FRENIC-Ace
Specifications for Global Model [GB]

FECA-TE-156

1. STANDARD SPECIFICATIONS

1.1. Three phase 230V class series

Items			Specifications							
Type (FRN□□□E2S-2GB)			0001	0002	0004	0006	0010	0012	0020	0030
Nominal applied motor [HP]*1		HND	1/4	1/2	1	2	3	5 *9	7.5 *9	10
		HHD	1/8	1/4	1/2	1	2	3	5	7.5
Output ratings	Rated capacity[kVA] *2	HND	0.5	0.8	1.4	2.4	3.8	4.8 *9	7.8 *9	12.0
		HHD	0.3	0.6	1.2	2.0	3.2	4.4	7.0	10.0
	Rated voltage[V] *3		Three-phase 200 to 240V (With AVR)							
	Rated current [A] *4	HND	1.3	2.0	3.5	6.0	9.6	12 *9	19.6 *9	30
		HHD	0.8	1.6	3.0	5.0	8.0	11	17.5	25
	Overload capability	HND	120% of nominal current for 1min							
		HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s							
Input ratings	Main power supply		Three-phase 200 to 240V, 50/60Hz							
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less *8, Frequency: +5 to -5%)							
	Rated current without DCR [A]*5	HND	1.8	2.6	4.9	6.7	12.8	17.9 *9	28.5 *9	42.7
		HHD	1.1	1.8	3.1	5.3	9.5	13.2	22.2	31.5
	Rated current with DCR [A] *5	HND	0.93	1.6	3.0	4.3	8.3	11.7 *9	19.9 *9	28.8
		HHD	0.57	0.93	1.6	3.0	5.7	8.3	14.0	21.1
	Required power supply capacity [kVA]*6	HND	0.4	0.6	1.2	1.7	3.3	4.6 *9	7.9 *9	11
		HHD	0.2	0.4	0.6	1.2	2.3	3.3	5.6	8.4
Braking	Braking torque [%]*7	HND	75%		53%	68%	48%	29% *9	27% *9	15%
		HHD	150%		100%		70%	40%		20%
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 80% (HND spec.), 0 to 100% (HHD spec.) of nominal current							
	Braking chopper		Built-in							
	Minimum connectable resistance[ohm]		100				40		33	20
	Braking resistor		Option							
DC reactor(DCR)		HND	Option							
		HHD	Option							
Enclosure (IEC60529)			IP20, UL open type							
Cooling method			Natural cooling				Fan cooling			
Mass [lbs(kg)]			1.1(0.5)	1.1(0.5)	1.3(0.6)	1.6(0.8)	3.3(1.5)	3.3(1.5)	4(1.8)	11(5.0)

*1 US 4-pole standard motor. At the selection of the inverter rating, consider not only the rating capacity(HP) is enough but also inverter output current is larger than selected the motor's nominal current.

*2 Rated capacity is calculated by assuming the output rated voltage as 230 V.

*3 Output voltage cannot exceed the power supply voltage.

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0001 to 0020：8kHz, type 0030 to 0115：10kHz,

HND spec.・・・type 0001 to 0020：4kHz, type 0030 to 0069：10kHz, type 0088,0115：4kHz

*5 The value is calculated assuming that the inverter is connected with a power supply with the capacity of 500 kVA (or 10 times the inverter capacity if the inverter capacity exceeds 50 kVA) and %X is 5%.

*6 Obtained when a DC reactor (DCR) is used.

*7 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

*8 Voltage unbalance (%) =(Max. voltage (V) - Min. voltage (V))/Three -phase average voltage (V) × 67 (IEC 61800 - 3) If this value is 2 to 3%, use an optional AC reactor (ACR).

*9 HND spec. of the type 0012 and 0020: allowable ambient temperature 40℃ (+104 °F) or less.
The rated output current at HND spec. is decreased 1% for every 1 ℃ (1.8 °F) when ambient temperature is +40℃ (+104 °F) or more.

Items			Specifications				
Type (FRN□□□E2S-2GB)			0040	0056	0069	0088	0115
Nominal applied motor [HP]*1		HND	15	20	25	30	40
		HHD	10	15	20	25	30
Output ratings	Rated capacity[kVA] *2	HND	16	22	27	35	46
		HHD	13	19	24	30	36
	Rated voltage[V] *3		Three-phase 200 to 240V (With AVR)				
	Rated current [A] *4	HND	40	56	69	88	115
		HHD	33	47	60	76	90
	Overload capability	HND	120% of nominal current for 1min				
		HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s				
Input ratings	Main power supply		Three-phase 200 to 240V, 50/60Hz				
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less *8, Frequency: +5 to -5%)				
	Rated current without DCR [A]*5	HND	60.7	80.0	97.0	112	151
		HHD	42.7	60.7	80.0	97.0	112
	Rated current with DCR [A] *5	HND	42.2	57.6	71.0	84.4	114
		HHD	28.8	42.2	57.6	71.0	84.4
	Required power supply capacity *6 [kVA]	HND	17	23	28	34	45
		HHD	11	17	23	28	34
Braking	Braking torque*7 [%]	HND	15%				
		HHD	20%				
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 80% (HND spec.), 0 to 100% (HHD spec.) of nominal current				
	Braking chopper		Built-in				
	Minimum connectable resistance[ohm]		15	10	8.6	4	
	Braking resistor		Option				
DC reactor(DCR)		HND	Option				
		HHD	Option				
Enclosure (IEC60529)			IP20, UL open type				
Cooling method			Fan cooling				
Mass [lbs(kg)]			11(5.0)	18(8.0)	20(9.0)	21(9.5)	22(10)

*1 US 4-pole standard motor. At the selection of the inverter rating, consider not only the rating capacity (HP) is enough but also inverter output current is larger than selected the motor's nominal current.

*2 Rated capacity is calculated by assuming the output rated voltage as 230 V.

*3 Output voltage cannot exceed the power supply voltage.

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0001 to 0020：8kHz, type 0030 to 0115：10kHz,

HND spec.・・・type 0001 to 0020：4kHz, type 0030 to 0069：10kHz, type 0088, 0115：4kHz

*5 The value is calculated assuming that the inverter is connected with a power supply with the capacity of 500 kVA (or 10 times the inverter capacity if the inverter capacity exceeds 50 kVA) and %X is 5%.

*6 Obtained when a DC reactor (DCR) is used.

*7 Average braking torque for the motor running alone. (*It* varies with the efficiency of the motor.)

*8 Voltage unbalance (%) =(Max. voltage (V) - Min. voltage (V))/Three -phase average voltage (V) × 67 (IEC 61800 - 3) If this value is 2 to 3%, use an optional AC reactor (ACR).

1.2. Three phase 460V class series

Items			Specifications							
Type (FRN□□□E2S-4GB)			0002	0004	0006	0007	0012	0022	0029	0037
Nominal applied motor [HP][*1]		ND	1	2	3	4	7.5	15	20	25
		HD	1	1.5	3	4	7.5	10	15	20
		HND	1	1.5	3	4[*9]	7.5[*9]	10	15	20
		HHD	1/2	1	2	3	5	7.5	10	15
Output ratings	Rated capacity[kVA] [*2]	ND	1.7	3.3	4.4	5.5	9.6	17.1	22.7	29.5
		HD	1.4	2.7	4.0	5.0	8.8	14	18	25
		HND	1.4	2.7	4.0	5.0[*9]	8.8[*9]	14	18	25
		HHD	1.2	2.0	3.3	4.4	7.2	10.3	14	19
	Rated voltage[V] [*3]		Three-phase 380 to 480V (With AVR)							
	Rated current [A] [*4]	ND	2.1	4.1	5.5	6.9	12	21.5	28.5	37
		HD	1.8	3.4	5.0	6.3	11.1	17.5	23	31
		HND	1.8	3.4	5.0	6.3[*9]	11.1[*9]	17.5	23	31
		HHD	1.5	2.5	4.2	5.5	9.0	13	18	24
	Overload capability	ND,HND	120% of nominal current for 1min							
		HD	150% of nominal current for 1min							
		HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s							
Input ratings	Main power supply		Three-phase 380 to 480V, 50/60Hz							
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less [*8], Frequency: +5 to -5%)							
	Rated current without DCR [*5] [A]	ND	2.7	4.8	7.3	11.3	16.8	33.0	43.8	52.3
		HD	2.7	3.9	7.3	11.3	16.8	23.2	33.0	43.8
		HND	2.7	3.9	7.3	11.3[*9]	16.8[*9]	23.2	33.0	43.8
		HHD	1.7	3.1	5.9	8.2	13.0	17.3	23.2	33.0
	Rated current with DCR [*5] [A]	ND	1.5	2.9	4.2	5.8	10.1	21.1	28.8	35.5
		HD	1.5	2.1	4.2	5.8	10.1	14.4	21.1	28.8
		HND	1.5	2.1	4.2	5.8[*9]	10.1[*9]	14.4	21.1	28.8
		HHD	0.85	1.6	3.0	4.4	7.3	10.6	14.4	21.1
	Required power supply capacity [*6] [kVA]	ND	1.2	2.3	3.3	4.6	8.0	16.8	23	28
		HD	1.2	1.7	3.3	4.6	8.0	11.5	17	23
		HND	1.2	1.7	3.3	4.6[*9]	8.0[*9]	11.5	17	23
		HHD	0.7	1.3	2.3	3.5	5.8	8.4	10	17
Braking	Braking torque[*7] [%]	ND	53%	50%	48%	29%	27%	12%		
		HD	53%	68%	48%	29%	27%	15%		
		HND	53%	68%	48%	29%[*9]	27%[*9]	15%		
		HHD	100%		70%	40%		20%		
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 60% (ND spec.), 0 to 80% (HD/HND spec.), 0 to 100% (HHD spec.) of nominal current							
	Braking chopper		Built-in							
	Minimum connectable resistance[ohm]		200		160		130	80	60	40
	Braking resistor		Option							
DC reactor(DCR)		ND	Option							
		HND,HD	Option							
		HHD	Option							
Enclosure (IEC60529)			IP20, UL open type							
Cooling method			Natural cooling		Fan cooling					
Mass [lbs(kg)]			2.6(1.2)	3.3(1.5)	3.3(1.5)	3.5(1.6)	4.2(1.9)	11(5.0)	11(5.0)	18(8.0)

*1 US 4-pole standard motor. At the selection of the inverter rating, consider not only the rating capacity (HP) is enough but also inverter output current is larger than selected the motor's nominal current.

*2 Rated capacity is calculated by assuming the output rated voltage as 460 V.

*3 The output voltage cannot exceed the power supply voltage.

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0002 to 0012：8kHz, type 0022 to 0168：10kHz, type 0203 to 0590：6kHz

HND spec.・・・type 0002 to 0012：8kHz, type 0022 to 0059：10kHz, type 0072 to 0168：6kHz, type 0203 to 0590：4kHz HD, ND spec.・・・All type：4kHz

*9 HND spec. of the type 0007 and 0012: allowable ambient temperature 40℃ (+104 °F) or less.
The rated output current at HND spec. is decreased 1% for every 1 ℃ (1.8 °F) when ambient temperature is +40℃ (+104 °F) or more.

Items			Specifications							
Type (FRN□□□E2S-4GB)			0044	0059	0072	0085	0105	0139	0168	0203
Nominal applied motor *1 [HP]		ND	30	40	50	60	75	100	125	150
		HD	25	30	40	50	60	75	100	125
		HND	25	30	40	50	60	75	100	125
		HHD	20	25	30	40	50	60	75	100
Output ratings	Rated capacity[kVA] *2	ND	35	47	57	68	84	111	134	162
		HD	30	36	48	60	73	89	120	140
		HND	30	36	48	60	73	89	120	140
		HHD	24	31	36	48	60	73	89	120
	Rated voltage[V] *3		Three-phase 380 to 480V (With AVR)							
	Rated current [A] *4	ND	44	59	72	85	105	139	168	203
		HD	38	45	60	75	91	112	150	176
		HND	38	45	60	75	91	112	150	176
		HHD	30	39	45	60	75	91	112	150
	Overload capability	ND,HND	120% of nominal current for 1min							
		HD	150% of nominal current for 1min							
		HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s							
Input ratings	Main power supply		Three-phase 380 to 480V, 50/60Hz							Three-phase 380 to 440V, 50Hz Three-phase 380 to 480V, 60Hz *10
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less *8, Frequency: +5 to -5%)							
	Rated current without DCR *5 [A]	ND	60.6	77.9	94.3	114	140	—	—	—
		HD	52.3	60.6	77.9	94.3	114	140	—	—
		HND	52.3	60.6	77.9	94.3	114	140	—	—
		HHD	43.8	52.3	60.6	77.9	94.3	114	140	—
	Rated current with DCR *5 [A]	ND	42.2	57.0	68.5	83.2	102	138	164	201
		HD	35.5	42.2	57.0	68.5	83.2	102	138	164
		HND	35.5	42.2	57.0	68.5	83.2	102	138	164
		HHD	28.8	35.5	42.2	57.0	68.5	83.2	102	138
	Required power supply capacity *6 [kVA]	ND	34	45	55	66	81	110	131	160
		HD	28	34	45	55	66	81	110	131
		HND	28	34	45	55	66	81	110	131
		HHD	23	28	34	45	55	66	81	110
Braking	Braking torque *7 [%]	ND	12%			5 to 9%				
		HD	15%			7 to 12%				
		HND	15%			7 to 12%				
		HHD	20%			10 to 15%				
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 60% (ND spec.), 0 to 80% (HD/HND spec.), 0 to 100% (HHD spec.) of nominal current							
	Braking chopper		Built-in			Option				
	Minimum connectable resistance[ohm]		34.4	16		—	—	—	—	—
	Braking resistor		Option							
DC reactor(DCR)		ND	Option					Attached as standard		
		HND, HD	Option						Attached as standard	
		HHD	Option							Attached as standard
Enclosure (IEC60529)			IP20, UL open type			IP00, UL open type				
Cooling method			Fan cooling							
Mass [lbs(kg)]			20(9.0)	21(9.5)	22(10)	55(25)	57(26)	66(30)	73(33)	88(40)

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0002 to 0012：8kHz, type 0022 to 0168：10kHz, type 0203 to 0590：6kHz

HND spec.・・・type 0002 to 0012：8kHz, type 0022 to 0059：10kHz, type 0072 to 0168：6kHz, type 0203 to 0590

：4kHz HD, ND spec.・・・All type：4kHz

Items			Specifications					
Type (FRN□□□E2S-4GB)			0240	0290	0361	0415	0520	0590
Nominal applied motor *1 [HP]		ND	200	250	300	350	450	500
		HD	150	200	250	300	350	400
		HND	150	200	250	300	350	450
		HHD	125	150	200	250	300	350
Output ratings	Rated capacity[kVA] *2	ND	191	231	288	330	414	470
		HD	167	202	242	300	330	380
		HND	167	202	242	300	330	414
		HHD	140	167	202	242	300	331
	Rated voltage[V] *3		Three-phase 380 to 480V (With AVR)					
	Rated current [A] *4	ND	240	290	361	415	520	590
		HD	210	253	304	377	415	477
		HND	210	253	304	377	415	520
		HHD	176	210	253	304	377	415
	Overload capability	ND,HND	120% of nominal current for 1min					
		HD	150% of nominal current for 1min					
		HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s					
Input ratings	Main power supply		Three-phase 380 to 440V, 50Hz *10 Three-phase 380 to 480V, 60Hz					
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less *8, Frequency: +5 to -5%)					
	Rated current without DCR *5 [A]	ND	—	—	—	—	—	—
		HD	—	—	—	—	—	—
		HND	—	—	—	—	—	—
		HHD	—	—	—	—	—	—
	Rated current with DCR *5 [A]	ND	238	286	357	390	500	559
		HD	201	238	286	357	390	443
		HND	201	238	286	357	390	500
		HHD	164	201	238	286	357	390
	Required power supply capacity *6 [kVA]	ND	190	228	284	311	398	445
		HD	160	190	228	284	310	353
		HND	160	190	228	284	310	398
		HHD	131	160	190	228	284	310
Braking	Braking torque [%]*7	ND	5 to 9%					
		HD	7 to 12%					
		HND	7 to 12%					
		HHD	10 to 15%					
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 60% (ND spec.), 0 to 80% (HD/HND spec.), 0 to 100% (HHD spec.) of nominal current					
	Braking chopper		Option					
	Minimum connectable resistance[ohm]		—	—	—	—	—	—
	Braking resistor		Option					
DC reactor(DCR)		ND	Attached as standard					
		HND,HD	Attached as standard					
		HHD	Attached as standard					
Enclosure (IEC60529)			IP00, UL open type					
Cooling method			Fan cooling					
Mass [lbs(kg)]			137(62)	139(63)	209(95)	211(96)	286(130)	309(140)

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0002 to 0012：8kHz, type 0022 to 0168：10kHz, type 0203 to 0590：6kHz

HND spec.・・・type 0002 to 0012：8kHz, type 0022 to 0059：10kHz, type 0072 to 0168：6kHz, type 0203 to 0590

：4kHz HD, ND spec.・・・All type：4kHz

The rated output current at HD/ND spec. is decreased 2% for every 1 ℃ (1.8 °F) when ambient temperature is +40℃ (+104 °F) or more.

*5 The value is calculated assuming that the inverter is connected with a power supply with the capacity of 500 kVA (or 10 times the inverter capacity if the inverter capacity exceeds 50 kVA) and %X is 5%.

Be sure to use the DCR when applicable motor capacity is 100HP or above.

*6 Obtained when a DC reactor (DCR) is used.

*7 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

*8 Voltage unbalance (%) = (Max. voltage (V) - Min. voltage (V))/Three -phase average voltage (V) × 67 (IEC 61800 - 3) If this value is 2 to 3%, use an optional AC reactor (ACR).

*10 The 400 V class with type 0203 or above is equipped with a set of switching connectors (male) which should be configured according to the power source voltage and frequency.

1.3. Single phase 230V class series

Items			Specifications					
Type (FRN□□□E2S-7GB)			0001	0002	0003	0005	0008	0011
Nominal applied motor [HP][*1]		HHD	1/8	1/4	1/2	1	2	3
Output ratings	Rated capacity[kVA][*2]	HHD	0.3	0.6	1.2	2.0	3.2	4.3
	Rated voltage[V][*3]		Three-phase 200 to 240V (With AVR)					
	Rated current [A][*4]	HHD	0.8	1.6	3.0	5.0	8.0	11
	Overload capability	HHD	150% of nominal current for 1min or 200% of nominal current for 0.5s					
Input ratings	Main power supply		Single-phase 200 to 240V, 50/60Hz					
	Voltage/frequency variations		Voltage: +10 to -10% Frequency: +5 to -5%					
	Rated current without DCR [*5] [A]	HHD	1.8	3.3	5.4	9.7	16.4	24.8
	Rated current with DCR [*5] [A]	HHD	1.1	2.0	3.5	6.4	11.6	17.5
	Required power supply capacity [*6] [kVA]	HHD	0.3	0.5	0.8	1.5	2.7	4.0
Braking	Braking torque [%][*7]	HHD	150%		100%		70%	40%
	DC braking		Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 100% (HHD spec.) of nominal current					
	Braking chopper		Built-in					
	Minimum connectable resistance[ohm]		100				40	
	Braking resistor		Option					
DC reactor(DCR)		HHD	Option					
Enclosure (IEC60529)			IP20, UL open type					
Cooling method			Natural cooling				Fan cooling	
Mass [lbs(kg)]			1.1(0.5)	1.1(0.5)	1.3(0.6)	2.0(0.9)	3.5(1.6)	4.0(1.8)

*1 US 4-pole standard motor. At the selection of the inverter rating, consider not only the rating capacity (HP) is enough but also inverter output current is larger than selected the motor's nominal current.

*2 Rated capacity is calculated by assuming the output rated voltage as 230 V.

*3 Output voltage cannot exceed the power supply voltage.

*4 When the carrier frequency (F26) is set to below value or higher, the inverter is sure to be necessary to derate their nominal current.

HHD spec.・・・type 0001 to 0011 ：8kHz

*5 The value is calculated assuming that the inverter is connected with a power supply with the capacity of 500 kVA (or 10 times the inverter capacity if the inverter capacity exceeds 50 kVA) and %X is 5%.

*6 Obtained when a DC reactor (DCR) is used.

*7 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

2.COMPLIANCE WITH GLOBAL STANDARDS

Marking	Compliant standards or directives	
CE	LVD	IEC/EN 61800-5-1：2007
	EMC	IEC/EN 61800-3：2004/A1:2012 IEC/EN 61326-3-1:2008 - Emission : Optional EMC filter : Category C2 Integrated EMC filter : Category C2/C3 Type of FRN0001E2E-2A ～ 0020E2E-2A: Category C2 Type of FRN0002E2E-4□ ～ 0012E2E-4□ : Category C2 Type of FRN0001E2E-7□ ～ 0011E2E-7□ : Category C2 Other than the above type : Category C3 - Immunity : Category C3 Second environment
	Safety (*)	EN ISO 13849-1:2008, Cat.3 / PL:e IEC/EN 60204-1：2005/2006, Stop Category 0 IEC/EN 61508-1 to -7 :2010 SIL3 IEC/EN 61800-5-2 :2007 SIL3 (Functional Safety : STO) IEC/EN 62061 :2005 SIL3
c UL us LISTED	UL 508C C22.2 No.14	UL Standard for Safety, Power Conversion Equipment, second edition and CSA Standard for Industrial Control Equipment
	GOST-R	Russia
	KC	South Korea
-	RoHS compliant	All models are compliant.

(*)Three phase 230V class：From Type 0030 to 0115 are compliant with the standard. (Still pending: From type 0001 to 0020)
Three phase 460V class：From Type 0022 to 0590 are compliant with the standard. (Still pending: From type 0002 to 0012) Single phase 230V class：Still pending (From Type 0001 to 0011).

3. OPERATING ENVIRONMENT AND STORAGE ENVIRONMENT

Operating environment	Installation location	Indoors
	Ambient temperature	HHD,HND spec. : -10 to +50℃ (14 to 122°(*1))
	Ambient humidity	5 to 95%RH (without condensation)
	Atmosphere	Shall be free from corrosive gases, flammable gases, oil mist, dusts, vapor, water drops and direct sunlight. (Pollution degree 2 (IEC60664-1)) The atmosphere must contain only a low level of salt. (0.01 mg/cm2 or less per year)
	Altitude	1000m (3300 ft) or lower If the inverter is used in an altitude above 1000 m (3300 ft), you should apply an output current derating factor as listed in below table.

Altitude		Outputcurrentderatingfactor
1000m or lower	(3300ft or lower)	1.00
1000 to 1500m	(3300 to 4900 ft)	0.97
1500 to 2000m	(4900 to 6600 ft)	0.95
2000 to 2500m	(6600 to 8200 ft)	0.91
2500 to 3000m	(8200 to 9800 ft)	0.88

Vibration

Three phase 460V class	TYPE：0203 or below	TYPE：0240 or above
2 to less than 9Hz	3mm(0.12inch)(Max. amplitude)	3mm(0.12inch)(Max. amplitude)
9 to less than 20Hz	9.8m/s^2	2m/s^2
20 to less than 55Hz	2m/s^2	2m/s^2
55 to less than 200Hz	1m/s^2	1m/s^2

Three/Single phase 230V class	TYPE：0115 or below
2 to less than 9Hz	3mm(0.12inch)(Max. amplitude)
9 to less than 20Hz	9.8m/s^2
20 to less than 55Hz	2m/s^2
55 to less than 200Hz	1m/s^2

Storage environment	Temperature	-25 to +70℃ (in transport) (-13 to +158°F)	Avoid such places where the inverter will be subjected to sudden changes in temperature that will cause condensation to form.
		-25 to +65℃ (in storage) (-13 to +149°F)	
	Relative	5 to 95%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/cm2 or less per year)	
	Atmospheric pressure	86 to 106kPa (during storage)	
		70 to 106kPa (during transportation)	

Do not leave the inverter directly on the floor.
If the environment does not satisfy the specified requirements listed above, wrap the inverter in an airtight vinyl sheet or the like for storage.

If the inverter is to be stored in a high-humidity environment, put a drying agent in the airtight package.

However, for storage exceeding three months, the surrounding temperature range should be within the range from -10 to 30℃ (14 to 86°F). This is to prevent electrolytic capacitors in the inverter from deterioration.

The package must be airtight to protect the inverter from moisture. Add a drying agent inside the package to maintain the relative humidity 70%. Inside the package within 70%.

If the inverter has not been powered on for a long time (one year or more), the property of the electrolytic capacitors may deteriorate. Power the inverters on once a year and keep the inverters powering on for 30 to 60 minutes.

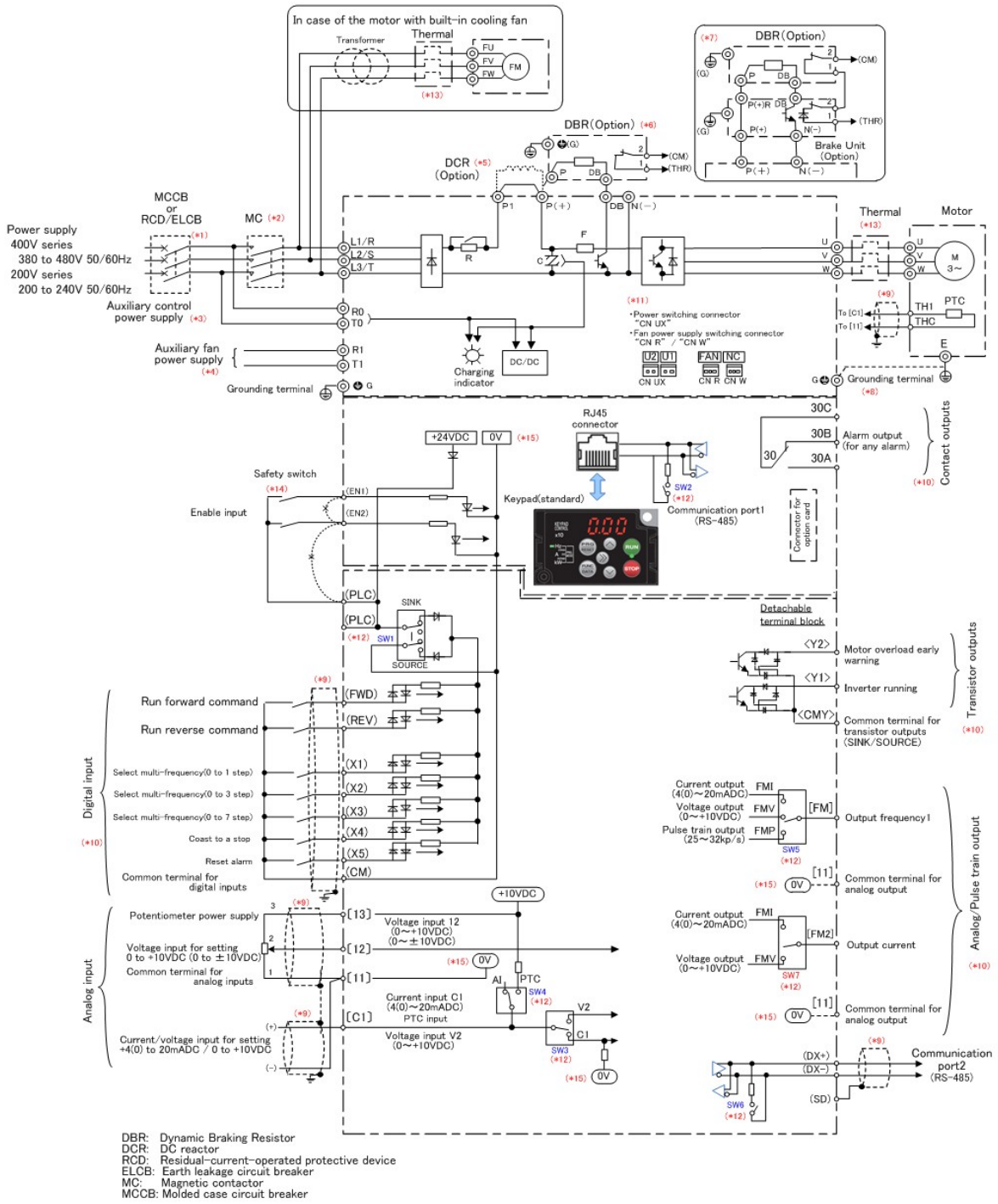
Designed lives

Designed life (*2)	Main circuit capacitor		10 years (*3)
	Electrolytic capacitor on PCB		10 years (*3)
	Cooling fan		10 years (*3)
	Fuse (460V Type：0240 or above)		10 years
	Conditions in design	Ambient	+40℃ (104 °F)
		Load factor	100% (HHD spec.: type 0030(230V class) or above and type 0022(460V class) or above) 80% (HHD spec.: type 0020(230V class) or below and type 0012(460V class) or below) 80% (ND/HD/HND spec.)

*1)ND spec. and ,HND spec. of type FRN0012E2S-2GB,FRN0020E2S-2GB,FRN0007E2S-4GB,FRN0012E2S-4GB, FRN0006E2E-2GA: -10 ～ +40℃ (14 ～ 104°F)
*2)The designed lives are the calculated values and not the guaranteed ones.
*3)ND spec. and HND spec. of type FRN0012E2S-2GB,FRN0020E2S-2GB,FRN0007E2S-4GB,FRN0012E2S-4GB： 7years

4. CONNECTION DIAGRAMS

4.1. FRN□□□□E2S-□GB



*1 Install a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection function) in the primary circuit of the inverter to protect wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.

*2 Install a magnetic contactor (MC) for each inverter to separate the inverter from the power supply, apart from the MCCB or RCD/ELCB, when necessary. Connect a surge absorber in parallel when installing a coil such as the MC or solenoid near the inverter.

*3 The R0 and T0 terminals are provided for inverters of type 0059 or above (460V class) and type 0088 or above (230V class). To retain an alarm output signal ALM issued on inverter's programmable output terminals by the protective function or to keep the keypad alive even if the main power has shut down, connect these terminals to the power supply lines. Even if without connecting the power supply to these terminals, the inverter can run as long as connecting the power supply to the terminals L1/R, L2/S, L3/T.

*4 Normally no need to be connected. Use these terminals when the inverter is equipped with a high power-factor, regenerative PWM converter (RHC series).
(Type 0203 or above/460V only)

*5 When connecting an optional DC reactor (DCR), remove the jumper bar from the terminals P1 and P(+).
For types 0139 (ND spec.), 0168 (HD/ND spec.) and 0203 or bigger capacity types, it is required to connect the DCR (460V only).
Use a DCR when the capacity of the power supply transformer exceeds 500 kVA and is 10 times or more the inverter rated capacity, or when there are thyristor-driven loads in the same power supply line.

*6 Inverters of type 0072 or below (460V class) and type 0115 or below (230V class) have a built-in braking chopper between the terminals P(+) and DB.

*7 For inverters of type 0085 or above (460V class), need to use a braking unit to connect the braking resistor in order to upgrade the braking capability of inverters.
Be sure to connect the braking unit (option) to terminals P(+) and N(-). Auxiliary terminals [1] and [2] have polarity. Be sure to connect as this figure.

*8 A grounding terminal for a motor. Use this terminal if needed.

*9 For control signal wires, use twisted or shielded-twisted wires. When using shielded-twisted wires, connect the shield of them to the common terminals of the control circuit. To prevent malfunction due to noise, keep the control circuit wiring away from the main circuit wiring as far as possible (recommended: 10 cm(3.9 inches) or more). Never install them in the same wire duct. When crossing the control circuit wiring with the main circuit wiring, set them at right angles.

*10 The connection diagram shows factory default functions assigned to digital input terminals [X1] to [X5], [FWD] and [REV], transistor output terminals [Y1] and [Y2], and monitor contact output terminals [FM] .

*11 The power switching connectors (CN UX) and the fan power supply switching connectors (CN R and CN W) are for type 0203(460 V class) or above.

*12 Slide switches on the control printed circuit board (control PCB). Use these switches to customize the inverter operations.

*13 Use auxiliary contacts of the thermal relay (manually restorable) to trip the molded case circuit breaker (MCCB) or magnetic contactor (MC).

*14 When using the Enable input function, be sure to remove the jumper wire from terminals [EN1],[EN2] and [PLC].

*15 0V and 0V are separated and insulated.

5. TERMINAL SPECIFICATIONS

Classification	Symbol	Name	Functions	Remarks
Main circuit	L1/R, L2/S,L3/T	Main circuit power inputs	Connect the three-phase input power lines.	
	L1/L, L2/N		Connect the single-phase input power lines.	
	R0, T0	Auxiliary power input for the control circuit	For a backup of the control circuit power supply, connect AC power lines same as that of the main power input.	Type 0059 or above(460V class) Type 0088 or above(230V class)
	R1, T1	Auxiliary power input for the cooling fans	Normally, no need to use these terminals. Use these terminals for an auxiliary power input of the fans in a power system using a power regenerative PWM converter.	Type 0203 or above (460V only)
	U, V, W	Inverter outputs	Connect a three-phase motor.	
	P(+), P1	DC reactor connection	Connect a DC reactor (DCR) for power factor correction.	
	P(+), DB	Braking resistor	Connect an external braking resistor (option).	Type 0072 or below(460V class) Type 0069 or below(230V class)
	⏚ G	Grounding for inverter	Grounding terminals for the inverter.	
Analog inputs	**[13]**	Power supply for the potentiometer	Power supply (+10 VDC) for frequency command potentiometer (Variable resistor : 1 to 5 kΩ is applicable). The potentiometer of 1/2 W rating or more should be connected.	Maximum supply rating: 10 VDC, 10 mADC.
	[12]	Analog setting voltage input	- External input voltage to be used as a below command.	Input impedance : 22 kΩ Maximum input level : ±15 VDC Input level is limited among -10 to 10 VDC regardless of excessive input of ±10 VDC. Gain: 0 to 200% Offset: 0 to ±5% Bias: ±100% Filter: 0.00 to 5.00s
		<Normal operation>	0 to +10 VDC / 0 to 100% (0 to +5 VDC / 0 to 100%)	
			0 to ±10 VDC / 0 to ±100% (0 to ±5 VDC / 0 to ±100%)	
		<Inverse operation>	+10 to 0 to -10VDC / -100% to 0 to 100%	
			-10V to 0 to +10VDC / +100% to 0 to -100%	
		(Main frequency setting)	-Use as the main frequency command set point.	
		(PID control)	-Use as PID command value or PID feedback signal.	
		(Auxiliary frequency setting1,2)	-Use as additional auxiliary setting to various frequency setting.	
		(Analog input monitor)	-By inputting analog signals from various sensors such as the temperature sensors in air conditioners to the inverter, you can monitor the state of external devices via the communications link. By using an appropriate display coefficient, you can also have various values to be converted into physical quantities such as temperature and pressure before they are displayed.	
		(Gain setting)	-Use as gain for the frequency command. -0% to 200% for 0 to 10 VDC	
		(Torque limit value)	-Use as analog torque limit value	
		(Torque command/Torque current command)	-Used as analog torque command value / Torque current command value. (The PG option card is required.)	
		(Torque bias amount)	-Used as analog torque bias command value.(The PG option card is required.)	
		(Speed limit value)	-Used as analog speed limit value of FWD/REV.(The PG option card is required.)	
	[C1]	Analog setting current input	-External input current to be used as a below command.	Input impedance: 250Ω Maximum input 30 mADC Input level is limited up to 20 mADC regardless of excessive input of 20 mADC. Gain: 0 to 200% Offset: 0 to ±5% Bias: ±100% Filter: 0.00 to 5.00s
		<Normal operation>	4 to 20 mADC / 0 to 100%/ -100% to 0 to 100% (*1)	
			0 to 20 mADC / 0 to 100%/ -100% to 0 to 100% (*1)	
		<Inverse	20 to 4 mADC / 0 to 100%/ -100% to 0 to 100% (*1)	
			20 to 0 mADC / 0 to 100%/ -100% to 0 to 100% (*1)	
		operation> (Main frequency setting)	-Use as the main frequency command set point.	
		(PID control)	-Use as PID command value or PID feedback signal.	
		(Auxiliary frequency setting1,2)	-Use as additional auxiliary setting to various frequency setting.	
		(Analog input monitor)	-By inputting analog signals from various sensors such as the temperature sensors in air conditioners to the inverter, you can monitor the state of external devices via the communications link. By using an appropriate display coefficient, you can also have various values to be converted into physical quantities such as temperature and pressure before they are displayed.	
		(Gain setting)	-Use as gain for the frequency command. -0 to 200% for 4(0) to 20mADC	
		(Torque limit value)	-Use as analog torque limit value	
		(Torque command/Torque current command)	-Used as analog torque command value / Torque current command value. (The PG option card is required.)	
		(Torque bias amount)	-Used as analog torque bias command value.(The PG option card is required.)	
		(Speed limit value)	-Used as analog speed limit value of FWD/REV.(The PG option card is required.)	

Classification	Symbol	Name	Functions	Remarks
Analog inputs	**(V2)**	Analog setting voltage input	-External input voltage to be used as a below command.	Input impedance: 22kΩ Maximum input ±15 VDC
		<Normal operation>	0 to +10 VDC/ 0 to 100% /-100 to 0 to 100% (0 to +5 VDC/ 0 to100%) 0 to +10 VDC/ 0 to ±100% /-100 to 0 to 100%(*1) (0 to +5 VDC/ 0 to ±100%)	Input level is limited among -10 to 10 VDC regardless of excessive input of ±10 VDC. Gain: 0 to 200% Offset: 0 to ±5% Bias: ±100% Filter: 0.00 to 5.00s
		<Inverse operation>	+10 to 0VDC/0 to 100%/-100% to 0 to 100% +10 to 0 VDC / 0 to ±100% /-100 to 0 to 100%(*1) (+5 to 0 VDC/ 0 to ±100%)	
		(Main frequency setting)	-Use as the main frequency command set point.	
		(PID control)	-Use as PID command value or PID feedback signal.	
		(Auxiliary frequency setting1,2)	-Use as additional auxiliary setting to various frequency setting.	
		(Analog input monitor)	-By inputting analog signals from various sensors such as the temperature sensors in air conditioners to the inverter, you can monitor the state of external devices via the communications link. By using an appropriate display coefficient, you can also have various values to be converted into physical quantities such as temperature and pressure before they are displayed.	
		(Gain setting)	-Use as gain for the frequency command. -0 to 200% for 0 to 10 VDC	
		(Torque limit value)	-Used as analog torque limit value	
		(Torque command/Torque current command)	-Used as analog torque command value / Torque current command value (The PG option card is required.)	
		(Torque bias amount)	-Used as analog torque bias command value.(The PG option card is required.)	
		(Speed limit value)	-Used as analog speed limit value of FWD/REV.(The PG option card is required.)	
		(PTC thermistor)	-PTC thermistor connection to protect the motor overheat.	
	[11]	Analog common	Common terminals for analog input signals [12], [13], [C1], and analog output signals [FM],[FM2].	This terminal is electrically isolated from terminal [CM], [CMY].
Analog outputs	**[FM]** **[FM2]**	Analog monitor	The output can be either analog DC voltage (0 to 10 VDC), analog DC current (4(0) to 20 mADC) or pulse train (25 to 32000 p/s). Any one item can be selected from the following items.	Gain: 0 to 300%
		<Voltage output>(*2)	0 to +10 VDC / 0 to 100% (0 to +5 VDC / 0 to 100%) Input impedance of the external device: Min. 5kΩ (at 0 to 10 VDC output) (While the terminal is outputting 0 to 10 VDC, it is capable of driving up to two analog voltmeters with 10 kΩ impedance.)	
		<Current output>(*2)	4 to 20 mADC / 0 to 100% 0 to 20 mADC / 0 to 100% Input impedance of the external device: Max. 500Ω (at 4(0) to 20 mA DC output)	
		Pulse monitor(*2)	Output form Pulse output: 25 to 32000 p/s at full scale, Pulse duty: approx. 50%	
		Monitor data	-Output frequency1(Before slip compensation) -Output frequency2(After slip compensation) -Output current -Output voltage -Output torque -Load factor -Input power -PID feedback amount (PV) -Actual speed / Estimated speed -DC link bus voltage -Universal AO -Motor output -Analog output calibration -PID command (SV)	

Classification	Symbol	Name	Functions	Remarks
Analog outputs		Monitor data	-PID output (MV) -Position deviation in synchronous operation(The PG option card is required.) -Customizable logic output 1 ～10 -Inverter cooling fin temperature -PG feedback value (The PG option card is required.)	
Digital inputs	**[CM]**	Digital Common	Common terminals for the digital input signals.	
	[X1]	Digital input 1	-The following functions can be assigned to terminals [X#], [FWD], and [REV]. <Common functions> -SINK/SOURCE is switchable by using the internal slide switch. -These function codes may also switch the logic system between normal and negative to define how the inverter logic interprets either ON or OFF status of each terminal. -Terminal [X5] can be defined as a pulse train input terminal with the function codes. (Using the PG option card disables the pulse train input function assigned to the inverter's terminal [X5].) Use exclusively with one digital input. 0 to 30kHz(Open Collector) / 100kHz(Push-pull)	Operation current at ON Source current: 2.5 to 5 mA Source current: 9.7 to 16 mA (terminal [X5]) ・・・ Pulse train input Voltage level: 2 V or below Operation current at OFF Allowable leakage current: 0.5 mA or less Voltage: 22 to 27 VDC
	[X2]	Digital input 2		
	[X3]	Digital input 3		
	[X4]	Digital input 4		
	[X5]	Digital input 5 / Pulse train input		
	[FWD]	Run forward command		
	[REV]	Run reverse command		
	(SS1)	Select multi-frequency (0 to 1 steps)		
	(SS2)	Select multi-frequency (0 to 3 steps)		
	(SS4)	Select multi-frequency (0 to 7 steps)		
	(SS8)	Select multi-frequency (0 to 15 steps)		
	(RT1)	Select ACC/DEC time (2 steps)		
	(RT2)	Select ACC/DEC time (4 steps)		
	(HLD)	Enable 3-wire operation		
	(BX)	Coast to a stop		
	(RST)	Reset alarm		
	(THR)	Enable external alarm trip		
	(JOG)	Ready for jogging		
	(Hz2/Hz1)	Select frequency command 2/1		
	(M2)	Select motor 2 (M2)		
	(DCBRK)	Enable DC braking		
	(TL2/TL1)	Select torque limiter level 2/1		
	(SW50)	Switch to commercial power (50 Hz)		
	(SW60)	Switch to commercial power (60 Hz)		
	(UP)	UP (Increase output frequency)		
	(DOWN)	DOWN (Decrease output 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	Applied for vector control with speed sensor.(The PG option card is required.)	
	(LE)	Enable communications link via RS- 485 or fieldbus (option)		
	(U-DI)	Universal DI		
	(STM)	Enable auto search for idling motor speed at starting		
	(STOP)	Force to stop		
	(EXITE)	Pre-excitation	Applied for vector control with speed sensor.(The PG option card is required.)	
	(PID-RST)	Reset PID integral and differential components		
	(PID-HLD)	Hold PID integral component		
	(LOC)	Select local (keypad) operation		
	(LS)	Activate the limit switch at start point	Applied for position control. (The PG option card is required.)	

Classification	Symbol	Name	Functions	Remarks
Digital inputs	**(S/R)**	Start/reset	Applied for position control. (The PG option card is required.)	
	(SPRM)	Switch to the serial pulse receiving mode	Applied for position control. (The PG option card is required.)	
	(RTN)	Enter the return mode	Applied for position control. (The PG option card is required.)	
	(OLS)	Enable overload stop		
	(LOCK)	Servo lock command	Applied for vector control with speed sensor.(The PG option card is required.)	
	(PIN)	Pulse train input	Available only on terminal [X5] (E05)	
	(SIGN)	Pulse train sign	Available on terminals except [X5] (E01 to E04)	
	(BATRY/UPS)	Enable Battery/UPS operation		
	(TB1)	Select torque bias 1	Applied for vector control with speed sensor.(The PG option card is required.)	
	(TB2)	Select torque bias 2	Applied for vector control with speed sensor.(The PG option card is required.)	
	(H_TB)	Hold torque bias	Applied for vector control with speed sensor.(The PG option card is required.)	
	(BRKE)	Check brake control		
	(Hz/LSC)	Cancel line speed control	Applied for V/f control with speed sensor. (The PG option card is required.)	
	(LSC-HLD)	Hold the line speed control frequency in the	Applied for V/f control with speed sensor. (The PG option card is required.)	
	(CRUN-M1)	Count the run time of commercial power-driven motor		
	(CRUN-M2)	Count the run time of commercial power-driven motor		
	(DROOP)	Select droop control		
	(MPRM1)	Select speed control parameter 1	Applied for vector control.	
	(MPRM2)	Select speed control parameter 2	Applied for vector control.	
	(CLC)	Cancel customizable logic		
	(CLTC)	Clear all customizable logic timers		
	(AR-CCL)	Cancel automatic deceleration		
	(FWD)	Run forward command		
	(REV)	Run reverse command		
	(NONE)	No function assigned		
	(PID-SS1)	PID multistep command 1		
	(PID-SS2)	PID multistep command 2		
Transistor outputs	**[PLC]**	PLC signal power	（1）Power supply for programmable controller output logic circiut (Max DC24V DC100mA.) （2）Power supply for transistor output logic circuit	24 VDC (22 to 27 VDC), Max. 100 mA
	[CM]	Digital input common	Common terminals for the digital input signals.	This terminal is electrically isolated from terminal [11]s and [CMY].
	[Y1]	Transistor output 1	-The following functions can be assigned to terminals [Y#].	allowable range: +22 to +27 VDC, 50 mA max.
	[Y2]	Transistor output 2	The output signals can support both normal logic and negative logic.	Leakage current 0.1mA or less
	(RUN)	Inverter running	-Both SINK or SOURCE type logic circuit can be connected.	2VDC or less(Turn on)
	(RUN2)	Inverter output on		
	(FAR)	Frequency (speed) arrival signal		
	(FAR2)	Frequency (speed) arrival signal 2		
	(FAR3)	Frequency (speed) arrival signal 3		
	(FDT)	Frequency (speed) detected		
	(FDT2)	Frequency (speed) detected 2		
	(FDT3)	Frequency (speed) detected 3		
	(LU)	Undervoltage detected (Inverter stopped)		
	(B/D)	Torque polarity detected		
	(IOL)	Inverter output limiting		
	(IPF)	Auto-restarting after momentary power failure		
	(IPF2)	Deceleration after momentary power failure detected		
	(OL)	Motor overload early warning		
	(IOL2)	Inverter output limiting with delay		
	(KP)	Keypad operation enabled		
	(RDY)	Inverter ready to run		
	(AX)	Select AX terminal function (For MC on primary side)	Activate in type 0059 or above(460V class), type 0088(230V class) or above.	

Classification	Symbol	Name	Functions	Remarks
Transistor outputs	**(TU)**	Stage transition signal for pattern operation		
	(TO)	Cycle completion signal for pattern operation		
	(STG1)	Pattern operation stage 1		
	(STG2)	Pattern operation stage 2		
	(STG4)	Pattern operation stage 4		
	(FAN)	Cooling fan in operation		
	(TRY)	Auto-resetting		
	(U-DO)	Universal DO		
	(OH)	Heat sink overheat early warning		
	(SY)	Synchronization completed	For master-slave control. (The PG option card is required.)	
	(LIFE)	Lifetime alarm		
	(REF OFF)	Reference loss detected		
	(OLP)	Overload prevention control		
	(ID)	Current detected		
	(ID2)	Current detected 2		
	(ID3)	Current detected 3		
	(IDL)	Low current detected		
	(PID-ALM)	PID alarm		
	(PID-CTL)	Under PID control		
	(PID-STP)	Motor stopped due to slow flowrate under PID control		
	(U-TL)	Low output torque detected		
	(TD1)	Torque detected 1		
	(TD2)	Torque detected 2		
	(SWM1)	Motor 1 selected		
	(SWM2)	Motor 2 selected		
	(FRUN)	Running forward		
	(RRUN)	Running reverse		
	(RMT)	In remote operation		
	(THM)	Motor overheat detected by thermistor		
	(BRKS)	Brake signal		
	(C1OFF)	Terminal [C1] wire break		
	(DNZS)	Speed valid	Applied for vector control with speed sensor.(The PG option card is required.)	
	(DSAG)	Speed agreement	Applied for vector control with speed sensor.(The PG option card is required.)	
	(PG-ERR)	PG error detected	Applied for the each control method with speed sensor.(The PG option card is required.)	
	(U-EDC)	Low Voltage detected		
	(OT)	Stop position override alarm	Applied for position control. (The PG option card is required.)	
	(POF)	Current position count overflowed	Applied for position control. (The PG option card is required.)	
	(PSET)	Positioning completion signal	Applied for position control. (The PG option card is required.)	
	(PTO)	Timer output	Applied for position control. (The PG option card is required.)	
	(MNT)	Maintenance timer		
	(FARFDT)	Frequency arrival signal		
	(AL1)	Alarm indication 1		
	(AL2)	Alarm indication 2		
	(AL4)	Alarm indication 4		
	(AL8)	Alarm indication 8		
	(L-ALM)	Light alarm		
	(ALM)	Alarm output (for any alarm)		
	(DECF)	Enable circuit failure detected		
	(ENOFF)	Enable input OFF		
	(DBAL)	Braking transistor broken	Activate in the model with built-in braking transistor.	
	(CL01)	Customizable logic output signal 1		
	(CL02)	Customizable logic output signal 2		
	(CL03)	Customizable logic output signal 3		
	(CL04)	Customizable logic output signal 4		
	(CL05)	Customizable logic output signal 5		

Classification	Symbol	Name	Functions	Remarks
Transistor outputs	**(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		
	[CMY]	Transistor output common	Common terminal for transistor output signal terminals.	This terminal is electrically isolated from terminal [11]s and [CM]s.
Relay output	**[30A], [30B],[30C]**	Alarm relay output (for any error)	-This outputs a non-voltage (dry) contact signal (1c) when the inverter is stopped with the protective function. -As a general-purpose relay output, the same functions as terminal Y can be assigned. -The logic value is switchable between "[30A] and [30C] are excited" and "non-excited."	Contact rating: 250 VAC, 0.3 A cosφ=0.3 48 VDC, 0.5A Contact life: 200000 times (Switching at intervals of one second)
Functional safety	**[EN1], [EN2]**	Enable Input 1 Enable Input 2	Compliance with EN ISO13849-1;2008 Cat.3 PL:e (Pending) -Turning off the circuit between terminals [EN1] and [PLC] or terminals [EN2] and [PLC] stops the inverter's output transistor. (Safe Torque Off: STO) -These terminals are exclusively used for the source mode input and cannot be switched to the sink mode. -If either one of these input terminals is kept OFF for 50 ms or more, the inverter interprets it as a discrepancy, causing an alarm ECF. This alarm state can be cleared only by turning the inverter off and on.	Source current at Turn-on : 5-10mA Threshold voltage between [PLC] - [EN] : 2V (Turn on) : 22 to 27V (Turn off) leakage current : 0.5mA or less
	[PLC]	PLC signal power	(1)Power supply for programmable controller output logic circuit (Max DC24V DC100mA.) (2)Power supply for transistor output logic circuit	
Communication	**RJ-45 connector for the keypad**	RS-485 communication port 1	(1)Used to connect the inverter with the keypad. The inverter supplies the power to the keypad through the pins specified below. The extension cable for remote operation also uses wires connected to these pins for supplying the keypad power. (2)Remove the keypad from the standard RJ-45 connector, and connect the RS-485 communications cable to control the inverter through the PC or PLC (Programmable Logic Controller). The protocol selection is available from the following. − Keypad protocol − Modbus RTU − Fuji general-purpose inverter protocol − Fuji SX protocol for FRENIC loader − Asynchronous start-stop system・Half-duplex − Max. transmission cable length： 500 m − Maximum communication speed： 38.4kbps	
	[DX+], [DX-], [SD]	RS-485 communication port 2	A communications port transmits data through the RS-485 multipoint protocol between the inverter and a personal computer or other equipment such as a PLC. The protocol selection is available from the following. − Modbus RTU − Fuji general-purpose inverter protocol − Fuji SX protocol for FRENIC loader − Asynchronous start-stop system・Half-duplex − Max. transmission cable length： 500 m − Maximum communication speed： 38.4kbps	

(*1) In case of applying bais/gain function.
(*2) Exclusive use. Need to swich on the terminal PCB.

6. . Common specifications

Output	**Maximum frequency**	− HHD/HND/HD spec.: 25 to 500 Hz variable (V/f control mode, Magnetic pole position sensorless vector control mode) (Up to 200 Hz under vector control with speed sensor) − ND spec.: 25 to 120 Hz variable (all control mode)	IMPG-VC
	Base frequency	25 to 500 Hz variable (in conjunction with the maximum frequency)	
	Starting frequency	0.1 to 60.0 Hz variable (0.0 Hz under vector control with speed sensor)	IMPG-VC
	Carrier frequency	Three phase 460V class - Type 0002 to 0059 : − 0.75 to 16kHz variable (HHD/HND/HD spec.) − 0.75 to 10kHz variable (ND spec.) - Type 0072 to 0168 : − 0.75 to 16kHz variable (HHD spec.) − 0.75 to 10kHz variable (HND/HD spec.) − 0.75 to 6kHz variable (ND spec.) − Type 0203 or above type of capacity : − 0.75 to 10kHz variable (HHD spec.) − 0.75 to 6kHz variable (HND/HD/ND spec.) Three phase 230V class - Type 0001 to 0010 and 0030 to 0088: − 0.75 to 16kHz variable (HHD/HND/ spec.) - Type 0012 and 0020: − 0.75 to 16kHz variable (HHD spec.) − 0.75 to 10kHz variable (ND spec.) - Type 0115: − 0.75 to 16kHz variable (HHD spec.) − 0.75 to 10kHz variable (HND spec.) Single phase 230V class - Type 0001 to 0011 − 0.75 to 16kHz variable (HHD spec.) Note: Carrier frequency drops automatically to protect the inverter depending on environmental temperature and output	
	Output frequency accuracy (Stability)	- Analog setting: ±0.2% of maximum frequency (at 25±10°C) (77±18°F)	
		- Keypad setting: ±0.01% of maximum frequency (at -10 to +50°C)(14 to 122°F)	
	Frequency setting resolution	- Analog setting: 0.05% of maximum frequency	
		- Keypad setting: 0.01 Hz (99.99 Hz or less), 0.1 Hz (100.0 to 500.0 Hz)	
		- Link setting: 0.005% of maximum frequency or 0.01 Hz (fixed)	
	Speed control range	- 1 : 1500 (Minimum speed : Nominal speed, 4-pole, 1 to 1500 r/min)	IMPG-VC
		- 1 : 100 (Minimum speed : Nominal speed, 4-pole, 15 to 1500 r/min)	IMPG-VF
		- 1 : 10 (Minimum speed : Nominal speed, 6-pole, 180 to 1800 r/min)	PM-SVC
	Speed control accuracy	- Analog setting: ±0.2% of maximum frequency or below (at 25 ±10°C) (77±18°F)	IMPG-VC
		- Digital setting: ±0.01% of maximum frequency or below (at -10 to +50°C)(14 to 122°F)	
		- Analog setting: ±0.5% of base frequency or below (at 25 ±10°C) (77±18°F)	PM-SVC
		- Digital setting: ±0.5% of base frequency or below (at -10 to +50℃)(14 to 122°F)	
Control	**Control method**	- V/f control	VF
		- Speed sensor less vector control (Dynamic torque vector control)	IM-SVC(DTV)
		- V/f control with slip compensation active	VF with SC
		- V/f control with speed sensor (The PG option card is required.)	IMPG-VF
		- V/f Control with speed sensor (＋Auto Torque Boost)(The PG option card is required.)	IMPG-ATB
		- Vector control with speed sensor (The PG option card is required.)	IMPG-VC
		- Vector control without magnetic pole position sensor	PM-SVC
	Voltage/frequency characteristic	− Possible to set output voltage at base frequency and at maximum output frequency (80 to 240 V). − Possible to set output voltage at base frequency and at maximum output frequency (160 to 500 V).	
		− Non-linear V/f setting (3 points): Free voltage (0 to 500 V) and frequency (0 to 500 Hz) can be set. − Non-linear V/f setting (3 points): Free voltage (0 to 240 V) and frequency (0 to 500 Hz) can be set.	
	Torque boost	− Auto torque boost (For constant torque load) − Manual torque boost : Torque boost value can be set between 0.0 and 20.0%. − Select application load with the function code. (Variable torque load or constant torque load)	
	Starting torque	Three phase 460V class − 200% or above (HHD spec.:type 0072 or below) / 150% or higher (HHD spec.:type 0085 or above) at reference frequency 0.5Hz − 120% or higher at reference frequency 0.5Hz, (HND/ND spec.) − 150% or higher at reference frequency 0.5Hz, (HD spec.) (Base frequency 50 Hz, with activating the slip compensation and the auto torque boost mode, applied motor is Fuji 4-pole standard motor.) Three phase 230V class and single phase 230V class − 200% or above (HHD spec.:type 0069 or below) at reference frequency 0.5Hz − 120% or higher at reference frequency 0.5Hz, (HND spec.) (Base frequency 50 Hz, with activating the slip compensation and the auto torque boost mode, applied motor is Fuji 4-pole standard motor.)	

Control

Start/stop operation	- Keypad: Start and stop with [RUN] and [STOP] keys (Standard keypad) Start and stop with [FWD] / [REV] and [STOP] keys (Option multi-functional keypad)	
	- External signals (digital inputs): Forward (Reverse) rotation, stop command (capable of 3-wire operation), coast- to-stop command, external alarm, alarm reset, etc.	
	- Link operation: Operation via built-in RS-485 or built-in CANOpen or field bus (option) communications	
	- Switching operation command: Remote/local switching, link switching	
Frequency setting	- Keypad: Settable with UP and DOWN keys	Analog input between DC+1 to +5V is available with analog bias/gain function for input.
	- External volume: Available to be set with external frequency command potentiometer. (1 to 5 kΩ 1/2 W)	
	-Analog input: 0 to ±10 V DC (±5 V DC)/ 0 to ±100% (terminal [12]) 0 to +10 V DC (+5 V DC)/ 0 to +100% (terminal [12]) +4 to +20 mA DC/ 0 to 100% (terminal [C1]) +4 to +20 mA DC/ -100 to 0 to 100% (terminal [C1]) 0 to +20 mA DC/ 0 to 100% (terminal [C1]) 0 to +20 mA DC/ -100 to 0 to 100% (terminal [C1]) 0 to +10 V DC (+5 V DC)/ 0 to +100% (terminal [V2]) 0 to +10 V DC (+5 V DC)/ -100 to 0 to +100% (terminal [V2])	
	- UP/DOWN operation: Frequency can be increased or decreased while the digital input signal is ON.	
	- Multi-step frequency: Selectable from 16 different frequencies (step 0 to 15)	
	- Pattern Operation Mode：Automatically run in accordance with the previously configured running time, rotation direction, acceleration/deceleration and reference frequency. Maximum allowable settings are 7 stages.	
	- Link operation: Can be specified via built-in RS-485 or built-in CANOpen communications. (Standard) Can be specified via bus communications. (Option)	
	- Switching frequency setting source：Two of frequency settings source can be switched with an external signal(digital input). Remote/local switching, Link switching	
	- Auxiliary frequency setting: Inputs at terminals [12], [C1] or [V2] can be added to the main setting as auxiliary frequency settings.	
	- Operation at a specified ratio: The ratio can be set by analog input signal. DC0-10V/0(4)-20mA /0-200%(variable)	
	Inverse operation: Switchable from "0 to +10 VDC/0 to 100%" to "+10 to 0 VDC/0 to 100%" by external command. (terminals [12]/[V2]) : Switchable from "0 to -10 VDC/0 to -100%" to "-10 to 0 VDC/0 to -100%" by external command.(terminal [12]) : Switchable from "4 to +20 mA DC/0 to 100%" to "+20 to 4 mA DC/0 to 100%" by external command.(terminal [C1]) : Switchable from "0 to +20 mA DC/0 to 100%" to "+20 to 0 mA DC/0 to 100%" by external command.(terminal [C1])	
	- Pulse train input (standard): Pulse input = Terminal [X5], Rotational direction = Another input terminal except [X5]. Complementary output: Max. 100 kHz, Open collector output: Max. 30 kHz	
	- Pulse train input (option):The PG option card is required. CW/CCW pulse, pulse + rotational direction Complementary output: Max. 100 kHz, Open collector output: Max. 30 kHz	
Acceleration/ deceleration time	− Setting range: From 0.00 to 6000 s − Switching: The four types of acceleration/deceleration time can be set or selected individually (switchable during operation). − Acceleration/deceleration pattern: Linear acceleration/deceleration, S-shape acceleration/deceleration (weak, free (set by function codes)), curvilinear acceleration/deceleration − Deceleration mode (coast-to-stop):Shut-off of the run command makes the motor coast to a stop. − ACC./DEC. time for "Jogging operation" can be set. (0.00 to 6000s) − Deceleration time for forcible stop: Deceleration stop by the forcible stop (STOP). S-curve will be canceled during "Force to Stop".	
Frequency limiter (Upper limit and lower limit frequencies)	− Specifies the upper and lower limits in Hz. − Selectable for the operation performed when the reference frequency drops below the lower limit specified by related function code.	
Bias for frequency/PID command	- Bias of set frequency and PID command can be independently set(setting range: 0 to ±100%).	
Analog input	− Gain : Set in the range from 0 to 200% − Off-set : Set in the range from -5.0 to +5.0% − Filter : Set in the range from 0.00s to 5.00 s − Polarity： Select from ± or +	
Jump frequency	- Three operation points and their common jump width (0.0 to 30.0 Hz) can be set.	
Timed operation	- Operate and stop by the time set with keypad. (1 cycle operation)	
Jogging operation	- Operation with RUN key (standard keypad), FWD or REV key (multi-functional keypad), or digital contact input FWD or REV.(Exclusive acceleration/deceleration time setting, exclusive frequency setting)	
Auto-restart after momentary power failure		
(Trip at power failure)	The inverter trips immediately after power failure.	
(Trip at power recovery)	Coast-to-stop at power failure and trip at power recovery.	
(Deceleration stop)	Deceleration stop at power failure, and trip after stoppage.	

Control	**(Continue to run)**	Operation is continued using the load inertia energy.	
	(Start at the frequency selected before momentary power failure)	Coast-to-stop at power failure and start after power recovery at the frequency selected before momentary stop.	
	(Start at starting frequency)	Coast-to-stop at power failure and start at the starting frequency after power recovery.	
	(Start at the searched frequency)	Coast-to-stop at power failure and start at the searched frequency after power recovery.	
	Hardware current limiter	- Limits the current by hardware to prevent an overcurrent trip caused by fast load variation or momentary power failure, which cannot be covered by the software current limiter. This limiter can be canceled.	
	Software current limiter	- Automatically reduces the frequency so that the output current becomes lower than the preset operation level. This limiter can be canceled.	
	Operation by commercial power supply	- With commercial power selection command, the inverter outputs 50/60 Hz (SW50,SW60).	
	Slip compensation	− Compensates the motor slip in order to keep their speed at the reference one regardless of their load torque. − Adjustable compensation time constant is possible.	
	Droop control	- In a machine driven with multi-motor system, this function adjusts the speed of each motor individually to balance their load torque.	
	Torque limiter **Torque current limiter**	Control output torque so that output torque is preset limiting value or less. - Switchable between 1st and 2nd torque limit values.	
		− Torque limit and Torque current limit are selectable. − Torque limit by analog input.	IMPG-VC PM-SVC
	Overload stopping	- When detected torque or current exceed the preset value, inverter will decelerate and stop or will coast to stop a motor.	
	PID Control	− PID processor for process control/dancer control − Normal operation/inverse operation − PID command: Keypad, analog input (from terminals [12], [C1] and [V2]), Multi-step setting(Selectable from 3 points), RS-485 communication − PID feedback value (from terminals [12], [C1] and [V2]) − Alarm output (absolute value alarm, deviation alarm) − Low liquid level stop function − Anti-reset wind-up function − PID output limiter − Integration reset/hold	
	Auto-reset	− The auto-reset function that makes the inverter automatically attempt to reset the tripped state and restart without issuing an alarm output (for any alarm) even if any protective function subject to reset is activated. − The allowable maximum number of reset times for the inverter to automatically attempt to escape the tripped state is 20.	
	Auto search for idling motor speed	- The inverter automatically searches for the idling motor speed to start to drive without stopping. (Motor constants must be needed tuning: Auto-tuning (offline))	
	Automatic deceleration	− If the DC link bus voltage or calculated torque exceeds the automatic deceleration level during deceleration, the inverter automatically prolongs the deceleration time to avoid overvoltage trip. (It is possible to select forcible deceleration actuated when the deceleration time becomes three times longer.) − If the calculated torque exceeds automatic deceleration level during constant speed operation, the inverter avoids overvoltage trip by increasing the frequency.	
	Deceleration characteristic (improved braking capacity)	- The motor loss is increased during deceleration to reduce the regenerative energy in the inverter to avoid overvoltage trip.	
	Auto energy saving operation	- The output voltage is controlled to minimize the total power loss of the motor and the inverter at a constant speed.	
	Overload prevention control	- If the ambient temperature or internal IGBT junction temperature is almost near the overheat level due to overload, the inverter drops its output frequency automatically in order to escape overload situation.	
	Battery/UPS operation	Cancels the undervoltage protection so that the inverter under an undervoltage condition runs the motor with battery/UPS power.	
	Auto-tuning (off-line)	− Measures the motor parameters while the motor is stopped or running, for setting up motor parameters. − Tuning mode to only identify %R1 and %X. − Tuning mode to identify the parameters for PM motor.	
	Auto-tuning (on-line)	- Automatically adjusts motor parameters while the motor is driving in order to prevent the motor speed fluctuation caused by the temperature rise of the motor.	
	Cooling fan ON/OFF control	− Detects inverter internal temperature and stops cooling fan when the temperature is low. − the fan control signal can be output to an external device.	

Control	**1st to 2nd motor settings**	- Switchable among the two motors It is possible to set the base frequency, rated current, torque boost, and electronic thermal slip compensation as the data for 1st to 2nd motors.	
	Universal DI	The status of external digital signal connected with the universal digital input terminal is transferred to the host controller.	
	Universal DO	Digital command signal from the host controller is output to the universal digital output terminal.	
	Universal AO	The analog command signal from the host controller is output to the analog output terminal.	
	Speed control	− Notch filter for vibration control (For IMPG-VC) − Selectable among the four set of the auto speed regulator (ASR) parameters. (The PG option card is required.)	IMPG-VC PM-SVC
	Line speed control	In a machine such as winder/unwinder, regulates the motor speed to keep the peripheral speed of the roll constant. (The PG option card is required.)	IMPG-VF
	Positioning control with pulse counter	The positioning control starts from the preset start point and counts the feedback pulses from PG inside the inverter. The motor can be automatically started decelerating to the cleep speed which can be detected the target position so that the motor can stop near the position.(The PG option card is required.)	Excluded IMPG-VC PM-SVC
	Master-follower operation	Enables synchronous operation of two motors equipped with a pulse generator(PG). (The PG option card is required.)	
	Pre-excitation	Excitation is carried out to create the motor flux before starting the motor.(The PG option card is required.)	IMPG-VC
	Zero speed control	The motor speed is held to zero by forcibly zeroing the speed command.(The PG option card is required.)	IMPG-VC
	Servo lock	Stops the motor and holds the motor in the stopped position.(The PG option card is required.)	IMPG-VC
	DC braking	When the run command turns OFF and the motor speed fall below the preset DC braking starting speed, the inverter starts to inject DC current into the motor in order to stop the motor. When the run command turns ON,the inverter starts to inject DC current into the motor in order to pre-excite.	
	Mechanical brake control	− The inverter can output the signal which ON/OFF timing adjusted so that the mechanical brake can be turned in conjunction with detected current, torque, frequency, and release/apply delay timers. − Mechanical brake interlock input	Excluded PM-SVC
	Torque control	− Analog torque/torque current command input − Speed limit function is provided to prevent the motor from becoming out of control. − Torque bias (analog setting, digital setting) (The PG option card is required.)	IMPG-VC
	Rotational direction control	- Select either of reverse or forward rotation prevention.	
	Customizable logic interface	The digital logic circuits and an analog arithmetic circuits can be chosen and connected with digital/analog input/output signals. The simple relay sequence which the customers' demands can be constituted and made to calculate. − Logic circuit (Digital) AND, OR, XOR, flip-flops, rising/falling edge detection,counters, etc. (Analog) Addition, subtraction, multiplication, division, limiter, absolute value, sign inversion addition, comparison, highest selection, lowest selection, average value, measure conversion . − Multifunctional timer On-delay, off-delay, pulse train, etc. Setting range: 0.0 to 9990 s − Input/output signal Terminal input/output(Digital and Analog), logic circuit output, inverter command/monitor data − Others The 200 steps are available. Each step has 2 inputs and 1 output.	
	Applicable functions for **− Wire drawing machine** **− Hoist** **− Spinning machine (Traverse)**	The specific functions which are suitable for each application field are realized by customizable logics.	
Indicate	**Display**	Detachable with 7 segments LEDs (4 digits) , 7 keys(PRG/RESET,FUNC/DATA,UP,DOWN, RUN,STOP,SHIFT) and 6LED indicator (KEYPAD CONTROL,Hz,A,kW,×10,RUN)	
	Running/Stopping	Speed monitor (reference frequency, output frequency, motor speed, load shaft speed, line speed, and speed indication with percent), Output current in RMS[A], Output voltage in RMS[V], Calculated torque [%], Input power [kW], PID command value, PID feedback value, PID output, Timer (Timed operation)[s], Load factor [%], Motor output [kW] Torque current [%] , Magnetic flux command [%], Analog input[%], Input watt hour [kWh] Constant feeding rate time (set value) (min), Constant feeding rate time (running) (s)	
	(Output frequency)	Output frequency before slip compensation.	
	(Output frequency)	Output frequency after slip compensation.	
	(Output current)	Output current in RMS.	
	(Output voltage)	Output voltage in RMS.	
	(Calculated torque)	Calculated output torque of the motor in %.	
	(Reference frequency)	Frequency specified by a frequency command.	
	(Rotational direction)	Rotational direction indicated. f: forward, r: reverse, ----: stop	

Indicate	**(Running status)**	Running status in 4-digit hexadecimal format.	
	(Motor speed)	Displayed value = (Output frequency Hz) × 120 / (No. of poles) If the value is 10000 or lager, the x10 LED turns ON and the LED monitor shows one-tenth of the value.	
	(Load shaft speed)	Displayed value = (Output frequency Hz) × (Function code E50: Coefficient for speed indication) If the value is 10000 or lager, the x10 LED turns ON and the LED monitor shows one-tenth of the value.	
	(Line speed)	Displayed value = (Output frequency Hz) × (Function code E50:Coefficient for speed indication) If the value is 10000 or lager, the x10 LED turns ON and the LED monitor shows one-tenth of the value.	
	(PID command value)	Physical quantity (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID command value using function code (PID display coefficients A and B). Displayed value = (PID command value) × (Coefficient A - B) + B If PID control is disabled, "----" appears.	
	(PID feedback amount)	Physical quantity (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID feedback amount using function code (PID display coefficients A and B). Displayed value = (PID feedback amount) × (Coefficient A - B) + B If PID control is disabled, "----" appears.	
	(Torque limit value)	Driving torque limit value A (based on motor rated torque). Braking 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 the ratio setting is not selected, "----" appears.	
	(E point pulse count)	Displays the E point of positioning control in the pulse count. Turning RTN OFF displays E point; turning it ON displays S point.	
	(Current position pulse count)	Displays the current position pulse count.	
	(Position deviation pulse count)	Displays the pulse count deviation between the current position and S point.	
	(Positioning control status)	Displays the position control status.	
	(PID output value)	PID output value in %. (100% means the maximum frequency) If PID control is disabled, "----" appears.	
	(Flux command value)	Flux command value in %.	IMPG-VC
	(Running status 2)	Running status 2 in 4-digit hexadecimal format.	
	(Reference torque)	Reference torque (based on the motor rated torque).	IMPG-VC
	(Reference torque current)	Reference torque current (based on the motor rated current).	IMPG-VC
	Life early warning	− The life early warning of the main circuit capacitors, capacitors on the PCBs and the cooling fan can be displayed. − An external output is issued in a transistor output signal. − Outputs the warning when the maintenance time or the number of start times has exceeded the preset.	
		− Ambient temperature: 40℃(104°F) − Load factor: Inverter rated current 100%(HHD spec.), 80%(HND/HD/ND spec.)	
	Maintenance monitor	- Displays DC link bus voltage, Max. Output current in RMS, Input watt-hour, Input watt-hour data, Temperature (inside the inverter and heat sink, Maximum value of each one), Capacitance of the DC link bus capacitor, Lifetime of DC link bus capacitor (elapsed hours and remaining hours), Cumulative run time of power-ON time counter of the inverter, electrolytic capacitors on the printed circuit boards, cooling fan and each motor, Remaining time before the next motor maintenance, Remaining startup times before the next maintenance, Number of startups (of each motor), Light alarm factors (Latest to 3rd last), Contents and numbers of RS-485 communications errors, Contents of CANOpen communications errors, Option error factors , Number of option errors, ROM version of the inverter, Keypad and Option port.	
	(Cumulative run time)	Shows the content of the cumulative power-ON time counter of the inverter. Counter range: 0 to 65,535 hours Display: Upper 2 digits and lower 3 digits are displayed alternately. Example: 0 <-> 535h (535 hours) 65 <-> 535h (65,535 hours) The lower 3 digits are displayed with h (hour). When the count exceeds 65,535, the counter will be reset to "0" and start over again.	
	(DC link bus voltage)	Shows the DC link bus voltage of the inverter main circuit.	
	(Max. temperature inside the inverter)	Shows the maximum temperature inside the inverter for every hour. (Temperatures below 20℃(68°F) are displayed as 20℃(68°F).)	
	(Max. temperature of heat sink)	Shows the maximum temperature of the heat sink for every hour. (Temperatures below 20℃(68°F) are displayed as 20℃(68°F).)	
	(Max. effective output current)	Shows the maximum current in RMS for every hour.	
	(Capacitance of the DC link bus capacitor)	Shows the current capacitance of the DC link bus capacitor in %, based on the capacitance when shipping as 100%.	
	(Cumulative run time of electrolytic capacitors on the printed circuit boards)	Shows the content of the cumulative run time counter of the electrolytic capacitors on the printed circuit boards, 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 Display range: 0 to 9999 and the "x10" LED turns ON. Actual cumulative run time of electrolytic capacitors on the printed circuit boards (hours) = Displayed value x 10 When the count exceeds 99,990 the counter stops and the LED monitor sticks to 9999.	
	(Cumulative run time of the 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 is enabled and the fan stops.	

Indicate	**(Number of startups)**	Shows the content of the motor 1 startup counter (i.e., the number of run commands issued). Counter range: 0 to 65,530 times Display range: 0 to 9999 If the count exceeds 10,000, the x10 LED turns ON and the LED monitor shows one-tenth of the value. When the count exceeds 65,530, the counter will be reset to "0" and start over again.	
	(Input watt-hour)	Shows the input watt-hour of the inverter. Display range: 0.001 to 9999 Input watt-hour = Displayed value × 100 kWh To reset the integrated input watt-hour and its data, set function code E51 to "0.000." When the input watt-hour exceeds 999,900 kWh, the counter will be reset to "0."	
	(Input watt-hour data)	Shows the value expressed by "input watt-hour (kWh) × E51" (whose data range is 0.000 to 9,999). Unit: None. (Display range: 0.001 to 9999 . The data 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. To reset the integrated input watt-hour data, set 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 9999, 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 1)	Shows the total number of errors that have occurred in the option. Once the count exceeds 9999, the counter will be reset to "0."	
	(Inverter's ROM version)	Shows the inverter's ROM version as a 4-digit code.	
	(Keypad's ROM version)	Shows the keypad's ROM version as 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 9999, 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 ROM version 1)	Shows the ROM version as a 4-digit code. If the option has no ROM, "----" appears on the LED monitor.	
	(Cumulative motor run time)	Shows the content of the cumulative power-ON time counter of motor 1. Counter range: 0 to 99,990 hours Display range: 0 to 9999 The x10 LED turns ON. Actual cumulative motor run time (hours) = Displayed value x 10 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 inside the inverter.	
	(Temperature of heat sink (real-time value))	Shows the current temperature of the heat sink inside the inverter.	
	(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.	
	(Lifetime of DC link bus capacitor (remaining hours))	Shows the remaining lifetime of the DC link bus capacitor, which is estimated by subtracting the elapsed time from the lifetime - HHD/HND/HD spec.:10 years - HND spec. of type FRN0012E2□-2G□,FRN0020E2□-2G□,FRN0007E2□-4G□,FRN0012E2□-4G□ /ND spec.:7yerars.	
	(Cumulative run time of motor 2)	Shows the content of the cumulative power-ON time counter of motor 2.	
	(Remaining time before the next motor 1 maintenance)	Shows the time remaining before 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 9999 The x10 LED turns ON. Time remaining before the next maintenance (hour) = Displayed value × 10	
	(Number of startups 2)	Shows the content of the motor 2 startup counter (i.e., the number of run commands issued).	
	(Remaining startup times before the next maintenance)	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.)	
	(Light alarm factor (Latest))	Shows the factor of the latest light alarm as an alarm code.	
	(Light alarm factor (Last))	Shows the factor of the last light alarm as an alarm code.	
	(Light alarm factor (2nd last))	Shows the factor of the 2nd last light alarm as an alarm code.	
	(Light alarm factor (3rd last))	Shows the factor of the 3rd last light alarm as an alarm code.	
	(Option error factor 1)	Shows the factor of the error that has occurred.	
	Number of built-in CAN communications errors	Shows the total number of errors that have occurred in the built-in CAN communications. Once the count exceeds 9999, the counter will be reset to "0."	

Indicate	**I/O checking**	Shows the status of the terminal Digital input/output, Relay out, Analog input/output.	
	(I/O signals on the control circuit terminals)	Shows the ON/OFF state of the digital I/O terminals.	
	(I/O signals on the control circuit terminals under communications control)	Shows the ON/OFF state of the digital I/O terminals that received a command via RS-485 and optional communications.	
	(Input voltage on terminal [12])	Shows the input voltage on terminal [12] in volts (V).	
	(Input current on terminal [C1])	Shows the input current on terminal [C1] in milliamperes (mA).	
	(Output voltage on terminal [FM])	Shows the output voltage on terminal [FM] in volts (V).	
	(Output frequency on terminal [FM])	Shows the output pulse rate per unit of time on terminal [FM] in (p/s).	
	(Input voltage on terminal [V2])	Shows the input voltage on terminal [V2] in volts (V).	
	(Output current on terminal [FM])	Shows the output current on terminal [FM] in milliamperes (mA).	
	Output voltage on terminal [FM2]	Shows the output current on terminal [FM2] in volts (V).	
	Output current on terminal [FM2]	Shows the output current on terminal [FM2] in milliamperes (mA).	
	(Option control circuit terminal (I/O) (options))	Shows the ON/OFF state of the digital I/O terminals on the digital input and output interface cards (option)	
	(Terminal [X5] pulse input monitor)	Shows the pulse rate of the pulse train signal on terminal [X5].	
	(PG pulse rate (A/B phase signal from the reference PG))	Shows the pulse rate (kp/s) of the A/B phase signal feed back from the reference PG. (The PG option card is required.)	
	(PG pulse rate (Z phase signal from the reference PG))	Shows the pulse rate (p/s) of the Z phase signal feed back from the reference PG. (The PG option card is required.)	
	(PG pulse rate (A/B phase signal from the controlled PG))	Shows the pulse rate (kp/s) of the A/B phase signal feed back from the controlled PG. (The PG option card is required.)	IMPG-VF IMPG-ATB IMPG-VC
	(PG pulse rate (Z phase signal from the controlled PG))	Shows the pulse rate (p/s) of the Z phase signal feed back from the controlled PG. (The PG option card is required.)	IMPG-VF IMPG-ATB IMPG-VC
	(Input voltage on terminal [32])	Shows the input voltage on terminal [32] on the analog interface card (option) in volts (V). (The AIO option card is required.)	
	(Input current on terminal [C2])	Shows the input current on terminal [C2] on the analog interface card (option) in milliamperes (mA). (The AIO option card is required.)	
	(Output voltage on terminal [AO])	Shows the output voltage on terminal [AO] on the analog interface card (option) in volts (V). (The AIO option card is required.)	
	(Output current on terminal [CS])	Shows the output current on terminal [CS] on the analog interface card (option) in milliamperes (mA). (The AIO option card is required.)	
	Locked by password	Limits to change or display in function code .	
	Trip mode	Displays the cause of trip by codes.	
	Light-alarm	Shows the light-alarm display L-AL .	
	Running or trip mode	− Trip history: Saves and displays the cause of the last four trips (with a code). − Saves and displays the detailed operation status data of the last four trips.	
PC-Loader	**Inverter loader**	Personal computer software tool that supports the operation of the inverter via an RS-485 communications link.	
	(Setting of function code)	Manage the function codes (list, edit, comparison, multi-monitor).	
	(Editing customizable logic) (Running status monitor)	Customizable logic editor.	
		I/O monitor, system monitor, alarm monitor and meter display.	
	(Test-running)	Remotely run or stop the inverter .	
	(Real-time trace)	The real-time trace monitors(minimum sampling time : 20 to 200ms) up to 4 analog readouts and up to 8 digital ON/OFF signals to display the running status of a selected inverter in real-time waveforms.	
	(Historical trace)	The historical trace monitors the running status of a selected inverter in greater detail with more contiguous waveforms than in the real-time trace. − Sampling time : 1 to 200ms − Up to 4 analog and 8 digital readouts(Maximum)(Data store size : 2kB)	

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

VF	V/f Control
IM-SVC(DTV)	Speed sensorless vector control (Dynamic torque
vector control) VF with SC	V/f control with slip compensation
IMPG-VF	V/f control with speed sensor (The PG option card is required.)
IMPG-ATB	V/f control with speed sensor (+Auto torque boost)(The PG option card is
required.) IMPG-VC	Vector control with speed sensor (The PG option card is required.)
PM-SVC	Magnetic pole position sensorless vector control

7. Protective Functions

Protective function	Overcurrent protection		The inverter is stopped for protection against overcurrent.	OC1
	Short-circuit protection		The inverter is stopped for protection against overcurrent caused by a short circuit in the output circuit.	OC2
	Ground fault protection		The inverter is stopped for protection against overcurrent caused by a grounding fault in the output circuit. (230V type 0115 or below / 460V type 0072 or below)	OC3
			Detecting zero-phase current of output current, the inverter is stopped for protection against overcurrent caused by a grounding fault in the output circuit. (460V type 0085 or above)	EF
	Overvoltage protection		The inverter is stopped when detected an excessive voltage (230V series: 400V DC / 460V series: 800V DC) in the DC link circuit. If an excessive voltage is applied by mistake, the protection can not be guaranteed.	OU1 OU2 OU3
	Undervoltage protection		The inverter is stopped when DC link bus voltage has dropped below the undervoltage detection level (230V series: 200VDC / 460V series: 400V DC). However, the alarm will not be issued when the re-starting after instantaneous stop is selected.	LU
	Input phase loss protection		− The input phase loss is detected to shut off the inverter output. This function protects the inverter. − When the load to be connected is small or DC REACTOR is connected a phase loss is not detected.	Lin
	Output phase loss detection		Stop the inverter output upon detection breaks in inverter output wiring at the start of running and during running,	OPL
	Overheat protection		Stop the inverter output upon detection of abnormal temperature of an inverter's heat sink, resulting from a cooling fan failure or overload.	OH1
			Stop the inverter output upon detection of an inner agitating fan failure. (460V type 0203 or above)	
			Stop the inverter output upon detection of abnormal temperature of the inverter inside, resulting from a cooling fan failure or overload.	OH3
			Stop the inverter output upon detection of abnormal temperature of the charging resistor inside the inverter. (230V type 0020 or below, 460V type 0012 or below and 0085 or above)	OH6
			Protect the braking resistor from overheat by setting the braking resistor electronic thermal function.	dbH
	Overload protection		Stop the inverter output upon detection of abnormal temperature of an inverter's heat sink and that of a switching element calculated from the output current.	OLU
	External alarm input		With the digital input signal (THR) opened, the inverter is stopped with an alarm.	OH2
	Fuse blown		The fuse inside the inverter blew. (460V type 0240 or above)	FUS
	Charging circuit abnormality		Stop the inverter output detecting the charge circuit abnormality in the inverter. (460V type 0203 or above)	PbF
	Brake transistor abnormality		Stop the inverter detecting the brake transistor abnormality. (DB transistor built-in type only)	dbA
	Over-speed protection		Stop the inverter output when the estimated speed/detected speed exceeds 120% of the maximum frequency or the upper limit frequency, whichever is smaller. (This function stops the inverter output even if the detected speed exceeds 120% of 200 Hz(Excluded ND spec.) under IMPG-VC mode, and if the estimated speed exceeds 120% of 500 Hz under PM-SVC mode, or estimated speed/detected speed exceeds 120% of 120Hz(ND spec.) under IMPG-VC mode or PM-SVC mode.)	OS
	Motor protection	Electronic thermal	The electronic thermal overload protection stops the inverter to protect the motor. Over all frequency range, whether to protect a synchronous motor with shaft-driven cooling fan or that with separately powered cooling fan can be specified. (The running level and thermal time constant (0.5 to 75.0 minutes) can be specified.)	OL1 OL2
		PTC thermistor	A PTC thermistor input stops the inverter to protect the motor. Connect a PTC thermistor between terminal C1 and 11 and set the switch on control print board and the function code.	OH4
		Overload early warning	Warning signal is output at the predetermined level before stopping the inverter with electronic thermal function.	—
	Command loss detected		A loss (breaking, etc.) of the frequency command is detected to output an alarm and the operation is continued at the preset frequency (set at a ratio to the frequency before detection).	—
	Memory error		Data is checked upon power-on and data writing to detect any fault in the memory. If any fault is detected, the inverter stops.	Er1
	Keypad communications error		The keypad is used to detect a communication fault between the keypad and inverter main body during operation and to stop the inverter.	Er2
	CPU error		Stop the inverter detecting a CPU error caused by noise.	Er3
	Option communications error		When each option is used, a fault of communication with the inverter main body is detected to stop the inverter.	Er4
	Option error		When each option is used, the option detects a fault to stop the inverter.	Er5
	Operation protection		STOP key priority Pressing the STOP key on the keypad or entering the digital input signal will forcibly decelerate and stop the motor even if the operation command through signal input or communication is selected. Er6 will be displayed after the stop.	Er6
			Start check: If the running command is being ordered when switching the running command method from power- on, alarm reset, or the linked operation, the operation starts suddenly. This function bans running and displays Er6 .	
	Tuning error		Stop the inverter output when tuning failure, interruption, or any fault as a result of tuning is detected during tuning for motor constant.	Er7
	RS-485 communications error (port1)		When the connection port of the keypad connected via RS-485 communication port to detect a communication error, the inverter is stopped and displays an error.	Er8

Protective function

RS-485 communications error (port2)	Stop the inverter output detecting the communication error between the inverter main unit and a mate when the RS-485 connection port of the keypad panel is used to configure the network.	ErP
Step-out detection	Stop the inverter output upon detection of a step-out of a PM-SVC mode.	Erd
Speed mismatch or excessive speed deviation	Stop the inverter output when the speed deviation (difference between reference speed and actual speed) excesses the specified value for IMPG-VC and PM-SVC mode.	ErE
	Stop the inverter output if a predetermined time has elapsed at start.	
Data save error during undervoltage	When the undervoltage protection function works, an alarm is displayed if the data is not properly saved.	ErF
Hardware error	Stop the inverter caused by an incorrect recognition of the power printed circuit board (power PCB).	ErH
Positioning control error	Stop the inverter output at detecting the excessive positioning deviation in the master-slave control mode and the servo lock mode. Also stop their output at detecting an undervoltage during position control mode or feedback pulse abnormality against its output frequency for IMPG-VC.	Ero
Abnormal setting related to the PG option card	Not ready to drive caused by abnormal setting related to the PG option card. Stop the inverter caused by incorrect connection or wire-break of the Z phase signal to PG option card.	PG
Mock alarm	Mock alarm is activated by the keypad operation.	Err
CAN bus communication error	An abnormal communication with the main body of the inverter is detected when the CAN bus is used, and the inverter is stopped.	Erb
PID feedback wire break detection	If the wire break of the current input [C1],[C2] allocated to the PID control feedback is detected, this function stops the inverter output(Enable/Disable selectable).	CoF
Enable circuit failure	Stop the inverter output detecting a failure of [EN1] or [EN2] circuit or the disagreement of [EN1] and [EN2] . Note that due to the internal circuit error, the reset feature of inverter itself cannot clear the alarm.	ECF
Customizable logic abnormality	Issues an alarm if a customizable logic configuration error is detected.	ECL
Locked by password	Alarm occurs if an malicious user fails to try to unlock password.	LoP
Light-alarm (warning)	The Following items can be registered as minor errors Alarm detection: Overheating of the heatsink (OH1), External alarm (OH2), Inverter overheat (OH3), Overheating of charging resistor(OH5), Overheating of braking resistor (dbH), Motor overload (OL1, OL2), Optional communication error (Er4), Option error (Er5), RS-485(port1) communication error (Er8), Inconsistent speed (excessive speed deviation) (FrE), RS-485 (port2) communication error (ErP), CAN bus communication error (Erb),Positioning control error (Ero),PID feedback wire break detection(CoF)	L-AL
	DC fan lock detected (460V type 0203 or above)	FAL
	Motor overload early warning	OL
	Heatsink overheat early warning	OH
	Life early warning (DC link bus capacitor electrolytic capacitor on printed circuit board cooling fan)	LIF
	Reference command loss detected	rEF
	PID warning output	Pid
	Low torque detected	UTL
	Thermistor detection (PTC)	PTC
	Machine life (cumulative motor run time error)	rTE
	Machine life (number of startups error)	CnT
Enable circuit turned off.	Not ready to drive because terminal EN1 and EN2 are both turned off.	--En
Alarm relay output (for any fault)	– The relay signal is output when the inverter stops upon an alarm. – PRG/RESET key, digital input (RST) or RESET command via communications are used to reset the alarm stop state.	
Stall prevention	Operates when the inverter output goes beyond the instantaneous overcurrent limiting level, and avoids tripping, during acceleration and constant speed operation.	
Retry function	When the inverter is tripped and stopped, this function automatically resets the tripping state and restarts operation. (Can be set retry counter and delay time to reset)	

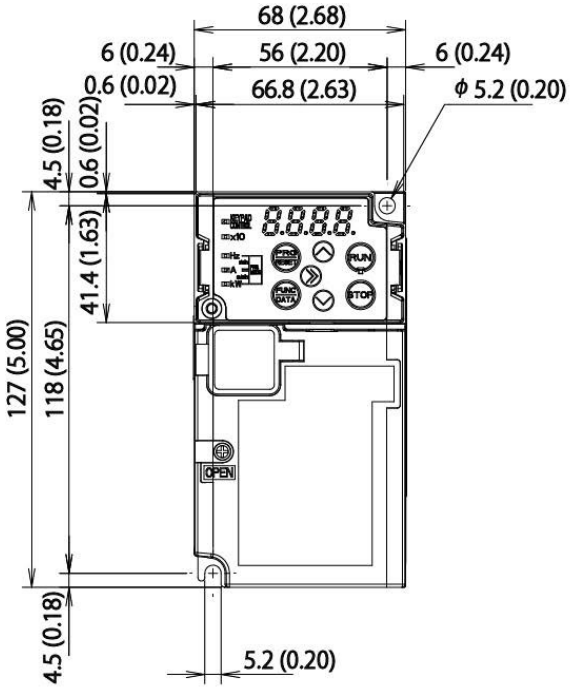
Protective function	Surge protection	The inverter is protected against surge voltage intruding between the main circuit power line and ground.	
	Momentary power failure protection	− A protective function (inverter stoppage) is activated upon a momentary power failure. − If restart upon momentary power failure is selected, the inverter restarts upon recovery of the voltage within the set time.	
	Command loss detection	When a loss (wire break, etc.) of the frequency command is detected, this function outputs an alarm and automatically continue to run at the preset frequency (set at a ratio to the frequency before detection).	
	Current limiter performed by hardware	− Limits the current by hardware to prevent an overcurrent trip from being caused by fast load variation or momentary power failure, which cannot be covered by the software current limiter. This limiter can be canceled. − This function protects demagnetization in permanent magnet synchronous motor driving mode(PM-SVC).	
	Current limiter performed by software	− Automatically decrease the output frequency so that the output current may become within the permitted level. − Selects the motor running state in which the current limiter becomes activated. − This function protects demagnetization in permanent magnet synchronous motor driving mode(PM-SVC).	
	Torque limiter	− Switchable between 1st and 2nd torque limit values − Torque limit, torque and current limit can be set.(IMPG-VC,PM-SVC) − Analog torque limit input	

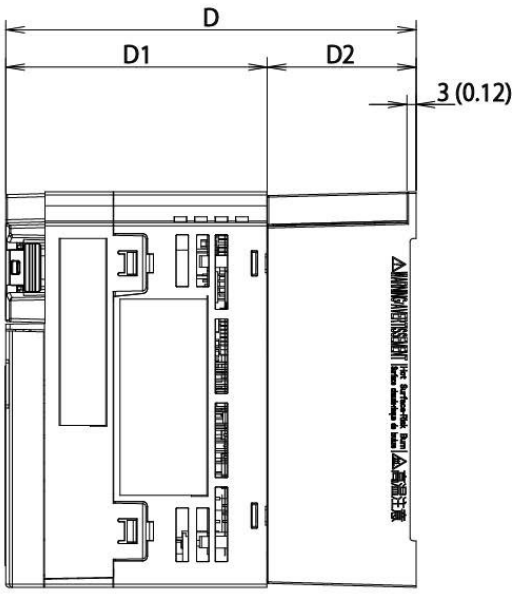
8. Options for operation and communication

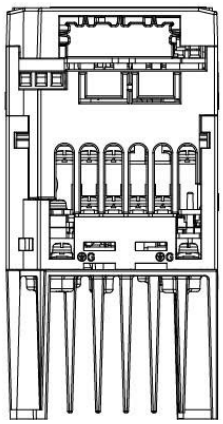
Option	Type	Functions
DeviceNet communications card	OPC-DEV	The DeviceNet interface option enables the FRENIC-Ace series of the inverters to interface with DeviceNet and the FRENIC-Ace can be operated as a DeviceNet slave.
CC-Link communications card	OPC-CCL	The CC-Link interface option enables the FRENIC-Ace series of the inverters to interface with CC-Link and the FRENIC-Ace can be operated as a CC-Link slave.
PROFIBUS-DP communications card	OPC-PDP3	The PROFIBUS DP interface option enables the FRENIC-Ace series of the inverters to interface with PROFIBUS DP and the FRENIC-Ace can be operated as a PROFIBUS DP slave.
EtherNet/IP, ProfiNet-RT communications card	OPC-PRT	This interface option enables the FRENIC-Ace series of the inverters to interface with EtherNet or ProfiNet-RT and the FRENIC-Ace can be operated as a EtherNet slave.
RS485 communications card	OPC-E2-RS	The RS-485 communications card provides two ports exclusively designed for use with the FRENIC-Ace series of the inverters.
CANopen communications card	OPC-COP	The CANopen interface option enables the FRENIC-Ace series of the inverters to interface with CANopen and the FRENIC-Ace can be operated as a CANopen slave.
PG interface (5 V) card	OPC-E2-PG	Speed control ,position control and synchronous drive are available mounting this card in the inverter. ・Open collector (pull-up resistor: 620Ω):30kHz ・Complementary (totem-pole push-pull) ・Voltage output:30kHz Terminal YA, YB, YZ are available to switch between the reference and feedback.
PG interface (12/15V) card	OPC-E2-PG3	Speed control ,position control and synchronous drive are available mounting this card in the inverter. ・Open collector (pull-up resistor: 2350Ω):30kHz ・Complementary (totem-pole push-pull) ・Voltage output:100kHz Terminal YA, YB, YZ are available to switch between the reference and feedback.
Digital I/O interface card	OPC-DIO	DI：The frequency set-point can be given by 8,12 bits and BCD code(0 to 99.9/0 to 999) and extended 13 digital inputs are available mounting this card in the inverter. DO：The monitoring with 8bit binary code and the digital outputs (extended 8 point) are available.
Analog I/O interface card	OPC-AIO	The Analog I/O interface card enables the FRENIC-Ace series of the inveretr to input analog set-points to the inverter and output analog monitors from the inverter.
Mounting adapter for option card	OPC-E2-ADP1 OPC-E2-ADP2 OPC-E2-ADP3	These adapters must be used at mounting the option cards except those of the terminal type. ADP1:The adapter is mounted on the front side of the inverter. ADP2,ADP3:The adapter is mounted inside of the inverter. The choice of ADP1,ADP3 or ADP2 is depended on the inverter capacity .
Multi-functional keypad	TP-A1-E2C	The operation keypad adopted LCD(Liquid Crystal Display) with a back light. The keypad can respond to many languages.
Simple keypad with USB port	TP-E1U	The operation keypad adopted large-sized 7 segment LED to be excelled in visibility. And the one do not need any converter which connects to a computer directly with a commercial USB cable (mini B) to be able to use a FRENIC loader.

Note：Two or more communication cards

External Dimensions

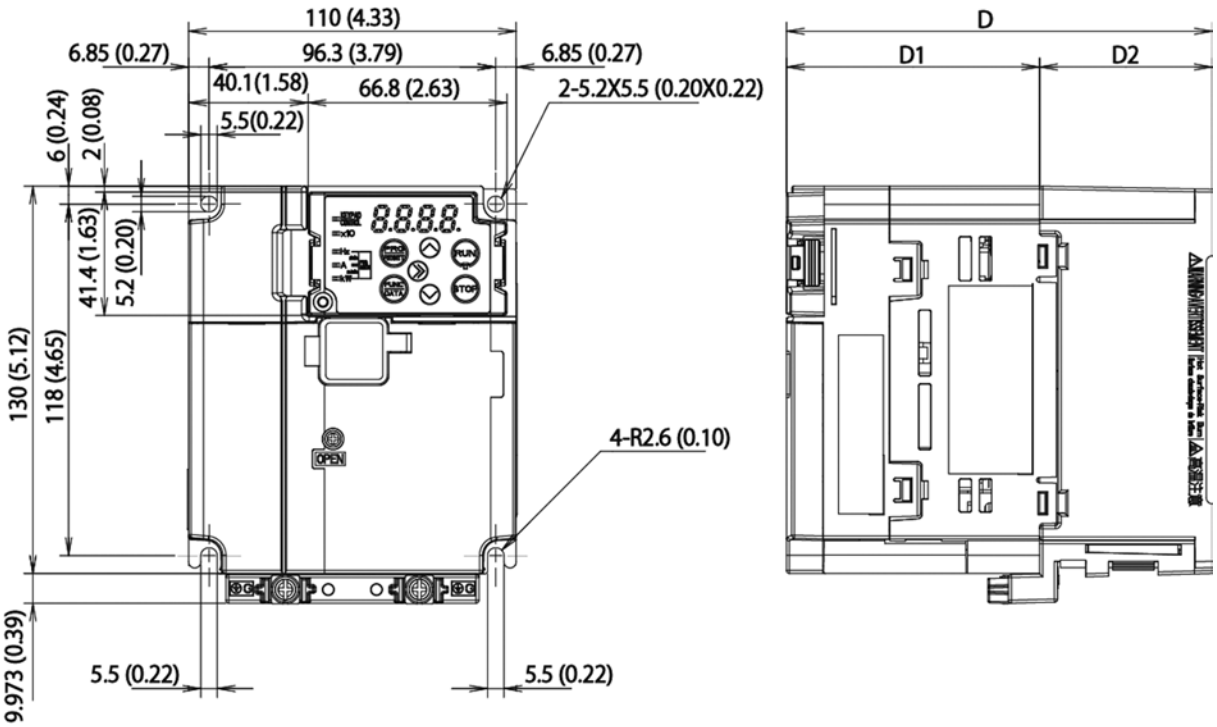


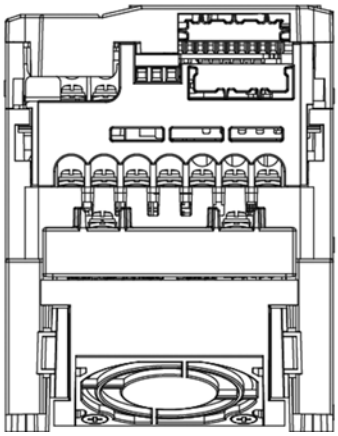




[Unit: mm (inch)]

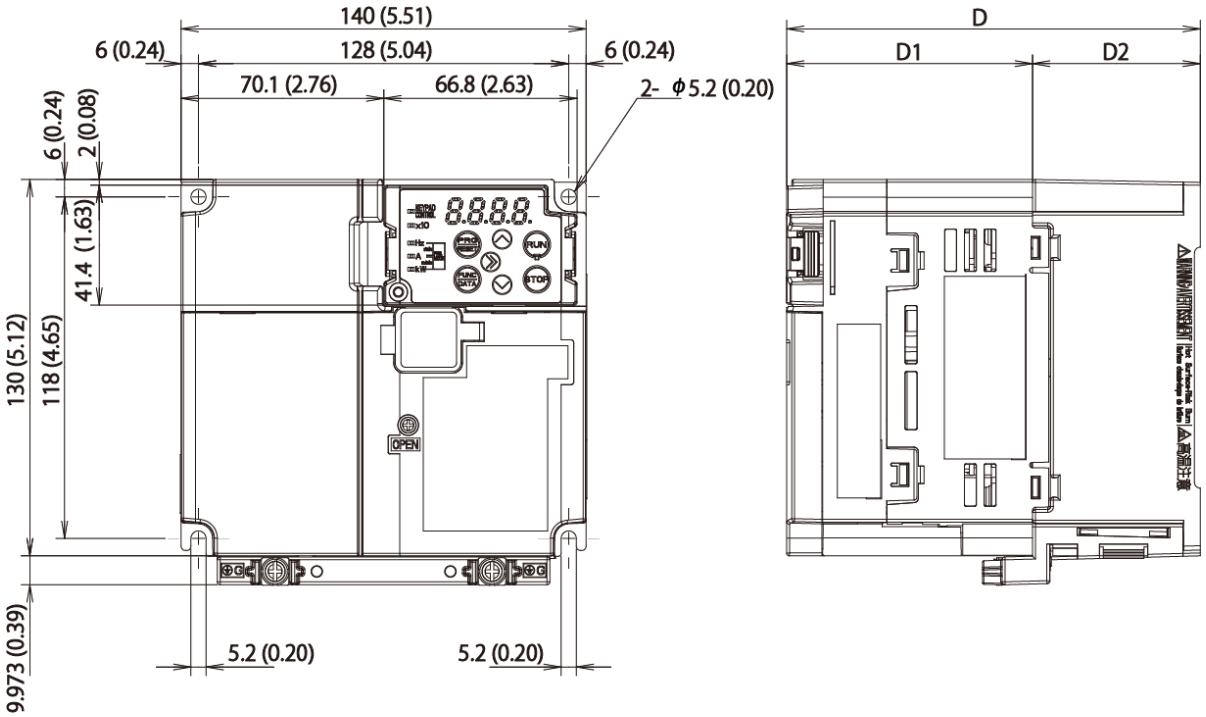
Power supply voltage	Inverter type	Dimension [mm (inch)]		
		D	D1	D2
Three-phase 230V	FRN0001E2S-2GB	85 (3.35)	77 (3.03)	8 (0.31)
	FRN0002E2S-2GB	85 (3.35)	77 (3.03)	8 (0.31)
	FRN0004E2S-2GB	100 (3.94)	77 (3.03)	23 (0.91)
	FRN0006E2S-2GB	132 (5.20)	84 (3.31)	48 (1.89)
Single-phase 230V	FRN0001E2S-7GB	85 (3.35)	77 (3.03)	8 (0.31)
	FRN0002E2S-7GB	85 (3.35)	77 (3.03)	8 (0.31)
	FRN0003E2S-7GB	107 (4.21)	84 (3.31)	23 (0.91)
	FRN0005E2S-7GB	152 (5.98)	104 (4.09)	48 (1.89)

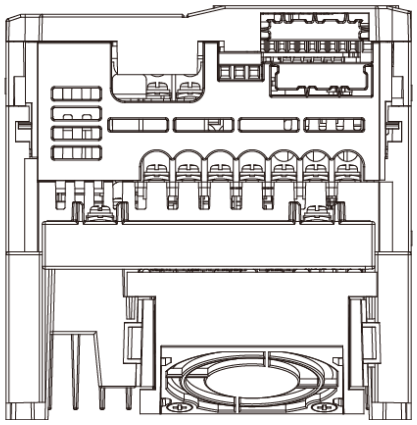




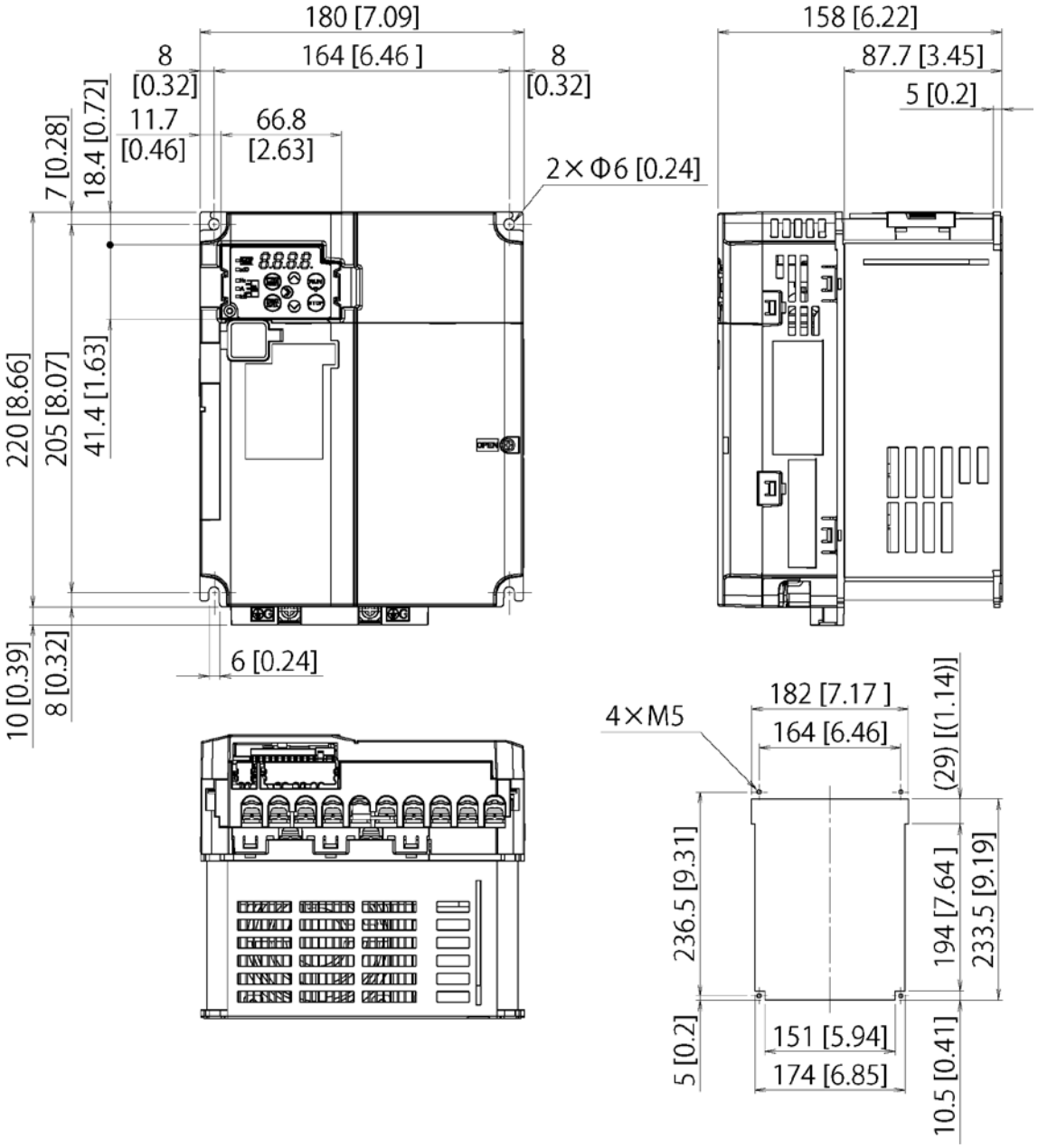
[Unit: mm (inch)]

Power supply voltage	Inverter type	Dimension [mm (inch)]		
		D	D1	D2
Three-phase 230V	FRN0010E2S-2GB	143 (5.63)	85 (3.35)	58 (2.28)
	FRN0012E2S-2GB	143 (5.63)	85 (3.35)	58 (2.28)
Three-phase 460V	FRN0002E2S-4GB	119 (4.69)	85 (3.35)	34 (1.34)
	FRN0004E2S-4GB	143 (5.63)	85 (3.35)	58 (2.28)
	FRN0006E2S-4GB	143 (5.63)	85 (3.35)	58 (2.28)
	FRN0007E2S-4GB	143 (5.63)	85 (3.35)	58 (2.28)
Single-phase 230V	FRN0008E2S-7GB	153 (6.02)	95 (3.74)	58 (2.28)



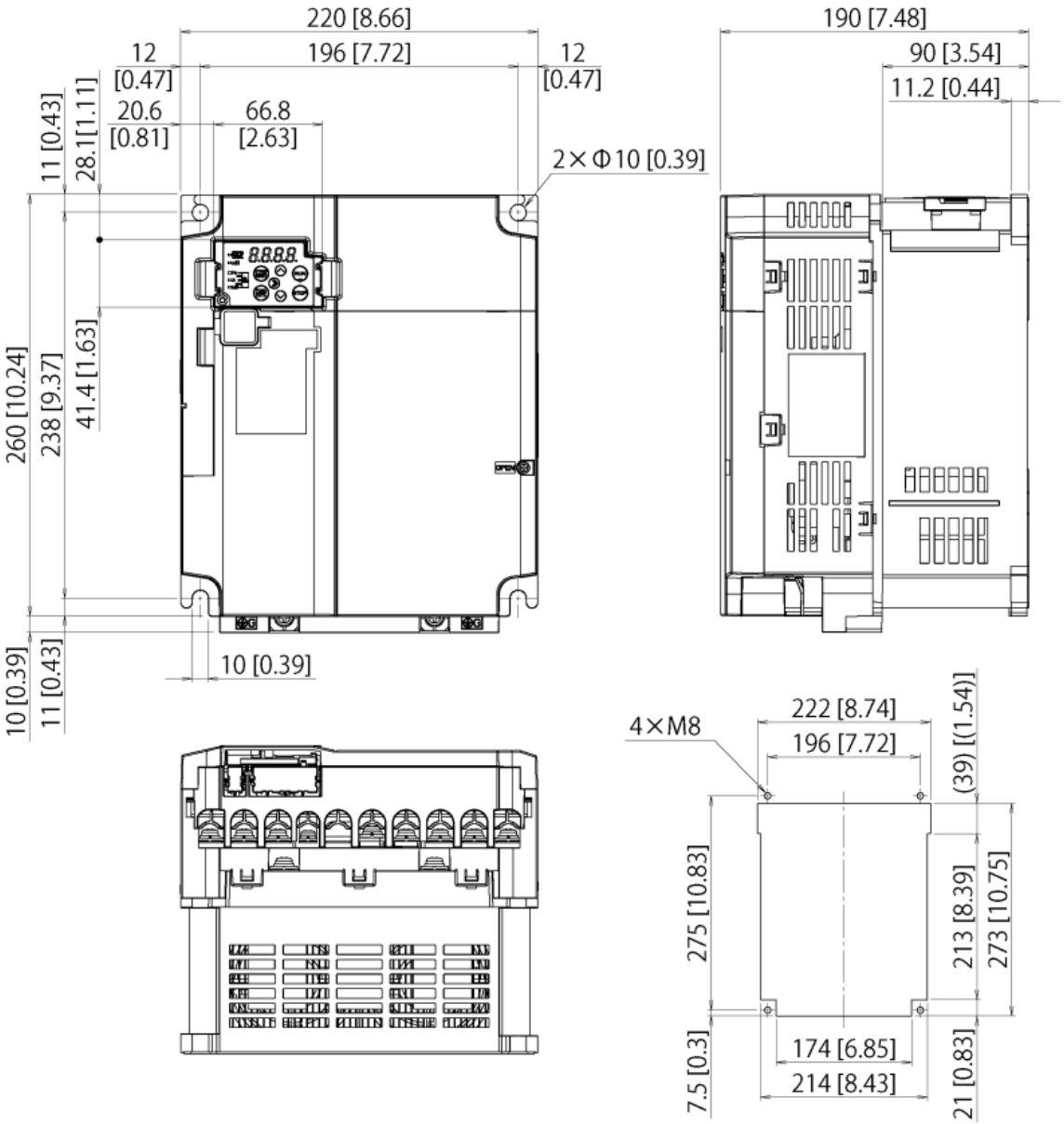


Power supply voltage	Inverter type	Dimension [mm (inch)]		
		D	D1	D2
Three-phase 230V	FRN0020E2S-2GB	143 (5.63)	85 (3.35)	58 (2.28)
Three-phase 460V	FRN0012E2S-4GB	143 (5.63)	85 (3.35)	58 (2.28)
Single-phase 230V	FRN0011E2S-7GB	143 (5.63)	85 (3.35)	58 (2.28)



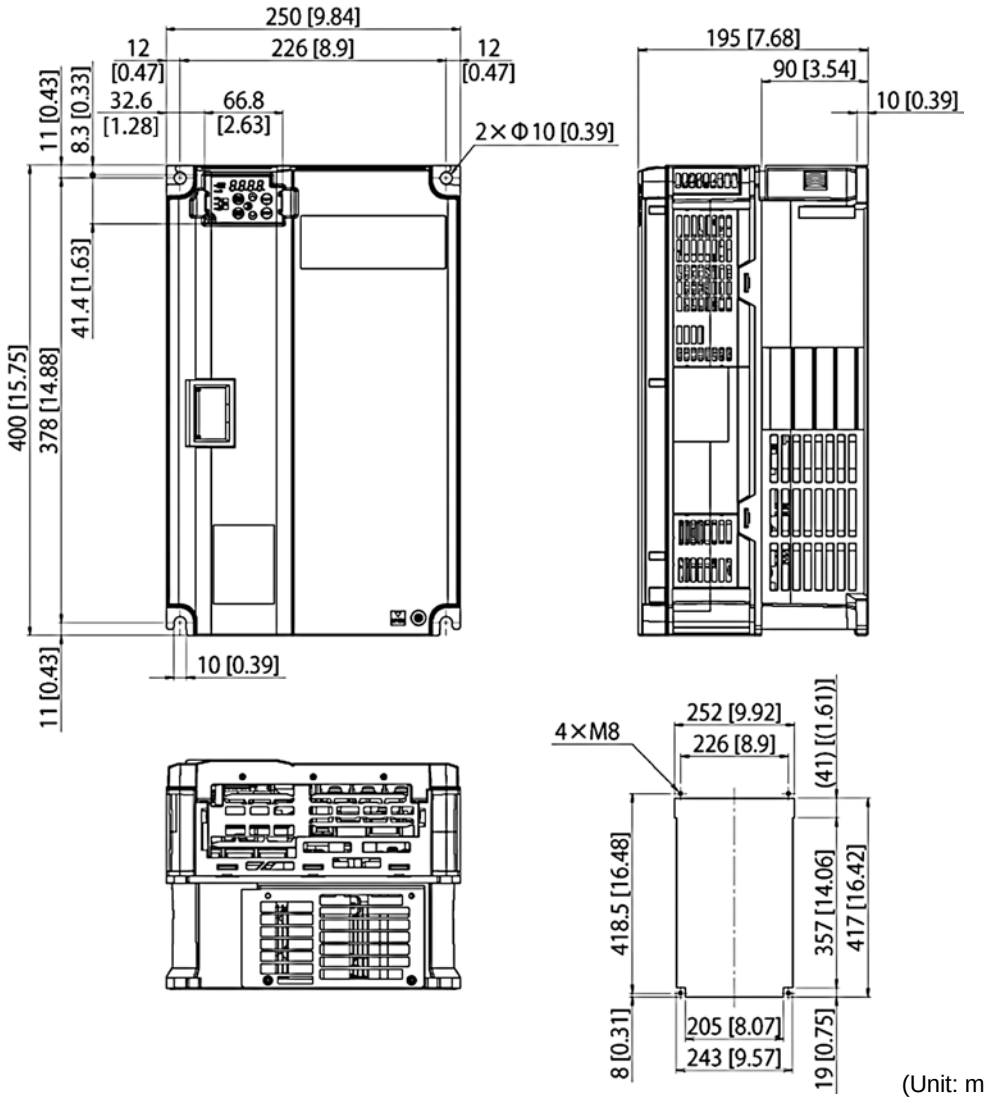
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 230V	FRN0030E2S-2GB
	FRN0040E2S-2GB
Three-phase 460V	FRN0022E2S-4GB
	FRN0029E2S-4GB



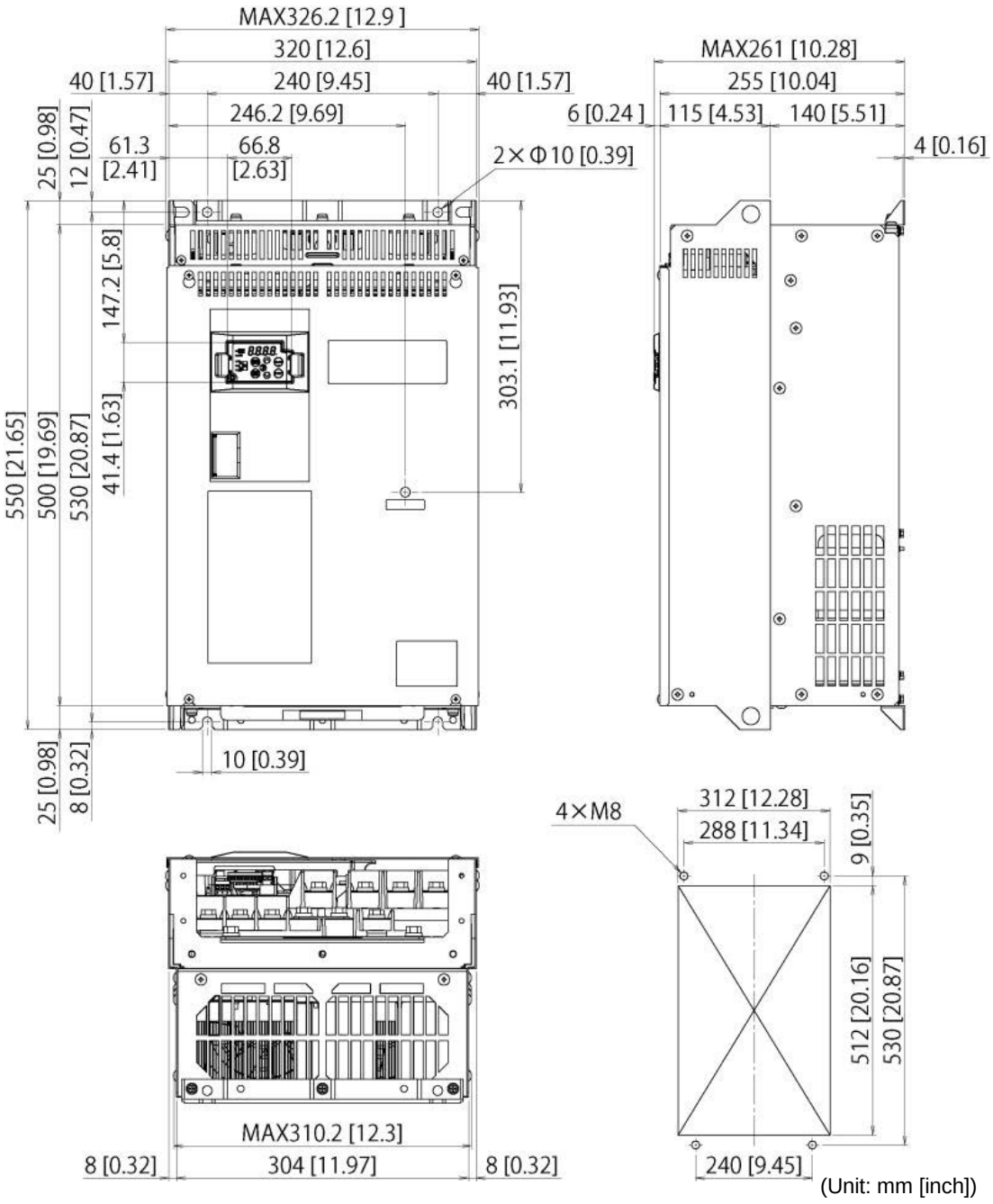
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 230V	FRN0056E2S-2GB
	FRN0069E2S-2GB
Three-phase 460V	FRN0037E2S-4GB
	FRN0044E2S-4GB



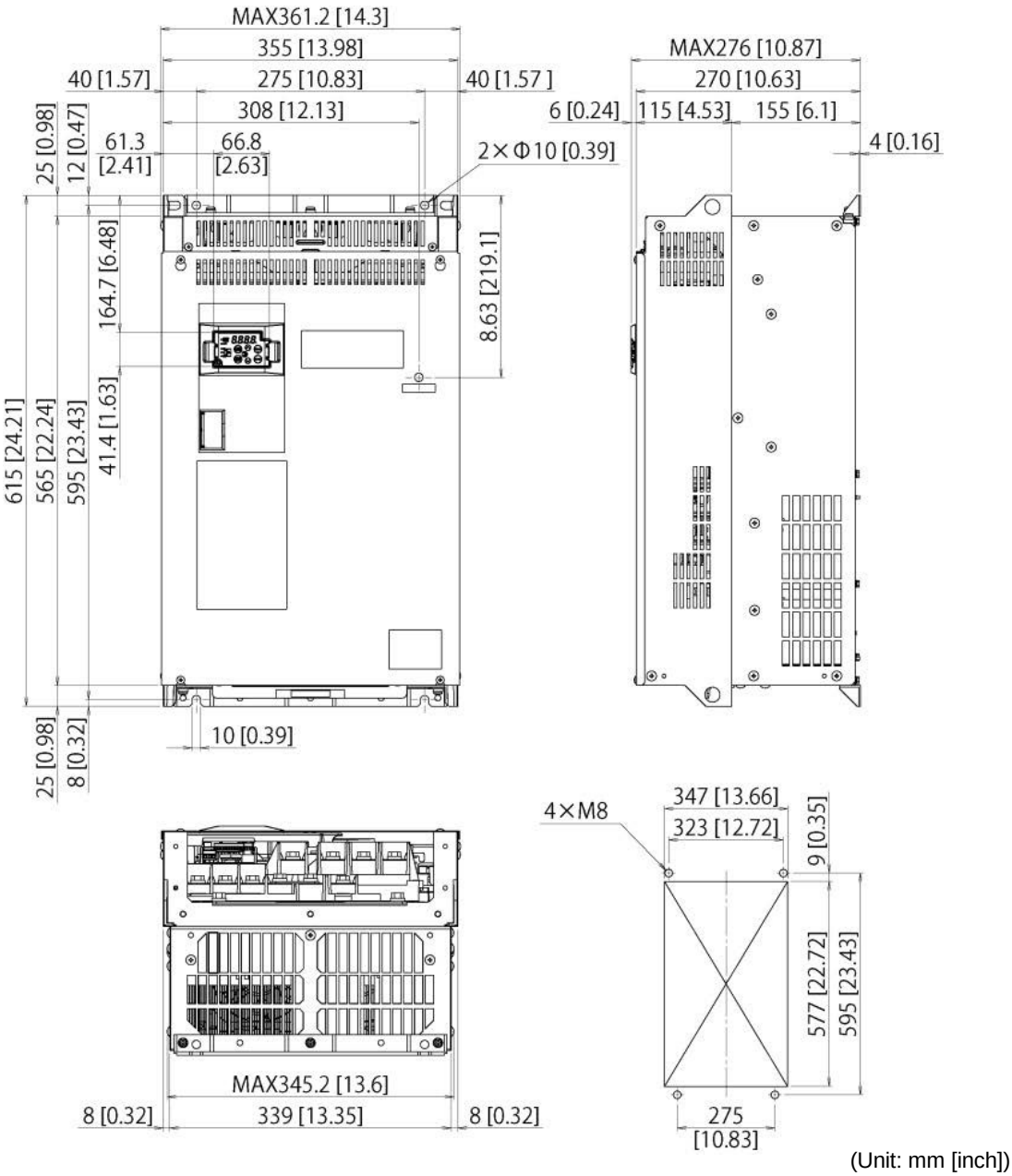
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 230V	FRN0088E2S-2GB
	FRN0115E2S-2GB
Three-phase 460V	FRN0059E2S-4GB
	FRN0072E2S-4GB



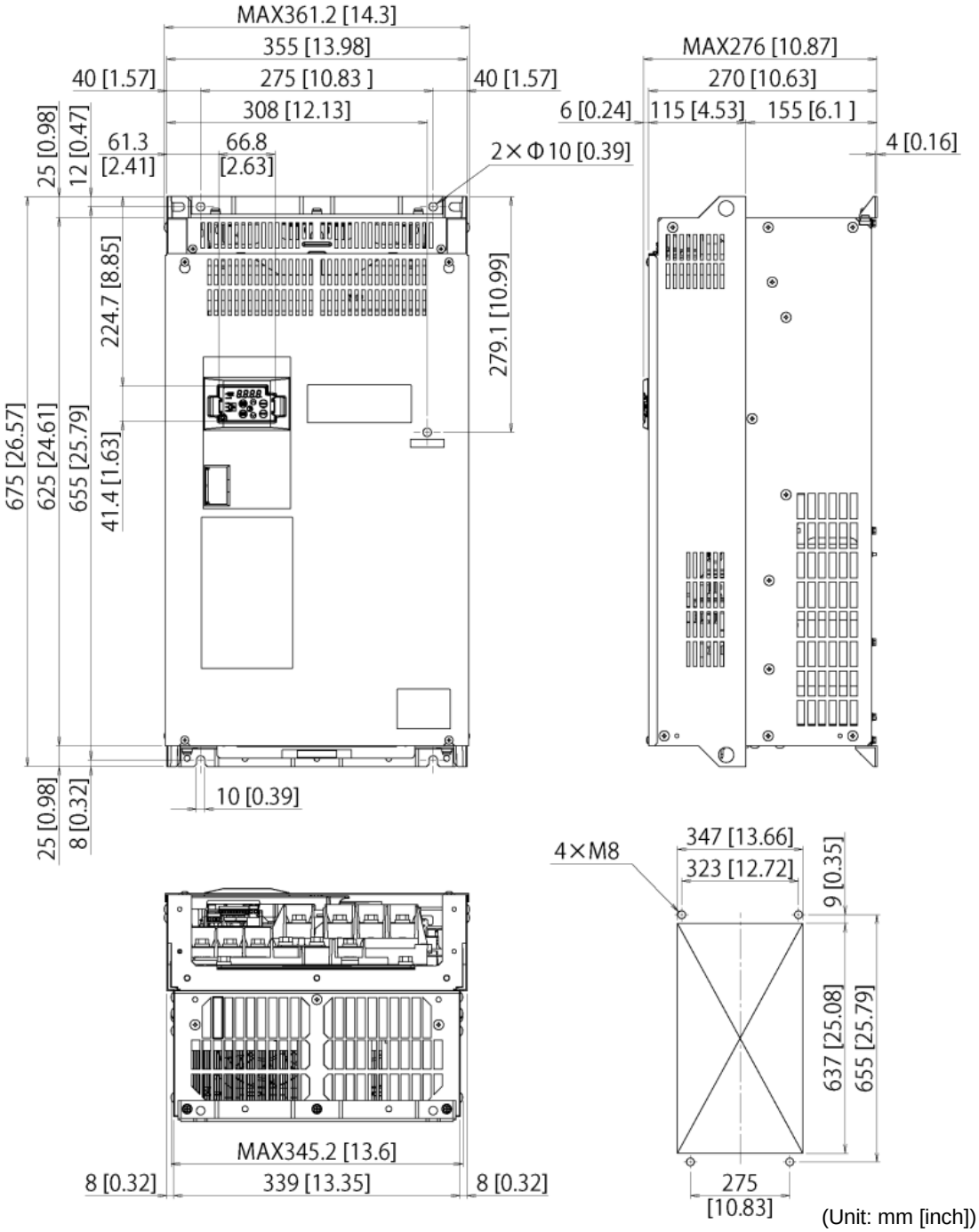
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0085E2S-4GB
	FRN0105E2S-4GB



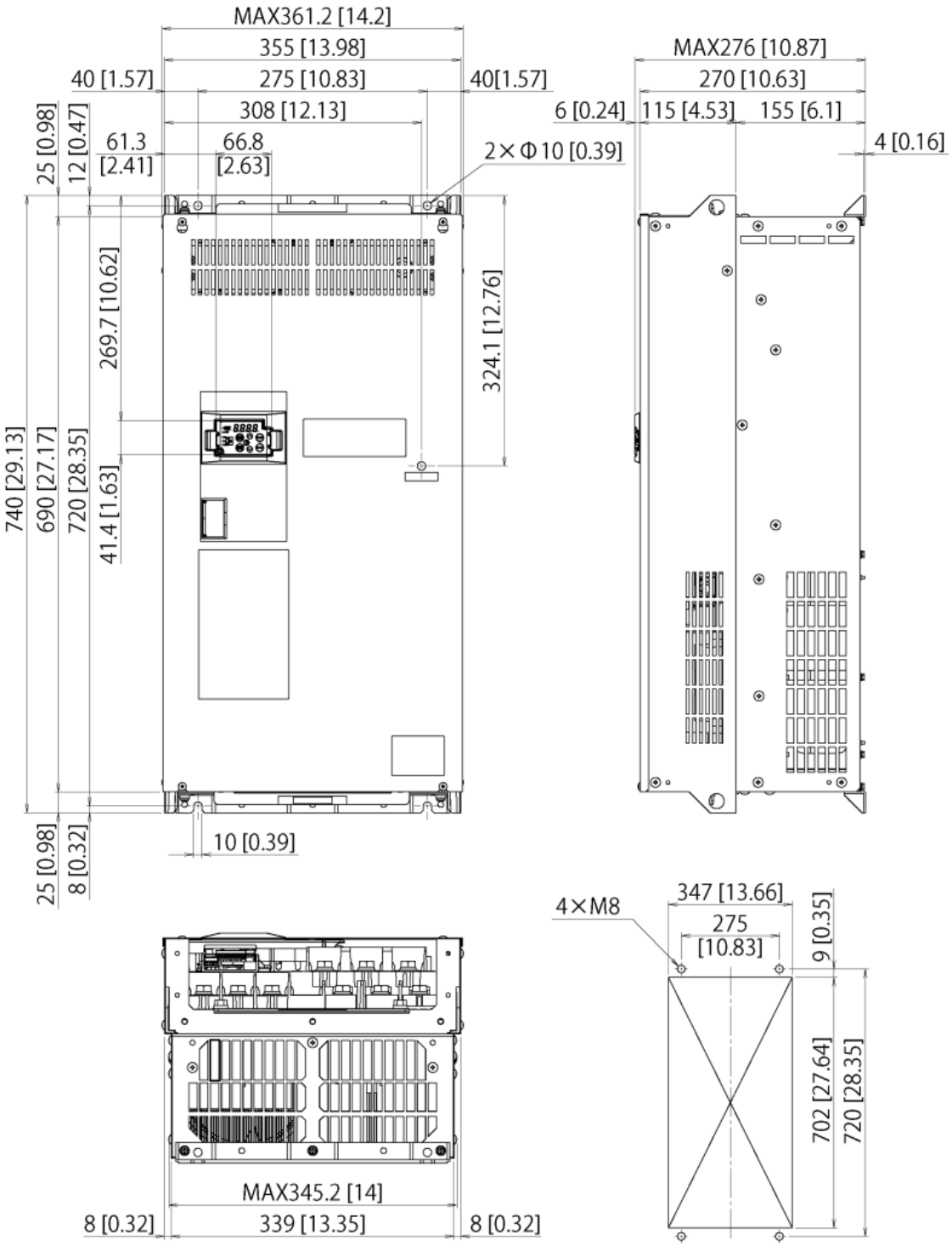
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0139E2S-4GB



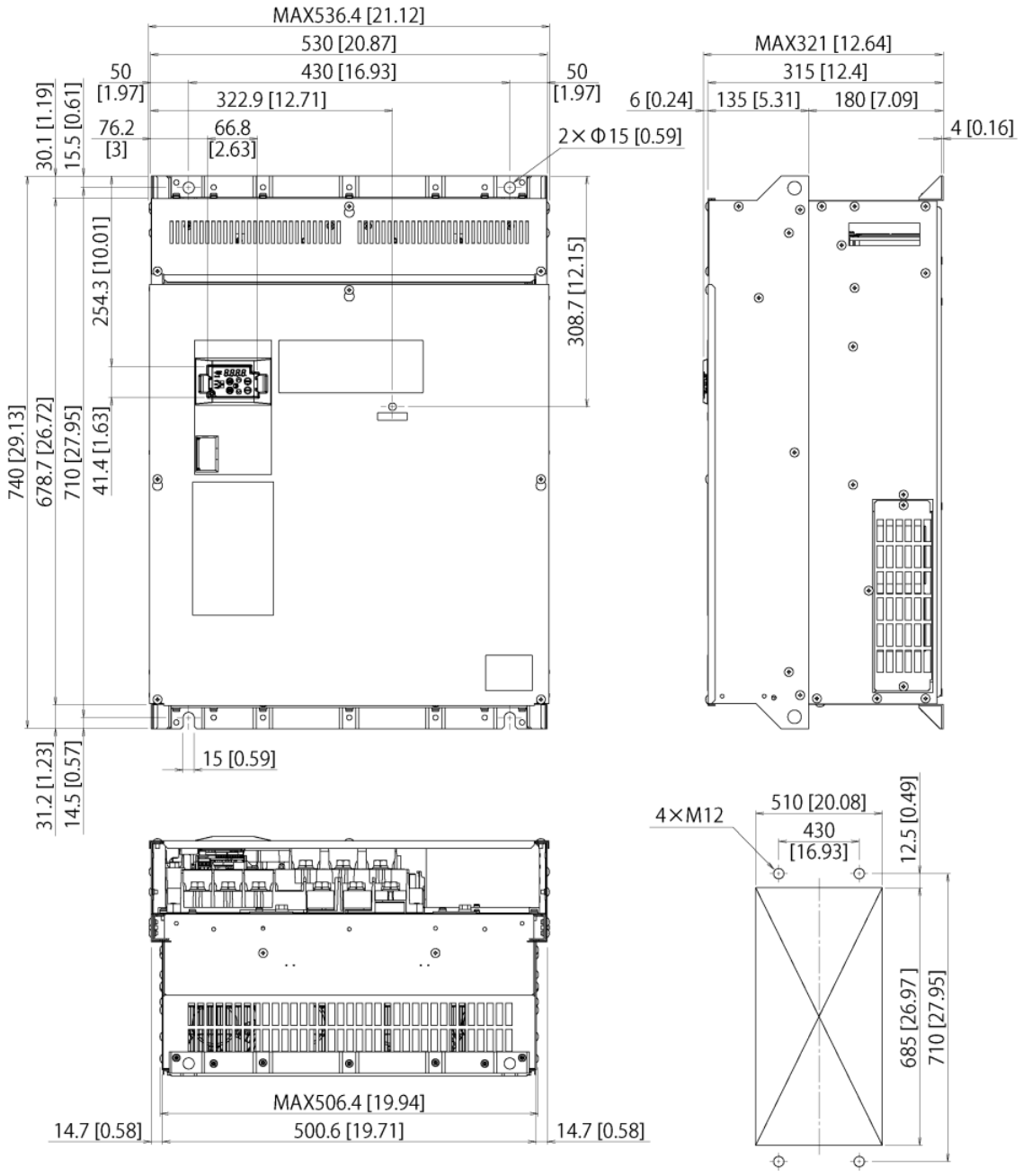
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0168E2S-4GB



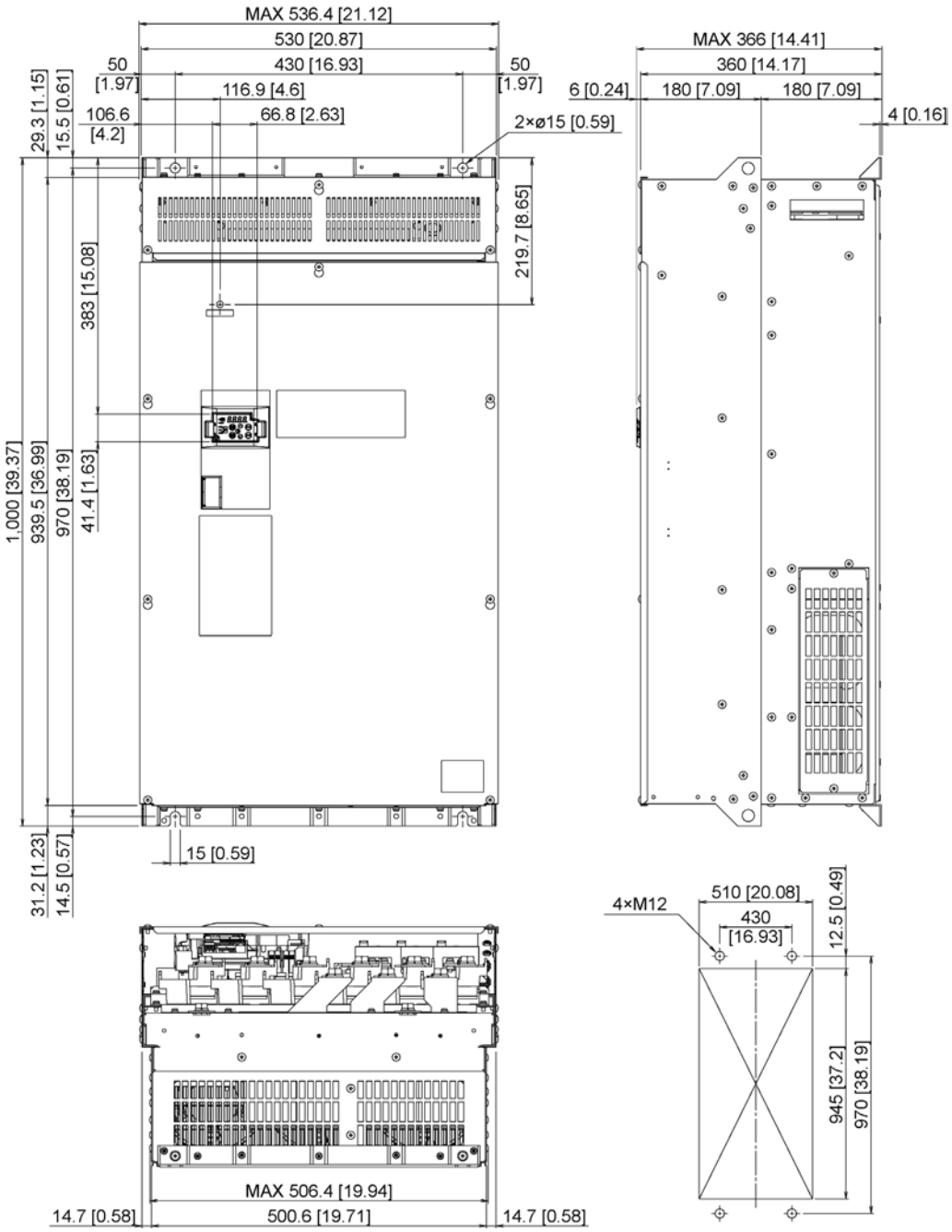
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0203E2S-4GB



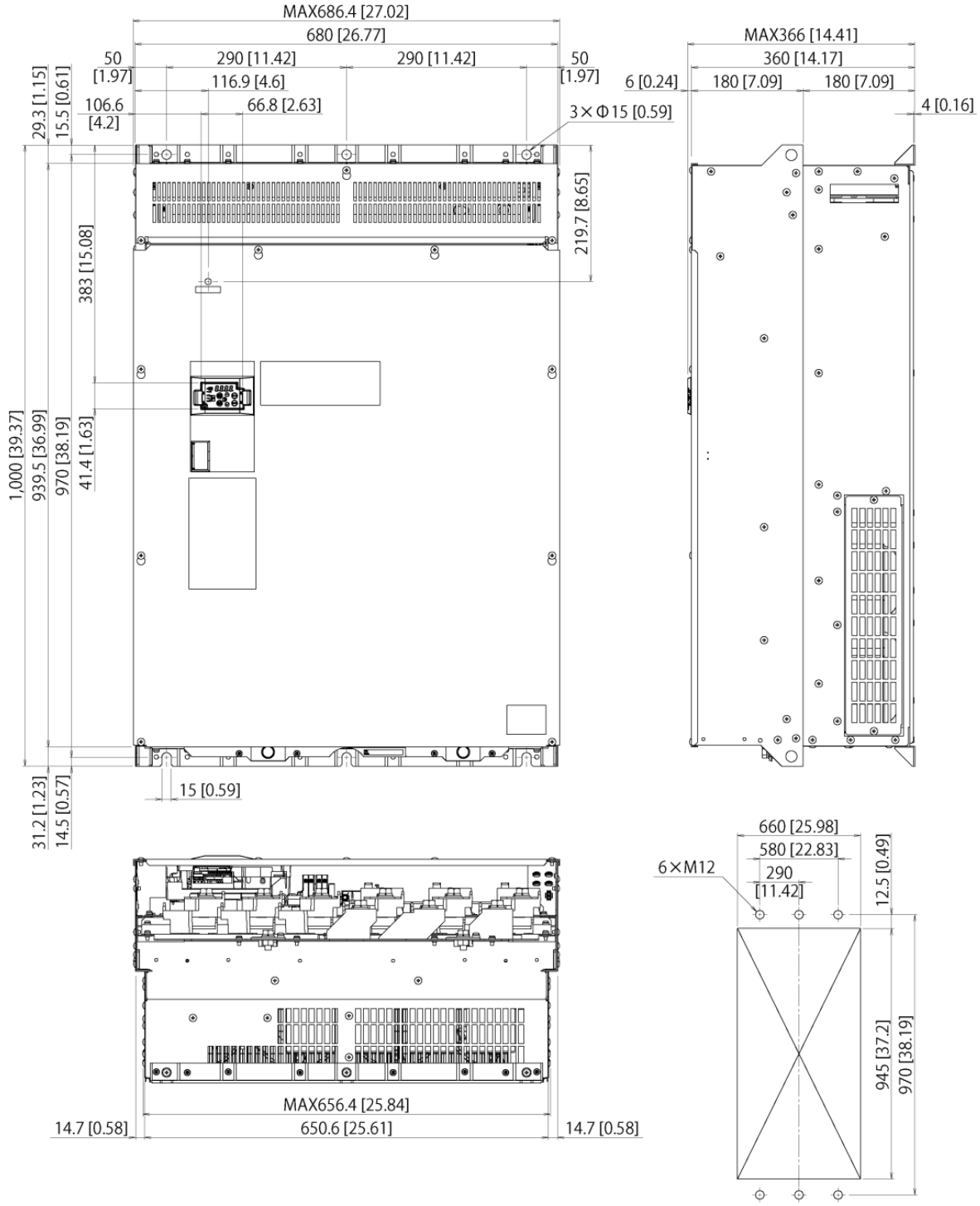
(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0240E2S-4GB
	FRN0290E2S-4GB



(Unit: mm [inch])

Power supply voltage	Inverter type
Three-phase 460V	FRN0361E2S-4GB
	FRN0415E2S-4GB

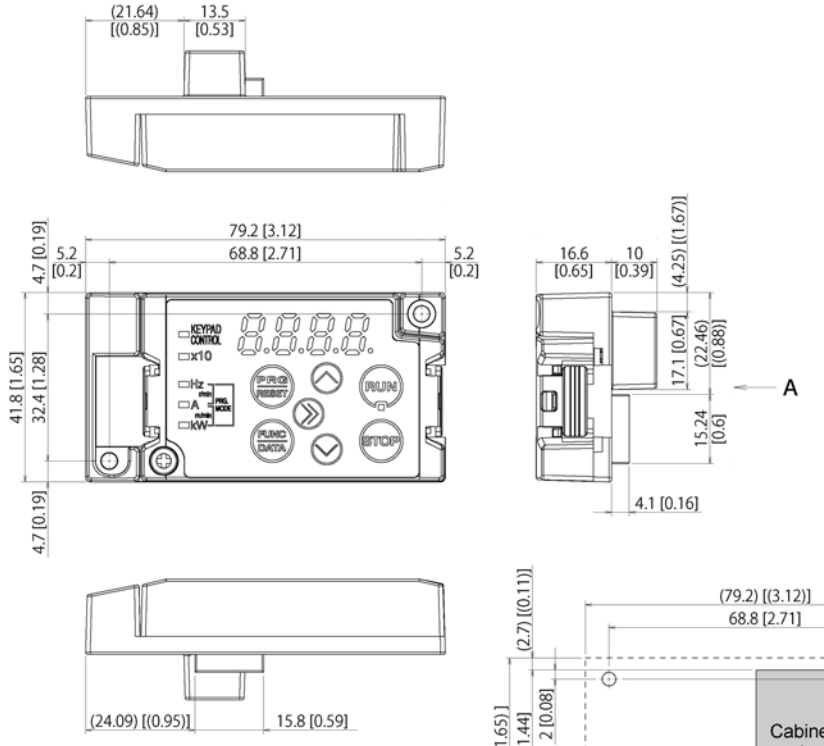


(Unit: mm [inch])

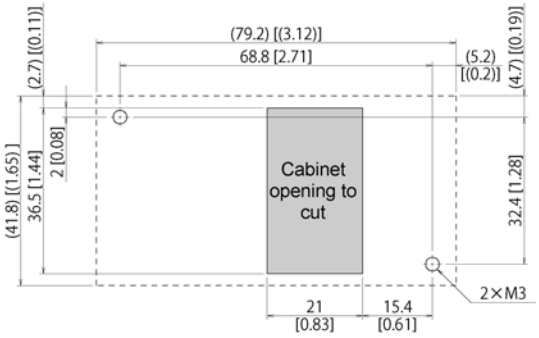
Power supply voltage	Inverter type
Three-phase 460V	FRN0520E2S-4GB
	FRN0590E2S-4GB

Keypad

(Unit: mm [inch])

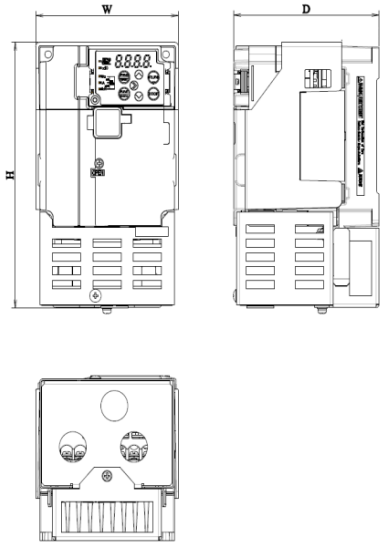


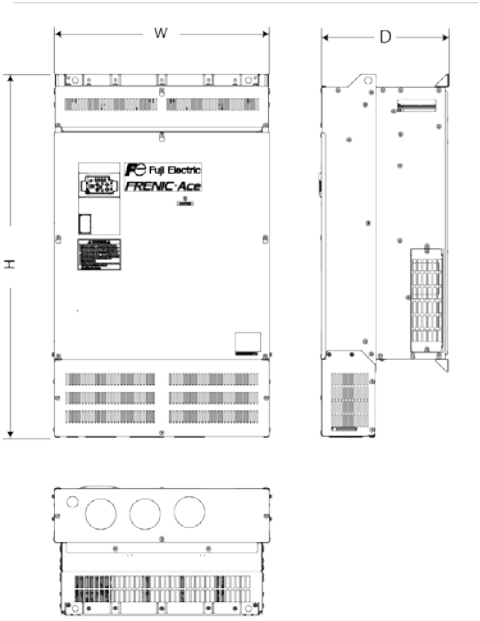
When operating the keypad at remote location or mounting it in a panel (Keypad rear cover attached)



Dimensions of panel cutting (viewed from arrow “A”)

External Dimensions with NEMA 1 Kit Attached





FRN0085E2S-4GB and above

Dimensions inch (mm)

1PH 230V	3PH 230V	3PH 460V	W	H	D
FRN0001E2S-7GB	FRN0001E2S-2GB		2.92 (74.2)	7.00 (177.8)	3.41 (86.6)
FRN0002E2S-7GB	FRN0002E2S-2GB				
	FRN0004E2S-2GB				4.00 (101.6)
	FRN0006E2S-2GB				5.26 (133.6)
FRN0003E2S-7GB					4.28 (108.6)
FRN0005E2S-7GB			2.94 (74.8)		6.05 (153.6)
		FRN0002E2S-4GB	4.59 (116.6)	7.48 (190.1)	4.69 (119)
	FRN0010E2S-2GB	FRN0004E2S-4GB			5.63 (143)
	FRN0012E2S-2GB	FRN0006E2S-4GB			
		FRN0007E2S-4GB			
FRN0008E2S-7GB					6.02 (153)
FRN0011E2S-7GB	FRN0020E2S-2GB	FRN0012E2S-4GB	5.76 (146.4)	7.93 (201.4)	5.63 (143)
	FRN0030E2S-2GB	FRN0022E2S-4GB	7.33 (186.2)	12.40 (315.0)	6.22 (158)
	FRN0040E2S-2GB	FRN0029E2S-4GB			
	FRN0056E2S-2GB	FRN0037E2S-4GB	8.91 (226.2)	13.86 (352.0)	7.48 (190)
	FRN0069E2S-2GB	FRN0044E2S-4GB			
	FRN0088E2S-2GB		9.84 (250.0)	19.29 (490.0)	7.68 (195.0)
		FRN0059E2S-4GB		22.24 (565.0)	
		FRN0072E2S-4GB			
	FRN0115E2S-2GB			22.05 (560.0)	
		FRN0085E2S-4GB	12.73 (323.4)	28.35 (720.0)	10.04 (255.0)
		FRN00105E2S-4GB			
		FRN0139E2S-4GB	14.11 (358.4)	31.69 (805.0)	11.42 (290.0)
		FRN0168E2S-4GB		34.06 (865.0)	
		FRN0203E2S-4GB		36.61 (930.0)	
		FRN0240E2S-4GB	21.00 (533.4)	35.43 (900.0)	12.40 (315.0)
		FRN0290E2S-4GB			
		FRN0361E2S-4GB		49.61 (1260.0)	14.17 (360.0)
		FRN0415E2S-4GB			
		FRN0520E2S-4GB	26.91 (683.4)	54.13 (1375.0)	
		FRN0590E2S-4GB			