Fuji Electric

Innovating *Energy Technology*

High Performance Inverter

FRENIC-Ace New

24A1-E-0042c

The Next Generation Of Inverters Have Arrived

Introducing Our New Standard Inverter!

Enjoy A Full Range Of Applications

The standard inverter for the next generation, the FRENIC-Ace, can be used in most types of application—from fans and pumps to specialized machinery.

	3-phase 400V series								3-phase 200V series				1-phase 200V series	
	ND rating		HD rating		HND rating		HHD rating		HND rating		HHD rating		HHD rating	
Nominal applied motor [kW]	Model	Rated output current	Model	Rated output current	Model	Rated output current	Model	Rated output current	Model	Rated output current	Model	Rated output current	Model	Rated output current
0.1											FRN0001E2S-2□	0.8A	FRN0001E2S-7□	0.8A
0.2									FRN0001E2S-2□	1.3A	FRN0002E2S-2□	1.6A	FRN0002E2S-7□	1.6A
0.4							FRN0002E2■-4□	1.5A	FRN0002E2S-2□	2A	FRN0004E2S-2□	3A	FRN0003E2S-7□	3A
0.75	FRN0002E2■-4□	2.1A	FRN0002E2■-4□	1.8A	FRN0002E2■-4□	1.8A	FRN0004E2■-4□	2.5A	FRN0004E2S-2□	3.5A	FRN0006E2S-2□	5A	FRN0005E2S-7□	5A
1.1			FRN0004E2■-4□	3.4A	FRN0004E2■-4□	3.4A			FRN0006E2S-2□	6A				
1.5	FRN0004E2■-4□	4.1A					FRN0006E2■-4□	4.2A			FRN0010E2S-2□	8A	FRN0008E2S-7□	8A
2.2	FRN0006E2■-4□	5.5A	FRN0006E2■-4□	5A	FRN0006E2■-4□	5A	FRN0007E2■-4□	5.5A	FRN0010E2S-2□	9.6A	FRN0012E2S-2□	11A	FRN0011E2S-7□	11A
3	FRN0007E2■-4□	6.9A	FRN0007E2■-4□	6.3A	FRN0007E2■-4□	6.3A			FRN0012E2S-2□	12A				
3.7							FRN0012E2■-4□	9A			FRN0020E2S-2□	17.5A		
5.5	FRN0012E2■-4□	12A	FRN0012E2■-4□	11.1A	FRN0012E2■-4□	11.1A	FRN0022E2■-4□	13A	FRN0020E2S-2□	19.6A	FRN0030E2S-2□	25A		
7.5			FRN0022E2■-4□	17.5A	FRN0022E2■-4□	17.5A	FRN0029E2■-4□	18A	FRN0030E2S-2□	30A	FRN0040E2S-2□	33A		
11	FRN0022E2■-4□	21.5A	FRN0029E2■-4□	23A	FRN0029E2■-4□	23A	FRN0037E2■-4□	24A	FRN0040E2S-2□	40A	FRN0056E2S-2□	47A		
15	FRN0029E2■-4□	28.5A	FRN0037E2■-4□	31A	FRN0037E2■-4□	31A	FRN0044E2■-4□	30A	FRN0056E2S-2□	56A	FRN0069E2S-2□	60A		
18.5	FRN0037E2■-4□	37A	FRN0044E2■-4□	38A	FRN0044E2■-4□	38A	FRN0059E2■-4□	39A	FRN0069E2S-2□	69A	FRN0088E2S-2□	76A		
22	FRN0044E2■-4□	44A	FRN0059E2■-4□	45A	FRN0059E2■-4□	45A	FRN0072E2■-4□	45A	FRN0088E2S-2□	88A	FRN0115E2S-2□	90A		
30	FRN0059E2■-4□	59A	FRN0072E2■-4□	60A	FRN0072E2■-4□	60A	FRN0085E2■-4□	60A	FRN0115E2S-2□	115A				
37	FRN0072E2■-4□	72A	FRN0085E2■-4□	75A	FRN0085E2■-4□	75A	FRN0105E2■-4□	75A						
45	FRN0085E2■-4□	85A	FRN0105E2■-4□	91A	FRN0105E2■-4□	91A	FRN0139E2■-4□	91A						
55	FRN0105E2■-4□	105A	FRN0139E2■-4□	112A	FRN0139E2■-4□	112A	FRN0168E2■-4□	112A						
75	FRN0139E2■-4□	139A	FRN0168E2■-4□	150A	FRN0168E2■-4□	150A	FRN0203E2■-4□	150A						
90	FRN0168E2■-4□	168A	FRN0203E2■-4□	176A	FRN0203E2■-4□	176A	FRN0240E2■-4□	176A						
110	FRN0203E2■-4□	203A	FRN0240E2■-4□	210A	FRN0240E2■-4□	210A	FRN0290E2■-4□	210A						
132	FRN0240E2■-4□	240A	FRN0290E2■-4□	253A	FRN0290E2■-4□	253A	FRN0361E2■-4□	253A						
160	FRN0290E2■-4□	290A	FRN0361E2■-4□	304A	FRN0361E2■-4□	304A	FRN0415E2■-4□	304A						
200	FRN0361E2■-4□	361A	FRN0415E2■-4□	377A	FRN0415E2■-4□	377A	FRN0520E2■-4□	377A						
220	FRN0415E2■-4□	415A	FRN0520E2■-4□	415A	FRN0520E2■-4□	415A	FRN0590E2■-4□	415A						
250			FRN0590E2■-4□	477A										
280	FRN0520E2■-4□	520A			FRN0590E2■-4□	520A								
315	FRN0590E2■-4□	590A												
Rating condition	Overload current rating 120% -1min	Max. ambient temp. 40˚C	Overload current rating 150% -1min	Max. ambient temp. 40˚C	Overload current rating 120% -1min	Max. ambient temp. 50˚C	Overload current rating 150% -1min, 200% -0.5sec	Max. ambient temp. 50˚C	Overload current rating 120% -1min	Max. ambient temp. 50˚C	Overload current rating 150% -1min, 200% -0.5sec	Max. ambient temp. 50˚C	Overload current rating 150% -1min, 200% -0.5sec	Max. ambient temp. 50˚C
Application	Fans, pumps Wire drawing		Vertical conveyance		Fans, pumps Wire drawing		Vertical conveyance Winding machines Printing machines		Fans, pumps Wire drawing		Vertical conveyance Winding machines Printing machines		Vertical conveyance Winding machines Printing machines	

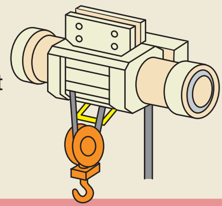
*3-phase 200V series supports only a product for Asia.

Customizable Logic

Customizable logic function is available as a standard feature. FRENIC-Ace has built-in customizable logic functions with a maximum of 200 steps including both digital and analog operation functions, giving customers the ability to customize their inverters—from simple logic functions to full-scale programming. Fuji Electric also has plans to offer programming templates for wire drawing machines, hoists, spinning machines, and other applications so that the FRENIC-Ace can be used as a dedicated purpose inverter.

Example: Hoist crane application

Programming the FRENIC-Ace main unit with the required logic for controlling a hoist

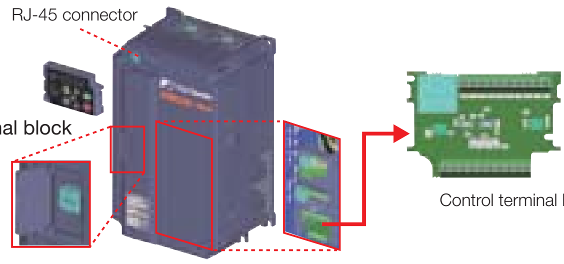
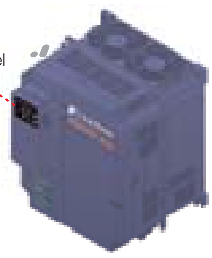


- (1) Set speed program
- (2) Reset the alarm by using the push-button switch
- (3) Mechanical limit switch function
- (4) Detect load
- (5) Automatic speed drive when no load is detected
- (6) Overload stop function

Dedicated/specialized functions for hoist application implemented by using customizable logic

Superior Flexibility

FRENIC-Ace has readily available interface cards and various types of fieldbus / network to maximize its flexibility.

<table>
<tr><th>Option</th><th>Installation type</th></tr>
<tr><td>RS485 communications card
PG interface (5V) card
PG interface (12/15V) card</td><td>Optional control terminal block

</td></tr>
<tr><td>DeviceNet communication card
CC-Link communication card
PROFIBUS-DP communication card (Coming Soon)
EtherNet/IP communication card (Coming Soon)
ProfiNet-RT communication card (Coming Soon)
CANopen communication card (Coming Soon)
Digital input/output interface card
Analog input/output interface card</td><td>Optional front face keypad mount


≧30kW(ND): option card is built-in</td></tr>
</table>

Wide Variety Of Functions As A Standard Feature

- Sensorless dynamic torque vector control
- Motor vector control with PG (with optional card)
- Synchronous motor with sensorless vector control
- 2-channel on-board RS485 communications port
- Standard CANopen compatibility
- Removable keypad device
- Removable control terminal block board

Multi-Function Keypad (option)

FRENIC-Ace has two different multi-function keypads available
- Multi-function keypad with LCD display: Enhanced HMI functionality
- USB keypad: Connect to a computer for more efficient operation (set-up, troubleshooting, maintenance, etc)

Multi-function keypad
with LCD screen

Functional Safety

FRENIC-Ace is equipped with STO functional safety function as a standard. Therefore output circuit magnetic contactors are not required for safe stop implementation. Enhanced standard features position FRENIC-Ace ahead of its class (Safety input: 2CH, output: 1CH).

■Complies with (coming soon)

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 (Safety feature: STO)
IEC/EN 62061: 2005 SIL3

10 Years Lifetime Design

FRENIC-Ace components have a design life of ten years.
A longer maintenance cycle also helps to reduce running costs.

Design life	Main circuit capacitor		10 years*
	Electrolytic capacitors on PCB		10 years*
	Cooling fan		10 years*
	Life conditions	Ambient temperature	+40°C
		Load rate	100% (HHD specifications) 80% (HND/HD/ND specifications)

* ND specifications have a rated current of two sizes higher than HHD specifications, so the life is 7 years.

Standards

■RoHS Directive

Standard compliance with European regulations that limit the use of specific hazardous substances (RoHS)

<Six hazardous substances>	Lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB), polybrominated biphenyl ether (PBDE)
<About RoHS>	Directive 2002/95/EC, issued by the European Parliament and European Council, limits the use of specific hazardous substances in electrical and electronic devices.

Global Compliance

■Standard compliance

EC Directives (CE Mark)

CE

UL Standard (cUL Certified)

c UL us LISTED

Standard Model Specifications

Three phase 400V class series

Items			Specifications										
Type (FRN□□□E2■-4E) *10, (FRN□□□E2S-4A), (FRN□□□E2S-K(0022~)), (FRN□□□E2S-G●(0002~0012)*12)			0002	0004	0006	0007	0012	0022	0029	0037	0044	0059	0072
Nominal applied motor *1 [kW]		ND	0.75	1.5	2.2	3.0	5.5	11	15	18.5	22	30	37
		HD	0.75	1.1	2.2	3.0	5.5	7.5	11	15	18.5	22	30
		HND	0.75	1.1	2.2	3.0*11	5.5*11	7.5	11	15	18.5	22	30
		HHD	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Output ratings	Rated capacity [kVA] *2	ND	1.6	3.1	4.2	5.3	9.1	16	22	28	34	45	55
		HD	1.4	2.6	3.8	4.8	8.5	13	18	24	29	34	46
		HND	1.4	2.6	3.8	4.8*11	8.5*11	13	18	24	29	34	46
		HHD	1.1	1.9	3.2	4.2	6.9	9.9	14	18	23	30	34
	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	37.0	44.0	59.0	72.0
		HD	1.8	3.4	5.0	6.3	11.1	17.5	23.0	31.0	38.0	45.0	60.0
		HND	1.8	3.4	5.0	6.3*11	11.1*11	17.5	23.0	31.0	38.0	45.0	60.0
		HHD	1.5	2.5	4.2	5.5	9.0	13.0	18.0	24.0	30.0	39.0	45.0
	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 (With AVR)										
	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	60.6	77.9	94.3
		HD	2.7	3.9	7.3	11.3	16.8	23.2	33.0	43.8	52.3	60.6	77.9
		HND	2.7	3.9	7.3	11.3*11	16.8*11	23.2	33.0	43.8	52.3	60.6	77.9
		HHD	1.7	3.1	5.9	8.2	13.0	17.3	23.2	33.0	43.8	52.3	60.6
	Rated current with DCR *5 [A]	ND	1.5	2.9	4.2	5.8	10.1	21.1	28.8	35.5	42.2	57.0	68.5
		HD	1.5	2.1	4.2	5.8	10.1	14.4	21.1	28.8	35.5	42.2	57.0
		HND	1.5	2.1	4.2	5.8*11	10.1*11	14.4	21.1	28.8	35.5	42.2	57.0
		HHD	0.85	1.6	3.0	4.4	7.3	10.6	14.4	21.1	28.8	35.5	42.2
	Required power supply capacity *6 [kVA]	ND	1.1	2.1	3.0	4.1	7.0	15	20	25	29	39	47
		HD	1.1	1.5	3.0	4.1	7.0	10	15	20	25	29	39
		HND	1.1	1.5	3.0	4.1*11	7.0*11	10	15	20	25	29	39
		HHD	0.6	1.2	2.1	3.1	5.1	7.3	10	15	20	25	29
Braking	Braking torque *7 [%]	ND	53%	50%	48%	29%	27%	12%					
		HD	53%	68%	48%	29%	27%	15%					
		HND	53%	68%	48%	29%*11	27%*11	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										
	Braking resistor		Option										
EMC filter *9								Compliant with EMC Directives, Emission and Immunity: Category C3 (2nd Env.) (EN61800-3:2004)					
DC reactor (DCR)		ND	Option										
		HND, HD	Option										
		HHD	Option										
Enclosure (IEC60529)			IP20, UL open type										
Cooling method			Natural cooling		Fan cooling								
Mass (Basic Type (EMC Filter Built-in Type)) [kg]			1.2	1.5	1.5	1.6	1.9	5.0(TBD)	5.0(TBD)	8.0(TBD)	9.0(TBD)	9.5(10.5)	10(11.2)

*1 Fuji 4-pole standard motor
*2 Rated capacity is calculated by assuming the output rated voltage as 440 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 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 °C (1.8 °F) when ambient temperature is +40 °C (+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 75kW 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).
*9 The EMC Filter Built-in Type supports only a product for EU.
*10 ■: S: Standard (basic type), E: EMC filter built-in type (0059 to 0590)
*11 HND spec. of the type 0007 and 0012: allowable ambient temperature 40 °C (+104 °F) or less.
The rated output current at HND spec. is decreased 1% for every 1 °C (1.8 °F) when ambient temperature is +40 °C (+104 °F) or more.
*12 ●: A: 1 CAN terminal, 1 analog current output
B: NONE CAN terminal, 2 analog current output

Standard Model Specifications

Three phase 400V class series

Items			0085	0105	0139	0168	0203	0240	0290	0361	0415	0520	0590
Type (FRN□□□E2■-4E) *11 (FRN□□□E2S-4A)			0085	0105	0139	0168	0203	0240	0290	0361	0415	0520	0590
Nominal applied motor *1 [kW]		ND	45	55	75	90	110	132	160	200	220	280	315
		HD	37	45	55	75	90	110	132	160	200	220	250
		HND	37	45	55	75	90	110	132	160	200	220	280
		HHD	30	37	45	55	75	90	110	132	160	200	220
Output ratings	Rated capacity [kVA] *2	ND	65	80	106	128	155	183	221	275	316	396	450
		HD	57	69	85	114	134	160	193	232	287	316	364
		HND	57	69	85	114	134	160	193	232	287	316	396
		HHD	46	57	69	85	114	134	160	193	232	287	316
	Rated voltage [V] *3		Three-phase 380 to 480V (With AVR)										
	Rated current [A] *4	ND	85.0	105	139	168	203	240	290	361	415	520	590
		HD	75.0	91.0	112	150	176	210	253	304	377	415	477
		HND	75.0	91.0	112	150	176	210	253	304	377	415	520
		HHD	60.0	75.0	91.0	112	150	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 480V (With AVR)	Three-phase 380 to 480V, 50/60Hz	Three-phase 380 to 440V, 50Hz Three-phase 380 to 480V, 60Hz*9								
	Voltage/frequency variations		Voltage: +10 to -15% (Voltage unbalance:2% or less *8, Frequency: +5 to -5%)										
	Rated current without DCR *5 [A]	ND	114	140	-	-	-	-	-	-	-	-	-
		HD	94.3	114	140	-	-	-	-	-	-	-	-
		HND	94.3	114	140	-	-	-	-	-	-	-	-
		HHD	77.9	94.3	114	140	-	-	-	-	-	-	-
	Rated current with DCR *5 [A]	ND	83.2	102	138	164	201	238	286	357	390	500	559
		HD	68.5	83.2	102	138	164	201	238	286	357	390	443
		HND	68.5	83.2	102	138	164	201	238	286	357	390	500
		HHD	57.0	68.5	83.2	102	138	164	201	238	286	357	390
	Required power supply capacity *6 [kVA]	ND	58	71	96	114	139	165	199	248	271	347	388
		HD	47	58	71	96	114	140	165	199	248	271	307
		HND	47	58	71	96	114	140	165	199	248	271	347
		HHD	39	47	58	71	96	114	140	165	199	248	271
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										
	Braking resistor		Option										
EMC filter *10			Compliant with EMC Directives, Emission and Immunity: Category C3 (2nd Env.) (EN61800-3:2004)										
DC reactor (DCR)		ND	Option		Attached as standard								
		HND, HD	Option			Attached as standard							
		HHD	Option				Attached as standard						
Enclosure (IEC60529)			IP00, UL open type										
Cooling method			Fan cooling										
Mass (Basic Type (EMC Filter Built-in Type)) [kg]			25(26)	26(27)	30(31)	33(33)	40(40)	62(62)	63(63)	95(95)	96(96)	130(130)	140(140)

*1 Fuji 4-pole standard motor
*2 Rated capacity is calculated by assuming the output rated voltage as 440 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 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 °C (1.8 °F) when ambient temperature is +40 °C (+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 75kW 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).
*9 The 400 V class series 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.
*10 The EMC Filter Built-in Type supports only a product for EU.
*11 ■: S: Standard (basic type), E: EMC filter built-in type (0059 to 0590)

Standard Model Specifications

Three phase 200V class series (Basic Type)

Items			Specifications												
Type (FRN□□□E2S-2A(0030~)) [*9], (FRN□□□E2S-2G●(0001~0020))[*11]			0001	0002	0004	0006	0010	0012	0020	0030	0040	0056	0069	0088	0115
Nominal applied motor [*1] [kW]		HND	0.2	0.4	0.75	1.1	2.2	3.0[*11]	5.5[*11]	7.5	11	15	18.5	22	30
		HHD	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Output ratings	Rated capacity [kVA] [*2]	HND	0.5	0.8	1.3	2.3	3.7	4.6[*11]	7.5[*11]	11	15	21	26	34	44
		HHD	0.3	0.6	1.1	1.9	3.0	4.2	6.7	9.5	13	18	23	29	34
	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[*11]	19.6[*11]	30	40	56	69	88	115
		HHD	0.8	1.6	3.0	5.0	8.0	11	17.5	25	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 [*5] [A]	HND	1.8	2.6	4.9	6.7	12.8	17.9[*11]	31.9[*11]	42.7	60.7	80.0	97.0	112	151
		HHD	1.1	1.8	3.1	5.3	9.5	13.2	22.2	31.5	42.7	60.7	80.0	97.0	112
	Rated current with DCR [*5] [A]	HND	0.93	1.6	3.0	4.3	8.3	11.7[*11]	19.9[*11]	28.8	42.2	57.6	71.0	84.4	114
		HHD	0.57	0.93	1.6	3.0	5.7	8.3	14.0	21.1	28.8	42.2	57.6	71.0	84.4
	Required power supply capacity [*6] [kVA]	HND	0.4	0.6	1.1	1.5	2.9	4.1[*11]	6.9[*11]	10	15	20	25	30	40
		HHD	0.2	0.4	0.6	1.1	2.0	2.9	4.9	7.3	10	15	20	25	30
Braking	Braking torque [*7] [%]	HND	75%		53%	68%	48%	29%[*11]	27%[*11]	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 60% (ND spec.), 0 to 80% (HD/HND spec.), 0 to 100% (HHD spec.) of nominal current												
	Braking chopper		Built-in												
	Braking resistor		Option												
DC reactor (DCR)		HND	Option												
		HHD	Option												
Enclosure (IEC60529)			IP20, UL open type												
Cooling method			Naturalural cool				Fan cooling								
Mass [kg]			0.5	0.5	0.6	0.8	1.5	1.5	1.8	5.0	5.0	8.0	9.0	9.5	10

*1 Fuji 4-pole standard motor
*2 Rated capacity is calculated by assuming the output rated voltage as 220 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 Three phase 200V class series supports only a product for Asia
*10 HND spec. of the type 0012 and 0020: allowable ambient temperature 40 °C (+104 °F) or less.
The rated output current at HND spec. is decreased 1% for every 1 °C (1.8 °F) when ambient temperature is +40 °C (+104 °F) or more.
*11 ●: A: 1 CAN terminal, 1 analog current output
B: NONE CAN terminal, 2 analog current output

Common Specifications

Items		Specifications	Remarks
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 400V 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 200V class - Type 0030,0040,0056,0069 - 0.75 to 16kHz variable (HHD/HND/ spec.) Note: Carrier frequency drops automatically to protect the inverter depending on environmental temperature and output current. (This auto drop function can be canceled.)	
	Output frequency accuracy (Stability)	- Analog setting: ±0.2% of maximum frequency 25±10°C	
		- Keypad setting: ±0.01% of maximum frequency -10 to +50°C	
	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 rpm)	IMPG-VC
		- 1 : 100 (Minimum speed : Nominal speed, 4-pole, 15 to 1500 rpm)	IMPG-VF
		- 1 : 10 (Minimum speed : Nominal speed, 6-pole, 180 to 1800 rpm)	PM-SVC
	Speed control accuracy	- Analog setting: ±0.2% of maximum frequency or below 25 ±10°C - Digital setting: ±0.01% of maximum frequency or below -10 to +50°C	IMPG-VC
		- Analog setting: ±0.5% of base frequency or below 25 ±10°C - Digital setting: ±0.5% of base frequency or below -10 to +50°C	PM-SVC
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 (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.	
	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 400V 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 200V 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.)	
	Start/Stop operation	- Keypad: Start and stop with RUN and STOP keys (Standard 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 field bus (option) communications	
		- Switching operation command: Remote/local switching, link switching	

Common Specifications

	Items	Specifications	Remarks
Control	Frequency setting	- Keypad: Settable with ∧ and ∨ keys	
		- 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])	Analog input between DC+1 to +5V is available with analog bias/gain function for input.
		- 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 Can be specified via bus communicatons. (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.	
		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 4 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.	
	Timer 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	
	(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.	

Common Specifications

Items		Specifications	Remarks
Control	(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 serched 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.	
	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	Control output torque or torque current so that output torque or torque current are preset limiting value or less. (The torque current limit is only available in IMPG-VC or PM-SVC mode.) - Switchable between 1st and 2nd torque limit values.	
	Torque current limiter	- "Torque limit" and "Torque current limit" are selectable. - "Torque limit" or "Torque current 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.	
	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.	
	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

Common Specifications

	Items	Specifications	Remarks
Control	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)	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, limitter, 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 600 s - Input/output signal terminal input / output, inverter control function - 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 is 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 (Timer 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)	
	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, Option error factors , Number of option errors ,ROM version of Inverter, Keypad and Option port.	
	I/O checking	Shows the status of the terminal Digital input/output, Relay out, Analog input/output.	
	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.	
Operating environment	Installation location	Indoors	
	Ambient	Standard (Open Type) -10 to +50°C (HHD/HND spec.) -10 to +40°C (HD/ND spec.) NEMA/UL Type 1 -10 to +40°C (HHD/HND spec.) -10 to +30°C (HD/ND spec.)	
	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)	

Common Specifications

<table>
<tr><th colspan="2">Items</th><th colspan="2">Specifications</th><th>Remarks</th></tr>
<tr><td rowspan="2">Operating environment</td><td>Altitude</td><td colspan="2">1000m or lower
If the inverter is used in an altitude above 1000 m, you should apply an output current derating factor as listed in below table.
<table>
<tr><th>Altitude</th><th>Output current derating factor</th></tr>
<tr><td>1000m or lower</td><td>1.00</td></tr>
<tr><td>1000 to 1500m</td><td>0.97</td></tr>
<tr><td>1500 to 2000m</td><td>0.95</td></tr>
<tr><td>2000 to 2500m</td><td>0.91</td></tr>
<tr><td>2500 to 3000m</td><td>0.88</td></tr>
</table></td><td></td></tr>
<tr><td>Vibration</td><td colspan="2">
<table>
<tr><th>Three phase 400V class series</th><th>TYPE:0203 or below</th><th>TYPE:0240 or above</th></tr>
<tr><td>2 to less than 9Hz</td><td>3mm:(Max. amplitude)</td><td>3mm:(Max. amplitude)</td></tr>
<tr><td>9 to less than 20Hz</td><td>9.8m/s²</td><td>2m/s²</td></tr>
<tr><td>20 to less than 55Hz</td><td>2m/s²</td><td>2m/s²</td></tr>
<tr><td>55 to less than 200Hz</td><td>1m/s²</td><td>1m/s²</td></tr>
</table>
<table>
<tr><th>Three phase 200V class series</th><th>TYPE:0069 or below</th></tr>
<tr><td>2 to less than 9Hz</td><td>3mm:(Max. amplitude)</td></tr>
<tr><td>9 to less than 20Hz</td><td>9.8m/s²</td></tr>
<tr><td>20 to less than 55Hz</td><td>2m/s²</td></tr>
<tr><td>55 to less than 200Hz</td><td>1m/s²</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="6">Storage environment</td><td rowspan="2">Temperature</td><td>-25 to +70°C (in transport)</td><td rowspan="3">Avoid such places where the inverter will be subjected to sudden changes in temperature that will cause condensation to form.</td><td rowspan="3"></td></tr>
<tr><td>-25 to +65°C (in storage)</td></tr>
<tr><td>Relative humidity</td><td>5 to 95%RH</td></tr>
<tr><td>Atmosphere</td><td colspan="2">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)</td><td></td></tr>
<tr><td rowspan="2">Atmospheric pressure</td><td colspan="2">86 to 106kPa (during storage)</td><td></td></tr>
<tr><td colspan="2">70 to 106kPa (during transportation)</td><td></td></tr>
</table>

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

VF	V/f control
IM-SVC(DTV)	Speed sensorless vector control (Dynamictorquevector 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