| | Password | ・Able to set the password by function code. Use each function code for input password and set password. | |
| | Select stop order | ・Select the deceleration way in the case of operation order "OFF"(ramp or coast-to-stop) ・Select performance (ignore input or coast-to-stop) in external fault EF signal. | |
| | Rotational direction limitation | ・Able to select the avoidance for Forward and reverse | |
| | Frequency order combination | ・Addition, subtraction is able to combine with setting frequencies ( No.1 and No.2) | |
| | Detect the waste order | ・Able to select the operation of waste order by breaking of frequency order signal (4 to 20mA) | |
| | UP/DOWN control | ・Set the frequencies of UP and DOWN order in Digital input terminal. | |
| | Regenerative avoid operation level setting | ・Set the regenerative avoid operation level regenerative by function code | |
| | | | |

| | Item | Specifications | Remark |
|---|---|---|---|
| Indication | Operating , Under Stop | ・Output frequency(before Slip compensation)[Hz] ・Output frequency(after Slip compensation)[Hz] ・Output current[A] ・Output voltage [V] ・DC link voltage [V] ・Consumption power[kW] | |
| | Under Trip | [Trip cause]<br>・OC (overcurrent)<br>・LU (under voltage)<br>・OU (over voltage)<br>・OH (overheating of cooling fan)<br>・EF (external alarm)<br>・OL (overload of motor)<br>・OL1(overload of inverter《overheating of IGBT》), etc. | |
| | Operating Under Trip | ・Trip history（last 6 times, indicate and storage） | |
| Protection | Overcurrent protection | ・Stop inverter for overcurrent by overload of output site. | |
| | Short-circuit protection | ・Stop inverter for overcurrent by short circuit of output site. | |
| | Overvoltage protection | ・Stop inverter in case of detect the over DC link voltage (200V : 400Vdc, 400V : 800Vdc) | |
| | Surge protection | ・Protect the inverter against to surge voltage which is invaded between main circuit power line and earth. | |
| | Undervoltage protection | ・Indicate the let down DC link voltage(200V:200Vdc,400V:400Vdc) and stop the inverter. | |
| | Overheating protection | ・Against failure of cooling fan and overload , indicate the temperature of heat sink and stop the inverter. | |
| | Overload protection | ・Protect inverter against overheating by overload of IGBT) | |
| | Motor protection / Electronic thermal | ・Function of Electronic thermal makes stop the inverter and protect motor (Thermal time constant :able to adjust 0.5 to 75.0 minute) | |
| | Retry | ・When it stops for trip, it is able to restart automatically. (Able to set the waiting time between retry and reset) | |

| | Items | specifications | Remark |
|---|---|---|---|
| Environment | Location | ・Indoor, without corrosive gas, flammable gas and dust(pollution level 2)<br>・Without sunlight | |
| | Temperature | ・-10 to +50℃ | |
| | humidity | ・up to 90%RH(no dew condensation) | |
| | Elevation | ・Under 1000m | |
| | Vibration | $9.80665 m/s^2$ (1g) : within up to 20Hz,<br>$5.88 m/s^2$ (0.6g) : 20 to 50Hz | |
| | Storage temperature | ・-20 to +60□ | |

## 3. Terminal Functions

| | Symbol | Terminal name | Specifications | Remark |
|---|---|---|---|---|
| **Main Circuit** | L1/R<br>L2/S<br>L3/T | Main power supply | ・Connect to the 3-Phase power supply. | |
| | L1/L<br>L2/N | | ・Connect to the single phase power supply. | |
| | U,V,W | Inverter output | ・Connect to 3-phase motor. | |
| | (+),(-) | Brake unit connection use | ・Connect with brake resistor（option）. | |
| | ⏚G | Inverter earth connection use | ・Inverter earth connection terminal. | |
| **Frequency Setting** | 13 | Power supply for variable resistor use | ・Use frequency setter（variable resistor : 5kΩ）as power supply.<br>(10Vdc 3mAdc max.) | |
| | 12/C1<br><br>Change-over by switch | Frequency setting voltage input | ・0 to +10Vdc/0 to 100% (0 to +5Vdc/0 to 100%) | Input impedance : 47kΩ |
| | | Frequency setting current Input | ・4 to 20mAdc/0 to 100% | Input impedance : 250Ω |
| | 11 | Analog common | ・ Common terminal for frequency setting signal(12,13,C1,FMA). | Isolate to CM terminal . |

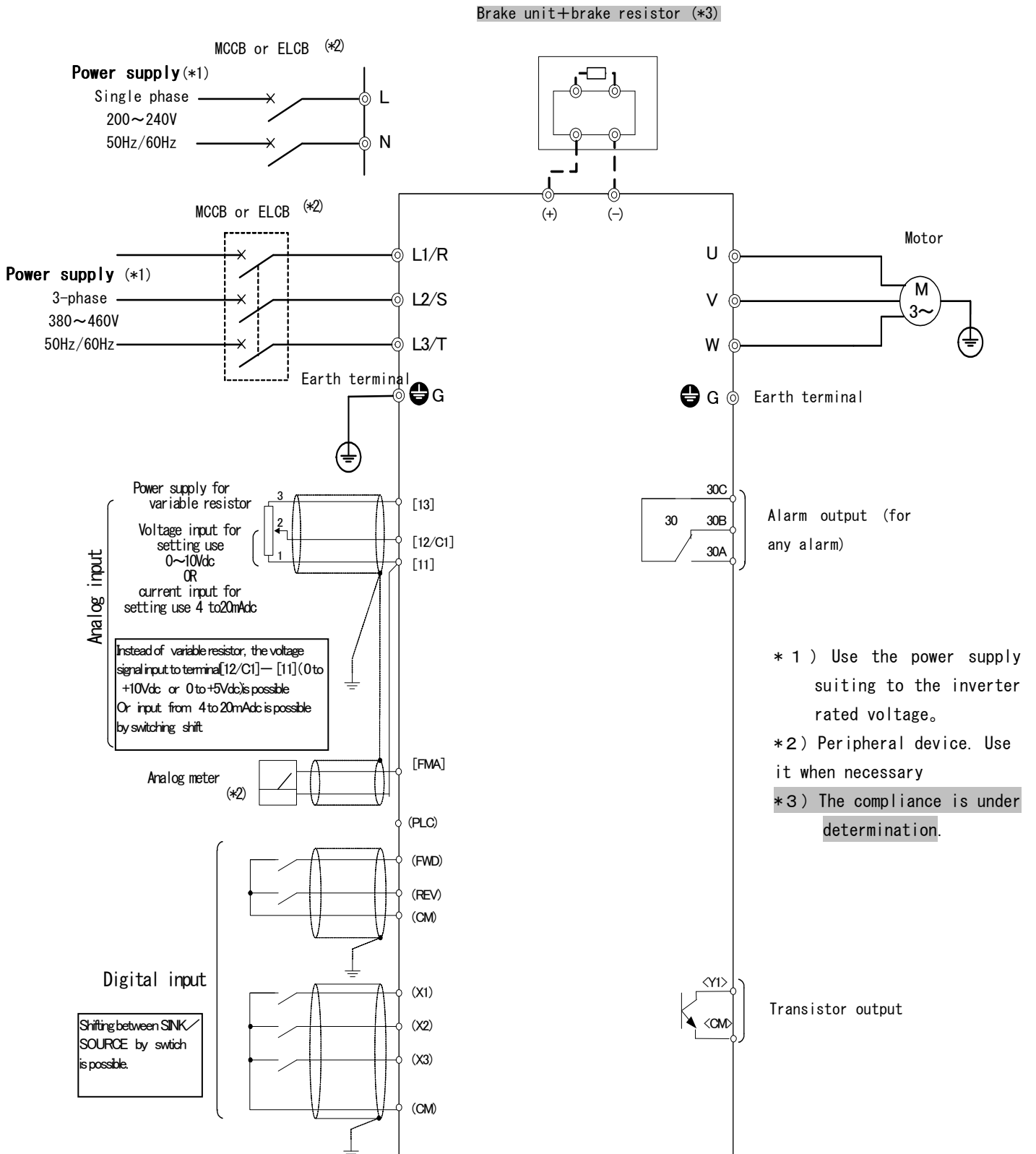| | Symbol | Terminal name | Specifications | Remark |
|---|---|---|---|---|
| Digital input | FWD | FWD operation command | ・The functions below can be set on terminal X1-X3, FWD and REV.<br><Common Function><br>・Sink/Source can be switched by the jumper switch built-in the inverter | FWD, REV terminal can also be used for other functions. Switch SINK/SOURCE by switch. |
| | REV | REV operation command | | |
| | X1 | Digital input1 | | |
| | X2 | Digital input21 | | |
| | X3 | Digital input31 | | |
| | (NONE) | No Function | ・No affect to behavior both ON/OFF | |
| | (FWD) | FWD operation command | ・When(FWD)is ON, FWD, when OFF, it will stop after deceleration | Setting is only available to FWD,REV terminals |
| | (REV) | REV operation command | ・When(REV)is ON,REV, when Off, it will stop after deceleration | |
| | (CRUN) | Run/stop command | ・When(CRUN) is ON, it runs, when OFF it will stop after deceleration. | |
| | (FWD/REV) | FWD/REV command | ・When(CRUN)is ON, and (FWD/REV)is ON, it will FED, it will REV when(FWD/REV)is OFF | |
| | (HLD) | 3-wire operation/stop command | ・Used as self hold signal in 3-wire operation case.<br>・When(HLD)is ON,(FWD) or (REV)signal will be self held and it will be released when the signal is OFF | Setting is only available to terminal X1 |
| | (EF1) | EF, Normal Open input | ・The inverter output is shut off immediately and the motor coasts-to-stop when (EF1) is ON. | |
| | (EF2) | EF, Normal close input | ・The inverter output is shut off immediately and the motor coasts-to-stop when (EF2) is OFF. | |
| | (RST) | Alarm （abnormality）reset | ・The alarm hold will be released when (RST) is ON. | |
| | (SS1)<br>(SS2)<br>(SS4) | Multi-step frequency selection | ・8 step speed running is possible by the ON/OFF signal from (SS1) to (SS4)。 | |
| | (Hz2/Hz1) | Frequency setting2 /frequency setting1 | ・When (Hz2/Hz1) is ON, frequency setting 2 will be selected。 | |
| | (HLR-HLD) | Acceleration prohibition command | ・When (HLR-HLD)is ON the acceleration and deceleration will prohibited。 | |
| | (RT1) | Acceleration time selection | ・Selection of acceleration/deceleration time 2/1 is possible by the ON/Off of (RT1). | |
| | (BB1) | Outside cutout, normal open input | ・Immediate output will be cutout by (B.B) ON. | |
| | (BB2) | Outside cutout, normal close input | ・Immediate output will be cutout by (B.B) Off. | |
| | (UP) | UP Command | ・Frequency up command will be done by (UP) ON. | |
| | (DOWN) | DOWN Command | ・Frequency down command will be done by (DOWN). | |
| | （AUTO） | Pattern operation command | ・Pattern operation can be started by (AUTO) ON. | |
| | (PAUSE) | Pattern operation interruption command | ・Pattern operation can be stopped by (PAUSE) ON. | |
| | (JOG-f) | Jogging frequency command | ・Select jogging frequency range by (JOG-f) ON. | |
| | (CNT-RST) | Counter reset | ・Reset current count by (CNT-RST) ON. | |
| | (SEL-C1) | C1 terminal selection | ・Select input from terminal C1 by (SEL-C1) ON. | |
| | (JOG-FWD) | Jogging FWD command | ・Practice jogging FWD by (JOG-FWD) ON. | |
| | (JOG-REV) | Jogging REV | ・Practice jogging REV by (JOG-REV) ON. | |
| | (WFI) | Driver running | ・Start vibration running by (WFI) ON. | |
| | (WFI-RST) | Driver running reset | ・Start vibration running by (WFI-RST) ON. | |
| | (EN1) | Emergency stop 1 normal open input | ・Practice emergency stop by (EN1) ON. | |
| | (EN2) | Emergency stop 2 normal close input | ・Practice emergency stop by (EN2) OFF. | |
| | (CNT) | Counter trigger signal | ・Counter signal is input from (CNT) | |
| | PLC | PLC signal power supply | ・Connect with the PLC output signal power supply。 Also available as 24V power supply. | +24V Max.20mA |
| | CM | Digital input common | ・Common terminal of digital input signal | Isolate from terminal 11 |

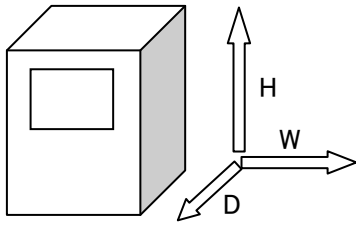| | Symbol | Terminal name | Specifications | Remark |
|---|---|---|---|---|
| Analog output | FMA | Analog monitor | One item selected from items below can be output by DC voltage.<br>・output frequency1(before slip compensation)<br>・output frequency2(after slip compensation)<br>・output current<br>・output voltage<br>・DC link voltage<br>・Input power<br>□analog voltmeter(0 to 10Vdc, Max 3mA input impedance : 3.3kΩ) can be used。<br>Gain adjustment range : 1 to 200% | |

| | Symbol | Terminal name | Specifications | Remark |
|---|---|---|---|---|
| Transistor output / Relay output (Transistor output) | Y1 | Transistor output | ・Output the selected signal from below. (48Vdc, Max.50mAdc) | |
| | 30A,30B, 30C | Alarm output(for any alarm) (Relay output) | When inverter stops during alarm, the voltage-less point signal(1c)will be output。<br>・The following signal is selectable as multi-purpose relay output (point power rate : 240Vac, 1.5Aac(Normal open)/0.5Aac(Normal close))<br>・If the alarm output is done by exciting behavior, the alarm output setting is switchable by non-excitation. | |
| | (NON) | No function | | |
| | (RUN) | During running | ・ON signal will be output when inverter runs over starting frequency . | |
| | (FAR) | Frequency arrival | ・ON signal will be output when output frequency reaches the setting frequency。<br>Detecting range is（ON:1.0Hz, OFF : 3.0Hz）fixed。 | |
| | (ZERO) | Zero speed | ・ON signal will be output during stop. | |
| | (OT) | Over torque detection | ・ON signal will be output by over torque detection. | |
| | (BB) | During Outside base block | ・ON signal will be output during outside base block by base block signal. | |
| | (LU) | During under voltage stop | ・ON signal will be output by under voltage. | |
| | (REM) | External terminal running mode | ・ON signal will be output under running mode from external terminal。 | |
| | (ALM) | Alarm output(for any alarm) | ・Batch alarm signals can be output as transistor output signal. | |
| | (FDT) | Frequency detection | ・ON signal will be output when the output frequency is over the setting detection level. | |
| | (AUTO) | During pattern operation | ・ON signal output during pattern operation | |
| | (TO) | Pattern operation one cycle completion | ・ON signal will be output after 1 cycle pattern operation completes. | |
| | (TE) | Pattern operation completion | ・ON signal will be output when pattern operation completes. | |
| | (TP) | Temperate stop during pattern operation | ・ON signal will be output during temperate pattern operation. | |
| | (CAR) | Terminal count value arrival | ・ON signal output on terminal value arrival. | |
| | (CARF) | Terminal designated count value arrival | ・ON signal output on terminal designated count value arrival | |
| | (RDY) | Operation preparation Output | ・ON signal will be output when inverter running preparation is finished. | |
| | (FRUN) | During FWD | ・ON signal output during FWD。 | |
| | (RRUN) | During REV | ・ON signal output during REV。 | |
| | (FRRUN) | FWD/REV direction | ・ON signal output during FWD OFF and REV ON. | |
| | CM | Transistor output common | Emitter terminal for transistor output signal(Y1) | Isolate from terminal 11 |
| communications | RS-485 Communications connector (RJ-45 connector) | RS-485 communications Input/output | ・Modbus-RTU protocol is built in the inverter | |

## 2. Connection Diagram

### 1) Basic connection

Brake unit+brake resistor (*3)

MCCB or ELCB (*2)

**Power supply**(*1)
Single phase
200~240V
50Hz/60Hz

L
N

MCCB or ELCB (*2)

**Power supply** (*1)
3-phase
380~460V
50Hz/60Hz

L1/R
L2/S
L3/T

Earth terminal ⏚ G

(+) (−)

Motor

M
3~

U
V
W

⏚ G Earth terminal

**Analog input**

Power supply for variable resistor

Voltage input for setting use 0~10Vdc OR current input for setting use 4 to20mAdc

[13]
[12/C1]
[11]

Instead of variable resistor, the voltage signal input to terminal[12/C1]— [11](0 to +10Vdc or 0 to+5Vdc)is possible Or input from 4 to 20mAdc is possible by switching shift

Analog meter (*2)

[FMA]

(PLC)

**Digital input**

(FWD)
(REV)
(CM)

Shifting between SINK/SOURCE by switch is possible.

(X1)
(X2)
(X3)

(CM)

30C
30 30B
30A

Alarm output (for any alarm)

\<Y1\>
\<CM\>

Transistor output

* 1 ) Use the power supply suiting to the inverter rated voltage。

*2) Peripheral device. Use it when necessary

*3) The compliance is under determination.

## 3. External dimensions



| Input voltage type | Power rate | W (mm) | H (mm) | D (mm) |
|---|---|---|---|---|
| 3-phase 400V | 0.4kW | 72.0 | 180.0 | 148.0 |
| | 0.75kW | | | |
| | 1.5kW | | | |
| | 2.2kW | 100.0 | 180.0 | 148.0 |
| | 3.7kW | | | |
| Single phase 200V | 0.2kW | 72.0 | 180.0 | 140.0 |
| | 0.4kW | | | |
| | 0.75kW | | | |
| | 1.5kW | 100.0 | 180.0 | 148.0 |
| | 2.2kW | | | |

## 4. Revisions

| INDX | Page | Revisons | Date | Drawn | Checked | Approved |
|---|---|---|---|---|---|---|
| — | | First version | 8 Feb 2011 | Y. Imamura | — | — |
| | | | | | | |