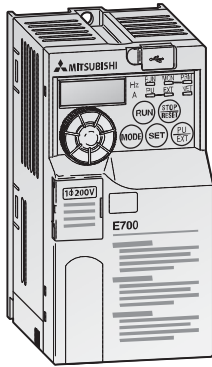


## The FR-E700 SC Series



The FR-E700 SC series with SLV control sets new standards for compact vector-controlled drive systems. The inverters of the FR-E700 SC series are exceptionally versatile and powerful, packed with advanced features like the Soft PWM system for reducing motor noise, adjustable torque limiting, automatic motor configuration and an integrated brake transistor (except FR-E720S-008SC and 015SC). Additionally the FR-E700 SC has the security function "Safety stop and Safe Torque Off" respectively (STO) conforming to EN 61800-5-2.

### Output range:

FR-E720S SC:  
0.1–2.2 kW, 200–240 V AC, single-phase  
FR-E740 SC:  
0.4–15 kW, 380–480 V AC, three-phase

### Available accessories:

Optional control units, versatile options and useful accessories are available for this frequency inverter.

Please refer to page 38 for details.

## Technical Details FR-E700 SC

| Product line                             |   | FR-E720S-□SC-EC-E6  |  |              |              |            |            | FR-E740-□SC-EC-E6                  |            |              |              |            |            |              |      |     |    |    |
|--|---|---|--|--------------|--------------|------------|------------|------------------------------------|------------|--------------|--------------|------------|------------|--------------|------|-----|----|----|
|  |   | 008   | 015  | 030          | 050          | 080        | 110        | 016                                | 026        | 040          | 060          | 095        | 120        | 170          | 230  | 300 |    |    |
| Output                                   | Rated motor capacity [kW] ①                                       | 0.1   | 0.2  | 0.4          | 0.75         | 1.5        | 2.2        | 0.4                                | 0.75       | 1.5          | 2.2          | 3.7        | 5.5        | 7.5          | 11   | 15  |    |    |
|  | Rated output capacity [kVA] ②                                     | 0.3   | 0.6  | 1.2          | 2            | 3.2        | 4.4        | 1.2                                | 2          | 3            | 4.6          | 7.2        | 9.1        | 13           | 17.5 | 23  |    |    |
|  | Rated current ③   | A   |  | 0.8<br>(0.8) | 1.5<br>(1.4) | 3<br>(2.5) | 5<br>(4.1) | 8<br>(7)                           | 11<br>(10) | 1.6<br>(1.4) | 2.6<br>(2.2) | 4<br>(3.8) | 6<br>(5.4) | 9.5<br>(8.7) | 12   | 17  | 23 | 30 |
|  | Overload capacity ④   | 150 % of rated motor capacity for 60 s; 200 % for 3 s   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Voltage ⑤   | 3-phase AC, 0 V to power supply voltage   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
| Input                                    | Power supply voltage  | 1-phase, 200–240 V AC, -15 %/+10 %  |  |              |              |            |            | 3-phase, 380–480 V AC, -15 %/+10 % |            |              |              |            |            |              |      |     |    |    |
|  | Voltage range   | 170–264 V AC at 50/60 Hz  |  |              |              |            |            | 325–528 V AC at 50/60 Hz           |            |              |              |            |            |              |      |     |    |    |
|  | Power supply frequency  | 50/60 Hz ± 5 %  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Rated input capacity ⑦  | kVA   |  | 0.5          | 0.9          | 1.5        | 2.5        | 4                                  | 5.2        | 1.5          | 2.5          | 4.5        | 5.5        | 9.5          | 12   | 17  | 20 | 28 |
| Control specifications                   | Control method  | V/f control, optimum excitation control, general-purpose magnetic flux vector control or advanced magnetic flux vector control                  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Modulation control  | Sine evaluated PWM, Soft PW   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Carrier frequency   | 0.7–14.5 kHz (user adjustable)  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Frequency range   | Hz  |  | 0.2–400      |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Frequency resolution  | Analog  | 0.06 Hz/0–50 Hz (terminal 2, 4; 0–10 V/10 Bit) |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  |   |   | 0.12 Hz/0–50 Hz (terminal 2, 4; 0–5 V/9 Bit)   |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Frequency resolution  | Digital   | 0.06 Hz/0–50 Hz (terminal 4; 4–20 mA/10 Bit)   |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  |   |   | 0.01 Hz  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Frequency precision   | ±0.5 % of max. output frequency (temperature range 25 °C ± 10 °C) during analog input;<br>±0.01 % of max. output frequency during digital input |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Voltage/frequency characteristics                                 | Base frequency adjustable from 0 to 400 Hz;<br>Constant torque/variable torque pattern can be selected  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Possible starting torque  | ≥ 200 %/0.5 Hz when advanced magnetic flux vector control is set (3.7 K or less)  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Torque boost  | Manual torque boost   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Acceleration/deceleration time                                    | 0.01–360 s, 0.1–3600 s (may be set individually for acceleration and deceleration)  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
|  | Acceleration/deceleration characteristics                         | Linear or S-pattern acceleration/deceleration mode selectable   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
| Braking torque                           | regenerative ⑧  | 150 %   |  | 100 %        |              | 50 %       |            | 20 %                               |            | 100 %        |              | 50 %       |            | 20 %         |      |     |    |    |
|  | DC braking  | Operating frequency: 0–120 Hz, operating time: 0–10 s, voltage: 0–30 % (externally adjustable)  |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
| Current stall prevention operation level | Response threshold 0–200 %, user adjustable                       |   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |
| Motor protection                         | Electronic motor protection relay (rated current user adjustable) |   |  |              |              |            |            |                                    |            |              |              |            |            |              |      |     |    |    |

Remarks:

Explanation for ① to ⑧ see next page.

| Product line                  |  |  | FR-E720S-□SC-EC/E6  |                  |                   |                 |                   |              | FR-E740-□SC-EC/E6 |             |        |        |              |        |             |        |        |
|-------------------------------|--|--|---|------------------|-------------------|-----------------|-------------------|--------------|-------------------|-------------|--------|--------|--------------|--------|-------------|--------|--------|
|                               |  |  | 008   | 015              | 030               | 050             | 080               | 110          | 016               | 026         | 040    | 060    | 095          | 120    | 170         | 230    | 300    |
| Control signals for operation | Frequency setting values                                 | Analog input                             | Terminal 2: 0–5 V DC, 0–10 V DC<br>Terminal 4: 0–5 V DC, 0–10 V DC, 0/4–20 mA   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               |  | Digital input                            | From operation panel or parameter unit, Frequency setting increment can be set. 4 digit BCD or 16bit binary data (when the option FR-A7AX-Ekit-SC-E is used)  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Input signals  |  | Any of 7 signals can be selected using parameters 178 to 184 (input terminal function selection): multi-speed selection, remote setting, stop-on contact selection, second function selection, terminal 4 input selection, JOG operation selection, PID control valid terminal, brake opening completion signal, external thermal input, PU-external operation switchover, V/F switchover, output stop, start self-holding selection, forward rotation, reverse rotation command, inverter reset, PU-NET operation switchover, external-NET operation switchover, command source switchover, inverter operation enable signal, PU operation external interlock  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Operation functions                                      |  | Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, automatic restart after instantaneous power failure operation, forward/reverse rotation prevention, remote setting, brake sequence, second function, multi-speed operation, stop-on contact control, droop control, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning function, PID control, computer link operation (RS485)  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Safety function "Safe Torque Off"                        |  | The signal for the safe shutdown of the output can be applied to the terminals S1 and S2. (in accordance with the safety standards EN ISO 13849-1 category 3, PLd EN62061, IEC61508 SIL2)   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Output signals   | Operating status                         | Can be selected using parameters 190 to 192 (output terminal function selection): inverter operation, up-to-frequency, overload alarm, output frequency detection, regenerative brake prealarm, electronic thermal relay function prealarm, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward/reverse rotation output, brake opening request, fan alarm <sup>⑧</sup> , heatsink overheat pre-alarm, deceleration at an instantaneous power failure, PID control activated, safety monitor output, safety monitor output 2, during retry, life alarm, current average value monitor, remote output, alarm output, fault output, fault output 3, maintenance timer alarm.   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
| Analog signal                 |  | 0–10 V DC                                |   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
| Display option                | Display on the operation panel or parameter unit FR-PU07 | Operating status                         | Output frequency, motor current (steady or peak value), output voltage, frequency setting, cumulative energization time, actual operation time, motor torque, converter output voltage (steady or peak value), regenerative brake duty, electronic thermal relay function load factor, output power, cumulative power, motor load factor, PID set point, PID measured value, PID deviation, inverter I/O terminal monitor, I/O terminal option monitor, motor thermal load factor, inverter thermal load factor   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               |  | Alarm display                            | Fault definition is displayed when the fault occurs and the past 8 fault definitions (output voltage/current/frequency/cumulative energization time right before the fault occurs) are stored.  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Additional displays on parameter unit FR-PU04/FR-PU07    | Operating status                         | Not used  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               |  | Interactive operating guide <sup>⑨</sup> | Interactive guide for operation and troubleshooting via help function   |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
| Protection                    | Functions  |  | Overcurrent during acceleration, overcurrent during constant speed, overcurrent during deceleration, overvoltage during acceleration, overvoltage during constant speed, overvoltage during deceleration, inverter protection thermal operation, motor protection thermal operation, heatsink overheat, input phase failure, output side earth (ground) fault overcurrent at start, output phase failure, external thermal relay operation <sup>⑩</sup> , option unit error <sup>⑩</sup> , parameter error, internal board fault, PU disconnection, retry count excess <sup>⑩</sup> , CPU fault, brake transistor alarm, inrush resistance overheat, communication error, analog input error, USB communication error, brake sequence error <sup>⑩</sup> , safety circuit fault, fan alarm <sup>⑩</sup> , overcurrent stall prevention, overvoltage stall prevention, PU stop, parameter write error, regenerative brake prealarm, electronic thermal relay function prealarm, maintenance output, undervoltage, operation panel lock, password locked, inverter reset, safety torque off |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
|                               | Protection rating  |  | IP20  |                  |                   |                 |                   |              |                   |             |        |        |              |        |             |        |        |
| Others                        | Cooling  | Self-cooling                             |   |                  | Fan cooling       |                 |                   | Self-cooling |                   | Fan cooling |        |        | Self-cooling |        |             |        |        |
|                               | Power loss [W]   | 14                                       | 20  | 32               | 50                | 85              | 115               | 40           | 55                | 90          | 100    | 180    | 240          | 300    | 400         | 500    |        |
|                               | Weight [kg]  | 0.6                                      | 0.6   | 0.9              | 1.4               | 1.5             | 2.0               | 1.4          | 1.4               | 1.9         | 1.9    | 1.9    | 3.2          | 3.2    | 6.0         | 6.0    |        |
|                               | Dimensions (WxHxD) [mm]                                  | 68x128x86.5                              |   | 68x128<br>x148.5 | 108x128<br>x141.5 | 108x128<br>x167 | 140x150<br>x161.5 | 140x150x120  |                   | 140x150x141 |        |        | 220x150x153  |        | 220x260x196 |        |        |
| Order information             | Single painted PCB                                       | Art. no.                                 | 234795  | 234796           | 234797            | 234798          | 234799            | 234800       | 234801            | 234802      | 234803 | 234804 | 234805       | 234806 | 234807      | 234808 | 234809 |
|                               | Double painted PCB (E6)                                  | Art. no.                                 | 240974  | 240975           | 240976            | 240977          | 240978            | 240979       | 240980            | 240981      | 240982 | 240983 | 240984       | 240985 | 240986      | 240987 | 240988 |

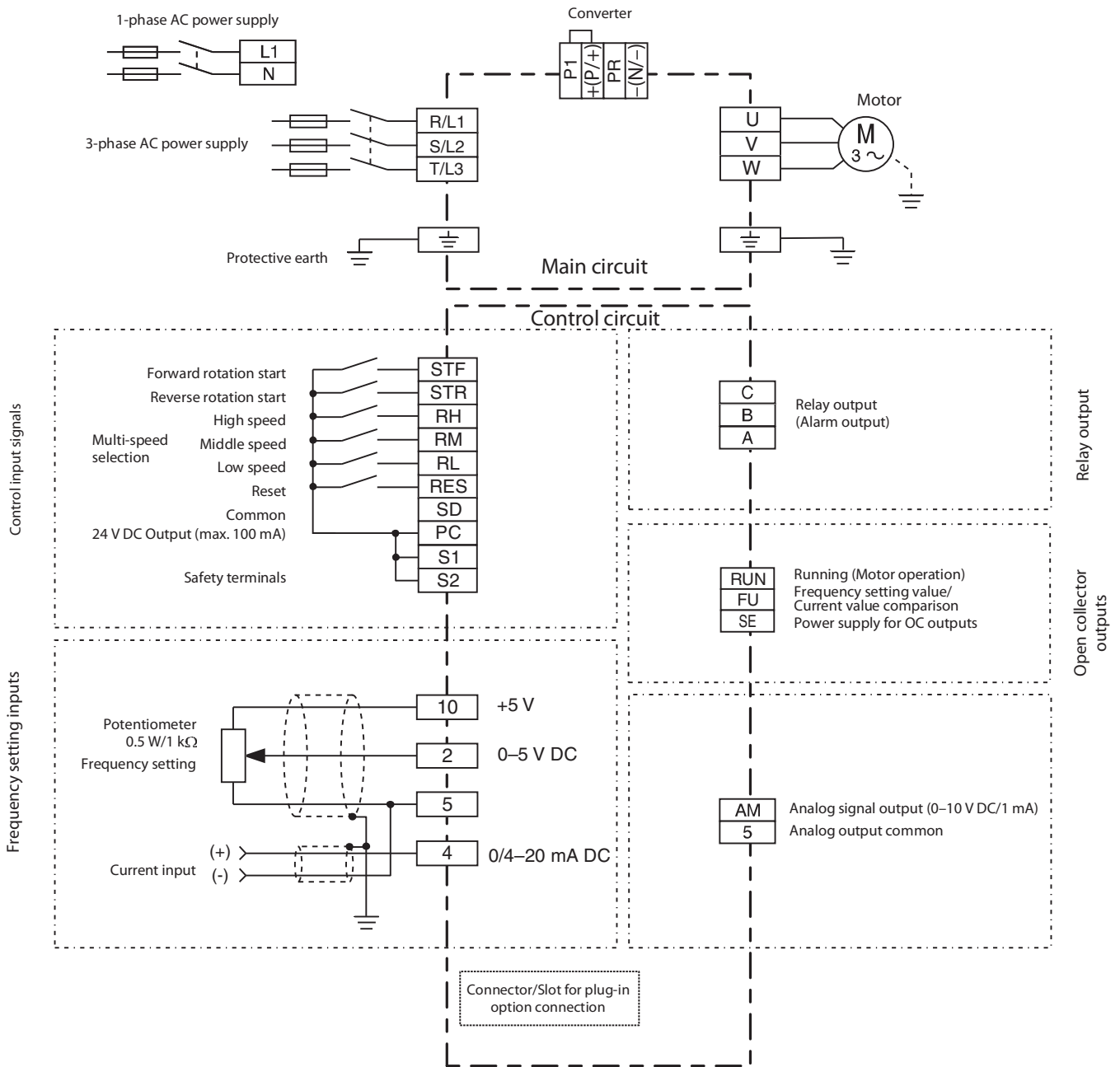
Remarks:

- ① The applied motor capacity indicated is the maximum capacity applicable for use of the MitsubishiElectric 4-pole standard motor.
- ② The specifications of the rated output capacity are related to a motor voltage of 440 V.
- ③ The rated output current in the parentheses applies for an ambient temperature less than 40 °C.
- ④ The % value of the overload capacity indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100 % load.
- ⑤ The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about  $\sqrt{2}$  that of the power supply.
- ⑥ The braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60 Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor FR-ABR-(H) when regenerative energy is large. A brake unit FR-BU2 or BU2 may also be used. (Option brake resistor cannot be used for FR-E720S-008SC and 0155C.)
- ⑦ The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
- ⑧ FR-E720S-050SC or above, FR-E740-040SC or above
- ⑨ This operation guide is only available with option parameter unit (FR-PU07).
- ⑩ This protective function does not function in the initial status.

For overseas types refer to page 78.

## Block Diagram FR-E700 SC


2 Specifications



## Assignment of Signal Terminals

| Function                    | Terminal   | Designation  | Description  |
|-----------------------------|------------|--|--|
| Control connection          | STF        | Forward rotation start                                     | The motor rotates forward, if a signal is applied to terminal STF. When the STF and STR signals are turned on simultaneously, the stop command is given.   |
|                             | STR        | Reverse rotation start                                     | The motor rotates reverse, if a signal is applied to terminal STR. When the STF and STR signals are turned on simultaneously, the stop command is given.   |
|                             | RH, RM, RL | Multi-speed selection                                      | Preset of 15 different output frequencies (fixed frequencies).   |
|                             | RES        | RESET input  | Used to reset alarm output provided when protective function is activated. Turn on the RES signal for more than 0.1 s, then turn it off. Initial setting is for reset always. By setting Pr. 75, reset can be set to enabled only at an inverter alarm occurrence. Recover about 1 s after reset is cancelled. |
| Common                      | SD         | Contact input common (sink)<br>24 V DC power supply common | A determined control function is activated, if the corresponding terminal is connected to the terminal SD (sink logic). The SD terminal is isolated from the digital circuits via optocouplers. The terminal is isolated from the reference potential of the analog circuit (terminal 5).                      |
|                             | PC         | Contact input common (source)<br>24 V DC power supply      | 24 V DC/0.1 A output; reference potential for source logic   |
| Setting value specification | 10         | Voltage output for potentiometer                           | Output voltage 5 V DC<br>Max. output current 10 mA<br>Recommended potentiometer: 1 k $\Omega$ , 0.5 W linear   |
|                             | 2          | Input for frequency setting value signal                   | The voltage setting value 0–5 (10) V is applied to this terminal. The voltage range is preset to 0–5 V. The input resistance is 10 k $\Omega$ $\pm$ 1 k $\Omega$ .   |
|                             | 5          | Reference point for frequency setting value signal         | Terminal 5 is the reference point for all analog setting values and for the analog output signal AM. The terminal is not isolated from the reference potential of the control circuit and must not be earthed.   |
|                             | 4          | Input for current setting value signal                     | The current setting value signal 4–20 mA DC (0–5(10) V) is applied to this terminal. The input resistance is 233 $\Omega$ $\pm$ 5 $\Omega$ .   |
| Signal outputs              | A, B, C    | Relay output (alarm output)                                | The alarm is output via relay contacts; programmable. The maximum contact load is 230 V AC/0.3 A or 30 V DC/0.3 A.   |
|                             | RUN        | Signal output for motor operation                          | The output is switched low, if the inverter output frequency is equal to or higher than the starting frequency. The output is switched high, if no frequency is output or the DC brake is in operation (programmable).   |
|                             | FU         | Signal output for monitoring output frequency              | The output is switched low once the output frequency exceeds a value preset in parameter 42 (or 43). Otherwise the FU output is switched high (programmable).  |
|                             | SE         | Reference potential for signal outputs                     | Reference potential for the signals RUN and FU. This terminal is isolated from the reference potential of the control circuit PC/SD.   |
|                             | AM         | Analog voltage output                                      | One of 18 monitoring functions can be selected, e.g. external frequency output. The functions are determined by parameters. A DC voltmeter can be connected. The max. output voltage is 10 V.  |
| Interface                   | —          | PU connector (RS485)                                       | Communications via RS485<br>I/O standard: RS485, Multi-Drop operation, max. 38,400 Baud  |
|                             | —          | USB connector  | The FR Configurator can be operated by connecting the inverter to the personal computer through USB. Interface: conforms to USB 1.1; Transmission speed: 12 MBaud; Connector: USB mini B connector (receptacle mini B type)  |
| Safety connection           | S1, S2     | Safety inputs  | Remove the shortening wire and connect the safety relay module when using the safety stop function.  |

## Assignment of Main Circuit Terminals

| Function                | Terminal  | Designation                        | Description   |
|-------------------------|---|------------------------------------|---|
| Main circuit connection | L1, N   | Power supply 1-phase               | Connect to the commercial power supply.   |
|                         | R/L1, S/L2, T/L3  | Power supply 3-phase               | Keep these terminals open when using the harmonic converter (FR-HC) or power regeneration common converter (FR-CV).                       |
|                         | +, –  | External brake unit connection     | Connect the brake unit (FR-BU2), power regeneration common converter (FR-CV) or harmonic converter (FR-HC).                               |
|                         | +, PR   | External brake resistor connection | Connect a brake transistor (FR-ABR) across terminals + and PR. (The brake resistor can not be connected to the FR-E720S-008SC and 015SC.) |
|                         | +, P1   | DC reactor connection              | Remove the jumper across terminals + and P1 and connect a DC reactor.   |
|                         | U, V, W   | Motor connection                   | Voltage output of the inverter (3-phase, 0 V up to power supply voltage, 0.2–400 Hz)  |
|                         |  | PE                                 | Protective earth connection of inverter   |