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**Product Specifications**

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**FRENIC-Ace  
(FRN-E3)  
Global Model**

	Date	Signature
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Drawing No.	Si27-7122	

# Nomenclature

**FRN 0001 E 3 S - 2 G**

Code	Series name
FRN	FRENIC series

Three-phase 200V series

Code	Applicable motor rating			
	HHD	HND	HD	ND
0001	0.1	0.2	-	-
0002	0.2	0.4	-	-
0004	0.4	0.75	-	-
0006	0.75	1.1	-	-
0010	1.5	2.2	-	-
0012	2.2	3.0	-	-
0020	3.7	5.5	-	-
0030	5.5	7.5	-	-
0040	7.5	11	-	-
0056	11	15	-	-
0069	15	18.5	-	-
0088	18.5	22	-	-
0115	22	30	-	-

Three-phase 400V series

Code	Applicable motor rating			
	HHD	HND	HD	ND
0002	0.4	0.75	0.75	0.75
0004	0.75	1.1	1.1	1.5
0006	1.5	2.2	2.2	2.2
0007	2.2	3	3	3
0012	3.7	5.5	5.5	5.5
0022	5.5	7.5	7.5	11
0029	7.5	11	11	15
0037	11	15	15	18.5
0044	15	18.5	18.5	22
0059	18.5	22	22	30
0072	22	30	30	37

Single-phase 200V series

Code	Applicable motor rating			
	HHD	HND	HD	ND
0001	0.1	0.2	-	-
0002	0.2	0.4	-	-
0004	0.4	0.55	-	-
0006	0.75	1.1	-	-
0010	1.5	2.2	-	-
0012	2.2	3.0	-	-

Code	Destination / Manual
G	Global / English

Code	Power supply
2	Three-phase 200V
4	Three-phase 400V
7	Single-phase 200V

Code	Enclosure
S	Standard (Basic type)
E	EMC filter built-in type ... coming soon
T	Finless type
N	Ethernet built-in type

Code	Development code
3	3

Code	Applicable area
E	For industrial / High performance / Multiple functionality

# 1. Standard Specifications

## 1-1. Basic Type, Finless Type, Ethernet built-in Type

### 1) Three-phase 200V series

Item			Specification																		
Type(FRN□□□□E3□-2G)			0001	0002	0004	0006	0010	0012* <sub>9</sub>	0020* <sub>9</sub>	0030	0040	0056	0069	0088	0115						
Standard applicable motor *1	HHD	kW	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22						
		HP	1/8	1/4	1/2	1	2	3	5	7.5	10	15	20	25	30						
	HND	kW	0.2	0.4	0.75	1.1	2.2	3	5.5	7.5	11	15	18.5	22	30						
		HP	1/4	1/2	1	1.5	3	4	7.5	10	15	20	25	30	40						
Output ratings	Rated capacity [kVA] *2		HHD	0.4	0.6	1.1	1.9	3	4.2	6.7	9.5	13	18	23	29	34					
			HND	0.5	0.8	1.3	2.3	3.7	4.6	7.5	11	15	21	26	34	44					
	Rated voltage [V] *3			Three-phase 200 to 240 V (with AVR function)																	
	Rated current [A] *4		HHD	1	1.6	3	5	8	11	17.5	25	33	47	60	76	90					
			HND	1.3	2	3.5	6	9.6	12	19.6	30	40	56	69	88	115					
	Overload current rating [A] (permissible overload time)		HHD	150% for 1 minute, 200% for 0.5 seconds																	
			HND	120% for 1 minute																	
	Ambient temperature	E3S E3N	HHD	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)																	
			HND	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range) Type of 0012 to 0020 -10 to +50 °C [14 to 122 °F] (current derating necessary in +40 to +50 °C [104 to 122 °F] range)																	
		E3T	HHD	-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)																	
HND			-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)																		
Rated frequency [Hz]			50 / 60 Hz																		
Voltage, frequency			Three-phase 200 to 240 V, 50/60 Hz																		
Voltage, frequency fluctuation			Voltage: +10 to -15% (interphase unbalance ratio: 2% or less) *8, Frequency: +5 to -5 %																		
Input ratings	Rated current [A] *5	With DCR	HHD	0.57	0.93	1.6	3	5.7	8.3	14	21.1	28.8	42.2	57.6	71	84.4					
		HND	0.93	1.6	3	4.3	8.3	11.7	19.9	28.8	42.2	57.6	71	84.4	114						
	Without DCR	HHD	1.1	1.8	3.1	5.3	9.5	13.2	22.2	31.5	42.7	60.7	80.1	97	112						
		HND	1.8	2.6	4.9	6.7	12.8	17.9	28.5	42.7	60.7	80.1	97	112	151						
Required power supply capacity (with DCR) [kVA] *6		HHD	0.2	0.4	0.6	1.1	2	2.9	4.9	7.3	10	15	20	25	30						
		HND	0.4	0.6	1.1	1.5	2.9	4.1	6.9	10	15	20	25	30	40						
Auxiliary control power supply voltage			-												Single-phase 200 to 240 V, 50/60 Hz						
Braking	Torque *7		HHD	150%			100%			70%			40%			20%					
			HND	75%			53%			68%			48%			29%			27%		
	Braking transistor		Built-in																		
	Connectable resistance value [Ω]		100 to 120					40 to 120					33 to 120	20 min.	15 min.	10 min.	8.6 min.	4 min.			
Braking resistor [Ω]			Option																		
DC reactor (DCR)			Option																		
Protective construction (IEC 60529)			IP20 enclosed type, UL open type																		
Cooling system		E3S E3N	Natural cooling						Fan cooling												
		E3T	See Chapter 7																		
Weight [kg(lbs)]		E3S	0.5 (1.1)	0.5 (1.1)	0.6 (1.3)	0.8 (1.8)	1.4 (3.1)	1.4 (3.1)	1.7 (3.7)	3.8 (8.4)	4 (8.8)	5.3 (12)	5.4 (12)	11 (24)	12 (26)						
		E3N	0.5 (1.1)	0.5 (1.1)	0.7 (1.5)	0.9 (2.0)	1.4 (3.1)	1.4 (3.1)	1.7 (3.7)	3.8 (8.4)	4 (8.8)	5.3 (12)	5.4 (12)	11 (24)	12 (26)						
		E3T	0.6 (1.3)	0.6 (1.3)	0.6 (1.3)	0.6 (1.3)	1.2 (2.6)	1.2 (2.6)	1.5 (3.3)	-											

(\*1) Standard applicable motor indicates Fuji Electric 4-pole standard motors. Select a motor not only based on inverter output (kW), but also so that the output rated current is greater than the motor rated current.

(\*2) The rated capacity indicates 220 V for the 200V series, and 440 V for the 400V series.

(\*3) It is not possible to output a voltage higher than the power supply voltage.

(\*4) Setting the carrier frequency (F26) to the following value or above requires current derating.

HHD spec. of types FRN0001E3□-2G to FRN0020E3□-2G ; 8 kHz, FRN0030E3□-2G to FRN0115E3□-2G ; 10 kHz

HND spec. of types FRN0001E3□-2G to FRN0020E3□-2G ; 4 kHz, FRN0030E3□-2G to FRN0088E3□-2G ; 10 kHz,

FRN0115E3□-2G ; 6 kHz

(\*5) This indicates the estimated value if the power supply capacity is 500 kVA (10 times inverter capacity if inverter capacity exceeds 50 kVA), and the motor is connected to a power supply of %X = 5%.

(\*6) This indicates the capacity when the motor is equipped with a DC reactor (DCR).

(\*7) This is the average braking torque when performing individual operation. (This will vary based on the motor efficiency.)

(\*8) Interphase unbalance ratio [%] = (Max. voltage [V] - min. voltage [V])/Three-phase average voltage [V] x 67 (see IEC/EN 61800-3).

If using the motor with an unbalance ratio of 2 to 3%, use an AC reactor (ACR: option).

(\*9) For FRN0012/0020E3S-2G, FRN0012/0020E3N-2G HND specifications, If the ambient temperature is 40°C or higher, the output current must be derated by 1%/°C.

2) Three-phase 400V series

Item			Specification												
Type(FRN□□□□E3□-4G)			0002	0004	0006	0007 *9	0012 *9	0022	0029	0037	0044	0059	0072		
Standard applicable motor *1	HHD	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22		
		HP	1/2	1	2	3	5	7.5	10	15	20	25	30		
	HND	kW	0.75	1.1	2.2	3	5.5	7.5	11	15	18.5	22	30		
		HP	1	1.5	3	4	7.5	10	15	20	25	30	40		
	HD	kW	0.75	1.1	2.2	3	5.5	7.5	11	15	18.5	22	30		
		HP	1	1.5	3	4	7.5	10	15	20	25	30	40		
	ND	kW	0.75	1.5	2.2	3	5.5	11	15	18.5	22	30	37		
		HP	1	2	3	4	7.5	15	20	25	30	40	50		
	Output ratings	Rated capacity [kVA] *2		HHD	1.1	1.9	3.2	4.2	7.0	11	14	18	24	30	34
				HND	1.4	2.6	3.8	4.8	8.5	13	18	27	31	34	46
		HD	1.4	2.6	3.8	4.8	8.5	13	18	24	29	34	46		
		ND	1.6	3.1	4.2	5.3	9.1	16	22	28	34	45	55		
Rated voltage [V] *3			Three-phase 400 to 480 V (with AVR function)												
Output ratings	Rated current [A] *4		HHD	1.5	2.5	4.2	5.5	9.2	14.8	18	24	31	39	45	
			HND	1.8	3.4	5	6.3	11.1	17.5	23	35	41	45	60	
			HD	1.8	3.4	5	6.3	11.1	17.5	23	35	41	45	60	
			ND	2.1	4.1	5.5	6.9	12	21.5	28.5	37	44	59	72	
Output ratings	Overload current rating [A] (permissible overload time)		HHD	150% for 1 minute, 200% for 0.5 seconds											
			HND	120% for 1 minute											
			HD	150% for 1 minute											
			ND	120% for 1 minute											
Output ratings	Ambient temperature	E3S E3N	HHD	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)											
			HND	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range) Type of 0007 to 0012 -10 to +50 °C [14 to 122 °F] (current derating necessary in +40 to +50 °C [104 to 122 °F] range)											
		E3T	HHD	-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)											
			HND	-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)											
	Rated frequency [Hz]		50 / 60 Hz												
	Voltage, frequency			Three-phase 380 to 480 V, 50/60 Hz											
Input ratings	Voltage, frequency fluctuation		Voltage: +10 to -15% (interphase unbalance ratio: 2% or less) *8, Frequency: +5 to -5 %												
	Rated current [A] *5	With DCR	HHD	0.85	1.6	3	4.4	7.3	10.6	14.4	21.1	28.8	35.5	42.2	
			HND	1.5	2.1	4.2	5.8	10.1	14.4	21.1	28.8	35.5	42.2	57	
			HD	1.5	2.1	4.2	5.8	10.1	14.4	21.1	28.8	35.5	42.2	57	
			ND	1.5	2.9	4.2	5.8	10.1	21.1	28.8	35.5	42.2	57	68.5	
		Without DCR	HHD	1.7	3.1	5.9	8.2	13	17.3	23.2	33	43.8	52.3	60.6	
			HND	2.7	3.9	7.3	11.3	16.8	23.2	33	43.8	52.3	60.6	77.9	
			HD	2.7	3.9	7.3	11.3	16.8	23.2	33	43.8	52.3	60.6	77.9	
			ND	2.7	4.8	7.3	11.3	16.8	33	43.8	52.3	60.6	77.9	94.3	
	Required power supply capacity (with DCR) [kVA] *6		HHD	0.6	1.2	2.1	3.1	5.1	7.3	10	15	20	25	29	
		HND	1.1	1.5	3	4.1	7	10	15	20	25	29	39		
		HD	1.1	1.5	3	4.1	7	10	15	20	25	29	39		
		ND	1.1	2.1	3	4.1	7	15	20	25	29	39	47		
Auxiliary control power supply voltage												Single-phase 380 to 480 V, 50/60 Hz			
Braking	Torque *7		HHD	100%		70%	40%		20%						
			HND	53%	68%	48%	29%	27%	15%						
			HD	53%	68%	48%	29%	27%	15%						
			ND	53%	50%	48%	29%	27%	12%						
Braking transistor			Built-in												
Connectable resistance value [Ω]			200		160 to 200		130 to 200	80 min.	60 min.	40 min.	34.4 min.	16 min.			
Braking resistor [Ω]			Option												
DC reactor (DCR)			Option												
Protective construction (IEC 60529)			IP20 enclosed type, UL open type												
Cooling system		E3S E3N	Natural cooling				Fan cooling								
		E3T	See Chapter 7												
Weight [kg(lbs)]	E3S	1.1	1.4	1.4	1.4	1.7	3.8	3.8	5.2	5.4	11	11			
		[2.4]	[3.1]	[3.1]	[3.1]	[3.7]	[8.4]	[8.4]	[11]	[12]	[24]	[24]			
	E3N	1.2	1.4	1.5	1.4	1.8	3.7	3.8	5.3	5.4	11	11			
		[2.6]	[3.1]	[3.3]	[3.1]	[4.0]	[8.2]	[8.4]	[12]	[12]	[24]	[24]			
E3T	1.2	1.2	1.2	1.2	1.6										
	[2.6]	[2.6]	[2.6]	[2.6]	[3.5]										

(\*1) Standard applicable motor indicates Fuji Electric 4-pole standard motors. Select a motor not only based on inverter output (kW), but also so that the output rated current is greater than the motor rated current.

(\*2) The rated capacity indicates 220 V for the 200V series, and 440 V for the 400V series.

(\*3) It is not possible to output a voltage higher than the power supply voltage.

(\*4) Setting the carrier frequency (F26) to the following value or above requires current derating.

HHD spec. of types FRN0002E3□-4G to FRN0012E3□-4G ; 8 kHz, FRN0022E3□-4G to FRN0072E3□-4G ; 10 kHz

HND spec. of types FRN0002E3□-4G to FRN0012E3□-4G ; 8 kHz, FRN0022E3□-4G to FRN0059E3□-4G ; 10 kHz, FRN0072E3□-4G ; 6 kHz

HD / ND spec. of types FRN0002E3□-4G to FRN0072E3□-4G ; 4 kHz

(\*5) This indicates the estimated value if the power supply capacity is 500 kVA (10 times inverter capacity if inverter capacity exceeds 50 kVA), and the motor is connected to a power supply of %X = 5%.

(\*6) This indicates the capacity when the motor is equipped with a DC reactor (DCR).

(\*7) This is the average braking torque when performing individual operation. (This will vary based on the motor efficiency.)

(\*8) Interphase unbalance ratio [%] = (Max. voltage [V] - min. voltage [V])/Three-phase average voltage [V] x 67 (see IEC/EN 61800-3). If using the motor with an unbalance ratio of 2 to 3%, use an AC reactor (ACR: option).

(\*9) For FRN0007/0012E3S-4G, FRN0007/0012E3N-4G HND specifications, If the ambient temperature is 40°C or higher, the output current must be derated by 1%/°C.

3) Single-phase 200V series

Item			Specification							
Type(FRN□□□□E3□-7G) *10			0001	0002	0004 *11	0006 *11	0010 *11	0012 *11		
Standard applicable motor *1	HHD	kW	0.1	0.2	0.4	0.75	1.5	2.2		
		HP	1/8	1/4	1/2	1	2	3		
	HND	kW	0.2	0.4	0.55	1.1	2.2 *8	3 *9		
		HP	1/4	1/2	3/4	1.5	3	4		
Output ratings	Rated capacity [kVA] *2		HHD	0.4	0.6	1.1	1.9	3.0	4.2	
			HND	0.5	0.7	1.3	2.3	3.7	4.6	
	Rated voltage [V] *3		Three-phase 200 to 240 V (with AVR function)							
	Rated current [A] *4		HHD	1	1.6	3	5	8	11	
			HND	1.2	1.9	3.5	6	9.6	12	
	Overload current rating [A] (permissible overload time)		HHD	150% for 1 minute, 200% for 0.5 seconds						
			HND	120% for 1 minute						
	Ambient temperature		E3S E3N	HHD	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)					
				HND	-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range) Type of 0004 to 0012 -10 to +50 °C [14 to 122 °F] (current derating necessary in +40 to +50 °C [104 to 122 °F] range)					
			E3T	HHD	-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)					
HND				-10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range)						
Rated frequency [Hz]		50 / 60 Hz								
Voltage, frequency		Three-phase 200 to 240 V, 50/60 Hz								
Voltage, frequency fluctuation		Voltage: +10 to -10% (interphase unbalance ratio: 2% or less) , Frequency: +5 to -5 %								
Input ratings	Rated current [A] *5	With DCR	HHD	1.1	2	3.5	6.4	11.6	17.5	
			HND	2.2	3.7	4.6	9.4	17.9	25	
	Without DCR	HHD	1.8	3.3	5.4	9.7	16.4	22		
		HND	3.3	4.9	7.3	13.8	20.2	26		
	Required power supply capacity (with DCR) [kVA] *6		HHD	0.3	0.4	0.7	1.3	2.4	3.5	
		HND	0.5	0.8	1.0	1.9	3.6	5.0		
Auxiliary control power supply voltage		-								
Braking	Torque *7		HHD	150%		100%		70%	40%	
			HND	75%		73%	68%	48%	29%	
	Braking transistor		Built-in							
	Connectable resistance value [Ω]		100 to 120							
Braking resistor [Ω]		Option								
DC reactor (DCR)		Option								
Protective construction (IEC 60529)		IP20 enclosed type, UL open type								
Cooling system		E3S E3N	Natural cooling			Fan cooling				
		E3T	See Chapter 7							
Weight [kg(lbs)]	E3S	0.5	0.5	0.6	0.9	1.4	1.7			
		[1.1]	[1.1]	[1.3]	[2.0]	[3.1]	[3.7]			
	E3N	0.5	0.5	0.7	0.9	1.5	1.7			
		[1.1]	[1.1]	[1.5]	[2.0]	[3.3]	[3.7]			
E3T	0.6	0.6	0.6	0.7	1.3	1.5				
	[1.3]	[1.3]	[1.3]	[1.5]	[2.9]	[3.3]				

(\*1) Standard applicable motor indicates Fuji Electric 4-pole standard motors. Select a motor not only based on inverter output (kW), but also so that the output rated current is greater than the motor rated current.

(\*2) The rated capacity indicates 220 V for the 200V series, and 440 V for the 400V series.

(\*3) It is not possible to output a voltage higher than the power supply voltage.

(\*4) Setting the carrier frequency (F26) to the following value or above requires current derating.

HHD spec. ; 8 kHz

HND spec. ; 4 kHz

(\*5) This indicates the estimated value if the power supply capacity is 500 kVA (10 times inverter capacity if inverter capacity exceeds 50 kVA), and the motor is connected to a power supply of %X = 5%.

(\*6) This indicates the capacity when the motor is equipped with a DC reactor (DCR).

(\*7) This is the average braking torque when performing individual operation. (This will vary based on the motor efficiency.)

(\*8) Input voltage is less than 220V, standard applicable motor is 2.0kW.

(\*9) Input voltage is less than 220V, standard applicable motor is 2.7kW.

(\*10) HND specifications, set F80=4.

(\*11) For FRN0004E3S-7G to FRN0012E3S-7G, FRN0004E3N-7G to FRN0012E3N-7G HND specifications  
If the ambient temperature is 40°C or higher, the output current must be derated by 2%/°C.

## 2. Standards

Compliance standards	
Low Voltage Directive	IEC 61800-5-1 Overvoltage Category III
EMC Directive	EN 61800-3 - Emissions: Option External EMC filter : Category C2 Option Built-in EMC filter : Category C2/C3 - Immunity: Second environment
Machine Directives	EN ISO 13849-1 Cat.3 / PL:e EN 61800-5-2 SIL3 (Functional Safety: STO)
RoHS2	Compliance
UL	E3S, E3N : UL61800-5-1 Overvoltage Category III E3T : UL Recognized
cUL	C22.2 No.274-17 Overvoltage Category III
KC	Korean standards
BTL	E3S,E3T : BACnet MS/TP, Protocol Revision 20

## 3. Operating Environment and Storage Environment

Operating environment	Installation location	Indoors													
	Ambient temperature	<p>[FRN-E3S(Basic Type), FRN-E3N(Ethernet built-in Type)]</p> <p>HHD : -10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)</p> <p>HND : -10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range) -10 to +50 °C [14 to 122 °F] (current derating necessary in +40 to +50 °C [104 to 122 °F] range) FRN0012E3□-2G, FRN0020E3□-2G, FRN0007E3□-4G, FRN0012E3□-4G, FRN0004E3□-7G, FRN0006E3□-7G, FRN0010E3□-7G, FRN0012E3□-7G</p> <p>HD / ND : -10 to +50 °C [14 to 122 °F] (current derating necessary in +40 to +50 °C [104 to 122 °F] range)</p> <p>When installed closely side-by-side</p> <p>HHD : -10 to +40 °C [14 to 104 °F] HND : -10 to +40 °C [14 to 104 °F] -10 to +30 °C [14 to 86 °F] FRN0012E3□-2G, FRN0020E3□-2G, FRN0007E3□-4G, FRN0012E3□-4G, FRN0004E3□-7G, FRN0006E3□-7G, FRN0010E3□-7G, FRN0012E3□-7G</p> <p>HD / ND : -10 to +30 °C [14 to 86 °F]</p> <p>[FRN-E3T(Finless Type)] -10 to +50 °C [14 to 122 °F] (current derating necessary in +35 to +50 °C [95 to 122 °F] range) When installed closely side-by-side : -10 to +25 °C [14 to 77 °F]</p>													
	Relative humidity	5 to 95% RH (there should no condensation)													
	Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive or flammable gases, oil mist, vapor, water drops or vibration. (Pollution degree 2 (IEC60664-1)) The atmosphere must contain only a low level of salt. (0.01 mg/cm <sup>2</sup> or less per year) There should be no condensation due to sudden temperature changes.													
	Altitude	1000 m (3300 ft) or lower If used in a location with altitude of 1000 m (3300 ft) or higher, do so after reducing the output current as shown in the following table.													
		<table border="1"> <thead> <tr> <th>Altitude</th> <th>Output current derating factor</th> </tr> </thead> <tbody> <tr> <td>1000 m or lower (3300 ft or lower)</td> <td>1.00</td> </tr> <tr> <td>1000 to 1500 m (3300 to 4900 ft)</td> <td>0.97</td> </tr> <tr> <td>1500 to 2000 m (4,900 to 6600 ft)</td> <td>0.95</td> </tr> <tr> <td>2000 to 2500 m (6600 to 8200 ft)</td> <td>0.91</td> </tr> <tr> <td>2500 to 3000 m (8200 to 9800 ft)</td> <td>0.88</td> </tr> </tbody> </table>	Altitude	Output current derating factor	1000 m or lower (3300 ft or lower)	1.00	1000 to 1500 m (3300 to 4900 ft)	0.97	1500 to 2000 m (4,900 to 6600 ft)	0.95	2000 to 2500 m (6600 to 8200 ft)	0.91	2500 to 3000 m (8200 to 9800 ft)	0.88	
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FRN0002E3□-4G to FRN0072E3□-4G															
FRN0001E3□-7G to FRN0012E3□-7G															

Storage environment	Storage temperature (Note 1)	-25 to +70 °C (during transport) (-13 to +158 °F)	Places not subjected to condensation or freezing due to sudden temperature changes
		-25 to +65 °C (during temporary storage) (-13 to +149 °F)	
		-10 to +30 °C (during long-term storage) (14 to 86 °F)	
	Relative humidity (Note 2)	During temporary storage: 5 to 95% RH (there should no condensation) During long-term storage: 5 to 70% RH	
	Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive or flammable gases, oil mist, vapor, water drops or vibration. The atmosphere must contain only a low level of salt. (0.01 mg/cm <sup>2</sup> or less per year)	
Atmospheric pressure	86 to 106 kPa (during storage) 70 to 106 kPa (during transport)		

(Note 1) Assuming comparatively short time storage, e.g., during transportation.

(Note 2) Even if the humidity is within the specified requirements, avoid such places where the inverter will be subjected to sudden changes in temperature that will cause condensation or freezing.

Do not install the inverter in an environment where it may be exposed to lint, cotton waste or moist dust or dirt which will clog the cooling fins, etc. If the inverter is to be used in such an environment, install it in a cabinet to prevent lint, etc. getting in.

#### Precautions for temporary storage

- Do not leave directly on the floor.
- If the atmosphere does not satisfy the above requirements, store the product after sealing and packaging it with a plastic sheet.
- If storing the inverter in a high-humidity environment, place desiccant (silica gel, etc.) in an airtight container, and then seal and package with a plastic sheet.

#### Precautions for long-term storage

- When storing the product for longer than 3 months, the surrounding temperature should be within the -10 to +30 °C (14 to 86 °F) range. This is to prevent electrolytic capacitors in the inverter from deterioration.
- The package must be airtight to protect the inverter from moisture. Add a desiccant (such as silica gel) inside the package to maintain the relative humidity inside the package within 70%.
- If the inverter has been in storage for longer than 1 year, the properties of the electrolytic capacitors may deteriorate. Connect the inverter to a power supply once a year, and turn it ON for 30 to 60 minutes.

#### Design life

		E3S, E3N	E3T
DC link bus capacitors		10 years (*1)	10 years (*1)
Electrolytic capacitors on PCBs		10 years (*1)	10 years (*1)
Cooling fans		10 years (*1)	-
Design conditions	Ambient temperature	+40 °C (104 °F)	+35 °C (90 °F)
	Load factor	HHD: 100% FRN0020E3□-2G or below model : 80% FRN0012E3□-4G or below model : 80% FRN0012E3□-7G or below model : 80% HND / HD / ND : 80%	HHD / HND / HD / ND : 80%

\*1 FRN0012E3□-2G(HND), FRN0020E3□-2G(HND), FRN0007E3□-4G(HND), FRN0012E3□-4G(HND) : 7 years

FRN0001E3□-7G(HND) to FRN0012E3□-7G(HND) : 7 years

The design life is not a measured value, and is therefore not guaranteed.

## 4. Specifications

Item	Description			
Output	Maximum output frequency	5 to 599 Hz (If the output frequency exceeds 599 Hz, the inverter will stop with overspeed protection.) If Vector control with speed sensor, this is determined by the maximum PG option card input frequency, number of motor poles, and number of encoder poles.		
	Base frequency	5 to 599 Hz variable		
	Number of motor poles setting	2 to 128 poles		
	Starting frequency	0.1 to 60.0 Hz variable (0.0 Hz under vector control)		
	Carrier frequency	FRN****E3S/N-2G	- 0.75 to 16 kHz variable setting	HHD specification : **** = 0001 ~ 0115 HND specification : **** = 0001 ~ 0010 0030 ~ 0088
			- 0.75 to 10 kHz variable setting	HND specification : **** = 0012 ~ 0020 0115
		FRN****E3T-2G	- 0.75 to 16 kHz variable setting	HHD specification : **** = 0001 ~ 0020 HND specification : **** = 0001 ~ 0010
			- 0.75 to 10 kHz variable setting	HND specification : **** = 0012 ~ 0020
		FRN****E3S/N-4G	- 0.75 to 16 kHz variable setting	HHD specification : **** = 0002 ~ 0072 HND specification : **** = 0002 ~ 0059 HD specification : **** = 0002 ~ 0059
			- 0.75 to 10 kHz variable setting	HND specification : **** = 0072 HD specification : **** = 0072 ND specification : **** = 0002 ~ 0059
		- 0.75 to 6 kHz variable setting	ND specification : **** = 0072	
FRN****E3T-4G		- 0.75 to 16 kHz variable setting	HHD specification : **** = 0002 ~ 0012 HND specification : **** = 0002 ~ 0006	
		- 0.75 to 10 kHz variable setting	HND specification : **** = 0007 ~ 0012	
FRN****E3S/N/T-7G		- 0.75 to 16 kHz variable setting	HHD specification : **** = 0001 ~ 0012	
		- 0.75 to 10 kHz variable setting	HND specification : **** = 0001 ~ 0012	
		Note) The carrier frequency may automatically lower depending upon the ambient temperature or the output current to protect the inverter. (The automatic lowering function can be disabled.)		
Frequency setting resolution	<ul style="list-style-type: none"> <li>Analog setting: 1/3000 of maximum output frequency</li> <li>Digital setting: 0.01 Hz (99.99 Hz or less), 0.1 Hz (100.0 to 599.0 Hz)</li> <li>Link setting: 0.005% of maximum frequency or 0.01 Hz (fixed)</li> </ul>			
Control	Speed control range	1 : 20	VF IMPG-VF *2	
		1 : 200	DTV IMPG-DTV *2 IM-SVC	
		1 : 1500	IMPG-VC *2 PMPG-VC *2	
		1 : 10 (without high-frequency superimposing) 1 : 100 (with high-frequency superimposing)	PM-SVC	
		1 : 2 (constant torque range : constant output range)	VF SCVF DTV IMPG-VF *2 IMPG-DTV *2 IM-SVC	
	Speed control accuracy Output frequency accuracy	Analog setting : ±0.2% or less of maximum output frequency (at 25 ±10 °C) (77 ±18 °F)		VF IMPG-VF IMPG-DTV IMPG-VC PMPG-VC
		Digital setting : ±0.01% or less of maximum output frequency (at -10 to +50 °C) (14 to 122 °F)		
		Analog setting : ±0.5% or less of maximum output frequency (at 25 ±10 °C) (77 ±18 °F)		IM-SVC PM-SVC
		Digital setting : ±0.5% or less of maximum output frequency (at -10 to +50 °C) (14 to 122 °F)		
	Control method	V/f control		VF
Dynamic torque vector control			DTV	
V/f control with slip compensation			SCVF	
V/f control with speed sensor (PG option card required)			IMPG-VF *2	
Dynamic torque vector control with speed sensor (PG option card required)			IMPG-DTV *2	
Vector control with speed sensor (PG option card required)			IMPG-VC *2	
Vector control without speed sensor			IM-SVC	
Vector control with magnetic pole position sensor (PG option card required)			PMPG-VC *2	
Vector control without magnetic pole position sensor		PM-SVC		



Item	Description		
Control	Voltage / frequency characteristics	<ul style="list-style-type: none"> <li>- The base frequency and maximum output frequency are common, and the voltage can be set between 80 and 240 V (200V series) and 160 and 500 V (400V series).</li> </ul>	
		<ul style="list-style-type: none"> <li>- Linear V/f setting (3 points) : The voltage can be set freely from 0 to 240 V (200V series) and 0 to 500 V (400V series), and the frequency can be set from 0 to 599 Hz.</li> <li>- AVR control can be turned ON or OFF.</li> </ul>	
	Torque boost	<ul style="list-style-type: none"> <li>- Auto torque boost (for constant torque load)</li> <li>- Manual torque boost: The torque boost value can be set between 0.0 and 20.0%.</li> <li>- The applicable load can be selected. (for constant torque load, quadratic-torque load)</li> </ul>	
Starting torque (HHD spec.)	150% or higher / 10% speed		VF
	200% or higher / 0.5 Hz		DTV
	150% or higher / 10% speed		SCVF
	150% or higher / 10% speed		IMPG-VF *2
	200% or higher / 0.5 Hz		IMPG-DTV *2
	200% or higher / 0.0 Hz		IMPG-VC *2
	200% or higher / 0.5 Hz		IM-SVC
	200% or higher / 0.0 Hz		PMPG-VC *2
	200 % or higher / 10% speed		PM-SVC
Running operation	<ul style="list-style-type: none"> <li>- Key operation : Run/stop with [RUN] and [STOP] keys (standard keypad) Run/stop with [FWD]/[REV] and [STOP] keys (multi-function keypad: option)</li> </ul>		*2
	<ul style="list-style-type: none"> <li>- External signals : Forward (reverse) rotation run/stop commands [2-wire/3-wire operation], (digital input "HLD", "DIR", "FWD", "REV") coast to stop command, external alarm, alarm reset, etc.</li> </ul>		*2
	<ul style="list-style-type: none"> <li>- Link setting : Setting by RS-485 communication (E3S,E3T), Setting by field bus communication (Option : E3S,E3T / Built-in : E3N)</li> </ul>		
	<ul style="list-style-type: none"> <li>- Run command switching : Remote/local switching, link switching</li> </ul>		*2
Frequency settings	<ul style="list-style-type: none"> <li>- Keypad : Setting possible with UP/DOWN keys</li> </ul>		*2
	<ul style="list-style-type: none"> <li>- External potentiometer : Using external frequency command potentiometer (external resistor of 1 to 5 kΩ, 1/2 W)</li> </ul>		
	<ul style="list-style-type: none"> <li>- Analog input : -10 to +10 VDC (-5 to +5 VDC) / -100 to +100% (terminal [12]) 0 to +10 VDC (0 to +5 VDC)/0 to +100% (terminal [12], [C1] (V2 function)) 0 to +10 VDC (0 to +5 VDC)/-100 to +100% (terminal [12], [C1] (V2 function)) 4 to 20 mA DC/0 to 100% (terminal [C1] (C1 function)) 4 to 20 mA DC/-100 to 0 to 100% (terminal [C1] (C1 function)) 0 to 20 mA DC/0 to 100% (terminal [C1] (C1 function)) 0 to 20 mA DC/-100 to 0 to 100% (terminal [C1] (C1 function)) [C1 function] and [V2 function] of terminal [C1] cannot be used at the same time. (exclusive)</li> </ul>		
	<ul style="list-style-type: none"> <li>- UP/DOWN operation: Frequency can be increased or decreased while the digital "UP" or "DOWN" signals are ON. It is possible to select whether to record or clear the current frequency when the power is turned OFF. The frequency recorded with digital input "STZ" can be cleared.</li> </ul>		
	<ul style="list-style-type: none"> <li>- Multistep frequency selection : Selectable from 16 different frequencies (step 0 to 15)</li> </ul>		
	<ul style="list-style-type: none"> <li>- Pattern operation : The inverter can be run automatically according to the previously specified run time, rotation direction, acceleration / deceleration time and reference frequency. Up to 7 stages can be set.</li> </ul>		
	<ul style="list-style-type: none"> <li>- Link setting1 Setting is possible with RS-485 communication (built-in as standard). Setting is possible with field bus communication (option:E3S,E3T / Built-in:E3N).</li> </ul>		
	<ul style="list-style-type: none"> <li>- Frequency setting switching : The frequency setting can be switched between two types with an external signal (digital input "Hz2/Hz1"). Remote/local switching ("LOC") and link switching ("LE") are also possible.</li> </ul>		*2
	<ul style="list-style-type: none"> <li>- Auxiliary frequency setting : Terminal [12] and [C1] inputs can be selected as the auxiliary frequency setting and added to the main settings.</li> </ul>		
	<ul style="list-style-type: none"> <li>- Operation at specified ratio : A ratio value can be set with analog input signals (terminal [12] and [C1]). 0 to 10 VDC/4(0) to 20 mA/0 to 200% (variable)</li> </ul>		

Item	Description	
Control	Inverse operation : The following settings can be specified with external commands (terminals) : - Can be switched from "0 to +10 VDC/0 to 100%" to "+10 to 0 VDC/0 to 100%" (terminal [12] / [C1] (V2 function)). - Can be switched from "0 to -10 VDC/0 to -100%" to "-10 to 0 VDC/0 to -100%" (terminal [12] / [C1] (V2 function)). - Can be switched from "4 to 20 mA DC / 0 to 100%" to "20 to 4 mA DC / 0 to 100%" (terminal [C1] (C1 function)). - Can be switched from "0 to 20 mA DC / 0 to 100%" to "20 to 0 mA DC / 0 to 100%" (terminal [C1] (C1 function)).	
	- Pulse train input (standard) : Pulse input "PIN" = Terminal [X5], rotational direction "SIGN" = input terminal other than [X5]. - Maximum input pulse When connected to complementary output transmitter: 100 kHz When connected to open collector output transmitter: 30 kHz	*2
	- Pulse train input (option): A PG option is required. CW / CCW pulse, pulse + rotation direction - Maximum input pulse When connected to complementary output transmitter: 100 kHz When connected to open collector output transmitter: 30 kHz	*2
Acceleration / deceleration time	- Setting range : 0.00 to 6000 seconds - Switching : The four types of acceleration/deceleration time can be set or selected individually (switchable during operation). - Acceleration/deceleration pattern : Linear acceleration/deceleration, S-curve acceleration/deceleration (week, Arbitrary), Curvilinear acceleration/deceleration (max. acceleration/deceleration at rated output) - Deceleration mode (coast to stop) : Coast to stop when run command turned OFF. - Deceleration time for forced stop : Deceleration stop in exclusive deceleration time by forced stop (STOP). During forced stop operation, S-curve acceleration/deceleration is disabled. - Dedicated acceleration/deceleration time for jogging - It is possible to switch between acceleration/deceleration time = 0 with acceleration/deceleration operation cancel "BPS".	
Frequency limiter (upper limit, lower limit frequency)	- Both the upper limit frequency and lower limit frequency are set in Hz values. - "Continue to run" or "Decelerate to a stop" selectable when the reference frequency drops below the lower limit. (disabled under vector control) - Setting is possible with analog input (terminal [12], [C1]).	
Frequency/ PID command bias	The frequency setting and PID command bias can be set independently. Frequency setting: (setting range: 0 to ±200%) PID command (setting range: 0 to ±100%)	
Analog input	- Gain: Setting range: 0 to 400% - Offset: Setting range from -5.0 to +5.0% - Filter: Setting range: 0.00 s to 5.00 s - Polarity selection (selection possible from ± or +)	
Jump frequency	Six points and their common jump width (0 to 30.0 Hz) can be set.	
Timed operation	The inverter runs and stops for only the operating time set with the keypad. (1 cycle operation)	*2
Jogging operation	- Operation with RUN key (standard keypad), FWD/REV keys (multi-function keypad), digital contact inputs FWD/REV or digital contact inputs "FWD", "REV" (dedicated acceleration time individual setting, dedicated frequency setting) - Jogging operation can be performed with independent commands "FJOG" for forward rotation jogging and "RJOG" for reverse rotation jogging without "FWD", "REV".	*2
Auto-restart after momentary power failure	- Trip after power failure : Immediate trip after power failure - Trip after power restoration : Motor coasts to a stop after power failure, and trip occurs after power restoration. - Trip after deceleration stop : Motor decelerates and stops after power failure, and trips after stopping. - Continue to run : Load inertia energy is used to continue operation. - Start at frequency selected before momentary power failure : Motor coasts to stop after power failure, and starts at frequency at time of power failure after power restoration. - Start at starting frequency : Motor coasts to stop after power failure, and starts at starting frequency after power restoration. - Start at frequency selected after power restoration : Motor coasts to stop after power failure, searches for speed and restarts after power restoration.	
Current limiting (hardware current limiter)	Current is limited with hardware to prevent overcurrent trip due to high-speed load fluctuations or momentary power failure which cannot be handled with software current limiting. (This limiter can be canceled.)	
Current limiting (software current limiter)	- Automatically reduces the frequency so that the output current becomes lower than the preset operation level. (This limiter can be canceled.) - The operation can be selected (operation at constant speed only, operation when accelerating and at constant speed).	
Operation by commercial power supply	- 50/60 Hz can be output with a switch to commercial power supply command ("SW50", "SW60"). - A commercial switching sequence is built in.	
Slip compensation	- Motor slip is compensated to keep the motor speed to a reference speed, regardless of the load torque. - The slip compensation responsiveness (time constant) can be adjusted.	

Item	Description		
Control	Droop control	- This function is used to adjust the speed of each motor individually to balance load torque on machines driven with multiple motor systems.	
	Torque limiting Torque current limiting Power limiting	The output torque or output torque current is controlled so that the output torque is equal to or less than the limiting value set beforehand. - The value can be switched between torque limit value 1 and torque limit value 2. - Torque limit values can be set individually for each of the four quadrants. - Torque limiting and torque current limiting can be selected. - Torque limiting is possible with analog input.	IMPG-VC PMPG-VC PM-SVC
	Overload stop	- If the detected torque or current exceeds the preset value, the motor can be stopped with a deceleration stop or coast to stop, or when contact is made with the stopper. - Operating conditions can be set in operation mode (while the motor is running at constant speed and while decelerating/while the motor is running at constant speed/all modes). - The torque during stopper contact can be adjusted.	
	PID control	- PID controller for process control/dancer control - Normal/inverse operation switching - Commands: keypad, analog input (terminal [12], [C1]), multi-step settings (selection possible from 3 points), RS-485 communication, field bus communication (Option : E3S,E3T/ Built-in : E3N) - Feedback values: analog input (terminal [12], [C1]) - Alarm output (absolute value alarm, deviation alarm) - Low liquid level stop function (pressurized operation possible before low liquid level stop) - Anti-reset wind-up function - Output limiter - Integral/differential reset/integral hold function - PID constant auto tuning function for process control PID controller	*2
	Retry	- Even if a protective function subject to a retry is triggered, an attempt is made to automatically cancel the trip condition up to the number of set times to resume operation without outputting an integrated alarm. - The number of attempts can be set up to 20 times (can be set with function code)	
	Auto search	The motor speed is estimated before startup, and the motor is started without ever stopping the motor while it is idling. (Motor constant tuning required : offline tuning)	
	Anti-regenerative control	- If the DC link bus voltage/torque calculation value reach or exceed the anti-regenerative control level when the motor is decelerating, the deceleration time is automatically extended to avoid an overvoltage trip. (Forced deceleration can be set at three or more times the deceleration time.) - If the torque calculation value reaches or exceeds the anti-regenerative control level during constant speed operation, overvoltage tripping is avoided by performing control to raise the frequency.	
	Deceleration characteristic (improved braking ability)	- During deceleration, this function increases the motor energy loss and decreases the regenerative energy returned to avoid an overvoltage trip. - Setting is also possible when using in combination with AVR cancel.)	
	Auto energy saving operation	Controls the output voltage in order to minimize the total motor and inverter power loss at constant speed.	
	Overload prevention control	If the surrounding temperature or IGBT junction temperature increases due to an overload, the inverter lowers the output frequency to avoid an overload.	
	Battery operation	Cancels the undervoltage protection so that the inverter under an undervoltage condition runs the motor with battery power. (FRN0088E3□-2G,FRN0115E3□-2G,FRN0059E3□-4G,FRN0072E3□-4G)	
	Offline tuning	- Measures the motor constant when the motor is stopped or rotating, and sets it in a motor constant function code. (IM motors, PM motors) - Mode in which IM motor %R1 and %X only are tuned - Mode in which PM motor magnetic pole position offset is tuned	PMPG-VC *2
	Online tuning	Automatically adjusts motor parameters while the motor is running to prevent fluctuations in motor speed due to rises in motor temperature.	DTV
	Cooling fan ON-OFF control	- Detects inverter internal temperature and stops cooling fan when the temperature is low. - Available to output a fan control signal to an external device.	
	Motor 1 ,2 settings	- Switching is possible between 2 motors. It is possible to set the base frequency, rated current, torque boost, electronic thermal slip compensation, ASR, notch filter, starting frequency, stopping frequency, thermistor operation selection, and speed display coefficients, etc. as the data for motors 1 to 2. Cumulative motor run count, start count	
	Motor selection	Equipped with parameters for Fuji standard motors. Optimum motor parameters can be set by setting the type and capacity. - Fuji standard motors, 8-series - Typical HP unit motors - Fuji premium efficiency motors (MLK1/MUL1 series) - Fuji synchronous motors (GNB2 series, GNP1 series)	
	Universal DI	Transfers the status of an external digital signal connected with the general-purpose digital input terminal to the host controller.	
	Universal DO	Outputs a digital command signal sent from the host controller to the general-purpose digital output terminal.	
Universal AO	Outputs an analog command signal sent from the host controller to the analog output terminal.		
Speed control	- Selectable among the four set of the auto speed regulator (ASR) parameters. - A vibration suppression notch filter can be set. (for IMPG-VC, PMPG-VC only) (A PG option card is required.)	IMPG-VF IMPG-DTV IMPG-VC IM-SVC PMPG-VC PM-SVC *2	

	Item	Description	
Control	Line speed control	Regulates the motor speed to keep the peripheral speed constant even if the roll winding diameter changes on machines such as winders and unwinders. Tension can be controlled when used in combination with PID control. (A PG option card is required.)	IMPG-VF IMPG-DTV IMPG-VC *2
	Master-follower operation	Two motors can be run synchronously using a pulse generator (PG). (A PG option card is required.)	IMPG-VF IMPG-DTV IMPG-VC *2
	Pre-excitation	- Excitation is carried out to create the motor flux before starting the motor. (A PG option card is required.)	IMPG-VC IM-SVC *2
	Zero speed control	- Zero speed control is performed by forcibly zeroing the speed command. (A PG option card is required.)	IMPG-VC PMPG-VC *2
	Servo lock	Stops the inverter and holds the motor at the stopped position. (A PG option card is required.)	IMPG-VC PMPG-VC *2
	DC braking	- Applies DC current to the motor at the operation start time or at the time of inverter stop to generate braking torque.	
	Mechanical brake control	- It is possible to output mechanical brake control signals with the brake ON/OFF timing adjusted by the output current, torque commands, output frequency and timer. - The output timing of control signals can be adjusted individually when performing forward rotation (hoisting) and reverse rotation (lowering). - Errors can be detected with mechanical brake operation check input signals.	Other than PM-SVC
	Torque control	- Analog torque commands/torque current commands possible - Speed limit function is provided to prevent the motor from becoming out of control. - Torque bias (with analog setting, digital setting) possible	IMPG-VC IM-SVC PMPG-VC
	Rotation direction restriction	Select either of reverse or forward rotation prevention.	
	Condensation prevention	Current flows automatically when the motor is stopped, and the motor temperature is raised to prevent condensation.	
	Customizable logic	It is possible to select or connect digital logic circuits or analog operation circuits with digital/analog I/O signals, configure a simple relay sequence, and operate it freely. - Logics : (Digital) AND, OR, XOR, flip-flop, detection of rising and falling edges, various counters. (Analog) Addition, subtraction, multiplication, division, remainders, limiters, absolute values, sign inversion addition, hold, comparison, maximum value selection, minimum value selection, average values, scale conversion, rate of change limiting, primary delay filter, primary functions, secondary functions, square root, function code reading/writing, temporary rewriting, bit extraction, etc. - Multifunction timer : On-delay, off-delay, pulse train, etc. (setting range: 0.0 to 9990 s) - Input/output signals : Terminal input/output (digital/analog), inverter control functions, keypad keys - User free parameter function codes : 50 codes (for reading), 10 codes (for writing when power shut OFF) - External input signals : 7 standard signals (X1 to X5, FWD, REV), 12 extension signals (using OPC-DIO: I1 to I12) - External output signals : 3 standard signals (Y1, Y2, 30ABC), 8 extension signals (using OPC-DIO: O1 to O8) - Other : Each step comprises 2 inputs and 1 output. Coast to stop mode : The execution cycle time is dependent on the maximum number of steps. The maximum number of steps is 260, and the execution cycle time is 20 ms.	
	Positioning control	Feedback pulses are counted from the preset count start point, and the motor automatically decelerates to the creep speed and stops at the target stop point. (A PG option card is required.)	IMPG-VF IMPG-DTV IMPG-VC *2
	Orientation function	This function makes it possible for rotors such as the machine tool spindle to be positioned. - Stop target position: 8 points - Machine shaft home position setting - Orientation frequency, orientation deceleration time - Stoppage to orientation mode (existence of shortcut) switching (A PG option card is required.)	IMPG-VF IMPG-DTV IMPG-VC *2
	Favorites Function code	The function codes can be registered in "Favorites" and displayed. (Applicable to all function codes)	*2
	Data initialization	All function codes and limited function codes can be initialized. - Initializes all function code. (Initial values are selectable from Fuji Electric standard default values and values set and saved by customers.) - Initializes only for the function codes related to motor parameter (each of motor 1 to 2). - Initializes the function codes with the exception of communication function. - Initializes only for the function codes related to the customizable logic. - Initializes only for the function codes registered in "Favorites" are initialized.	
Start check function	To ensure safety, it is available to check for the existence of run commands when turning the power ON, when resetting alarms, and when changing the run command method, and display an alarm if a run command has been input.		
Destination setting	The factory default values such as voltage, frequency, and other function codes can be changed based on whether the machine is being shipped for use in Japan, Asia, China, Europe, USA, Taiwan, or East Asia. This setting is not necessary for Japanese model or Chinese model.		

Item	Description		
Control	Multifunction key	During the operation mode the "SHIFT" key on standard keypads (TP-M3) and "M/SHIFT" key on option keypad (TP-E2) can be used as an input source to activate the input terminal function like the X terminal. Any function is not assigned as a factory default.	*2
	E1 series function code copy	By using the option keypad (TP-E2), setting parameters can be copied from the previous series (E1 and E2 series) to the E3 series with automatic conversion.	*2
	E2 series function code copy		*2
	E1 series communication compatibility mode	The E3 inverter has a communication compatibility mode with the previous series (E1, E2 series). By enabling this function, it can be replaced from the E1/E2 series without any modification on the communication master side.	
E2 series communication compatibility mode			
Indicates (*1).	Display	The display is equipped with a 7-segment LED (4 digits), 7 keys (PRG/RESET, FUNC/DATA, UP, DOWN, RUN, STOP, SHIFT), and 6 LED indicators (KEYPAD CONTROL,x10,Hz,A,kW,RUN), and the keypad is removable.	*2
	Run monitor	This is used to monitor the running status during maintenance and test running.	*2
	(Output frequency 1)	Shows the output frequency (Hz) before slip compensation.	
	(Output frequency 2)	Shows the output frequency (Hz) after slip compensation.	
	(Output current)	Shows the output current (A <sub>RMS</sub> ).	
	(Output voltage)	Shows the output voltage (V <sub>RMS</sub> ).	
	(Calculated torque)	Shows the torque produced by the motor (calculated value) (%).	
	(Reference frequency)	Shows the reference frequency.	
	(Rotation direction)	Shows the operation direction being output. F: forward, r: reverse, - - - -: stop	
	(Operating status)	Shows operating status in 4-digit hexadecimal format	
	(Motor speed)	Display value = $120 \times \frac{\text{Output frequency (Hz)}}{\text{Motor constant}}$	
	(Load shaft speed)	Display value = (Output frequency (Hz)) x $\frac{\text{Function code E50}}{\text{Function code E39}}$	
	(Feed speed)	Display value = (Output frequency (Hz)) x $\frac{\text{Function code E50}}{\text{Function code E39}}$	
	(PID command value)	Virtual physical value (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID command value using function code J106 and J107 data (PID display Maximum scale/ minimum scale) Display value = $\frac{\text{PID command value (\%)}}{100} * (\text{Max. scale} - \text{Min. scale}) + \text{Min. scale}$ If PID control is disabled, " - - - - " appears. When using TP-A2SW, setting is possible with J105/J205.	
	(PID feedback value)	Virtual physical value (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID feedback amount using function code J106 and J107 data (PID display Maximum scale/ minimum scale) Display value = $\frac{\text{PID feedback value (\%)}}{100} * (\text{Max. scale} - \text{Min. scale}) + \text{Min. scale}$ If PID control is disabled, " - - - - " appears. When using TP-A2SW, setting is possible with J105/J205.	
	(Torque limit value)	Shows driving torque limit value A (based on motor rated torque). Shows driving torque limit value B (based on motor rated torque).	
	(Ratio setting)	When this setting is 100%, the LED monitor shows 1.00 time of the value to be displayed. If no ratio setting is selected, " - - - - " is displayed.	
	(Stop target position)	Shows the stop target position.	
	(Current position)	Shows the current position.	
	(Position deviation)	Shows the position deviation.	
	(Position control status monitor)	Shows the positioning control status.	
	(PID output value)	Shows the PID output value (%) (100% indicates maximum frequency). If PID control is disabled, " - - - - " is displayed.	
	(Flux command value)	Shows the flux command value (%).	IMPG-VC IM-SVC
	(Operating status 2)	Shows operating status 2 in 4-digit hexadecimal format	
	(Master-follower operation deviation)	Shows the position deviation (in angle units) for master-follower operation.	
	(PG feedback value)	Shows the PG feedback amount converted to a frequency value (Hz).	
	(Torque bias command value)	Shows the selected torque bias command value (%).	
	(PG pulse rate (A/B phase of the command (master)))	Shows the pulse rate input to the PG AB-phase used as the command (master) side.	
	(PG pulse rate (Z phase of the command (master)))	Shows the pulse rate input to the PG Z-phase used as the command (master) side.	
	(PG pulse rate (A/B phase of the feedback (follower)))	Shows the pulse rate input to the PG AB-phase used as the feedback (follower) side.	
	(PG pulse rate (Z phase of the feedback (follower)))	Shows the pulse rate input to the PG Z-phase used as the feedback (follower) side.	

Item	Description		
Indicates (*1).	Inverter lifetime alarm	- Deterioration diagnosis can be carried out for main circuit capacitors, electrolytic capacitors on PCBs, cooling fans, and IGBTs, lifetime alarms can be displayed, and data can be output externally. - Warning information can be displayed and output externally if the maintenance time or startup count set beforehand is exceeded. - Operating temperature: 40 °C (104 °F) Finless type: 35 °C (95 °F) - Load factor: Inverter rated current of 100% (HHD specification), 80% (HND/HD/ND specification)	*2
	Maintenance monitor (Cumulative run time)	Displays information necessary for performing inverter maintenance. Shows the content of the cumulative power-ON time counter of the inverter. Measurement range: 0 to 65,535 When the time display exceeds 65,535 hours, the counter will be reset to "0" and starts over again.	*2
	(DC link bus voltage)	Shows the DC link bus voltage (V) for the inverter main circuit.	
	(Max. temperature inside the inverter)	Shows the maximum temperature (°C) inside the inverter for every hour. (20 °C (temperatures of 68 °F or lower are 20 °C (displayed as 68 °F).)	
	(Max. cooling fin temperature)	Shows the maximum temperature of the inverter cooling fin for every hour. (20 °C (temperatures of 68 °F or lower are 20 °C (displayed as 68 °F).)	
	(Max. effective output current) (Capacitance of DC link bus capacitor)	Shows the maximum current (A <sub>RMS</sub> ) for every hour. Shows the current capacitance of the DC link bus capacitor (reservoir capacitor) in %, based on the capacitance when shipping as 100%.	
	(Cumulative run time of electrolytic capacitors on the PCBs)	Shows the content of the cumulative run time counter of the electrolytic capacitors on PCBs, which is calculated by multiplying the cumulative run time count by the coefficient based on the surrounding temperature condition. Counter range: 0 to 99,990 hours When the count exceeds 99,999 the counter stops and the LED monitor sticks to 99990.	
	(Cumulative run time of cooling fan)	Shows the content of the cumulative run time counter of the cooling fan. This counter does not work when the cooling fan ON/OFF control (function code H06) is enabled and the fan stops.	
	(Number of startups) (Startup count of 2)	Shows the content of the motor 1 to 2 startup counter (i.e., the number of run commands issued). Measurement range : 0 to 65,535 times When the count exceeds 65,535, the counter will be reset to "0" and starts over again.	
	(Input watt-hour)	Shows the integral power consumption in 1 kWh. Display range : 0.001 to 9999 Integral power consumption = Display value x 1 kWh To reset the integral power consumption and integral power data, set function code E51 to "0.000." When 9,999,900 kWh is exceeded, the counter will be reset to "0".	
	(Input watt-hour data)	Integral power data displays the integral power consumption (1.000 = 100 kWh) x function code E51 data. The function code E51 setting range is 0.000 to 9,999. Display unit : none (Display range: 0.001 to 9999. The count cannot exceed 9999. (It will be fixed at 9,999 once the calculated value exceeds 9999.)) Depending on the value of integrated input watt-hour data, the decimal point on the LED monitor shifts to show it within the LED monitors' resolution. The integral power data can be reset by setting function code E51 to "0.000".	
	(Number of RS-485 communications errors (COM port 1))	Shows the total number of errors that have occurred in RS-485 communication (COM port 1, connection to keypad) after the power is turned ON. Once the count exceeds 9,999, the counter will be reset to "0".	
	(Content of RS-485 communications error (COM port 1))	Shows the latest error that has occurred in RS-485 communication (COM port 1) in decimal.	
	(Number of option errors)	Shows the total number of errors that have occurred in the option. Once the count exceeds 9,999, the counter will be reset to "0".	
	(Inverter's ROM version)	Shows the inverter ROM version with a 4-digit code.	
	(Keypad's ROM version)	Shows the keypad ROM version with a 4-digit code.	
	(Number of RS-485 communications errors (COM port 2))	Shows the total number of errors that have occurred in RS-485 communication (COM port 2, connection to terminal block) after the power is turned ON. Once the count exceeds 9,999, the counter will be reset to "0".	
	(Content of RS-485 communications error (COM port 2))	Shows the latest error that has occurred in RS-485 communication (COM port 2, connection to terminal block) in decimal.	
	(Option's ROM version 1)	Shows the option ROM version as a 4-digit code. If the option has no ROM, " - - - " is displayed on the LED monitor.	
	(Type of option)	Shows the type of option installed.	
	(Cumulative run time of motor 1 ,2)	Shows the content of the cumulative power-ON time counter for motor 1 ,2. Counter range: 0 to 99,990 hours When the count exceeds 99,990, the counter will be reset to "0" and start over again.	
	(Temperature inside the inverter (real-time value))	Shows the current temperature (°C) inside the inverter. The internal temperature is not measured at inverters of FRN0069E3□-2G / FRN0044E3□-4G / FRN0012E3□-7G or below models, and therefore the temperature is not displayed.	
	(Temperature of cooling fin (real-time value))	Shows the current temperature of the inverter cooling fin.	
	(Lifetime of DC link bus capacitor (elapsed hours))	Shows the cumulative time during which a voltage is applied to the DC link bus capacitor. When the main power is shut down, the inverter automatically measures the discharging time of the DC link bus capacitor and corrects the elapsed time.	
	(Service life of DC link bus capacitor (remaining time))	Shows the remaining lifetime of the DC link bus capacitor, which is estimated by subtracting the elapsed time from the lifetime (10 years).	
	(Time remaining until motor 1 maintenance)	Shows the time remaining until the next maintenance, which is estimated by subtracting the cumulative run time of motor 1 from the maintenance interval specified by H78. (This function applies to motor 1 only.) Display range: 0 to 99,990 hours	

Item	Description	
Indicates (*1).	(Remaining startup times before the next maintenance 1)	Shows the startup times remaining before the next maintenance, which is estimated by subtracting the number of startups from the preset startup count for maintenance specified by H79. (This function applies to motor 1 only.)
	(Warning content (Latest))	Shows the content for latest warning as a code.
	(Warning content (Last))	Shows the content for the previous warning as a code.
	(Warning content (2nd most recent))	Shows the content for 2nd most recent warning as a code.
	(Warning content (3rd most recent))	Shows the content for 3rd most recent warning as a code.
	(Warning content (4th most recent))	Shows the content for 4th most recent warning as a code.
	(Warning content (5th most recent))	Shows the content for 5th most recent warning as a code.
	(Warning content (6th most recent))	Shows the content for 6th most recent warning as a code.
	(Option error cause)	Shows the content of the error that occurred at the option card.
	(Maximum regenerative load factor)	Shows the maximum regenerative load factor in inverter operation.
	(Regenerative load factor)	Shows the regenerative load factor (Recent 100 seconds)
	(Braking resistor thermal overload ratio)	Shows the attainment level for the braking resistor protection electronic thermal overload trip level in percentage (%).
	(Inverter thermal 1)	Shows the attainment level to the inverter protection electronic thermal overload trip level in percentage (%).
	(Electronic thermal overload protection for motors)	Motor electronic thermal overload protection (based on electronic thermal overload relay overload protection level).
	(Estimated IGBT life)	Shows the the estimated remaining service life of IGBT to the expected design life in %. The warning " $I_{ub}$ " or " $I_{F}$ " appears and output if the customer activates those and the estimated life is less than 10%. (Factory default setting: 100%)
	(IP Address)	Displays the following information that is set to connect to Ethernet.
	(Subnet Mask)	- IP Address
	(Default Gateway)	- Subnet Mask - Default Gateway
		The 4-digit number is switched and displayed with the   button.
	I/O check	Shows the I/O signal states of control circuit terminals using the segment ON/OFF of the 7-segment LED monitor or hexadecimal format. (Digital and analog signals)
(Control circuit terminals (input/output))	Shows the ON/OFF state of the digital I/O terminals.	
(Communication control signals (input/output))	Shows the ON/OFF state of the digital I/O terminals that received a command via RS-485 or option field bus communications.	
(Input voltage on terminal [12])	Shows the input voltage on terminal [12] in volts (V).	
(Input current on terminal [C1](C1 function))	Shows the input current on terminal [C1] in milliamperes (mA).	
(Input voltage on terminal [C1](V2 function))	Shows the input voltage on terminal [C1] in volts (V).	
(Output voltage on terminal [FM1])	Shows the output voltage on terminal [FM1] in volts (V).	
(Output current on terminal [FM1])	Shows the output current on terminal [FM1] in milliamperes (mA).	
(Output frequency on terminal [FMP])	Shows the output pulse rate per unit of time on terminal [FM1] in (p/s).	
(Output voltage on terminal [FM2])	Shows the output voltage on terminal [FM2] in volts (V).	
(Output current on terminal [FM2])	Shows the output current on terminal [FM2] in milliamperes (mA).	
(Option control circuit terminals (I/O))	Shows the ON/OFF state of digital input/output terminals on the digital input/output interface card. (Available to be shown when the OPC-DIO is installed.)	
(Option relay terminals output)	Shows the ON/OFF state of relay output terminals on the relay output interface card.(Available to be shown when the OPC-CP-RY is installed)	
(Terminal [X5] pulse input monitor)	Shows the number of pulse train signal pulses input to terminals [X5]	
(PG pulse rate (A/B phase of the command (master)))	Shows the AB-phase signal feedback pulse rate (kp/s) from the command (master) side PG. (Available to be shown when a PG option card is installed.)	
(PG pulse rate (Z phase of the command (master)))	Shows the Z-phase signal feedback pulse rate (p/s) from the command (master) side PG. (Available to be shown when a PG option card is installed.)	
(PG pulse rate (A/B phase of the feedback (follower)))	Shows the AB-phase signal feedback pulse rate (kp/s) from the feedback (follower) side PG. (Available to be shown when a PG option card is installed.)	IMPG-VF IMPG-DTV IMPG-VC PMPG-VC
(PG pulse rate (Z phase of the feedback (follower)))	Shows the Z-phase signal feedback pulse rate (p/s) from the feedback (follower) side PG. (Available to be shown when a PG option card is installed.)	IMPG-VF IMPG-DTV IMPG-VC PMPG-VC
(Input voltage on terminal [32])	Shows the input voltage on terminal [32] on the analog interface card (option) in volts (V). (Available to be shown when the OPC-AIO is installed.)	
(Input current on terminal [C2])	Shows the input current on terminal [C2] on the analog interface card (option) in milliamperes (mA). (Available to be shown when the OPC-AIO is installed.)	

Item		Description	
Indicates (*1).	(Output voltage on terminal [AO])	Shows the output voltage on terminal [AO] on the analog interface card (option) in volts (V). (Available to be shown when the OPC-AIO is installed.)	
	(Output current on terminal [CS])	Shows the output current on terminal [CS] on the analog interface card (option) in milliamperes (mA). (Available to be shown when the OPC-AIO is installed.)	
	(PTC terminal input voltage)	Shows the input voltage for terminal [C1](PTC function) in volts (V).	
	(Customizable logic timer monitor)	Shows the timer or counter value in the customizable logic specified with U91.	
	When a password is applied	An access limitation is activated for the function code change/display until the password matches.	*2
	When trip occurs	Shows the cause of a trip.	
	When warning appears	Shows a warning cause. When the cause is removed, it is recorded in the warning history and the display disappears.	
	Fault history	- The cause up to the last ten faults can be stored and displayed with codes. - Details of all relevant data when a fault occurs is also stored and displayed for up to the last four faults.	*2
PC Loader	Support function	The engineering PC tool to configure drives, manage parameters and program with customizable logic via USB or RS-485 communications.	
	(Function code editing)	The function code setting status can be checked. Function codes can be edited, transferred, compared, initialized, printed, and saved.	
	(Customizable logic editing)	Customizable logic can be edited, transferred, compared, monitored, printed, and saved.	
	(Operating status monitor)	The I/O monitor, system monitor, and alarm history can be monitored.	
	(Test-running)	The inverter can be run and stopped while monitoring the inverter status.	
	(Real-time trace)	Data read in real time (min. 5 to 200 ms sampling) can be displayed in a graph. Up to 4 analog channels, up to 8 digital channels	
	(Historical trace)	Normal data display: Sampling data (sampling time: 0.5 to 200 ms) saved at the inverter or in a file can be read all at once and displayed in a graph. Up to 4 analog channels, up to 8 digital channels (data capacity: 2 kB)	
	(Traceback)	Operating status data (traceback data) such as the speed, torque, current, and voltage immediately prior to the trip stoppage is automatically saved to the standard keypad or multi-function keypad TP-A2SW (option). The saved data can be read or displayed in a graph. Sampling cycle: 0.5 to 200 ms	
(Function code conversion)	Function codes for older models (E1,E2) can be converted to function codes for the E3.		

\*Note : The meaning of the described abbreviations are shown as follows.

VF	V/f control
SCVF	V/f control with slip compensation
DTV	Dynamic Torque Vector Control
IMPG-VF	V/f control with speed sensor (The PG option card required)
IMPG-DTV	Dynamic Torque Vector Control with speed sensor (The PG option card required)
IMPG-VC	Vector control with speed sensor (The PG option card required)
IM-SVC	Vector control without speed sensor
PMPG-VC	Vector control with magnetic pole position sensor (The PG option card is required.)
PM-SVC	Vector control without magnetic pole position sensor

\*1 : The items in this table are displayed in the LED display on the LED keypad. Refer to the multi-function keypad.

\*2 : Some functions cannot be used with E3N.

Specification	Representative function
Keypad connection	Running operation and frequency settings by keypad, Timed operation, Remote/local switching, Display/change of function code setting value, Display of various monitor items
Pulse train input PG interface card	Frequency setting by pulse train, Mototr control with speed sensor, Positioning control, Orientation function, Servo lock



## 5. Protective/Detecting Functions


Function		Description	Symbol <sup>1)</sup>	Warning output <sup>2)</sup>	
Protective/detecting functions	Overcurrent protection	Stops the inverter to protect it from overcurrent caused by an overload.	OC1 OC2 OC3	Y1	
	Short circuit protection	Stops if the inverter detects an overcurrent due to a short circuit in the output circuit.			
	Ground fault protection	Stops if the inverter detects an overcurrent due to a short circuit in the output circuit. It may not be detected at powered if an inverter output is under the ground fault status.			
	Overvoltage protection	Stops the inverter if a DC link bus circuit overvoltage (400V series: 800 VDC, 200V series: 400 VDC) is detected. The inverter cannot be protected if an excessively large voltage is applied by accident.	OU1 OU2 OU3	Y1	
	Undervoltage protection	Stops the inverter if a drop in DC link bus voltage (400V series: 400 VDC, 200V series: 200 VDC) is detected. However, this is disabled based on the restart after momentary power failure setting. Furthermore, operation is possible (regenerative operation only) at a voltage level lower than that above when performing battery operation.	LU	Y1	
	Input phase loss protection	Stops the inverter if input phase loss or input phase voltage unbalance is detected. The input phase loss protection may not work under light load or with DC reactor.	Lin	Y1	
	Output phase loss protection	Stops the inverter if inverter output phase loss is detected during operation. This protective function also functions during auto tuning and during magnetic pole position tuning. (Operation selection possible)	OPL	Y1	
	Overheat protection	Stops the inverter if a cooling fan fault, or cooling fin overheating when an overload occurs is detected.	OH1	Y1	
			OH3	Y1	
			OH6	Y1	
			ObH	Y1	
	Inverter overload protection	Stops the inverter if overheating is detected by calculating the IGBT internal temperature from the output current and detected internal temperature.	OLU	Y1	
	External alarm input	Stops the inverter and displays an error if a digital input signal (THR) is input.	OH2	Y1	
	Charging circuit fault	Stops the inverter and displays an error if an inverter charging circuit error is detected.	PbF	Y1	
	Braking transistor fault	Stops the inverter and displays an error if a braking transistor error is detected.	dbR	Y1	
	Motor protection	Motor 1 overload Motor 2 overload (Electronic thermal)	Stops the inverter if a motor overload is detected by setting the electronic thermal. Protects general-purpose motors and inverter motors in the entire frequency range. (The operation level and thermal time constant (0.5 to 75.0 minutes) can be set.)	OL1 OL2	Y1
		PTC thermistor	The motor temperature is detected by the PTC thermistor, and the inverter is stopped if overheating is detected. To enable this function, connect the PTC thermistor between terminals [C1] and [11], and enable the switch on the control board.	OH4	Y1
	Memory error	When the power is turned ON, a data check is performed when writing data, and an error is displayed if a memory error is detected.	Er1	Y1	
	Keypad communication error	Stops the inverter and displays an error if a communication fault is detected at the keypad during operation.	Er2	Y1	
	CPU error	Stops the inverter and displays an error if a CPU error is detected due to noise, etc.	Er3	Y1	
	Option communication error	Stops the inverter and displays an error if a communication error with the inverter unit is detected when using an option.	Er4	Y1	
	Option error	Stops the inverter and displays an error if an error is detected at the option side when using an option.	Er5	Y1	
	Operation error	STOP key priority	Even when run commands are entered via the terminal block or communication, by pressing the keypad [STOP] key, the inverter forcibly decelerates and stops the motor, and an error is displayed after the motor has come to a stop.	Er6	Y1
		Start check	When the power is turned ON, an alarm is cleared, or when switching the run command method from link operation, the sudden starting of operation is suppressed if a run command has been entered, and an error is displayed to notify the operator.		
		Brake status error	Stops the inverter and displays an error if the brake signal (BRKS) output status and brake ON check signal (BRKE) input status do not match.		
		Base frequency setting error	Blocks to start running when a run command is entered if the ratio of the base frequency to the maximum frequency exceeds 1:16.		
	Tuning error	Stops the inverter and displays an error if tuning failure or interruption is detected during motor constant tuning, or if the tuning result is a defect.	Er7	Y1	
RS485 communication error (COM port 1)	Stops the inverter and displays an error if a communication error is detected when communicating via RS-485 COM port 1.	Er8	Y1		
RS485 communication error (COM port 2)	Stops the inverter and displays an error if a communication error is detected when communicating via RS-485 COM port 2.	Er9	Y1		
Data saving error during undervoltage	Stops the inverter and displays an error if unable to successfully save data when undervoltage protection is triggered.	ErF	Y1		
Position control error	Stops the inverter and displays an error if the positioning deviation is excessive when the servo lock is applied, or when performing master-follower operation.	ErO	Y1		
Hardware error	Stops the inverter and displays an error if an inverter internal hardware fault is detected.	ErH	Y1		
STO input (EN1, EN2) terminal circuit fault	Stops the inverter and displays an error if the inverter detects an EN1 or EN2 terminal circuit mismatch.	EEF	Y1		
PG wire break	Stops the inverter and displays an error if a pulse encoder wire break is detected. (This function is valid on some PG interface option cards.)	PG	Y1		
Excessive positioning deviation	Stops the inverter and displays an error if the position deviation is found to be excessive while performing position control.	dO	Y1		

Function		Description	Symbol <sup>1</sup>	Warning output <sup>2</sup>	
Protective/detecting functions	Overspeed protection	Stops the inverter and displays an error if the following conditions are met. - If d35 = 999, the speed detection value is the maximum output frequency x (d32 or d33) x 120% or higher - If d35 ≠ 999, the speed detection value is the maximum output frequency x (d35) or higher - The detected speed exceeds 599 Hz	05	Y1	
	Magnetic pole position detection error	Stops the inverter and displays an error if the signal from the magnetic pole position sensor mounted on the PM motor is abnormal.	ErL	Y1	
	Step-out detection/detection failure of magnetic pole position at start	This occurs when a PM motor step-out is detected, or if magnetic pole position at start failed to be detected.	ErD	Y1	
	Speed mismatch or excessive speed deviation	Stops the inverter and displays an error if an excessive deviation appears between the reference speed and detected/estimated speed.	ErE	Y1	
	Password protection	Stops the inverter and displays an error if a malicious person tries to unlock the password set by the customer.	LoP	Y1	
	Customizable logic alarm	Stops the inverter and displays an alarm when the alarm condition defined by the customer in the customizable logic is met. (It is not an alarm related to the inverter faults)	ELL	Y1	
	Simulation fault	A simulation fault can be produced if the keypad [STOP] key and [FUNC/DATA] key are held down for 5 seconds or longer. A simulation fault can be produced even if function code H45 is set to "1".	Err	Y1	
	Current input terminal signal wire break detection	Stops the inverter and displays an alarm if a current input wire break is detected when current is less than 2 mA when using the current input terminal (terminal [C1] or [C2]) as current input 4 to 20 mA.	LoF	Y1	
	Customizable logic alarm	An error is displayed if the alarm conditions defined by the user with customizable logic are met. (This is not an error at the inverter itself.)	EL1~ EL5	Y1	
	EN (STO) terminal OFF	This is displayed if the run command turns ON when both terminal [EN1] and [EN2] are OFF, and the inverter is not ready to perform operation (STO status).	..En		
	Warning	The following items can be registered as warnings.			Y1, Y2
		Cooling fin overheating (0H1), external alarm (0HC), inverter internal overheating (0H3), charging resistor overheating (0HD), motor overload (0L1, 0L2), option communication error (Er4), option error (Er5), RS-485 communication error (COM port 1) (ErB), RS-485 communication error (COM port 2) (ErP), master-follower synchronization error (ErO), speed does not reach (ErE) · excessive speed deviation (ErE), current input (terminal [C1]/[C2]) wire break detection (LoF), excessive position deviation (dU), low battery warning/Date and time information loss (Lab), Customizable logic alarm (EL1 to EL5)			
		Motor overload early warning		0L	Y2
		Motor overload early warning		0H	
		Cooling fin overheat early warning		LiF	
		Lifetime warning		rEF	
		Reference command loss detected		Pid	
PID warning output			ufl		
Overheat warning by PTC thermistor in motor			PfL		
Machine life (Cumulative motor running hours)			rFE		
Inverter life (Number of startups)			Enf		
IGBT lifetime warning			iUb		
Relay signals are output while the inverter is stopped due to an alarm. The alarm is cleared with digital input signal "RST". (Reset the alarm using the [PRG/RESET] key on the optional multi-function keypad.)			-		
Retry		The inverter can be automatically reset allowing it to be restarted when it stops due to a trip. (The number of retries and the latency between stop and reset can be specified.)		-	-
Surge protection	This function protects the inverter from a surge voltage between main circuit power lines and the ground.		-	-	
Main circuit power cutoff detection	Inverter operation is not possible when the inverter AC input power supply (main power supply) is not ON. In such cases as when supplying power via a PWM converter or when using a DC bus bar connection, set main circuit power cutoff detection to "None".		-	-	
Forced operation (Fire mode)	Alarms other than critical alarms are ignored, and a retry is performed forcibly.	FoD			

\*1) These symbols are displayed on keypad LEDs or on the LCD.

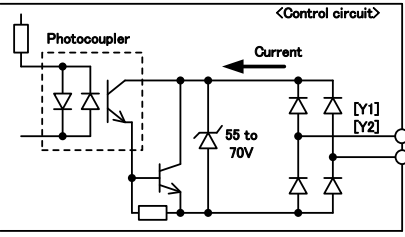
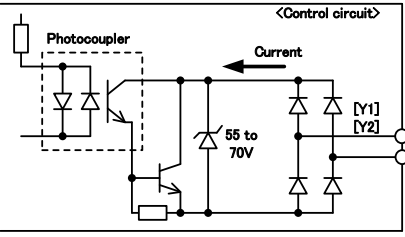

\*2) Y1 indicates that relay output 30A, B, and C are functioning. Y2 indicates that the protective functions are not functioning because they have been disabled in the warning settings.

## 6. Terminal Specifications

Class	Symbol	Terminal name	Explanation	Remarks
Main circuit	L1/R, L2/S, L3/T	Main power supply input terminals	Connect a three-phase power supply.	
	R0, T0	Auxiliary control power input terminals	There is normally no need to use these terminals. If wishing to retain the integrated alarm signal issued if the protective function is triggered even when the inverter main power supply is cut off, or to constantly display the keypad, connect control power auxiliary input terminals to a power supply. If connecting a PWM converter, do not connect the power supply directly to the inverter control power auxiliary input terminals (R0, T0).	FRN0088E3□-2G FRN0115E3□-2G FRN0059E3□-4G FRN0072E3□-4G
	U, V, W	Inverter output terminals	Connect three-phase motor terminals U, V, and W to match the phase sequence.	
	P1, P(+)	DC reactor connection terminals	Connect a DC reactor (DCR) (option) for power-factor improvement.	
	P(+), N(-)	DC link bus connection terminals	Connect braking unit terminals P(+) and N(-). Furthermore, DC link bus circuit of other inverters and PWM converters can be connected.	
	P(+), DB	Braking resistor connection terminals	Connect terminals P(+) and DB of the inverter to braking resistor terminals (option).	
	 G	Inverter grounding terminal	This is a grounding terminal for the inverter chassis (case). Be sure to ground grounding terminals to ensure safety, and as a noise countermeasure.	

Class	Symbol	Name	Function	E3S	E3E	E3T	E3N
Analog input	13	Power supply for potentiometer	Power supply for frequency setting (+10 VDC) (Potentiometer: 1 to 5 kΩ) Connect a potentiometer with rating of 1/2 W or higher.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	12	Analog setting Voltage input	(1) Specify the frequency based on the external voltage input. - 0 to ±10 VDC/0 to ±100% (normal operation) - +10 to 0 VDC/0 to 100% (inverse operation) (2) In addition to frequency settings, PID commands, PID feedback signals, auxiliary frequency command settings, ratio settings, torque limiter level settings, and analog input monitors, etc. can be assigned to this terminal. (3) Hardware specifications - Input impedance: 22 kΩ - The maximum input is ±15 VDC, but is handled as ±10 VDC for voltages greater than ±10 VDC.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	C1	Analog setting Current input (C1 function)	(1) The frequency is specified based on the external current input. - 4(0) to 20 mA DC/0 to 100% (normal operation) - 20 to 4(0) mA DC/0 to 100% (inverse operation) (2) In addition to frequency settings, PID commands, PID feedback signals, auxiliary frequency command settings, ratio settings, torque limiter level settings, and analog input monitors, etc. can be assigned to this terminal. (3) Hardware specifications - Input impedance: 250 Ω - The maximum input is +30 mA DC, but is handled as +20 mA DC for currents greater than +20 mA DC. (4) If using this function, set SW3 to the "C1" side, SW4 to the "AI" side.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		Analog setting Voltage input (V2 function)	(1) Specify the frequency based on the external voltage input. - 0 to ±10 VDC/0 to ±100% (normal operation) - +10 to 0 VDC/0 to 100% (inverse operation) (2) In addition to frequency settings, PID commands, PID feedback signals, auxiliary frequency command settings, ratio settings, torque limiter level settings, and analog input monitors, etc. can be assigned to this terminal. (3) Hardware specifications - Input impedance: 22 kΩ - The maximum input is +15 VDC, but is handled as +10 VDC for voltages greater than +10 VDC. (4) If using this function, set SW3 to the "V2" side, SW4 to the "AI" side.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		PTC thermistor input	(1) PTC (Positive Temperature Coefficient) thermistors are connected for motor protection. (2) If using this function, set SW3 to the "C1" side, SW4 to the "PTC" side.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	11	Analog common	This is a common terminal for analog input signals (terminals [13], [12], [C1], [FM1], and [FM2]). This terminal is isolated from terminals [CM] and [CMY].	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Class	Symbol	Name	Function	E3S	E3E	E3T	E3N																							
Digital input	X1	Digital input 1	<p>(1) Various signals (coast to stop command, external alarms, multistep frequency selection, etc.) can be set for terminals [X1] to [X5], [FWD], and [REV].</p> <p>(2) The input mode and SINK/SOURCE can be switched using SW1.</p> <p>(3) The operating mode between each digital input terminal and terminal [CM] can be switched to "ON when shorted (active ON)" or "OFF when shorted (active OFF)".</p> <p>(4) Digital input terminals [X5] can be set up as pulse train input terminals by changing the function code.</p> <p>- When connected to complementary output pulse generator: max. 100 Hz</p> <p>- When connected to open collector output pulse generator: max. 30 Hz</p> <p>(A pull-up resistor and pull-down resistor are required.)</p>	○	○	○	○																							
	X2	Digital input 2		○	○	○	○																							
	X3	Digital input 3		○	○	○	○																							
	X4	Digital input 4		○	○	○	-																							
	X5	Digital input 5		○	○	○	-																							
	FWD	Forward rotation/stop command input	<p>&lt;Digital input circuit specifications&gt;</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operating voltage (SINK)</td> <td>ON level</td> <td>0 V</td> <td>2 V</td> </tr> <tr> <td>OFF level</td> <td>20 V</td> <td>27 V</td> </tr> <tr> <td rowspan="2">Operating voltage (SOURCE)</td> <td>ON level</td> <td>20 V</td> <td>27 V</td> </tr> <tr> <td>OFF level</td> <td>0 V</td> <td>2 V</td> </tr> <tr> <td>Operating current when ON (X5 input terminal)</td> <td>2.5 mA</td> <td>5 mA</td> </tr> <tr> <td>Permissible leakage current when OFF</td> <td>-</td> <td>0.5 mA</td> </tr> </tbody> </table>	Item	Min.	Max.	Operating voltage (SINK)	ON level	0 V	2 V	OFF level	20 V	27 V	Operating voltage (SOURCE)	ON level	20 V	27 V	OFF level	0 V	2 V	Operating current when ON (X5 input terminal)	2.5 mA	5 mA	Permissible leakage current when OFF	-	0.5 mA	○	○	○	○
	Item	Min.		Max.																										
	Operating voltage (SINK)	ON level		0 V	2 V																									
		OFF level		20 V	27 V																									
	Operating voltage (SOURCE)	ON level		20 V	27 V																									
OFF level		0 V	2 V																											
Operating current when ON (X5 input terminal)	2.5 mA	5 mA																												
Permissible leakage current when OFF	-	0.5 mA																												
REV	Reverse rotation/stop command input	<p>(1) By opening the circuit between terminals [EN1] and [PLC], or between terminals [EN2] and [PLC], inverter output transistor operation is stopped by the IEC/EN 61800-5-2-compliant STO safety stop function.</p> <p>(2) The input mode for terminals [EN1] and [EN2] is fixed at SOURCE mode.</p> <p>(3) If either [EN1] or [EN2] is OFF, and an alarm occurs.</p> <p>(4) SW9 enables and disables the STO function. If using the STO function, set SW9 to the "OFF" side.</p> <p>&lt;[EN1][EN2] input circuit specifications&gt;</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operating voltage</td> <td>ON level</td> <td>20 V</td> <td>27 V</td> </tr> <tr> <td>OFF level</td> <td>0 V</td> <td>2 V</td> </tr> <tr> <td>Operating current when ON (when input voltage 27 V)</td> <td>-</td> <td>4.5 mA</td> </tr> <tr> <td>Permissible leakage current when OFF</td> <td>-</td> <td>0.5 mA</td> </tr> </tbody> </table>	Item	Min.	Max.	Operating voltage	ON level	20 V	27 V	OFF level	0 V	2 V	Operating current when ON (when input voltage 27 V)	-	4.5 mA	Permissible leakage current when OFF	-	0.5 mA	○	○	○	○								
Item	Min.		Max.																											
Operating voltage	ON level		20 V	27 V																										
	OFF level		0 V	2 V																										
Operating current when ON (when input voltage 27 V)	-		4.5 mA																											
Permissible leakage current when OFF	-	0.5 mA																												
EN1	Enable input 1	<p>(1) Connect the output signal power supply for the programmable controller. (Rated voltage +24 VDC (power supply voltage fluctuation range: +20.4 to +27 VDC), maximum 100 mA DC)</p> <p>(2) The terminal can also be used as the power supply for loads connected to transistor outputs.</p>	○	○	○	○																								
EN2	Enable input 2		○	○	○	○																								
PLC	Programmable controller signal power supply		○	○	○	○																								
CM	Digital common		○	○	○	○																								
PLC	Programmable controller signal power supply		○	○	○	○																								
Analog output	FM1	Analog monitor 1 FMV function FMI function	Both terminals output analog DC voltage (0 to ±10 V) or analog DC current (4(0) to 20 mA) monitor signals. The output form (FMV/FMI) is switched using SW5 on the PCB. Output monitor data, gain, bias, and filter time constants can be adjusted with specified function codes.	○	○	○	○																							
		Pulse monitor FMP function	Pulse output: 25 to 32000 p/s with full scale, duty of 50%	○	○	○	○																							
	FM2	Analog monitor 2 FMV function FMI function	Both terminals output analog DC voltage (0 to ±10 V) or analog DC current (4(0) to 20 mA) monitor signals. The output form (FMV2/FMI2) is switched using SW7 on the PCB. Output monitor data, gain, bias, and filter time constants can be adjusted with specified function codes.	○	○	○	-																							
	11	Analog common	This is a common terminal for analog input/output signals. This terminal is isolated from terminals [CM] and [CMY].	○	○	○	○																							

Class	Symbol	Name	Function	E3S	E3E	E3T	E3N
Transistor output	Y1	Transistor output 1	(1) Various signals (running signals, frequency arrival signals, overload early warning signals, etc.) set with function codes E20 to E21 can be output. (2) The operating mode between transistor output terminals [Y1] and [Y2] and terminal [CMY] can be switched to "ON when signal output (active ON)" or "OFF when signal output (active OFF)".  (Transistor output circuit specifications) 	○	○	○	○
	Y2	Transistor output 2	(1) Various signals (running signals, frequency arrival signals, overload early warning signals, etc.) set with function codes E20 to E21 can be output. (2) The operating mode between transistor output terminals [Y1] and [Y2] and terminal [CMY] can be switched to "ON when signal output (active ON)" or "OFF when signal output (active OFF)".  (Transistor output circuit specifications) 	○	○	○	-
	CMY	Transistor output common	This is a common terminal for transistor output signals. This terminal is isolated from terminals [CM] and [11].	○	○	○	○
Relay output	30A 30B 30C	Integrated alarm output	(1) When the inverter stops with an alarm, an integrated alarm is output at the relay contact (1C). Contact capacity: 250 VAC 0.3 A $\cos\phi = 0.3$ , 48 VDC 0.5 A (2) The same signals as those of terminals [Y1] to [Y2] can be selected and output. (3) It is possible to switch between a "short circuit between terminals [30A] and [30C]" when an ON signal is output (excitation: active ON)" or an "open circuit between terminals [30A] and [30C]" when an ON signal is output (non-excitation: active OFF)".	○	○	○	○
Communication	DX+ DX- SD	RS-485 COM port 2 (terminal block)	This is an input/output terminal used to connect a personal computer or programmable controller, etc. by RS-485 communication. Protocols can be selected from the following. - Modbus RTU, dedicated Fuji inverter protocols - Start-stop synchronization, half-duplex method - Max. communication distance: 500 m - Max. communication speed: 115.2 kbps	○	○	○	-
	RJ-45 connector Keypad	RS-485 COM port 1 (for keypad connection)	(1) This is used as a connector for connecting the keypad. The keypad power is supplied from the inverter via an extension cable for remote operation. To connect the keypad remotely, the keypad relay adapter CBAD-CP is required separately. (2) This is used to connect a personal computer or programmable controller, etc. by RS-485 communication after disconnecting the keypad. Protocols can be selected from the following. - Dedicated keypad protocol (automatically selected) - Modbus RTU, dedicated Fuji inverter protocols - Start-stop synchronization, half-duplex method - Max. communication distance: 20 m (when using RS-485 communication: 500 m) - Max. communication speed: 115.2 kbps(*) (*) The communication speed when the engineering PC tool "FRENIC Loader 4" is connected is automatically adjusted.	○	○	○	-
	Ethernet RJ-45 connector	Ethernet Port 1 Port 2	This is a connector that connects a programmable controller, etc. via Ethernet communication.	-	-	-	○
	USB connector	USB port	This is a USB connector (miniB specification) for connecting to a personal computer. Function codes can be edited, transferred, or verified, an inverter test run can be carried out, and all states can be monitored using the engineering PC tool "FRENIC Loader 4".  It is possible to edit, transfer, and verify the function code of "FRENIC Loader" with USB bus power.	○	○	○	○
Power supply	P24	DC24V input	By connecting a power supply to this terminal, Ethernet communication is possible even when the main power supply of the inverter is cut off. The inverter can be operated without inputting power to this terminal.  Input voltage range : +22 to +26V DC Current consumption : max.200 mA	-	-	-	○
	N24	DC24V common	Common terminal for DC24V	-	-	-	○
Grounding terminal		Grounding terminal for Ethernet	This is the terminal that connects the shield part of the Ethernet communication cable to FG, and is connected to the G terminal of the inverter. Keep the cable length as short as possible.	-	-	-	○

## 6.1 Multifunction Inputs

Symbol	Function	Remarks
"SS1"	Select multistep frequency (0 to 1 steps)	
"SS2"	Select multistep frequency (0 to 3 steps)	
"SS4"	Select multistep frequency (0 to 7 steps)	
"SS8"	Select multistep frequency (0 to 15 steps)	
"RT1"	Acceleration/deceleration selection (2 steps)	
"RT2"	Acceleration/deceleration selection (4 steps)	
"HLD"	Select 3-wire operation	
"DIR"	Forward rotation/reverse rotation selection (2-wire/3-wire operation)	
"BX"	Coast to stop	
"RST"	Reset alarm	
"THR"	External fault input	
"JOG"	Ready for jogging	
"FJOG"	Jogging forward rotation/stop command	
"RJOG"	Jogging reverse rotation/stop command	
"Hz2/Hz1"	Select frequency setting 2/ frequency setting 1	
"M2"	Select motor 2	
"DCBRK"	Enable DC braking	
"TL2/TL1"	Select torque limit 2/ torque limit 1	
"SW50"	Switch to commercial power (50 Hz)	
"SW60"	Switch to commercial power (60 Hz)	
"UP"	UP command	
"DOWN"	DOWN command	
"STZ"	Clear UP/DOWN frequency	
"WE-KP"	Enable data change with keypad	
"Hz/PID"	Cancel PID control	
"IVS"	Switch normal/ inverse operation	
"IL"	Interlock	
"Hz/TRQ"	Cancel torque control	
"LE"	Enable communications link (RS-485, fieldbus(option))	
"U-DI"	Universal DI	
"STM"	Enable auto search for idling motor speed at start	
"STOP"	Force to stop	
"EXITE"	Pre-excitation	
"PID-RST"	Reset PID integral and differential terms	
"PID-HLD"	Hold PID integral term	
"LOC"	Select local (keypad) command	
"RE"	Operation enable	
"DWP"	Protect motor from dew condensation	
"LS"	Home position limit switch	
"S/R"	Start/Reset	
"SPRM"	Switch to the serial pulse receiving mode	
"RTN"	Enter the return mode	
"OLS"	Enable overload stop command	
"LOCK"	Servo lock command	
"PIN"	Pulse train input	Can only be assigned to terminals [X5].
"SIGN"	Pulse train sign input	Can only be assigned to terminals except [X5].
"BATRY/UPS"	Enable battery-driven operation / UPS operation	FRN0088E3□-2G FRN0115E3□-2G FRN0059E3□-4G FRN0072E3□-4G
"TB1"	Select torque bias1	
"TB2"	Select torque bias2	
"H-TB"	Hold torque bias	
"BRKE"	Check brake	
"Hz/LSC"	Cancel line speed control	
"LSC-HLD"	Hold line speed control frequency in the memory	
"CRUN-M1"	Count the run time of commercial power-driven motor 1	
"CRUN-M2"	Count the run time of commercial power-driven motor 2	
"DROOP"	Select droop control	
"MPRM1"	Speed control parameter selection 1	
"MPRM2"	Speed control parameter selection 2	
"CLC"	Cancel customizable logic	
"CLTC"	Clear all customizable logic timers	
"AR-CCL"	Cancel anti-regenerative control	
"PG-SEL"	Select pulse input	
"BPS"	Cancel (bypass) acceleration/deceleration	
"FWD"	Forward rotation/stop command	
"REV"	Reverse rotation/stop command	
"NONE"	No function assigned	
"PID-SS1"	PID control multistage command 1	
"PID-SS2"	PID control multistage command 2	
"CLI1"	Customizable logic input 1	
"CLI2"	Customizable logic input 2	
"CLI3"	Customizable logic input 3	
"CLI4"	Customizable logic input 4	
"CLI5"	Customizable logic input 5	
"CLI6"	Customizable logic input 6	
"CLI7"	Customizable logic input 7	
"CLI8"	Customizable logic input 8	
"CLI9"	Customizable logic input 9	
"ORT"	Orientation command	
"INC/ABS"	Switch Incremental/absolute position	

Symbol	Function	Remarks
"POS-SEL1"	Positioning data selection 1	
"POS-SEL2"	Positioning data selection 2	
"POS-SEL4"	Positioning data selection 4	
"P-PRESET"	Preset position	
"POS-SET"	Set command of positioning data	
"FMS"	Forced operation command	
"P-SEL"	Cancel integral term of Auto speed regulator	

## 6.2 Multifunction Outputs

Symbol	Function	Remarks
"RUN"	Inverter running	
"RUN2"	Inverter outputting	
"FAR"	Frequency (speed) arrival	
"FAR2"	Frequency (speed) arrival 2	
"FAR3"	Frequency (speed) arrival 3	
"FARFDT"	Frequency arrival and frequency detected	
"FDT"	Frequency (speed) detected	
"FDT2"	Frequency (speed) detection 2	
"FDT3"	Frequency (speed) detection 3	
"LU"	Undervoltage detected	
"B/D"	Detected torque polarity	
"IOL"	Inverter output limiting	
"IOL2"	Inverter output limiting (with delay)	
"IPF"	Auto-restarting after momentary power failure	
"IPF2"	During deceleration in momentary power failure	
"OL"	Motor overload early warning	
"KP"	Under keypad operation	
"RDY"	Inverter ready to run	
"AX"	AX terminal function (input side MC operation)	FRN0088E3□-2G FRN0115E3□-2G FRN0059E3□-4G FRN0072E3□-4G
"AX2"	Operation command accepted	
"TU"	Pattern operation stage transition	
"TO"	Pattern operation cycle completed	
"STG1"	Pattern operation stage No. 1	
"STG2"	Pattern operation stage No. 2	
"STG4"	Pattern operation stage No. 4	
"FAN"	Cooling fan ON-OFF control	
"TRY"	Auto-resetting	
"U-DO"	Universal DO	
"OH"	Cooling fin overheat early warning	
"SY"	Master-follower operation complete	
"LIFE"	Lifetime early warning	
"REF OFF"	Reference loss detected	
"OLP"	Under overload prevention control	
"ID"	Current detected	
"ID2"	Current detected 2	
"ID3"	Current detected 3	
"IDL"	Low current detected	
"PID-ALM"	PID alarm output	
"PID-CTL"	Under PID control	
"PID-STP"	Under sleep mode of PID control	
"U-TL"	Low torque detected	
"TD1"	Torque detected 1	
"TD2"	Torque detected 2	
"SWM1"	Motor 1 selected	
"SWM2"	Motor 2 selected	
"FRUN"	Running forward rotation	
"RRUN"	Running reverse rotation	
"RMT"	Under remote mode	
"THM"	Motor overheat detected by thermistor	
"BRKS"	Mechanical brake control	
"C10FF"	Current input wire break detected (terminal [C1] and [C2])	
"DNZS"	Speed valid	
"DSAG"	Speed agreement	
"PG-ERR"	Speed deviation error detection	
"U-EDC"	Low DC link bus voltage detection	
"PSET"	In-position/orientation completed	
"OT"	Stop position override alarm	
"PO"	Under positioning	
"POF"	Current position count over-flowed	
"MNT"	Maintenance timer counted up	
"PTD"	Magnetic pole position tuning done	
"AL1"	Alarm content 1	
"AL2"	Alarm content 2	
"AL4"	Alarm content 4	
"AL8"	Alarm content 8	
"L-ALM"	Warning	
"ALM"	Alarm output (for any alarm)	
"DECF"	EN circuit failure detected	
"ENOFF"	EN terminal inputs OFF	
"DBAL"	Braking transistor broken	

Symbol	Function	Remarks
"CLO1"	Customizable logic output signal 1	
"CLO2"	Customizable logic output signal 2	
"CLO3"	Customizable logic output signal 3	
"CLO4"	Customizable logic output signal 4	
"CLO5"	Customizable logic output signal 5	
"CLO6"	Customizable logic output signal 6	
"CLO7"	Customizable logic output signal 7	
"CLO8"	Customizable logic output signal 8	
"CLO9"	Customizable logic output signal 9	
"CLO10"	Customizable logic output signal 10	
"CLO11"	Customizable logic output signal 11	
"CLO12"	Customizable logic output signal 12	
"CLO13"	Customizable logic output signal 13	
"CLO14"	Customizable logic output signal 14	
"POUT"	Watt-hour pulse output	
"S-LIM"	During speed limiting	
"T-LIM"	During torque limiting	
"FMRUN"	During fire mode operation	
"MTGL"	M / shift key status	

### 6.3 Analog Input Functions

Item	Remarks
No extension function assignment	
Auxiliary frequency setting 1	
Auxiliary frequency setting 2	
Auxiliary frequency setting 3	
Auxiliary frequency setting 4	
PID command 1	
PID feedback value	
Ratio setting	
Analog torque limiter A	
Analog torque limiter B	
Torque bias	
Torque command	
Torque current command	
Acceleration/deceleration time ratio setting	
Upper limit frequency	
Lower limit frequency	
Speed limit for forward rotation	
Speed limit for reverse rotation	
Analog signal input monitor	

### 6.4 Analog/Pulse Output Functions

Item	Remarks
Output frequency 1 (before slip compensation)	
Output frequency 2 (after slip compensation)	
Output current	
Output voltage	
Output torque	
Load factor	
Power consumption	
Speed detection value/estimated speed value	
DC link bus voltage	
Universal AO	
Motor output	
Analog output test	
PID command (SV)	
PID feedback value (PV)	
PID output (MV)	
Master-follower angle deviation	
Inverter cooling fin temperature	
PG feedback value	
Torque current command	
PID deviation	Available with "OPC-AIO" and "OPC-DIO".
Set frequency (before acceleration/deceleration calculation)	
Customizable logic output signal 1 to 14	



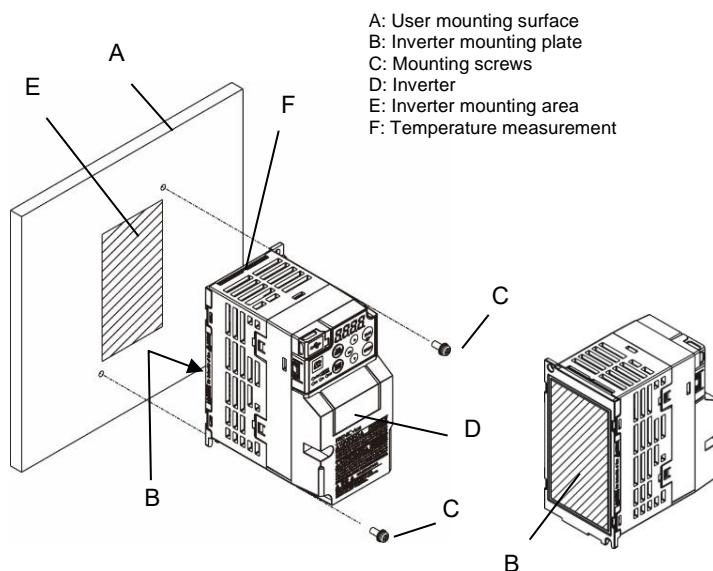
## 7. Use the finless type (E3T)

### 7.1 Inverter mounting method

Procedure	Check item	Details	Remarks
1	Installation environment	Ensure that the ambient temperature is equal to or less than that indicated in the specifications.	—
2	Inverter specification	Ensure that the inverter specification is set to HHD or HND.	—
3	Inverter mounting plate temperature	Check the permissible temperature at part F, and use at that temperature or less. Measure the temperature at part F with a thermocouple, etc. The temperature can be checked using the method indicated in "Remarks" as a reference value. Refer to the "Table 7.1-1" for the permissible temperature value.	1. Keypad 5_03: Max. temperature at part F 5_25: Temperature at part F (real-time value) 2. Analog/pulse output F31 = 18: Part F temperature (10 V/200 °C)
4	B: Application of compound to reverse side of inverter mounting plate	Apply the recommended thermal compound. Remove any protruding thermal compound.	Recommended maker: Momentive Performance Materials Type: TIG2000 Application thickness: 100 to 250 μm
5	A: Inverter mounting area surface roughness and surface flatness	Machine the surface with the machining accuracy indicated in "Remarks".	Surface roughness: Rz ≤ 25 μm (Ra ≤ 6.3 μm) Surface flatness: 0.1 mm or less per 100 mm
6	C: Mounting screw tightening torque	Tighten to the value indicated in "Remarks".	Screw size: M4 Tightening torque: 1.8 ±0.2 N·m

Table 7.1-1

Type	Ambient temperature °C (°F)	Upper limit temperature °C (°F)		
		HHD	HND	
Three-phase 200V	35 (95)	FRN0001E3T-2G	95(203)	95(203)
		FRN0002E3T-2G	95(203)	94(201)
		FRN0004E3T-2G	95(203)	95(203)
		FRN0006E3T-2G	96(204)	96(204)
		FRN0010E3T-2G	70(158)	71(159)
		FRN0012E3T-2G	78(172)	70(158)
FRN0020E3T-2G		82(179)	75(167)	
Three-phase 400V		FRN0002E3T-4G	85(185)	86(186)
		FRN0004E3T-4G	88(190)	90(194)
		FRN0006E3T-4G	98(208)	102(215)
		FRN0007E3T-4G	69(156)	65(149)
Single-phase 200V		FRN0012E3T-4G	85(185)	80(176)
	FRN0001E3T-7G	94(201)	94(201)	
	FRN0002E3T-7G	94(201)	93(199)	
	FRN0004E3T-7G	96(204)	90(194)	
	FRN0006E3T-7G	96(204)	96(204)	
	FRN0010E3T-7G	69(156)	58(136)	
FRN0012E3T-7G	69(156)	57(134)		



- \*1 If the refrigerant temperature changes suddenly while the inverter is running, the life of the inverter may be shortened.
- \*2 Do not use in an environment where dew condensation occurs.
- \*3 Check that the cooling function operates normally before operating the inverter.

## 7.2 Method of designing a refrigerant to cool the inverter

Since the finless type is a product that does not have a cooling mechanism in the main body of the inverter, it is necessary to select a cooling element to cool the inverter. The calculation formulas and parameters required for selection (calculation) are shown.

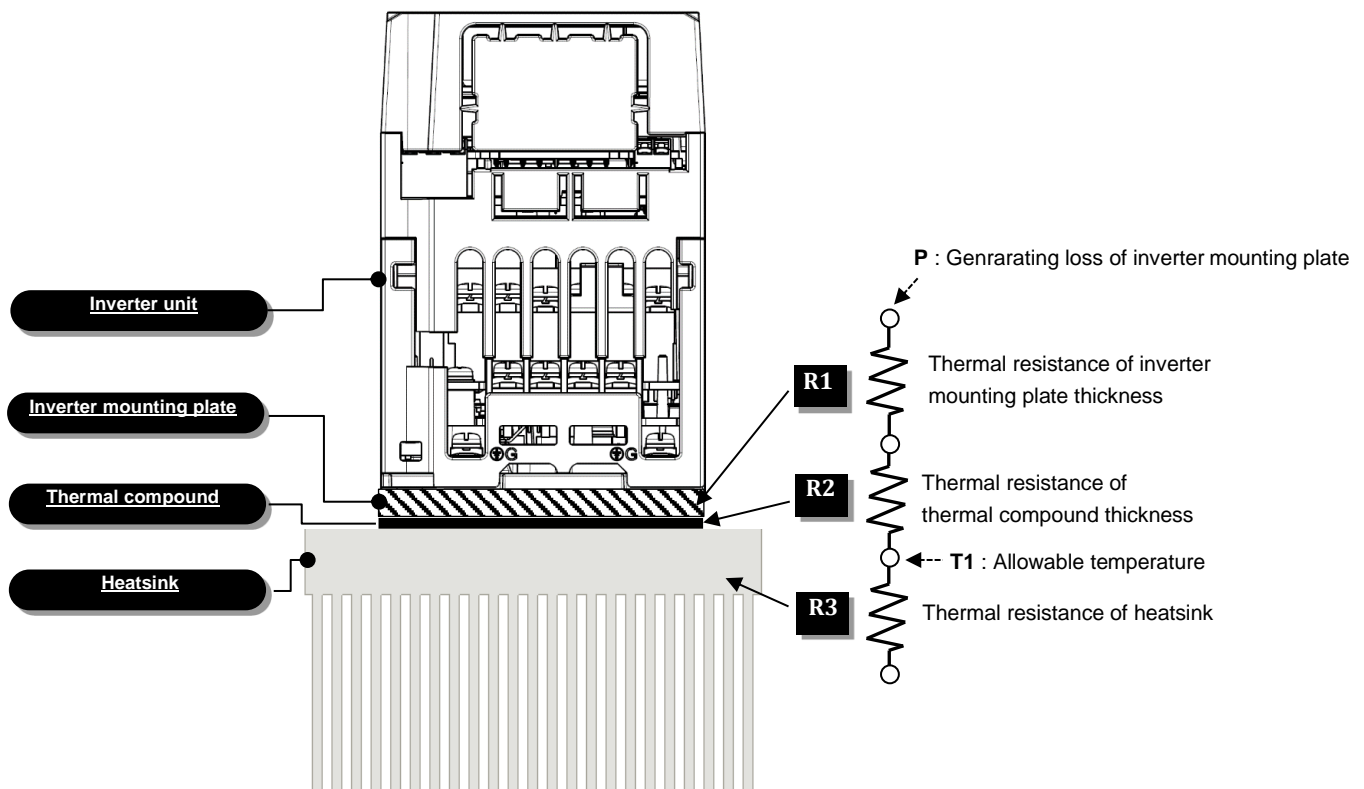
Table 7.2-1 Calculation formula

Purpose of calculation	Details	Calculation formula
Selection of heat sink	Calculate the thermal resistance <b>R3</b> of the heat sink and prepare a heat sink equivalent to it.	$R3=(T1-T2)/P-R1-R2$
Confirmation of whether the existing inverter heatsink can be used	Calculate the allowable temperature <b>T1</b> and estimate whether the existing inverter heatsink can be used.	$T1=P \cdot (R1+R2+R3)+T2$
Calculate the thermal resistance of thermal compound	Calculate the thermal resistance <b>R2</b> of the thermal compound and use it in the calculation formula for selecting the inverter heatsink.	$R2=t/(\lambda \cdot S)$

Table 7.2-2 Parameter list for calculation

Parameter	FRN0001E3T-2G FRN0002E3T-2G FRN0004E3T-2G FRN0006E3T-2G FRN0001E3T-7G FRN0002E3T-7G FRN0004E3T-7G FRN0006E3T-7G	FRN0010E3T-2G FRN0012E3T-2G FRN0002E3T-4G FRN0004E3T-4G FRN0006E3T-4G FRN0007E3T-4G FRN0010E3T-7G	FRN0020E3T-2G FRN0012E3T-4G FRN0012E3T-7G	
<b>T1</b>	Allowable temperature [°C]	Refer to Table 7.1-1		
<b>T2</b>	Ambient temperature of inverter (heatsink) [°C]	User ambient temperature (within product specifications)		
<b>P</b>	Inverter generating loss [W]	Refer to Table 7.3-1		
<b>R1</b>	Thermal resistance of the inverter mounting plate [K/W]	0.26	0.17	0.13
<b>R2</b>	Thermal resistance of the thermal compound [K/W] (*1)	0.01		
<b>S</b>	Area of the back of the inverter mounting plate [m <sup>2</sup> ]	0.0086	0.0154	0.0196
<b>λ</b>	Thermal conductivity of thermal compound [W/(m · K)]	2.0		
<b>t</b>	Thermal compound thickness [μm]	100		

\*1 If you use a thermal compound other than the recommended product, the characteristics may differ. After confirming the characteristic value of the thermal compound to be used, calculate using the above formula for thermal resistance R2.



### 7.3 Inverter generating loss

Table 7.3-1 Inverter generating loss

Power system	Inverter type	HND specification							
		Carrier frequency (F26) [kHz]	High carrier			Carrier frequency (F26) [kHz]	Low carrier		
			Generating loss [W]				Generating loss [W]		
		Inside the unit	Inverter mounting plate	Total loss	Inside the unit	Inverter mounting plate	Total loss		
Three-phase 200V	FRN0001E3T-2G	8	13	5	18	2	13	4	17
	FRN0002E3T-2G	8	16	9	25	2	16	7	23
	FRN0004E3T-2G	8	20	18	38	2	20	15	35
	FRN0006E3T-2G	8	30	28	58	2	30	24	54
	FRN0010E3T-2G	8	34	51	84	2	32	42	74
	FRN0012E3T-2G	8	42	68	111	2	41	57	98
Three-phase 400V	FRN0020E3T-2G	8	47	118	165	2	44	96	139
	FRN0002E3T-4G	8	21	18	39	2	19	11	30
	FRN0004E3T-4G	8	23	30	53	2	21	19	40
	FRN0006E3T-4G	8	27	49	76	2	25	32	57
	FRN0007E3T-4G	8	38	66	103	2	34	45	79
Single-phase 200V	FRN0012E3T-4G	8	63	101	165	2	59	71	130
	FRN0001E3T-7G	8	12	6	18	2	12	5	17
	FRN0002E3T-7G	8	14	10	25	2	14	9	23
	FRN0004E3T-7G	8	17	22	39	2	17	19	36
	FRN0006E3T-7G	8	22	38	60	2	22	33	55
	FRN0010E3T-7G	8	34	54	88	2	32	46	78
	FRN0012E3T-7G	8	38	79	116	2	35	65	100

Power system	Inverter type	HND specification							
		Carrier frequency (F26) [kHz]	High carrier			Carrier frequency (F26) [kHz]	Low carrier		
			Generating loss [W]				Generating loss [W]		
		Inside the unit	Inverter mounting plate	Total loss	Inside the unit	Inverter mounting plate	Total loss		
Three-phase 200V	FRN0001E3T-2G	4	13	6	19	2	13	6	19
	FRN0002E3T-2G	4	18	11	29	2	18	11	29
	FRN0004E3T-2G	4	28	20	47	2	28	19	47
	FRN0006E3T-2G	4	34	32	67	2	34	32	66
	FRN0010E3T-2G	4	37	59	95	2	36	58	94
	FRN0012E3T-2G	4	43	73	117	2	43	72	115
Three-phase 400V	FRN0020E3T-2G	4	56	128	183	2	54	125	179
	FRN0002E3T-4G	8	20	22	42	2	18	14	32
	FRN0004E3T-4G	8	27	39	66	2	25	25	50
	FRN0006E3T-4G	8	30	62	91	2	27	42	69
	FRN0007E3T-4G	4	33	66	99	2	32	63	95
Single-phase 200V	FRN0012E3T-4G	4	47	108	155	2	47	103	150
	FRN0001E3T-7G	4	12	7	19	2	12	7	19
	FRN0002E3T-7G	4	14	15	29	2	14	15	29
	FRN0004E3T-7G	4	21	26	47	2	21	26	47
	FRN0006E3T-7G	4	19	47	67	2	19	47	66
	FRN0010E3T-7G	4	31	64	95	2	31	63	94
	FRN0012E3T-7G	4	35	82	117	2	35	80	115

## 8. Options

### 8.1 Multifunction Keypad

Option name	Explanation	Remarks
Remote keypad (TP-E2)	<ul style="list-style-type: none"> <li>- 7 keys</li> <li>- USB port (Mini-B)</li> <li>- Front side : IP40. Back side : IP20</li> <li>- The function codes can be set, checked, and copied.</li> <li>- The inverter operation information can be monitored, test-run and traceback function can be performed.</li> </ul>	External option
Multi-function keypad with LCD (TP-A2SW)	<ul style="list-style-type: none"> <li>- 128 x 128 pixel LCD display, 3 LED status indicators</li> <li>- 11 keys</li> <li>- Support for 20 languages</li> <li>- USB port (Mini-B)</li> <li>- Built-in microSD card slot*</li> <li>- Built-in RTC (backed up with CR2032* coin battery)</li> <li>- Built-in wireless communication (Bluetooth 5.0, D054097)</li> <li>- Radio law of japan</li> <li>- Technical regulations conformity certification (MIC:209-J00282)</li> <li>- European Standard (RED)</li> <li>- USA FCC (FCC ID: 2AYOMBGM13P)</li> <li>- Canada ISED (IC: 26827-BGM13P)</li> <li>- China SRRC (CMIIT ID: 2021DJ11006)</li> <li>- Thailand NBTC (SDoC RT.1657)- Front side: IP55, Back side: IP20</li> <li>- The function codes can be set, checked, and copied.</li> <li>- The inverter operation information can be monitored, test-run and traceback function can be performed.</li> </ul>	External option

\* The microSD cards (Industrial grade SDHC cards are recommended, SD / SDXC / SDUC cards are not supported), and coin batteries (Maxell, Panasonic or equivalents are recommended) should be prepared by the customer.

\* Not available for E3N type.

### 8.2 Keypad extension cable

Option name	Explanation	Remarks
CB-1S	Cable length : 1m (3.3ft)	
CB-3S	Cable length : 3m (9.8ft)	
CB-5S	Cable length : 5m (16.4ft)	

### 8.3 Encoder Interface Options

Option name	Explanation	Remarks
PG interface card (12V/15V) (OPC-CP-PG3)	<p>Signal input method : complementary or open collector Pulse resolution: 20 to 3600 P/R, A-phase, B-phase, Z-phase (incremental)</p> <p>Pulse frequency : max. 100 kHz (complementary), max. 30 kHz (open collector)</p> <p>Power supply output for PG : 12 V, 80 mA 15 V, 60 mA</p>	Built-in option
PG interface card (5V) (OPC-CP-PG)	<p>Signal input method : complementary or open collector Pulse resolution: 20 to 3600 P/R, A-phase, B-phase, Z-phase (incremental)</p> <p>Pulse frequency : max. 30 kHz (complementary), max. 30 kHz (open collector)</p> <p>Power supply output for PG : 5 V, 200 mA</p>	Built-in option

\* Not available for E3N type.

### 8.4 I/O Interface Options

Option name	Explanation	Remarks
Digital I/O interface card (OPC-DIO)	<p>12 digital input terminals. (SINK/SOURCE switching is possible.) The frequency can be set with binary codes (8, 12 bits) and BCD codes. These terminals are also available to use as programmable digital input terminals.</p> <p>8 digital output terminals. (SINK/SOURCE switching is possible.) The monitor data is converted to binary code (8 bits) and output. These terminals are also available to use as programmable digital output terminals.</p>	Built-in option
Analog interface card (OPC-AIO)	<p>One analog voltage input: <math>\pm 10</math> VDC One analog current input: 4 to 20 mA DC One analog voltage output: <math>\pm 10</math> VDC One analog current output: 4 to 20 mA DC</p>	Built-in option
Relay output card (OPC-CP-RY)	3 digital output terminals (1C)	Built-in option

\* Not available for E3N type.

## 8.5 Field Bus Communication Interface Options

Option name	Explanation	Remarks
ProfiBus-DP communication card (OPC-PDP3)	The PROFIBUS-DP communication card is used to connect to a PROFIBUS-DP master unit via PROFIBUS. Supports DP-V0 communication.	Built-in option
DeviceNet communication card (OPC-DEV)	The DeviceNet communication card is used to connect to a DeviceNet master via DeviceNet. Passed CT31.	Built-in option
CANopen communication card (OPC-COP2)	The CANopen communication card is used to connect to a CANopen master unit (e.g., PC or PLC) via a CANopen network.	Built-in option
Multiprotocol Ethernet communication card (OPC-CP-ETM)	The multi-protocol compatible Ethernet option card is used to connect to an Ethernet master, Profinet master, or EtherCAT master, etc. - Modbus RTU protocol(Supported soon) - EtherNet/IP protocol Passed CT19. - Profinet-RT protocol V2.43 - BACnet IP protocol(Supported soon) - EtherCAT(Supported soon)	Built-in option
CC-Link communication card (OPC-CCL)	CC-Link (Control & Communication Link) is a Mitsubishi Electric FA open field network system. The CC-Link communication card is used to connect the inverter to a CC-Link master unit via CC-Link. Supports Ver1.10 and Ver2.00.	Built-in option
RS-485 communication card (OPC-CP-RS)	The RS-485 communication card is used for multidrop connections on RJ-45 connectors.	Built-in option

\* Not available for E3N type.

## 8.6 Mounting adapter

This adapter is required when installing the following options.

- Digital I/O interface card : OPC-DIO
- Analog interface card : OPC-AIO
- Relay output card : OPC-CP-RY
- ProfiBus-DP communication card : OPC-PDP3
- DeviceNet communication card : OPC-DEV
- CANopen communication card : OPC-COP2
- Multiprotocol Ethernet communication card : OPC-CP-ETM
- CC-Link communication card : OPC-CCL

Option name	Applicable inverter type	Remarks
Mounting adapter (OPC-CP-ADP)	FRN0001E3S-2G to FRN0115E3S-2G, FRN0.4E3S-4G to FRN0072E3S-4G, FRN0001E3S-7G to FRN0012E3S-7G  FRN0001E3E-2G to FRN0115E3E-2G, FRN0.4E3E-4G to FRN0072E3E-4G, FRN0001E3E-7G to FRN0012E3E-7G  FRN0001E3T-2G to FRN0020E3T-2G, FRN0.4E3T-4G to FRN0012E3T-4G, FRN0001E3T-7G to FRN0012E3T-7G	-

\* Not available for E3N type.

## 8.7 External Cooling Fan Attachments

The use of an external cooling attachment allows cooling fins to be directed outside the panel. This enhances cooling efficiency and allows the panel size to be reduced. It can release from the panel approximately 70% of the inverter's generated loss.

Option name	Applicable inverter type	Remarks
External cooling attachment PB-E1-7.5	Mounting adapter for external cooling FRN0030E3S-2G, FRN0040E3S-2G, FRN0022E3S-4G, FRN0029E3S-4G FRN0030E3N-2G, FRN0040E3N-2G, FRN0022E3N-4G, FRN0029E3N-4G	External option
External cooling attachment PB-F1-15	Mounting adapter for external cooling FRN0056E3S-2G, FRN0069E3S-2G, FRN0037E3S-4G, FRN0044E3S-4G FRN0056E3N-2G, FRN0069E3N-2G, FRN0037E3N-4G, FRN0044E3N-4G	External option
External cooling attachment PB-F1-30	Mounting adapter for external cooling FRN0088E3S-2G, FRN0115E3S-2G, FRN0059E3S-4G, FRN0072E3S-4G FRN0088E3N-2G, FRN0115E3N-2G, FRN0059E3N-4G, FRN0072E3N-4G	External option

## 8.8 DIN Rail mounting bases

This is an option for mounting the inverter on a DIN rail (35mm width).

Option name	Applicable inverter type	Remarks
RMA-E2-0.75	FRN0001E3S-2G to FRN0006E3S-2G, FRN0001E3S-7G to FRN0006E3S-7G FRN0001E3N-2G to FRN0006E3N-2G, FRN0001E3N-7G to FRN0006E3N-7G	External option
RMA-E2-2.2	FRN0010E3S-2G to FRN0012E3S-2G, FRN0002E3S-4G to FRN0007E3S-4G, FRN0010E3S-7G FRN0010E3N-2G to FRN0012E3N-2G, FRN0002E3N-4G to FRN0007E3N-4G, FRN0010E3N-7G	External option
RMA-E2-3.7	FRN0020E3S-2G,FRN0012E3S-4G,FRN0012E3S-7G FRN0020E3N-2G,FRN0012E3N-4G,FRN0012E3N-7G	External option

## 8.9 Adapter for Keypad panel

This option is required when remotely controlling the keypad.

Option name	Explanation	Remarks
CBAD-CP	- <u>Mounting adapter</u> Fix it to the control panel and attach the keypad of the inverter main unit. - <u>Connection accessories</u> Attach this adapter to the part where the keypad of the inverter body is attached.	External option

\* Not available for E3N type.

## 8.10 Control Terminal Block Option

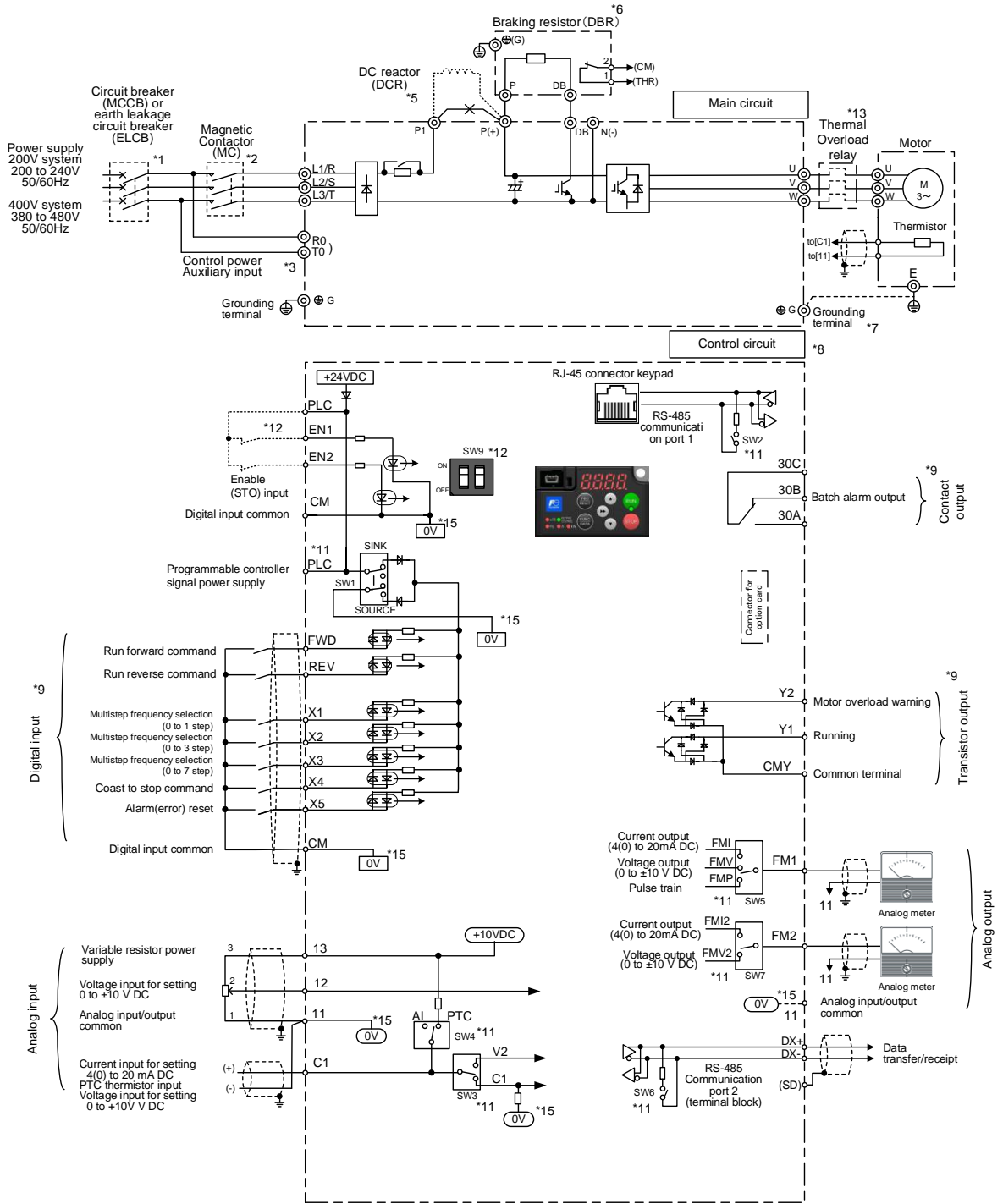
This is a control terminal option that converts terminal blocks other than [30A/B/C] and [EN] terminals to rod terminals/screw terminals.

Option name	Explanation	Remarks
OPC-E2-TB1	Rod terminals / Screw terminals	Built-in option

\* Not available for E3N type.

# 9. Basic Wiring Diagram

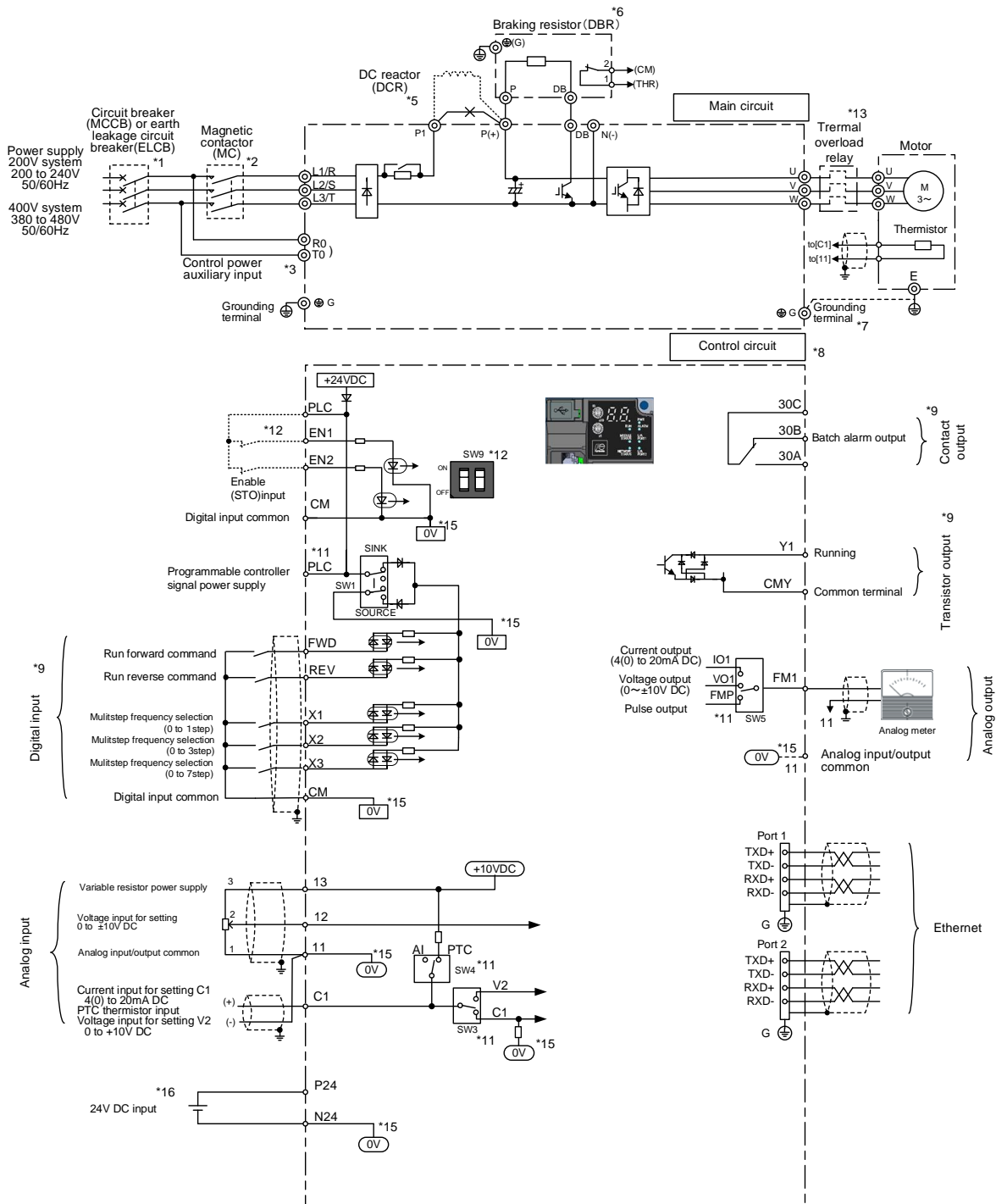
## 9.1 Basic type (E3S) / Finless type (E3T)



- \*1 Install the molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the inverter input side (primary side) to protect wiring. Do not use a circuit breaker that exceeds the recommended rated current.
- \*2 An MCCB or ELCB is also used if isolating the inverter from the power supply, and therefore the magnetic contactor (MC) recommended for each inverter should be installed if required. Please note that if installing a coil such as an MC or solenoid near the inverter, connect a surge absorber in parallel.
- \*3 If wishing to retain the integrated alarm signal issued if the protective function is triggered even when the inverter main power supply is cut off, or to constantly display the keypad, connect these terminals to the power supply. (on FRN0088E3□-2G or higher / FRN0059E3□-4G or higher)  
The inverter can be run even without inputting the power supply to these terminals.
- \*5 Remove the shorting bar between the inverter main circuit terminals P1 and P(+) before connecting the DC reactor (DCR) (option). Use a DC reactor (DCR) when the capacity of the power supply transformer is 500 kVA or more and is 10 times or more the inverter rated capacity, or when there are "thyristor-driven" loads.
- \*6 Inverters are equipped with a built-in braking transistor, allowing direct connection of braking resistors between P(+) and DB.
- \*7 This terminal is used for grounding the motor. Connect if required.
- \*8 Use twisted wire or shielded wire for control signal lines.  
Shielded wires are generally grounded, however, if subject to significant induction noise from outside, it may be possible to suppress the effect of the noise by connecting wires to [CM]. Isolate control signal lines from the main circuit wiring as best as possible, and do not run inside the same duct (a distance of 10 cm or greater is recommended.) If lines intersect, ensure that they do so almost perpendicularly to the main circuit wiring.
- \*9 Each of the functions described for terminals [FWD] and [REV], terminals [X1] to [X5] (digital input), terminals [Y1] to [Y2] (transistor output), and terminal [30A/B/C] (contact output) indicate functions assigned by factory default.
- \*11 These are the switches on control PCBs, and are used to specify settings for inverter operation. Refer to the User's Manual for details.
- \*12 Safety function terminals [EN1] and [EN2] are disabled with SW9 (2-pole switch) on the control PCB by factory default. If using this terminal function, be sure to change the respective SW9 switches to the OFF position and connect.
- \*13 The thermal overload relay is applicable as necessary. Make the circuit breakers (MCCB) or the magnetic contactors (MC) trip by the thermal relay auxiliary contacts (manual recovery).
- \*15 0V and 0V are separated and insulated.



# 9.1 Ethernet built-in type (E3N)



- \*1 Install the molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the inverter input side (primary side) to protect wiring. Do not use a circuit breaker that exceeds the recommended rated current.
- \*2 An MCCB or ELCB is also used if isolating the inverter from the power supply, and therefore the magnetic contactor (MC) recommended for each inverter should be installed if required. Please note that if installing a coil such as an MC or solenoid near the inverter, connect a surge absorber in parallel.
- \*3 If wishing to retain the integrated alarm signal issued if the protective function is triggered even when the inverter main power supply is cut off, or to constantly display the keypad, connect these terminals to the power supply. (on FRN0088E3□-2G or higher / FRN0059E3□-4G or higher)  
The inverter can be run even without inputting the power supply to these terminals.
- \*5 Remove the shorting bar between the inverter main circuit terminals P1 and P(+) before connecting the DC reactor (DCR) (option). Use a DC reactor (DCR) when the capacity of the power supply transformer is 500 kVA or more and is 10 times or more the inverter rated capacity, or when there are “thyristor-driven” loads.
- \*6 Inverters are equipped with a built-in braking transistor, allowing direct connection of braking resistors between P(+) and DB.
- \*7 This terminal is used for grounding the motor. Connect if required.
- \*8 Use twisted wire or shielded wire for control signal lines.  
Shielded wires are generally grounded, however, if subject to significant induction noise from outside, it may be possible to suppress the effect of the noise by connecting wires to [CM]. Isolate control signal lines from the main circuit wiring as best as possible, and do not run inside the same duct (a distance of 10 cm or greater is recommended.) If lines intersect, ensure that they do so almost perpendicularly to the main circuit wiring.
- \*9 Each of the functions described for terminals [FWD] and [REV], terminals [X1] to [X3] (digital input), terminal [Y1] (transistor output), and terminal [30A/B/C] (contact output) indicate functions assigned by factory default.
- \*11 These are the switches on control PCBs, and are used to specify settings for inverter operation. Refer to the User's Manual for details.
- \*12 Safety function terminals [EN1] and [EN2] are disabled with SW9 (2-pole switch) on the control PCB by factory default. If using this terminal function, be sure to change the respective SW9 switches to the OFF position and connect.
- \*13 The thermal overload relay is applicable as necessary. Make the circuit breakers (MCCB) or the magnetic contactors (MC) trip by the thermal relay auxiliary contacts (manual recovery).
- \*15 0V and 0V are separated and insulated.
- \*16 By connecting a power supply to this terminal, Ethernet communication is possible even when the main power supply of the inverter is cut off. The inverter can be operated without inputting power to this terminal.



Power system	Inverter type	Figure	Inverter external dimensions [mm (inch)]				
			W	H	D	D1	D2
Three-phase 200 V	FRN0001E3S-2G	A	68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0002E3S-2G		68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0004E3S-2G		68(2.68)	127(5)	113(4.45)	90(3.54)	23(0.9)
	FRN0006E3S-2G	B	68(2.68)	127(5)	145(5.71)	97(3.82)	48(1.89)
	FRN0010E3S-2G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0012E3S-2G	C	110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0020E3S-2G		140(5.51)	130(5.12)	156(6.14)	-	-
	FRN0030E3S-2G	D	180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0040E3S-2G		180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0056E3S-2G	E	220(8.66)	260(10.24)	203(7.99)	-	-
FRN0069E3S-2G	220(8.66)		260(10.24)	203(7.99)	-	-	
FRN0088E3S-2G	F	250(9.84)	400(15.75)	203(7.99)	-	-	
FRN0115E3S-2G		250(9.84)	400(15.75)	203(7.99)	-	-	
Three-phase 400 V	FRN0002E3S-4G	B	110(4.33)	130(5.12)	132(5.2)	98(3.85)	34(1.33)
	FRN0004E3S-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0006E3S-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0007E3S-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0012E3S-4G	C	140(5.51)	130(5.12)	156(6.14)	-	-
	FRN0022E3S-4G		180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0029E3S-4G	D	180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0037E3S-4G		220(8.66)	260(10.24)	203(7.99)	-	-
	FRN0044E3S-4G	E	220(8.66)	260(10.24)	203(7.99)	-	-
FRN0059E3S-4G	250(9.84)		400(15.75)	203(7.99)	-	-	
FRN0072E3S-4G	F	250(9.84)	400(15.75)	203(7.99)	-	-	
Single-phase 200 V	FRN0001E3S-7G	A	68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0002E3S-7G		68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0004E3S-7G		68(2.68)	127(5)	120(4.72)	97(3.82)	23(0.9)
	FRN0006E3S-7G		68(2.68)	127(5)	165(6.5)	117(4.61)	48(1.89)
	FRN0010E3S-7G	B	110(4.33)	130(5.12)	166(6.54)	108(4.25)	58(2.27)
	FRN0012E3S-7G	C	140(5.51)	130(5.12)	156(6.14)	98(3.86)	58(2.27)



Power system	Inverter type	Figure	Inverter external dimensions [mm (inch)]				
			W	H	D	D1	D2
Three-phase 200 V	FRN0001E3N-2G	G	68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0002E3N-2G		68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0004E3N-2G		68(2.68)	127(5)	113(4.45)	90(3.54)	23(0.9)
	FRN0006E3N-2G		68(2.68)	127(5)	145(5.71)	97(3.82)	48(1.89)
	FRN0010E3N-2G	H	110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0012E3N-2G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0020E3N-2G	I	140(5.51)	130(5.12)	156(6.14)	-	-
	FRN0030E3N-2G	J	180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0040E3N-2G		180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0056E3N-2G	K	220(8.66)	260(10.24)	203(7.99)	-	-
	FRN0069E3N-2G		220(8.66)	260(10.24)	203(7.99)	-	-
	FRN0088E3N-2G	L	250(9.84)	400(15.75)	203(7.99)	-	-
FRN0115E3N-2G	250(9.84)		400(15.75)	203(7.99)	-	-	
Three-phase 400 V	FRN0002E3N-4G	H	110(4.33)	130(5.12)	132(5.2)	98(3.85)	34(1.33)
	FRN0004E3N-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0006E3N-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0007E3N-4G		110(4.33)	130(5.12)	156(6.14)	98(3.85)	58(2.27)
	FRN0012E3N-4G	I	140(5.51)	130(5.12)	156(6.14)	-	-
	FRN0022E3N-4G	J	180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0029E3N-4G		180(7.09)	220(8.66)	171(6.73)	-	-
	FRN0037E3N-4G	K	220(8.66)	260(10.24)	203(7.99)	-	-
	FRN0044E3N-4G		220(8.66)	260(10.24)	203(7.99)	-	-
FRN0059E3N-4G	L	250(9.84)	400(15.75)	208(8.19)	-	-	
FRN0072E3N-4G		250(9.84)	400(15.75)	208(8.19)	-	-	
Single-phase 200 V	FRN0001E3N-7G	G	68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0002E3N-7G		68(2.68)	127(5)	98(3.85)	90(3.54)	8(0.31)
	FRN0004E3N-7G		68(2.68)	127(5)	120(4.72)	97(3.82)	23(0.9)
	FRN0006E3N-7G		68(2.68)	127(5)	165(6.5)	117(4.61)	48(1.89)
	FRN0010E3N-7G	H	110(4.33)	130(5.12)	166(6.54)	108(4.25)	58(2.27)
	FRN0012E3N-7G	I	140(5.51)	130(5.12)	156(6.14)	98(3.86)	58(2.27)

### 10.3 Finless type (E3T)

Fig. M

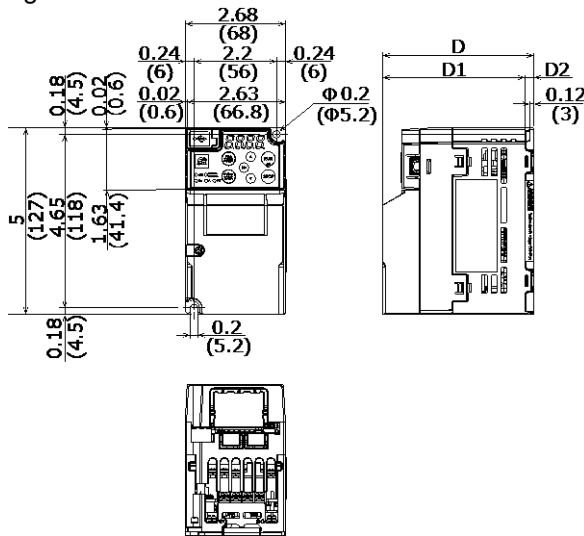


Fig. N

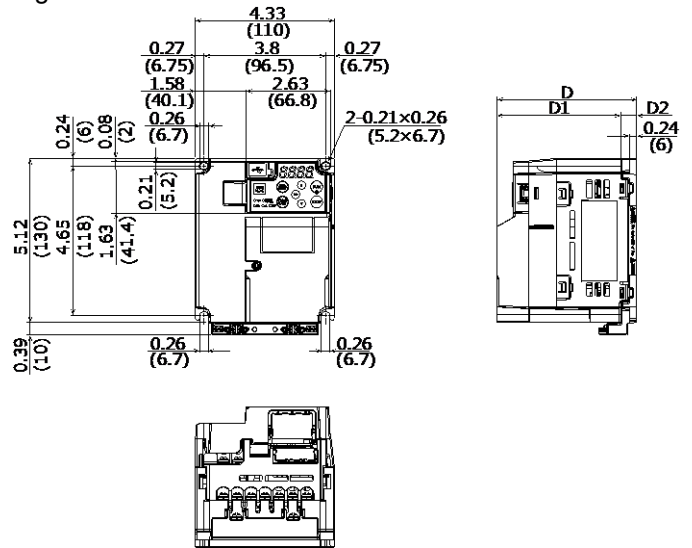
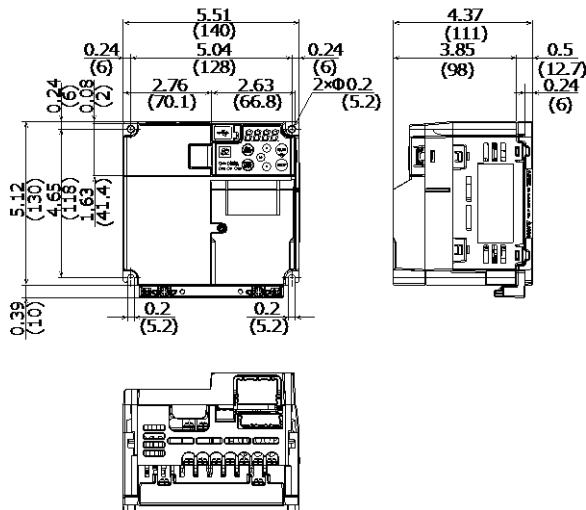


Fig. O



Power system	Inverter type	Figure	Inverter external dimensions [mm (inch)]				
			W	H	D	D1	D2
Three-phase 200 V	FRN0001E3T-2G	M	68(2.68)	127(5)	96(3.78)	90.1(3.55)	5.9(0.23)
	FRN0002E3T-2G		68(2.68)	127(5)	96(3.78)	90.1(3.55)	5.9(0.23)
	FRN0004E3T-2G		68(2.68)	127(5)	96(3.78)	90.1(3.55)	5.9(0.23)
	FRN0006E3T-2G	N	68(2.68)	127(5)	103(4.06)	97.1(3.82)	5.9(0.23)
	FRN0010E3T-2G		110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
	FRN0012E3T-2G		110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
Three-phase 400 V	FRN0020E3T-2G	O	140(5.51)	130(5.12)	111(4.37)	98(3.85)	6(0.24)
	FRN0002E3T-4G	N	110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
	FRN0004E3T-4G		110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
	FRN0006E3T-4G		110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
	FRN0007E3T-4G	O	110(4.33)	130(5.12)	111(4.37)	98.3(3.87)	12.7(0.5)
	FRN0012E3T-4G		140(5.51)	130(5.12)	111(4.37)	98(3.85)	6(0.24)
Single-phase 200 V	FRN0001E3T-7G	M	68(2.68)	127(5)	96(3.78)	90.1(3.55)	5.9(0.23)
	FRN0002E3T-7G		68(2.68)	127(5)	96(3.78)	90.1(3.55)	5.9(0.23)
	FRN0004E3T-7G		68(2.68)	127(5)	103(4.06)	97.1(3.82)	5.9(0.23)
	FRN0006E3T-7G	N	68(2.68)	127(5)	123(4.84)	117.1(4.61)	5.9(0.23)
	FRN0010E3T-7G		110(4.33)	130(5.12)	121(4.76)	108.3(4.26)	12.7(0.5)
	FRN0012E3T-7G		140(5.51)	130(5.12)	111(4.37)	98(3.85)	6(0.24)

### Revision History

Revision	Date	Drawn	Checked	Approved	Contents
-	24 Jul, 2023	Y.Takami T.Yayama K.Yamazawa K.Nomura	-	-	