

A1000

High performance vector control



» Able to control IM & PM motors

» Safety built-in

» Application parameter presets

High performance motor control...

The A1000 provides remarkable advantages through excellent motor drive performance, environmental benefits and energy savings, as well as many user orientated operational features. Moreover, the A1000 offers advanced characteristics that are included as standard.

In response to the needs of users, we have introduced next-generation product features to A1000 vector control technology.

In addition to built-in safety, IM & PM motor control, application parameter presets, USB copy unit, dual rating function and terminal board with parameter set-up, the following features will also ensure high performance motor control while saving costs and enabling you to work more efficiently:

- Up to 315 kW
- Open-loop IPM motor control
- Powerful starting torque
- High-performance current vector control
- 10 years lifetime design
- CE, UL and RoHS compliant



Drive any kind of motor



Induction motor



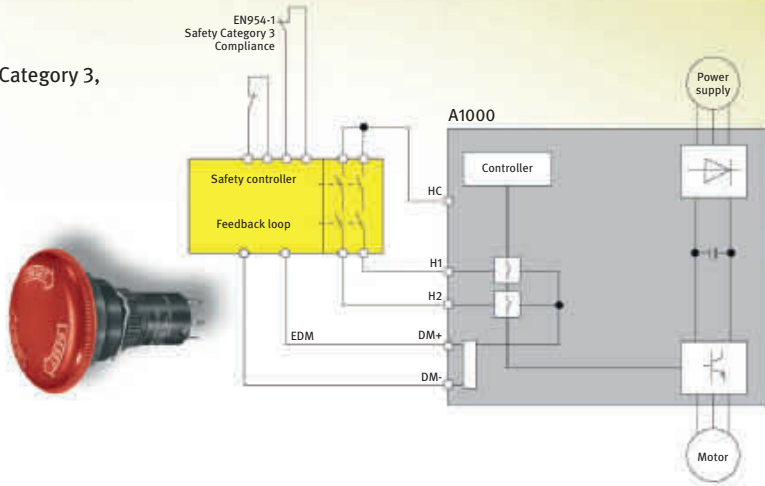
Synchronous motor (SPM)



Synchronous motor (IPM)

... at your
finger tips

Safety:
According EN954-1 Category 3,
EN61508 SIL2



Application presets: Select your application and A1000 will optimize parameter settings according to it.



Setting	Setting
00	General-purpose
01	Water Supply Pump
02	Conveyor
03	Exhaust Fan
04	HVAC Fan
05	Air Compressor
06	Crane (Hoist)
07	Crane (Traverse)

Parameters are programmed automatically	
A1-02	Control mode selection
C1-01	Accel Time 1
C1-02	Decel Time
C6-01	ND / HD Selection

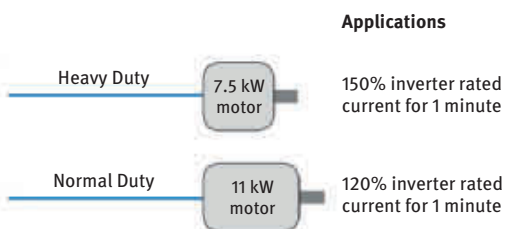
USB copy unit:
With copy & paste parameter
functionality



Terminal board with parameter set-up:
Integrated memory with all inverter's parameter data for
replacement jobs



Dual rating: A single parameter lets the user set the
drive for Normal Duty or Heavy Duty



CIMR-A

A1000

High performance Vector Control

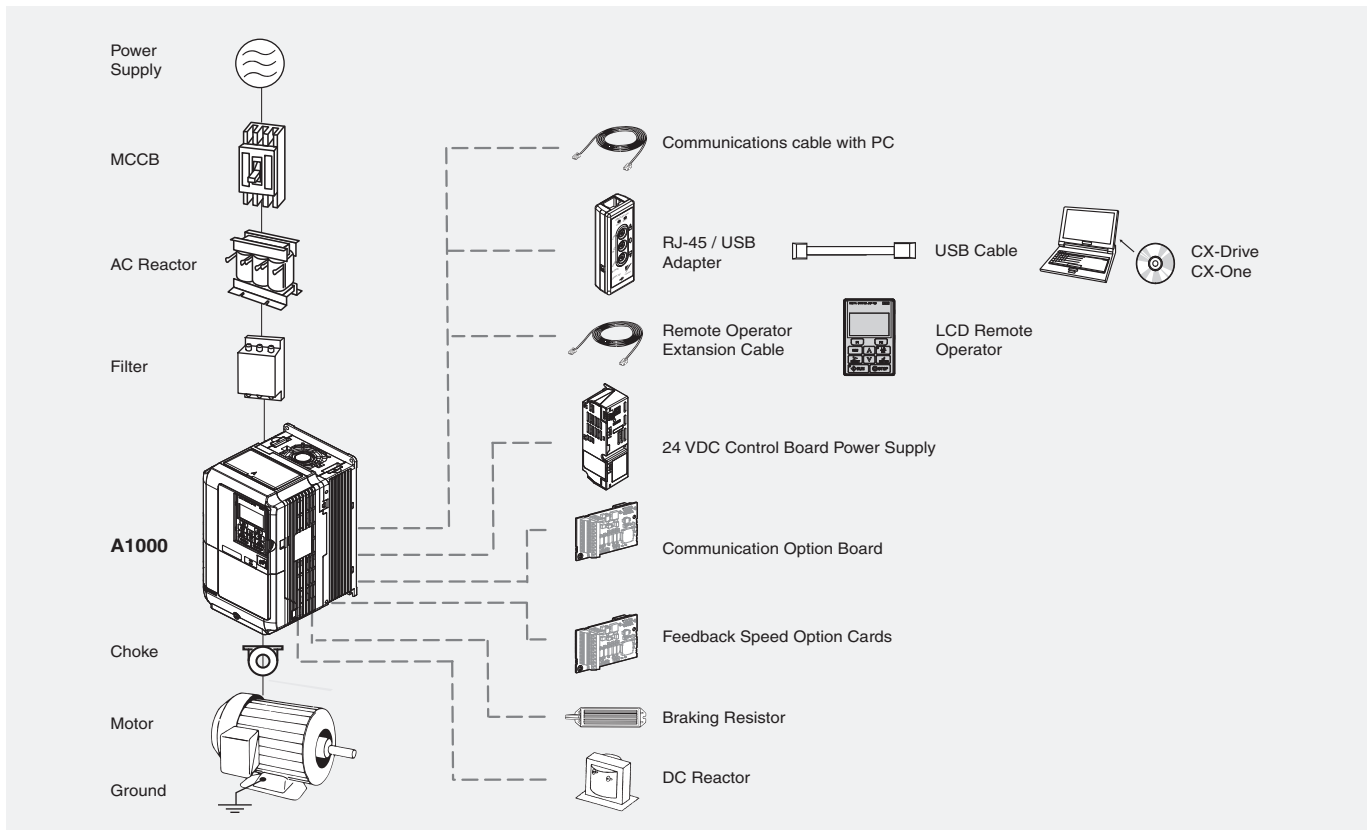
- Current vector control, with or without PG
- High starting torque (200% / 0.3 Hz, spd range 1:200 OLV), (200% at 0 r/min, spd range 1:1500 CLV)
- Double rating ND 120%/1min and HD 150%/1 min
- IM&PM motor control
- Advanced Auto-Tuning for IM & PM Motors
- Open Loop Control of PM Motors
- Low-noise Low carrier technology
- 10 years lifetime design
- Screw-less terminals
- Control Terminals with memory backup
- 24 VDC control board power supply option
- Fieldbus communications: Modbus, Profibus, CanOpen, DeviceNet, ML-II
- Safety embedded: EN954-1 safety cat. 3, stop category 0, IEC EN 61508 SIL 2 and EN61800-5-1 with EDM
- CE, UL, cUL and TUV

Ratings

- 200 V Class three-phase 0.4 to 110 kW
- 400 V Class three-phase 0.4 to 315 kW

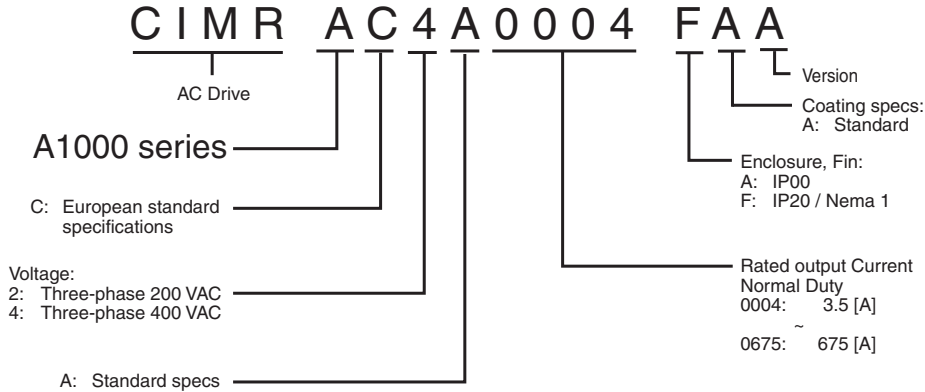


System configuration



Specifications

Type designation



200 V class

Three-phase: CIMR-A□2A		0004	0006	0010	0012	0021	0030	0040	0056	0069	0081	0110	0138	0169	0211	0250	0312	0360	0415	
Motor kW ¹	For HD setting	0.40	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	
	For ND setting	0.75	1.1	2.2	3.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	110	
Output characteristics	Inverter capacity kVA at HD ²	1.2	1.9	3	4.2	6.7	9.5	12.6	17.9	23	29	32	44	55	69	82	108	132	158	
	Inverter capacity kVA at ND ²	1.3	2.3	3.7	4.6	8	11.4	15.2	21	26	31	42	53	64	80	95	119	137	158	
	Rated output current (A) at HD	3.2 ⁴	5 ⁴	8 ⁴	11 ⁴	17.5 ⁴	25 ⁴	33 ⁴	47 ⁴	60 ⁴	75 ⁴	85 ⁴	115 ⁴	145 ⁵	180 ⁵	215 ⁵	283 ⁵	346 ⁵	415 ³	
	Rated output current (A) at ND ³	3.5	6	9.6	12	21	30	40	56	69	81	110	138	169	211	250	312	360	415	
	Max. output voltage	Proportional to input voltage: 0..240 V																		
	Max. output frequency	400 Hz																		
Power supply	Rated input voltage and frequency	3-phase 200..240 V 50/60 Hz																		
	Allowable voltage fluctuation	-15%..+10%																		
	Allowable frequency fluctuation	+5%																		
	Input Current (A) at HD ⁶	2.9	5.8	7.5	11	18.9	28	37	52	68	80	82	111	136	164	200	271	324	394	
	Input Current (A) at ND ⁶	3.9	7.3	10.8	13.9	24	37	52	68	80	96	111	136	164	200	271	324	394	471	

- Based on a standard 4-pole motor for maximum applicable motor output:
- Rated Motor Capacity is calculated with a rated output voltage of 220 V:
- Carrier frequency is set to 2kHz. Current derating is required in order to raise the carrier frequency:
- Carrier frequency can be increased up to 8 kHz while keeping this current rating. Higher carrier frequency settings require derating:
- Carrier frequency can be increased up to 5 kHz while keeping this current rating. Higher carrier frequency settings require derating:
- Assumes operation at rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance:

400 V class

Three-phase: CIMR-A□4A		0002	0004	0005	0007	0009	0011	0018	0023	0031	0038	0044	0058	
Motor kW ¹	For HD setting	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5	22	
	For ND setting	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5	22	30	
Output characteristics	Inverter capacity kVA at HD ²	1.4	2.6	3.7	4.2	5.5	7	11.3	13.7	18.3	24	30	34	
	Inverter capacity kVA at ND ²	1.6	3.1	4.1	5.3	6.7	8.5	13.3	17.5	24	29	34	44	
	Rated output current (A) at HD	1.8 ⁴	3.4 ⁴	4.8 ⁴	5.5 ⁴	7.2 ⁴	9.2 ⁴	14.8 ⁴	18 ⁴	24 ⁴	31 ⁴	39 ⁴	45 ⁴	
	Rated output current (A) at ND ³	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23	31	38	44	58	
	Max. output voltage	380..480V (proportional to input voltage)												
	Max. output frequency	400 Hz												
Power supply	Rated input voltage and frequency	3-phase 380..480 VAC, 50/60 Hz												
	Allowable voltage fluctuation	-15%..+10%												
	Allowable frequency fluctuation	+5%												
	Input Current (A) at HD ⁶	1.8	3.2	4.4	6	8.2	10.4	15	20	29	39	44	49	
	Input Current (A) at ND ⁶	2.1	4.3	5.9	8.1	9.4	14	20	24	38	44	52	58	

Specifications

Three-phase: CIMR-A□4A		0072	0088	0103	0139	0165	0208	0250	0296	0362	0414	0515	0675
Motor kW ¹	For HD setting	30	37	45	55	75	90	110	132	160	185	220	315
	For ND setting	37	45	55	75	90	110	132	160	185	220	250	355
Output characteristics	Inverter capacity kVA at HD ²	48	57	69	85	114	137	165	198	232	282	343	461
	Inverter capacity kVA at ND ²	55	67	78	106	126	159	191	226	276	316	392	514
	Rated output current (A) at HD	60 ⁴	75 ⁴	91 ⁴	112 ⁵	150 ⁵	180 ⁵	216 ⁵	260 ⁵	304 ³	370	450	605
	Rated output current (A) at ND ³	72	88	103	139	165	208	250	296	362	414	515	675
	Max. output voltage	380..480V (proportional to input voltage)											
	Max. output frequency	400 Hz											
Power supply	Rated input voltage and frequency	3-phase 380..480 VAC, 50/60 Hz											
	Allowable voltage fluctuation	-15%..+10%											
	Allowable frequency fluctuation	+5%											
	Input Current (A) at HD ⁵	58	71	86	105	142	170	207	248	300	346	410	584
	Input Current (A) at ND ⁵	71	86	105	142	170	207	248	300	346	410	465	657

1. Based on a standard 4-pole motor for maximum applicable motor output:
2. Rated Motor Capacity is calculated with a rated output voltage of 440 V:
3. Carrier frequency is set to 2kHz. Current derating is required in order to raise the carrier frequency:
4. Carrier frequency can be increased up to 8 kHz while keeping this current rating. Higher carrier frequency settings require derating:
5. Carrier frequency can be increased up to 5 kHz while keeping this current rating. Higher carrier frequency settings require derating:
6. Assumes operation at rated output current. Input current rating varies depending on the power supply transformer, input reactor, Wiring conditions, and power supply impedance:

Common specifications

Model number CIMR-A		Specifications
Control functions	Control methods	Sine wave PWM (V/f control, V/f control with PG, Open loop vector control, Closed loop vector control, Open loop vector control for PM, Closed loop vector control for PM, Advanced Open Loop Vector Control for PM)
	Output frequency range	0.01..400 Hz
	Frequency tolerance	Digital set value: ±0.01% of the max. output frequency (-10..+40 °C) Analogue set value: ±0.1% of the max. output frequency (25 ±10 °C)
	Resolution of frequency set value	Digital set value: 0.01 Hz Analogue set value: 0.03 Hz / 60 Hz (11 bit)
	Resolution of output frequency	0.001 Hz
	Frequency set value	-10..+10 V (20 kΩ), 0..10 V (20 kΩ), 4..20 mA (250 Ω), Pulse train input, frequency setting value (selectable)
	Starting Torque	150%/3Hz (V/f control, V/f control with PG), 200%/0.3Hz* ¹ (Open loop vector control), 200%/0 r/min* ¹ (Closed loop vector control, Closed loop vector control for PM, Advanced Open Loop Vector Control for PM), 100% / 5% speed (Open loop vector control for PM),
	Speed Control Range	1:1500 (Closed loop vector control, Closed loop vector control for PM), 1:200 (Open loop vector control), 1:40 (V/f control, V/f control with PG), 1:20 (Open Loop Vector Control for PM), 1:100 (Advanced Open Loop Vector Control for PM)
	Speed Control Accuracy	±0.2% in Open loop vector control (25 ±10 °C) * ² , 0.02% in Closed loop vector control (25 ±10 °C)
	Speed Response	10 Hz in Open loop vector control (25 ±10 °C), 50Hz in Closed loop Vector Control (25 ±10 °C), (excludes temperature fluctuation when performing Rotational Auto-Tuning)
	Torque Limit	All Vector Control allows separate settings in four quadrants
	Accel/Decel Time	0.00 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)
Functionality	Braking torque	Drives of 200/400 V 30 kW or less have a built-in braking transistor. 1. Short-time decel torque* ³ , over 100% for 0.4/0.75 kW motors, over 50% for 1.5 kW motors, and over 20% for 2.2 kW and above motors (over excitation braking/High-Slip Braking approx. 40%) 2. Continuous regen, torque approx. 20% (approx. 125% with dynamic braking resistor option* ⁴ , 10% ED, 10 s, internal braking transistor)
	V/f Characteristics	User-selected programs and V/f preset patterns possible
Protection functions	Main Control Functions	Torque Control, Droop control, Speed/torque control switching, Feedforward control, Zero-servo control, Momentary power loss ride-thru, Speed search, Overtorque detection, Torque Limit, 17-step speed (max), Accel/Decel time switch S-curve Accel/Decel, 3-wire sequence, Auto-tuning (rotational, stationary), Online Tuning, Dwell Cooling fan on/off switch, slip compensation, Torque compensation, Frequency Jump, Upper/lower limits for frequency, DC injection braking at start and stop, Over excitation braking, High Slip braking, PID control (with sleep function), Energy saving control, MEMOBUS comm. (RS-485/422 max. 115.2kbps), Fault restart, Application presets, Removable terminal block with parameter backup function...
	Motor protection	Motor overheat protection based on output current
	Momentary overcurrent Protection	Drive stops when output current exceeds 200% of Heavy Duty Rating
	Overload Protection	Drive stops after 60 s at 150% of rated output current (Heavy Duty Rating)* ⁵
	Overvoltage Protection	200 V class: Stops when DC bus exceeds approx. 410 V, 400 V class: Stops when DC bus exceeds approx. 820V
	Undervoltage Protection	200 V class: Stops when DC bus exceeds approx. 190 V, 400 V class: Stops when DC bus exceeds approx. 380V
	Momentary power loss Ride-Thru	Immediately stop after 15 ms or longer power loss (default), Continuous operation during power loss than 2 s (standard)* ⁶
	Heatsink Overheat Protection	Protected by thermister
	Braking Resistance Overheat Protection	Overheat sensor for braking resistor (optional)
	Stall prevention	Stall prevention during acceleration/deceleration and constant speed operation
Ground fault	Protected by electronic circuit* ⁷	
Power charge indication	Charge LED remains lit until DC bus has fallen below approx. 50 V.	

Ambient conditions	Area of Use	Indoor (no corrosive gas, dust, etc.)
	Ambient Temperature	-10°C..+50°C(open chassis) up to 60°C with output current derating, -10°C..+40°C (NEMA Type 1)
	Ambient humidity	95% RH or less (without condensation)
	Storage temperature	-20°C..+60°C (short-term temperature during transportation)
	Altitude	Up to 1000 meters (output derating of 1% per 100 m above 1000 m, max. 3000 m)
	Vibration / Shock	10 Hz to 20 Hz, 9.8 m/s ² max. 20 Hz to 55Hz, 5.9 m/s ² (200 V: 45kW or more, 400 V: 55kW or more) or 2.0 m/s ² max. (200 V: 55 kW or less, 400 V: 75 kW or less)
	Safety Standard	EN954-1 safe category 3 stop category 0; EN ISO 13849-1; IEC EN 61508 SIL2
	Protection Design	IP00 open-chassis, IP20, NEMA Type 1 enclosure

- Requires a drive with recommended capacity.
- Speed control accuracy may vary slightly depending on installation conditions or motor used.
- Momentary average deceleration torque refers to the deceleration torque from 60 Hz down to 0 Hz. This may vary depending on the motor.
- If L3-04 is enabled when using a braking resistor or braking resistor unit, the motor may not stop in the specified deceleration time.
- Overload protection may be triggered when operating with 150% of the rated output current, if the output frequency is less than 6 Hz.
- Varies in accordance with the drive capacity and load. Drives with a capacity of smaller than 11 kW in the 200 V (model CIMR- AA0056 or 400 V (model CIMR- AA0031) require a separate Momentary Power Loss Unit to continue operating.
- Protection may not be provided under the following conditions as the motor windings are grounded internally during run: #Low resistance to ground from the motor cable or terminal block. #Drive already has a short-circuit when the power is turned on.

Dimensions

Open-Chassis [IP00]

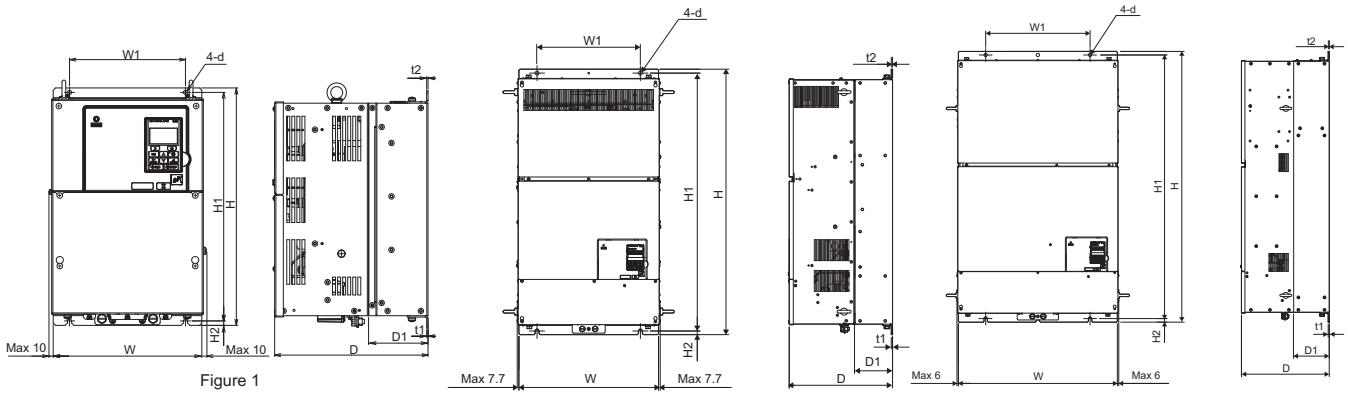


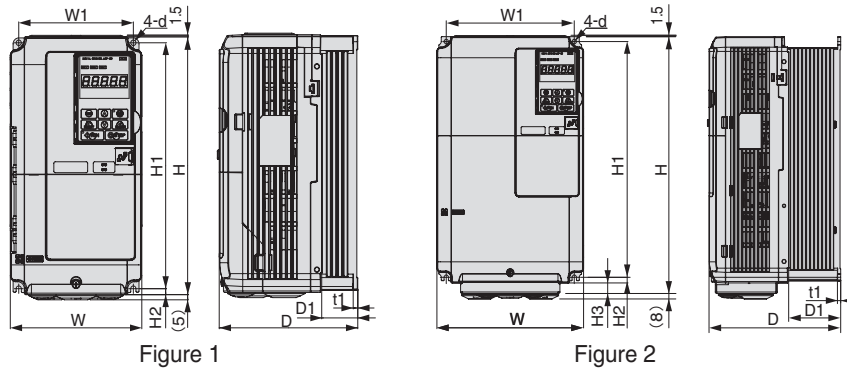
Figure 1

Figure 2

Figure 3

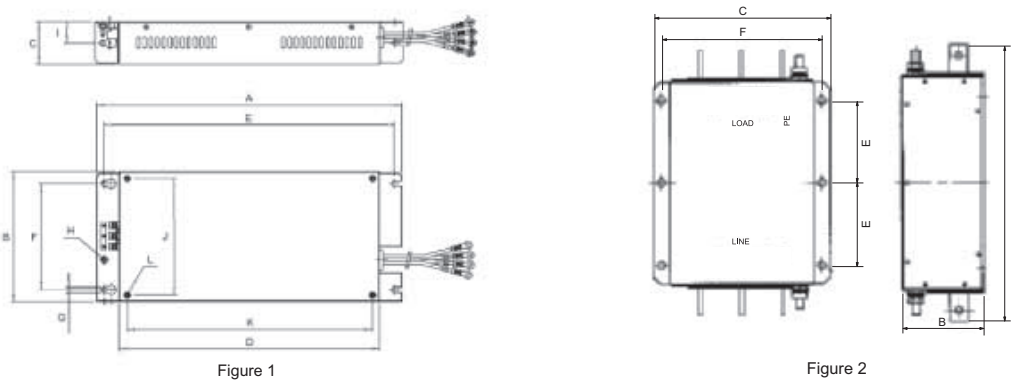
Voltage class	Max. applicable motor output kW		Inverter model CIMR-A□	Figure	Dimensions in mm										Weight (kg)	
	ND	HD			W	H	D	W1	H1	H2	D1	t1	t2	d		
Three-phase 200 V	30	22	0110	1	250	400	258	195	385	7.5	100	2.3	2.3	M6	21	
	37	30	0138		275	450		220	435						25	
	45	37	0169		325	550	283	260	535	110	130	4.5	4.5	M12	37	
	55	45	0211												76	
	75	55	0250		450	705	330	325	680	12.5	130	3.2	3.2	M10	80	
	90	75	0312		500	800	350	370	773	13					98	
	110	90	0360		500	800	350	370	773	13	130	4.5	4.5	M12	99	
	110	110	0415												216	
Three-phase 400 V	30	22	0058	1	250	400	258	195	385	7.5	100	2.3	2.3	M6	21	
	37	30	0072		275	450		220	435						25	
	45	37	0088		325	510	283	260	495	7.5	105	2.3	3.2	M6	36	
	55	45	0103												36	
	75	55	0139		325	550	283	260	535	7.5	110	2.3	2.3	M6	41	
	90	75	0165												42	
	110	90	0208		450	705	330	325	680	12.5	130	3.2	3.2	M10	79	
	132	110	0250		500	800	350	370	773	13					130	4.5
	160	132	0296								102					
	185	160	0362		500	950	370	370	923	13	135	4.5	4.5	M12	107	
	220	185	0414												125	
	250	220	0515		3	670	1140	370	440	1110	15	150	4.5	4.5	M12	216
	355	315	0675													221

Enclosed Panel [NEMA Type1]



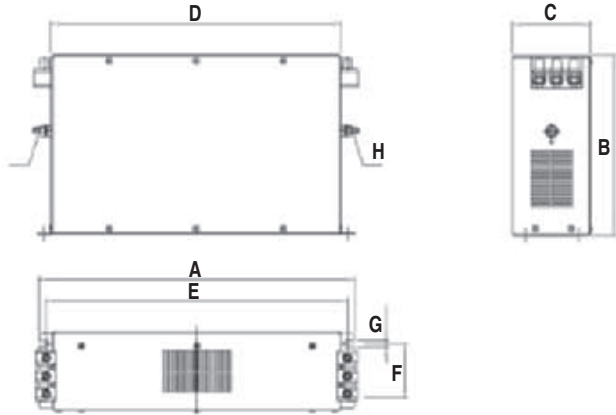
Voltage class	Max. applicable motor output kW		Inverter model CIMR-A□	Figure	Dimensions in mm										Weight (kg)										
	ND	HD			W	H	D	W1	H1	H2	D1	t1	t2	d											
Three-phase 200 V	0.75	0.4	0004	1	140	260	147	122	248	6	38	5	-	M5	3.1										
	1.1	0.75	0006				3.1																		
	2.2	1.5	0010				3.2																		
	3	2.2	0012				3.2																		
	5.5	4.0	0021				3.5																		
	7.5	5.5	0030				4.0																		
	11	7.5	0040				4.0																		
	15	11	0056				5.6																		
	18.5	15	0069				8.7																		
Three-phase 200 V	22	18.5	0081	2	180	300	187	160	284	8	75	5	-	M6	9.7										
	220	350	197	192	335	78	8.7																		
	220	365	197	192	335	78	9.7																		
Three-phase 400 V	0.75	0.4	0002	1	140	260	147	122	248	6	38	5	-	M5	3.2										
	1.5	0.75	0004				3.2																		
	2.2	1.5	0005				3.2																		
	3	2.2	0007				3.4																		
	4.0	3	0009				3.5																		
	5.5	4.0	0011				3.5																		
	7.5	5.5	0018				3.9																		
	11	7.5	0023				3.9																		
	15	11	0031				5.4																		
	18.5	15	0038				5.7																		
	22	18.5	0044				8.3																		
	Three-phase 400 V	220	350				197				2				180	300	187	160	284	8	75	5	-	M6	8.3
		220	350				197				192				335	78	8.3								
220		365	197	192	335	78	8.3																		

Schaffner Flat Filters



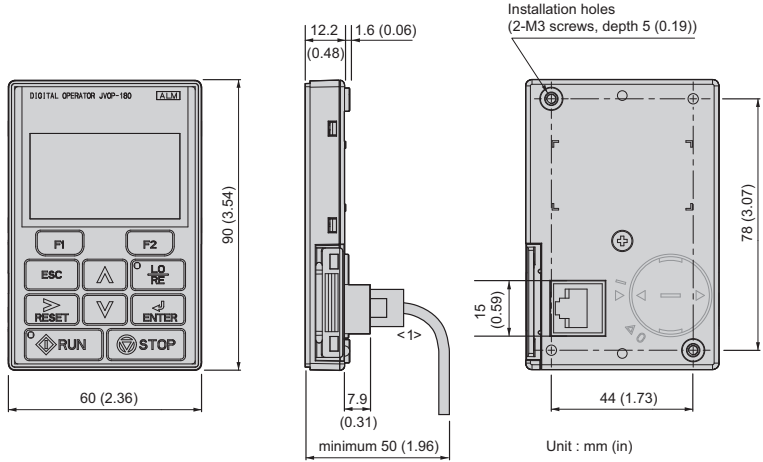
Flat Filters		Fig	Dimensions										Weight KG
			A	B	C	D	E	F	G	H	I	L	
200 V	3G3RV-PFI2035-SE	1	330	141	46	281	313	115	5.5	M5	23	M5	1.4
	3G3RV-PFI2060-SE		355	206	60	302	336	175	6.5	M6	30	M6	3
	3G3RV-PFI2100-SE		408	236	80	355	390	205	6.5	M6	40	M6	4.9
400 V	3G3RV-PFI3010-SE	1	330	141	46	281	313	115	5.5	M4	23	M5	1.2
	3G3RV-PFI3018-SE		330	141	46	281	313	115	5.5	M4	23	M5	1.3
	3G3RV-PFI3035-SE		355	206	50	302	336	175	6.5	M5	25	M6	2.2
	3G3RV-PFI3060-SE		408	236	65	355	390	205	6.5	M6	32.5	M6	4
	3G3RV-PFI3410-SE	2	386	115	260	-	120	235	12.0	M12	-	-	8.5
	3G3RV-PFI3600-SE		386	135	260	-	120	235	12.0	M12	-	-	11.0
	3G3RV-PFI3800-SE		564	160	300	-	210	275	9.0	M12	-	-	31.0

Bookform Filters



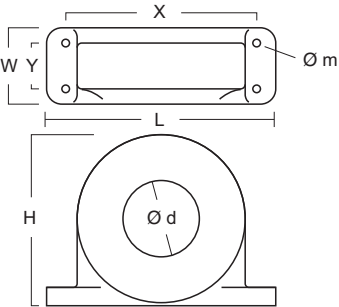
Bookform Filters		Dimensions								Weight KG
		A	B	C	D	E	F	G	H	
200 V	3G3RV-PFI2130-SE	310	180	90	280	295	65	6.5	M10	4.3
	3G3RV-PFI2160-SE	380	170	120	350	365	102	6.5	M10	6.0
	3G3RV-PFI2200-SE	518	240	130	480	498	90	8.2	M10	11.0
400 V	3G3RV-PFI3070-SE	329	185	80	300	314	55	6.5	M6	3.4
	3G3RV-PFI3130-SE	310	180	90	280	295	65	6.5	M10	4.7
	3G3RV-PFI3170-SE	380	170	120	350	365	102	6.5	M10	6.0
	3G3RV-PFI3250-SE	610	240	130	480	498	90	8.3	M10	11.7
	3G3RV-PFI3410-SE	386	115	260	-	120	235	12.0	M12	8.5
	3G3RV-PFI3600-SE	386	135	260	-	120	235	12.0	M12	11.0
	3G3RV-PFI3800-SE	564	160	300	-	210	275	9.0	M12	31.0

Remote LCD operator

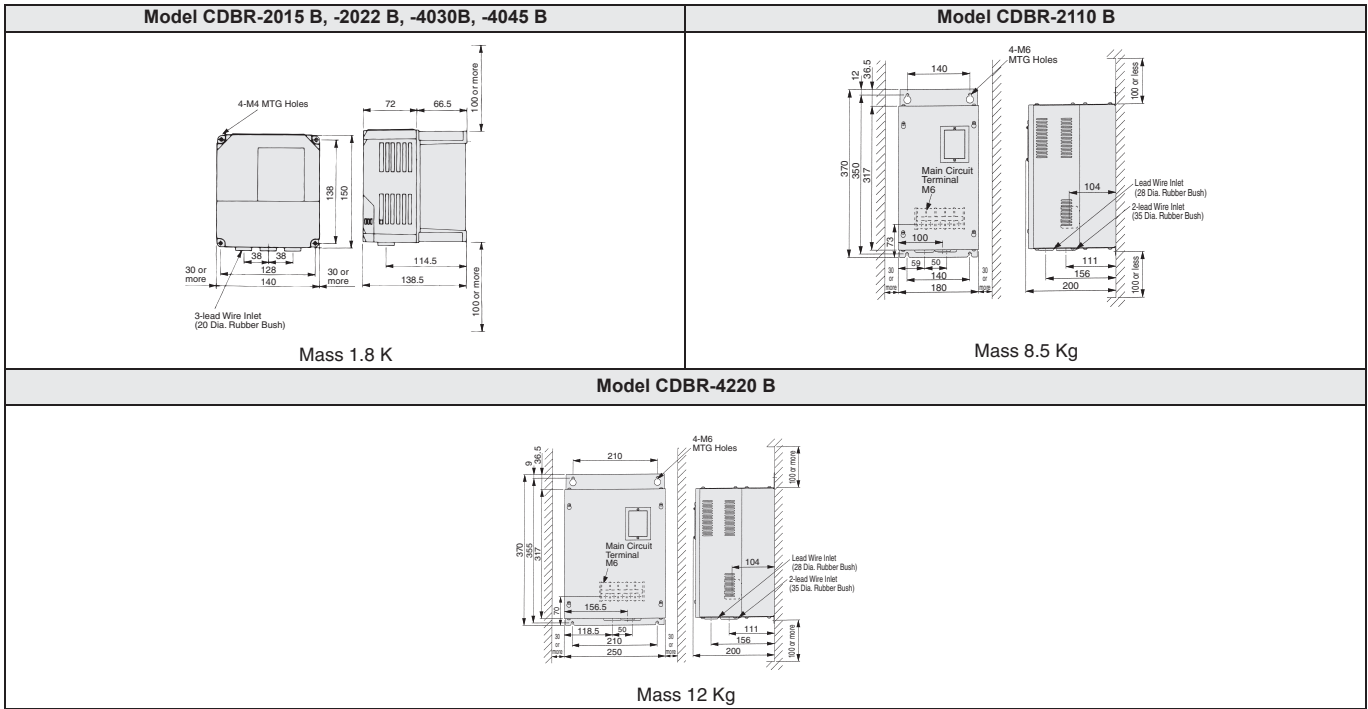


Chokes

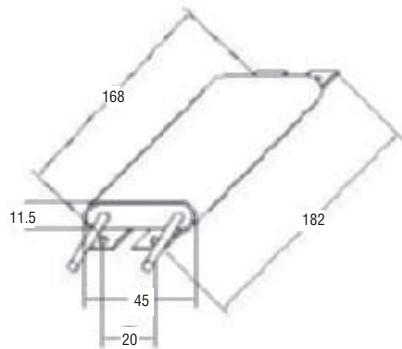
Description	D diameter	Motor KW	Dimensions						Weight Kg
			L	W	H	X	Y	m	
A1000-FEV2102-RE	21	< 2.2	85	22	46	70	-	5	0.1
A1000-FEV2515-RE	25	< 15	105	25	62	90	-	5	0.2
A1000-FEV5045-RE	50	< 45	150	50	110	125	30	5	0.7
A1000-FEV6045-RE	60	> 45	200	65	170	180	45	6	1.7



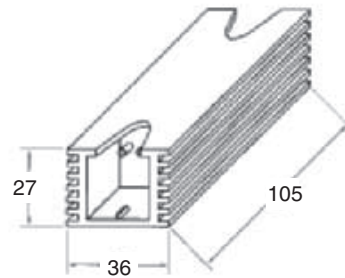
Braking Unit



Resistor Dimensions
A1000-REJ0K15



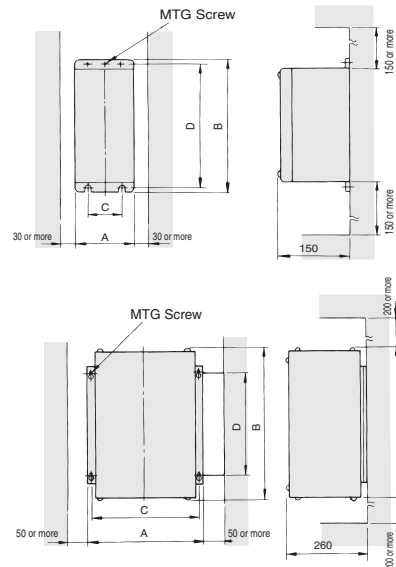
A1000-REJ0K10



Braking Resistor Unit

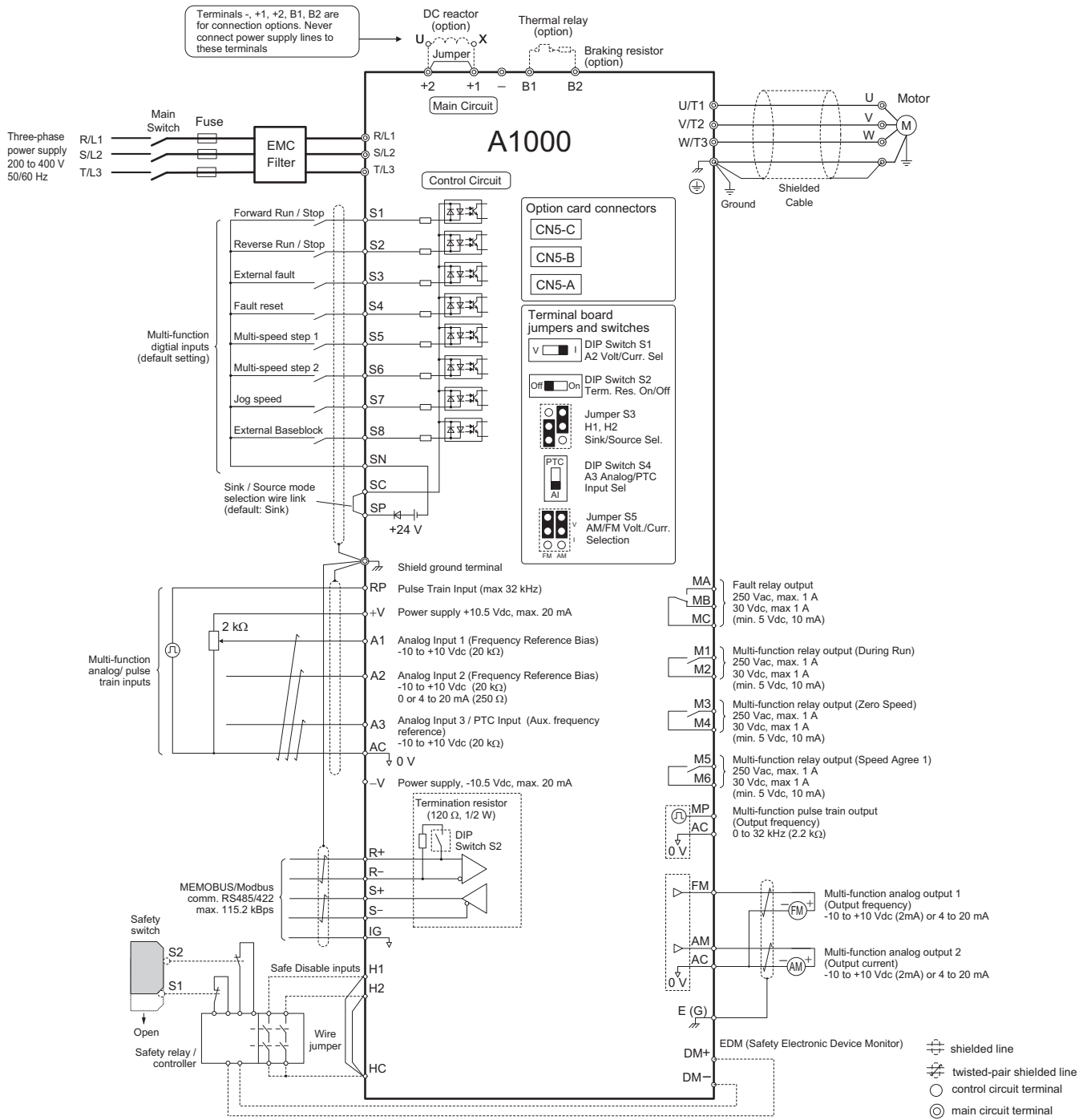
Voltage	Model LKEB- <u> </u>	Dimensions in mm					MTG Screw	Mass kg
		A	B	C	D			
220 V Class	21P5	130	350	75	335	M5 x 3	4.5	
	22P2							
	23P7							
	25P5	250	350	200	335	M6 x 4	7.5	
	27P5						8.5	
	2011	266	543	246	340	M8 x 4	10	
	2015	356	543	336	340	M8 x 4	15	
	2018	446	543	426	340	M8 x 4	19	
2022								
400 V Class	41P5	130	350	75	335	M5 x 4	4.5	
	42P2							
	43P7							
	45P5	250	350	200	335	M6 x 4	7.5	
	47P5						8.5	
	4011	350	412	330	325	M6 x 4	16	
	4015						18	
	4018	446	543	426	340	M8 x 4	19	
	4022							
	4030	356	956	336	740	M8 x 4	25	
	4037	446	956	426	740	M8 x 4	33	
4045	446	956	426	740	M8 x 4	33		

Fig 1



Installation

Standard connections



Main circuit

Terminal	Name	Function (signal level)
R/L1, S/L2, T/L3	Main circuit power supply input	Used to connect line power to the drive.
U/T1, V/T2, W/T3	Inverter output	Used to connect the motor
B1, B2	Braking resistor connection	Available for connecting a braking resistor or the braking resistor unit option.
+2, +1	DC reactor connection	Remove the short bar between +2 and +1 when connecting DC reactor (option)
+1, -	DC power supply input	For power supply input (+1: positive electrode; - : negative electrode)*
+3	Braking Unit	Connection for Braking Unit between terminals +3 and -
⊕	Grounding	For grounding (grounding should conform to the local grounding code.)

Control Circuit

Type	No.	Signal name	Function	Signal level
Digital input signals	S1	Multi-function input selection 1	Factory setting: runs when CLOSED, stops when OPEN.	24 VDC, 8 mA photocoupler insulation
	S2	Multi-function input selection 2	Factory setting: runs when CLOSED, stops when OPEN.	
	S3	Multi-function input selection 3	Factory setting: External Fault (N.O.)	
	S4	Multi-function input selection 4	Factory setting: Fault reset	
	S5	Multi-function input selection 5	Factory setting: Multi-step speed cmd 1	
	S6	Multi-function input selection 6	Factory setting: Multi-step speed cmd 2	
	S7	Multi-function input selection 7	Factory setting: Jog Frequency	
	S8	Multi-function input selection 8	Factory setting: Closed gives external baseblock	
	SC	Multi-function input selection Common	Common for control signal	
Analog input signals	+V	Power Supply for Frequency Setting	+10.5 V (allowable max current 20 mA)	
	-V	Power Supply for Frequency Setting	-10.5 V (allowable max current 20 mA)	
	A1	Multi-function analogue input 1	Main Frequency Reference -10 to +10 VDC, 0 to +10 VDC (20 kΩ)	
	A2	Multi-function analogue input 2	Voltage input or current input -10 to +10 VDC, 0 to +10 VDC (20 kΩ) 4 to 20 mA (250 Ω)	
	A3	Multi-function analogue input 3	-10 to +10 V, 0 to +10 V (20 kΩ)	
	AC	Frequency reference common	0 V	
Safety input	HC	Safety Input Common	+24 V (max allowable current 10 mA)	
	H1	Safety Input 1	Open: Stop Closed: Normal Operation	Photocoupler 24 V DC, 8 mA
	H2	Safety Input 2		
Safety monitor output	DM+	Safety monitor output	Open: Safety inputs 1 and 2 are open	48 Vdc, 50mA or less
	DM-	Safety monitor output common		
Digital output signals	MA	NO contact output	Factory setting: "fault"	Contact capacity 250 VAC, 1 A or less 30 VDC, 1 A or less
	MB	NC Output		
	MC	Relay Output common		
	M1	Multi-function contact output (N.O)	Factory setting Closed: During run	
	M2			
	P1	Photocoupler output 1	Factory setting: Zero speed	
	P2	Photocoupler output 2	Factory setting: Frequency Agree	
	PC	Photocoupler output common	0 V	
Analog output signals	FM	Multi-function analog monitor (1)	Factory setting: Output frequency	
	AM	Multi-function analog monitor (2)	Factory setting: "Current monitor, 5 V/drive rated current	
	AC	Analog monitor common	0 V	
Pulse/O	RP	Main Speed Cmd Pulse Train Input	32 kHz max. (3 kΩ)	
	MP	Pulse Train Output	Factory setting: Frequency reference input (H6-01=0) 0 to 33 kHz (2.2 kΩ)	
RS-485/422	R+	Communication input (+)	For MEMOBUS communication operation by RS-485 or RS-422 communication is available.	RS-485/422 MEMOBUS protocol
	R-	Communication input (-)		
	S+	Communication output (+)		
	S-	Communication output (-)		

Inverter heat loss

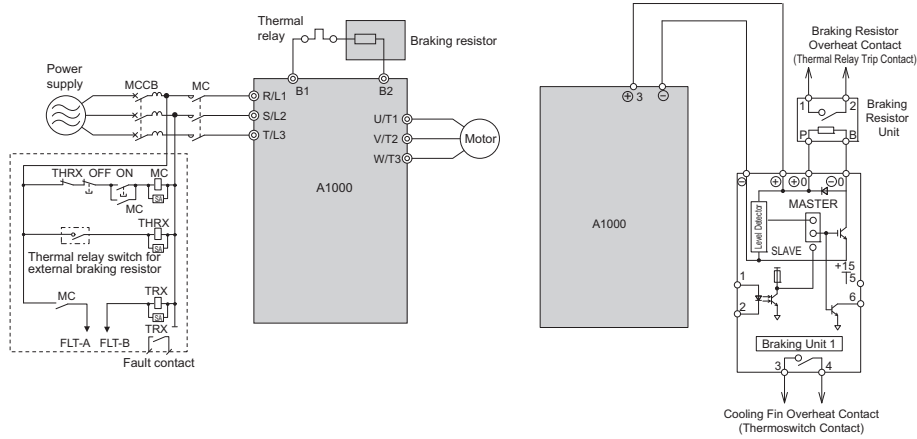
Three-phase 200 V class

Model Number CIMR-A□	Heavy Duty				Normal Duty			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
2A0004	3.2	14.8	44	59	3.5	18.4	47	66
2A0006	5.0	24	48	72	6.0	31	51	82
2A0010	8.0	43	52	95	9.6	57	58	115
2A0012	11.0	64	58	122	12.0	77	64	141
2A0021	17.5	101	67	168	21	138	83	222
2A0030	25	194	92	287	30	262	117	379
2A0040	33	214	105	319	40	293	145	437
2A0056	47	280	130	410	56	371	175	546
2A0069	60	395	163	558	69	491	205	696
2A0081	75	460	221	681	81	527	257	785
2A0110	85	510	211	721	110	719	286	1005
2A0138	115	662	250	912	138	842	312	1154
2A0169	145	816	306	1122	169	1014	380	1394
2A0211	180	976	378	1354	211	1218	473	1691
2A0250	215	1514	466	1980	250	1764	594	2358
2A0312	283	1936	588	2524	312	2020	665	2686
2A0360	346	2564	783	3347	360	2698	894	3591
2A0415	415	2672	954	3626	415	2672	954	3626

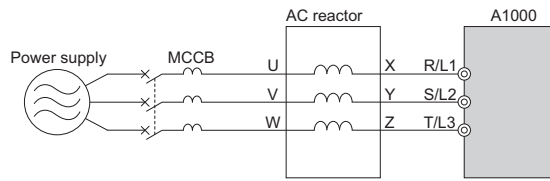
Three-phase 400 V class

Model Number CIMR-A□	Heavy Duty				Normal Duty			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0002	1.8	15.9	45	61	2.1	20	48	68
4A0004	3.4	25	46	70	4.1	32	49	81
4A0005	4.8	37	49	87	5.4	45	53	97
4A0007	5.5	48	53	101	6.9	62	59	121
4A0009	7.2	53	55	108	8.8	66	60	126
4A0011	9.2	69	61	130	11.1	89	73	162
4A0018	14.8	135	86	221	17.5	177	108	285
4A0023	18.0	150	97	247	23	216	138	354
4A0031	24	208	115	323	31	295	161	455
4A0038	31	263	141	403	38	340	182	521
4A0044	39	330	179	509	44	390	209	599
4A0058	45	349	170	518	58	471	215	686
4A0072	60	484	217	701	72	605	265	870
4A0088	75	563	254	817	88	684	308	993
4A0103	91	723	299	1022	103	848	357	1205
4A0139	112	908	416	1325	139	1215	534	1749
4A0165	150	1340	580	1920	165	1557	668	2224
4A0208	180	1771	541	2313	208	1800	607	2408
4A0250	216	2360	715	3075	250	2379	803	3182
4A0296	260	2391	787	3178	296	2448	905	3353
4A0362	304	3075	985	4060	362	3168	1130	4298
4A0414	370	3578	1164	4742	414	3443	1295	4738
4A0515	450	3972	1386	5358	515	4850	1668	6518
4A0675	605	4191	1685	5875	675	4861	2037	6898

Connections for braking unit and braking resistor

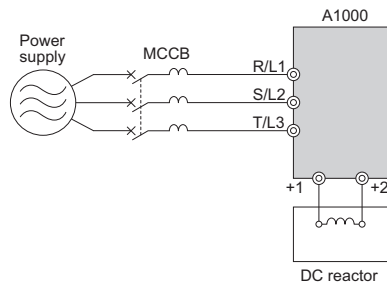


AC reactor



200 V class			400 V class		
Max. applicable motor output kW	Current value A	Inductance mH	Max. applicable motor output kW	Current value A	Inductance mH
0.4	2.5	4.2	0.4	1.3	18
0.75	5	2.1	0.75	2.5	8.4
1.5	10	1.1	1.5	5	4.2
2.2	15	0.71	2.2	7.5	3.6
4.0	20	0.53	4.0	10	2.2
5.5	30	0.35	5.5	15	1.42
7.5	40	0.265	7.5	20	1.06
11	60	0.18	11	30	0.7
15	80	0.13	15	40	0.53
18.5	90	0.12	18.5	50	0.42
22	120	0.09	22	60	0.36
30	160	0.07	30	80	0.28
37	200	0.05	37	90	0.24
45	240	0.044	45	120	0.18
55	280	0.039	55	150	0.15
75	360	0.026	75	200	0.11
90	500	0.02	90/110	250	0.09
110	600	0.02	132/160	330	0.06
-	-	-	160/185/220	490	0.04
-	-	-	315	660	0.03

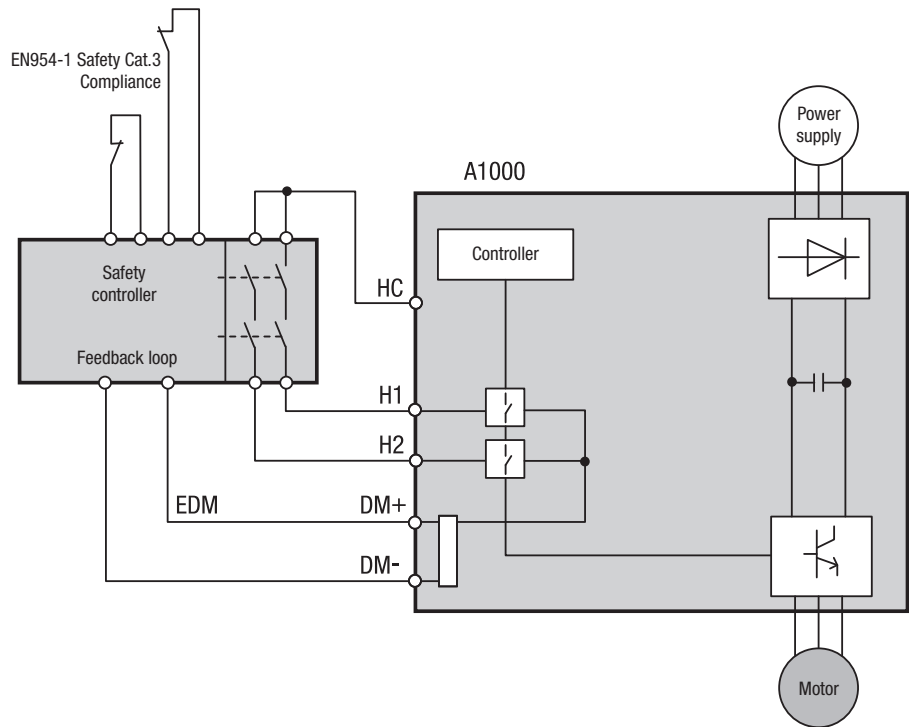
DC reactor



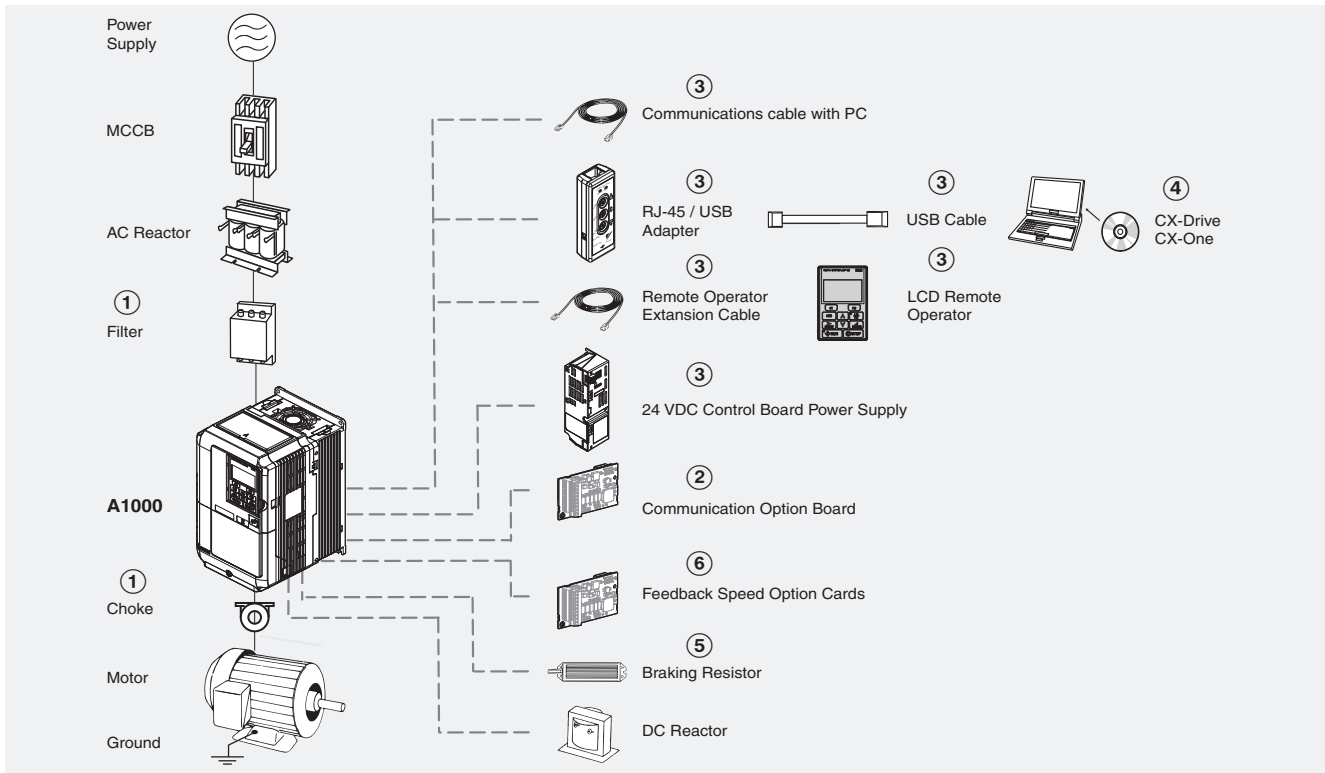
200 V class			400 V class		
Max. applicable motor output kW	Current value A	Inductance mH	Max. applicable motor output kW	Current value A	Inductance mH
0.4	5.4	8	0.4	3.2	28
0.75					
1.5					
2.2	18	3	2.2	5.7	11
4.0					
5.5					
7.5	36	1	5.5	23	3.6
7.5					
11					
15	72	0.5	11	33	1.9
15					
18.5					
18.5	90	0.4	18.5	47	1.3
22 to 110	Built-in		22 to 315	Built-in	

Safety System

- A1000 provides Safe Torque Off (STO) functional safety in compliance with EN954-1 safety category 3 stop category 0, EN ISO 13849-1, PLC, IEC/EN61508 SIL2.
- An External Device Monitor (EDM) function has also been added to monitor the safety status of the drive.



Ordering information



A1000

	Specifications				Model
	Heavy Duty		Normal Duty		Standard
200 V	0.4 kW	3.2 A	0.75 kW	3.5 A	CIMR-AC2A0004FAA
	0.75 kW	5.0 A	1.1 kW	6.0 A	CIMR-AC2A0006FAA
	1.5 kW	8.0 A	2.2 kW	9.6 A	CIMR-AC2A0010FAA
	2.2 kW	11.0 A	3.0 kW	12.0 A	CIMR-AC2A0012FAA
	4.0 kW	17.5 A	5.5 kW	21.0 A	CIMR-AC2A0021FAA
	5.5 kW	25.0 A	7.5 kW	30.0 A	CIMR-AC2A0030FAA
	7.5 kW	33.0 A	11.0 kW	40.0 A	CIMR-AC2A0040FAA
	11 kW	47.0 A	15.0 kW	56.0 A	CIMR-AC2A0056FAA
	15 kW	60.0 A	18.5 kW	69.0 A	CIMR-AC2A0069FAA
	18.5 kW	75 A	22 kW	81 A	CIMR-AC2A0081FAA
	22 kW	85 A	30 kW	110 A	CIMR-AC2A0110AAA
	30 kW	115 A	37 kW	138 A	CIMR-AC2A0138AAA
	37 kW	145 A	45 kW	169 A	CIMR-AC2A0169AAA
	45 kW	180 A	55 kW	211 A	CIMR-AC2A0211AAA
	55 kW	215 A	75 kW	250 A	CIMR-AC2A0250AAA
	75 kW	283 A	90 kW	312 A	CIMR-AC2A0312AAA
	90 kW	346 A	110 kW	360 A	CIMR-AC2A0360AAA
110 kW	415 A	110 kW	415 A	CIMR-AC2A0415AAA	
400 V	0.4 kW	1.8 A	0.75 kW	2.1 A	CIMR-AC4A0002FAA
	0.75 kW	3.4 A	1.5 kW	4.1 A	CIMR-AC4A0004FAA
	1.5 kW	4.8 A	2.2 kW	5.4 A	CIMR-AC4A0005FAA
	2.2 kW	5.5 A	3.0 kW	6.9 A	CIMR-AC4A0007FAA
	3.0 kW	7.2 A	4.0 kW	8.8 A	CIMR-AC4A0009FAA
	4.0 kW	9.2 A	5.5 kW	11.1 A	CIMR-AC4A0011FAA
	5.5 kW	14.8 A	7.5 kW	17.5 A	CIMR-AC4A0018FAA
	7.5 kW	18.0 A	11.0 kW	23.0 A	CIMR-AC4A0023FAA
	11 kW	24.0 A	15.0 kW	31.0 A	CIMR-AC4A0031FAA
	15 kW	31.0 A	18.5 kW	38.0 A	CIMR-AC4A0038FAA
	18.5 kW	39 A	22 kW	44 A	CIMR-AC4A0044FAA
	22 kW	45 A	30 kW	58 A	CIMR-AC4A0058AAA
	30 kW	60 A	37 kW	72 A	CIMR-AC4A0072AAA
	37 kW	75 A	45 kW	88 A	CIMR-AC4A0088AAA
	45 kW	91 A	55 kW	103 A	CIMR-AC4A0103AAA
	55 kW	112 A	75 kW	139 A	CIMR-AC4A0139AAA
	75 kW	150 A	90 kW	165 A	CIMR-AC4A0165AAA
	90 kW	180 A	110 kW	208 A	CIMR-AC4A0208AAA
	110 kW	216 A	132 kW	250 A	CIMR-AC4A0250AAA
	132 kW	260 A	160 kW	296 A	CIMR-AC4A0296AAA
	160 kW	304 A	185 kW	362 A	CIMR-AC4A0362AAA
185 kW	370 A	220 kW	414 A	CIMR-AC4A0414AAA	
220 kW	450 A	250 kW	515 A	CIMR-AC4A0515AAA	
315 kW	605 A	355 kW	675 A	CIMR-AC4A0675AAA	

① Line filters

Voltage	Inverter	Line filter		
	Model CIMR-A□	Reference	Rated current (A)	Weight (kg)
3-Phase 200 VAC	2CA0004 / 2CA0006 / 2CA0008	3G3RV-PFI3010-SE	10	1.2
	2CA0010 / 2CA0012 / 2CA0018 / 2CA0021	3G3RV-PFI3018-SE	18	1.3
	2CA0030 / 2CA0040 / 2CA0056	3G3RV-PFI2035-SE	35	1.4
	2CA0069 / 2CA0081	3G3RV-PFI2060-SE	60	3
	2CA00110 / 2CA0138	3G3RV-PFI2100-SE	100	4.9
	2CA0169 / 2CA0211	3G3RV-PFI3170-SE	170	6.0
3-Phase 400 VAC	4CA0002 / 4CA0004 / 4CA0005 / 4CA0007	3G3RV-PFI3010-SE	10	1.2
	4C0009 / 4C0011	3G3RV-PFI3018-SE	18	1.3
	4CA0018 / 4CA0023 / 4CA0031	3G3RV-PFI3035-SE	35	2.2
	4CA0038 / 4CA0044 / 4CA0058	3G3RV-PFI3060-SE	60	4.0
	4CA0072 / 4CA0088	3G3RV-PFI3100-SE	100	4.5
	4CA0103 / 4CA0139 / 4CA0165	3G3RV-PFI3170-SE	170	6.0
	4CA0208 / 4CA0250	3G3RV-PFI3200-SE	250	11
	4CA0296 / 4CA0362	3G3RV-PFI3400-SE	400	8.5
	4CA0414 / 4CA0515	3G3RV-PFI3600-SE	600	11.0
	4CA0675	3G3RV-PFI3800-SE	800	31.0

Chokes

Model	Diameter	Description
A1000-FEV2102-RE	21	Recommended for motors below 2.2 KW
A1000-FEV2515-RE	25	Recommended for motors below 15 KW
A1000-FEV5045-RE	50	Recommended for motors below 45 KW
A1000-FEV6045-RE	60	Recommended for motors above 45 KW

② Communication cards

Type	Model	Description	Function
Communication option board	SI-N3	DeviceNet option card	• Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through DeviceNet communication with the host controller.
	SI-P3	PROFIBUS-DP option card	• Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through PROFIBUS-DP communication with the host controller.
	SI-S3	Can open option card	• Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CANopen communication with the host controller.
	SI-T3	Mechatrolink II option card	• Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through Mechatrolink II communication with the host controller.

③ Accessories

Types	Model	Description	Functions
Digital operator	JVOP-180	LCD remote operator	LCD Display operator with language support
	3G3AX-CAJOP300-EE	Remote operator cable	3 meters cable for connecting remote operator
Accessories	JVOP-181	USB converter / USB cable	USB converter unit with copy and backup function
	PS-V10S	24 VDC option board	24V DC control board power supply VZA-B/2/4 from 0.1 to 4 KW
	PS-V10M		24V DC control board power supply VZA-2/4 from 5.5 to 15 KW
	A1000-CAVPC232-EE	PC connection cable	RS232 PC tool connection cable

④ Computer software

Types	Model	Description	Installation
Software	CX-drive	Computer software	Configuration and monitoring software tool
	CX-One	Computer software	Configuration and monitoring software tool

⑤ Braking unit, braking resistor unit

Inverter		Braking unit		Braking Resistor ¹											
Max. Applicable Motor kW	Model CIMR-A ₁ 2A	Model CDBR ₋	No. of used	Model A1000-RE ₋	Specifications of Resistor		Qty	Braking torque % (3% ED)	Type		Braking torque % (10% ED)	Min Resist Value Ω			
					Model LKEB-	Specifications of Resistor			Qty	Braking torque % (10% ED)					
200 V Class	0.4	0004 HD	Built-in	J0K15200-IE	190W	200 Ω	1	220	-	-	-	-	48		
		0004 ND							-	-	-	-	-	48	
	0.75	0006 HD		J0K15100-IE	190 W	100 Ω	1	125	21P5	260W	100Ω	1	150	48	
		0006 ND								-	-	-	-		-
	1.1	0008 HD		J0K15070-IE	190 W	70 Ω	1	120	22P2	260W	70Ω	1	120	48	
		0008 ND								-	-	-	-		-
	1.5	0010 HD		J0K15062-IE	190 W	62 Ω	1	100	23P7	390W	40Ω	1	150	16	
		0010 ND								-	-	-	-		-
	2.2	0012 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0012 ND													
	3	0018 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0018 ND													
	3.7	0021 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0021 ND													
	5.5	0030 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0030 ND													
	7.5	0040 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0040 ND													
	11	0056 HD		-	-	-	-	-	-	-	-	-	-	-	-
		0056 ND													
15	0069 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0069 ND													-	-
18.5	0081 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0081 ND													-	-
22	0110 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0110 ND													-	-
30	0138 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0138 ND													-	-
37	0169 HD	2015B	2	-	-	-	2	110	25P5	520W	30Ω	1	115	16	
	0169 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
45	0211 HD	2022B	2	-	-	-	-	-	27P5	780W	20Ω	1	125	16	
	0211 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
55	0250 HD	2022B	2	-	-	-	-	-	2011	2400W	13.6Ω	1	125	9.6	
	0250 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
75	0312 HD	2110B	1	-	-	-	-	-	2015	3000W	10Ω	1	125	9.6	
	0312 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
90	0360 HD	2110B	1	-	-	-	-	-	2015	3000W	10Ω	1	100	9.6	
	0360 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
110	0415 HD	2110B	1	-	-	-	-	-	2015	3000W	10Ω	2	100	9.6	
	0415 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
0.4	0002 HD	Built in		J0K10750-IE	60 W	750 Ω	1	230	-	-	-	-	-	96	
	0002 ND			J0K10750-IE	60 W	750 Ω	1	130	-	-	-	-	-	-	96
0.75	0004 HD			J0k15400-IE	190 W	400 Ω	1	125	41P5	260W	400Ω	1	125	96	
	0004 ND									-	-	-	-	-	-
1.5	0005 HD			J0k15300-IE	190 W	300 Ω	1	115	42P2	260W	250Ω	1	135	64	
	0005 ND									-	-	-	-	-	-
2.2	0007 HD			J0k15200-IE	190 W	200 Ω	1	125	42P2	260W	250Ω	1	100	64	
	0007 ND									-	-	-	-	-	-
3	0009 HD			J0k15200-IE	190 W	200 Ω	1	105	43P7	390W	150Ω	1	150	32	
	0009 ND									-	-	-	-	-	-
3.7	0011 HD			J0k15200-IE	190 W	100 Ω	2	135	43P7	390W	150Ω	1	135	32	
	0011 ND									-	-	-	-	-	-
5.5	0018 HD			-	-	-	-	-	-	-	-	-	-	-	-
	0018 ND														
7.5	0023 HD			-	-	-	-	-	-	-	-	-	-	-	-
	0023 ND														
11	0031 HD			-	-	-	-	-	-	-	-	-	-	-	-
	0031 ND														
15	0038 HD			-	-	-	-	-	-	-	-	-	-	-	-
	0038 ND														
18.5	0044 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0044 ND													-	-
22	0058 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0058 ND													-	-
30	0072 HD	-	-	-	-	-	-	-	-	-	-	-	-		
	0072 ND													-	-
37	0088 HD	4045B	1	-	-	-	-	-	45P5	520W	100Ω	1	135	32	
	0088 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
45	0103 HD	4045B	1	-	-	-	-	-	47P5	780W	75Ω	1	130	32	
	0103 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
55	0139 HD	4030B	2	-	-	-	-	-	4011	1040W	50Ω	1	135	32	
	0139 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
75	0165 HD	4045B	2	-	-	-	-	-	4015	1560W	40Ω	1	125	20	
	0165 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
90	0208 HD	4045B	2	-	-	-	-	-	4018	4800W	32Ω	1	125	20	
	0208 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
110	0250 HD	4220B	1	-	-	-	-	-	4022	4800W	27.2Ω	1	125	19.2	
	0250 ND	-	-	-	-	-	-	-	-	-	-	-	-	-	

Inverter		Braking unit		Braking Resistor ¹									
				Type									
Max. Applicable Motor kW	Model CIMR-A□2A	Model CDBR	No. of used	Model A1000-RE	Specifications of Resistor	Qty	Braking torque % (3% ED)	Model LKEB-	Specifications of Resistor		Qty	Braking torque % (10% ED)	Min Resist Value Ω
400 V Class	132	0250 ND	4220B	1	-			4045	9600W	13.6Ω	4	140	3.2
		0296 HD			-								
	160	0296 ND	4220B	1	-			4045	9600W	13.6Ω	4	120	3.2
		0362 HD			-								
	185	0362 ND	4220B	1	-			4045	9600W	13.6Ω	4	100	3.2
		0414 HD			-								
	220	0414 ND	4220B	1	-			4037	9600W	16Ω	5	110	3.2
		0515 HD			-								
250	0515 ND	4220B	1	-	4045	9600W	13.6Ω	6	105	3.2			
315	0675 HD	4220B	2	-									
355	0675 ND	4220B	2	-									

1. When connecting a mounting type resistor or braking resistor unit, set system constant L3-04 to 0 (Stall prevention disabled during deceleration). Motor will not stop at set deceleration time if this constant is not changed. Additionally the Internal braking transistor protection (L8-55) should be set to "0" when a external braking unit (CDBR-) is used.

⑥ Feedback speed option card

Type	Model	Description	Function
PG option card	PG-B3	Complementary PG	<ul style="list-style-type: none"> For speed feedback input by connecting a motor encoder Input: 3 track (one or two tracks), for HTL encoder connection, 50 KHz max Output: 3 track open collector Encoder power supply: 12 V, 200 mA max
	PG-X3	Line Driver PG	<ul style="list-style-type: none"> For speed feedback input by connecting a motor encoder Input: 3 track, line driver, 300 kHz max Output: 3 track, line driver Encoder power supply: 5 V or 12 V, 200 mA max

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

OMRON EUROPE B.V. Wegalaan 67-69, NL-2132 JD, Hoofddorp, The Netherlands. Tel: +31 (0) 23 568 13 00 Fax: +31 (0) 23 568 13 88 www.industrial.omron.eu

Austria

Tel: +43 (0) 2236 377 800
www.industrial.omron.at

Belgium

Tel: +32 (0) 2 466 24 80
www.industrial.omron.be

Czech Republic

Tel: +420 234 602 602
www.industrial.omron.cz

Denmark

Tel: +45 43 44 00 11
www.industrial.omron.dk

Finland

Tel: +358 (0) 207 464 200
www.industrial.omron.fi

France

Tel: +33 (0) 1 56 63 70 00
www.industrial.omron.fr

Germany

Tel: +49 (0) 2173 680 00
www.industrial.omron.de

Hungary

Tel: +36 1 399 30 50
www.industrial.omron.hu

Italy

Tel: +39 02 326 81
www.industrial.omron.it

Netherlands

Tel: +31 (0) 23 568 11 00
www.industrial.omron.nl

Norway

Tel: +47 (0) 22 65 75 00
www.industrial.omron.no

Poland

Tel: +48 (0) 22 645 78 60
www.industrial.omron.pl

Portugal

Tel: +351 21 942 94 00
www.industrial.omron.pt

Russia

Tel: +7 495 648 94 50
www.industrial.omron.ru

South Africa

Tel: +27 (0)86 066 7661
www.industrial.omron.co.za

Spain

Tel: +34 913 777 900
www.industrial.omron.es

Sweden

Tel: +46 (0) 8 632 35 00
www.industrial.omron.se

Switzerland

Tel: +41 (0) 41 748 13 13
www.industrial.omron.ch

Turkey

Tel: +90 216 474 00 40
www.industrial.omron.com.tr

United Kingdom

Tel: +44 (0) 870 752 08 61
www.industrial.omron.co.uk

More Omron representatives
www.industrial.omron.eu

Automation Systems

- Programmable logic controllers (PLC) • Human machine interfaces (HMI) • Remote I/O
- Industrial PC's • Software

Motion & Drives

- Motion controllers • Servo systems • Inverters

Control Components

- Temperature controllers • Power supplies • Timers • Counters • Programmable relays
- Digital panel indicators • Electromechanical relays • Monitoring products • Solid-state relays
- Limit switches • Pushbutton switches • Low voltage switch gear

Sensing & Safety

- Photoelectric sensors • Inductive sensors • Capacitive & pressure sensors
- Cable connectors • Displacement & width-measuring sensors • Vision systems
- Safety networks • Safety sensors • Safety units/relay units • Safety door/guard lock switches