



# U1000

## LOW HARMONICS REGENERATIVE MATRIX CONVERTER

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## Experience and Innovation

Since 1915 YASKAWA has manufactured and supplied products for machine building and industrial automation. Our standard products as well as tailor-made solutions are well known and have a high reputation for outstanding quality and reliability.

YASKAWA is the leading global manufacturer of inverter drives, servo drives, machine controllers, medium voltage inverters, and industrial robots.

We have always been a pioneer in motion control and drive technology, launching product innovations, which optimise the productivity and efficiency of both machines and systems.

Today we produce more than 1.8 million inverters per year. Considering this, YASKAWA is probably the biggest inverter manufacturer in the world.



YASKAWA Motoman Robots

Furthermore, with a yearly production of more than 800,000 servo motors and 20,000 robots we offer a wide range of products for drive automation processes in many different industries. YASKAWA technology is used in all fields of machine building and industrial automation.



YASKAWA Eschborn, Germany

## Wherever You Are – Our Local Support is Near.



Employing more than 14,600 people worldwide

More than 1,350 employees in worldwide service network

More than 1,300 employees in Europe

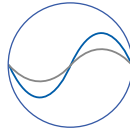
## U1000 - The Drive for Maximum Efficiency

The U1000 is a highly efficient inverter drive based on latest Matrix converter technology. With full power regeneration capability it offers great energy saving potential while sinusoidal input currents and a power factor close to one reduce stress on grid components like transformers and power lines. With an ultra-compact shape the U1000 is the first choice for innovative, energy-efficient drive solutions with or without power regeneration.



### INNOVATIVE MATRIX TECHNOLOGY

The U1000 comes without a DC bus and provides highly efficient direct conversion of power from AC to AC up to a maximum output frequency of 400 Hz. With this and the capability to run induction as well as permanent magnet motors with and without encoder feedback U1000 is the perfect match for a variety of applications and machinery.



### CLEAN POWER

The sinusoidal input current with a total harmonic distortion of less than 5% and a displacement power factor of  $\sim 1$  minimize losses in grid components like generators and transformers. This, at the same time, greatly reduces the potential of disturbance of other devices and improves the reliability of a machine or installation.



### ENERGY SAVING 4Q OPERATION

Thanks to Matrix technology U1000 can operate fully regenerative, means braking energy is fed back to the grid and made available for other consumers. By that not only energy cost are reduced but also braking resistors and their cooling become obsolete and the risk of fire is reduced.



### TIME SAVING INSTALLATION

As no external components are required, connecting a U1000 drive becomes a matter of minutes. 3 wires in, 3 wires out, done. It cannot be easier to build up a low harmonic regenerative solution.



### Functional Safety Built in

U1000 has a SIL3 STO function built in and so offers a simple solution for improving machine safety.



### UP TO 50% SMALLER

U1000 does not need any external components like AC chokes or harmonic filters. Even an EMC filter is built in. Nevertheless the required installation space is up to 50% smaller than other regenerative or low-harmonic drive solutions.



### REDUCE COSTS

In addition to a reduction of energy consumption U1000 provides cost saving benefits by a simplified installation, smaller space requirements and smaller panels, less cooling requirement and less need for maintenance.



## Power Regeneration to Maximize Efficiency

Rising energy cost and polluted power supply systems continuously drive the need for low harmonics and power regeneration. The U1000 offers both without the complexity of traditional solutions. On first sight it looks like a new Inverter Drive. But it contains all you need to get a system architecture with maximum efficiency at a minimum footprint.

### Built in Power Regeneration

The U1000 has power regeneration built in. Braking energy that is typically wasted in resistors can be used by other consumers in the same grid, saving energy and cost.

- ▶ Saves energy
- ▶ Less heat generation, reduced need for ventilation
- ▶ Greatly reduced risk of fire
- ▶ Less maintenance
- ▶ Less parts

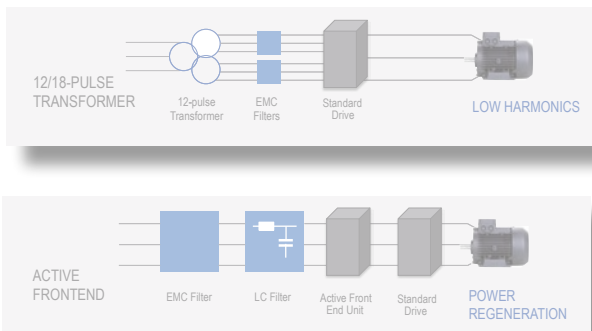


### Compact and Easy

The all-integrated design of the U1000 reduces the required installation space for more than 50%. Traditional regenerative and low harmonic solutions often use external transformers, reactors, and filter circuits. Not so the U1000. EMC and current filter components are built in and external components are not necessary.

The U1000 needs only a minimum of space and is easily installed in shortest time.

- ▶ Smaller panels
- ▶ Less components to handle
- ▶ Simple installation in short time
- ▶ Perfectly fits in existing installations – easy retro fit



Traditional low harmonics and regenerative solutions



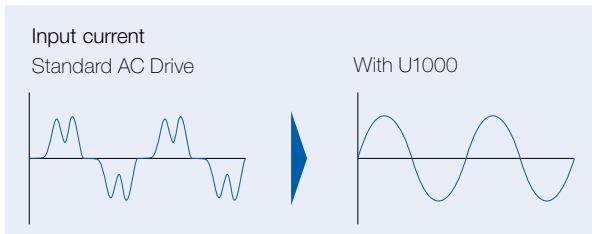
U1000 Matrix Converter Solution

**Smaller footprint up to -50%**

## Clean Power

With the YASKAWA U1000 typical field problems caused by current harmonics, such as excessive heating of power grid devices or malfunction of peripheral electronics, are history. The U1000 matrix converter provides clean power with a total harmonic current distortion of less than 5%.

- ▶ No over-dimensioning of transformers, generators, or cables
- ▶ Less watt loss on power grid components
- ▶ Sinusoidal input current with power factor ~0.98
- ▶ Easy installation by all-integrated design
- ▶ Reduced lifecycle cost



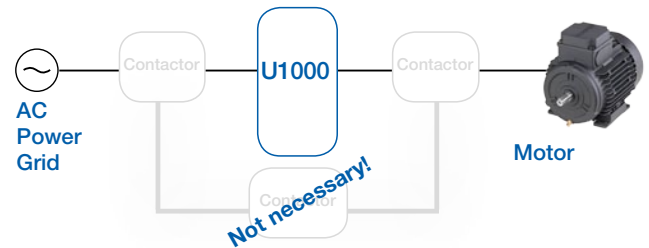
- ▶ No trouble in IT and Control Systems
- ▶ Reliable Operation

## U1000 – A Class of its Own

- Precise control of induction and permanent motors with or without encoder
- Highly efficient AC to AC direct conversion
- Automatic motor data adjustment
- Built in EMC filter
- 13 language full text keypad built in
- 10 years maintenance free design

## Built in Bypass Operation

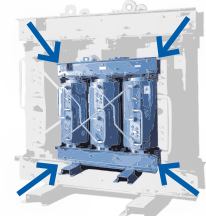
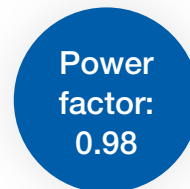
The U1000 has a built in bypass function. Whenever an application is running at the frequency and voltage of the power grid, U1000 can stop modulating the output and switch the motor directly to the grid.



- ▶ No external components needed
- ▶ Minimum watt loss on drive
- ▶ Silent motor operation

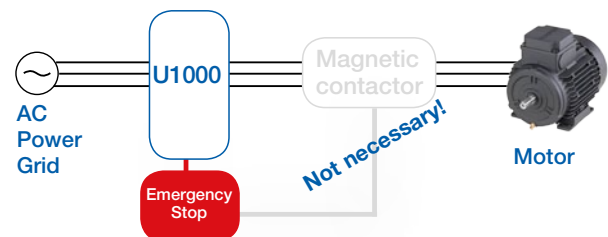
## Improved Power Factor

The U1000 provides a power factor close to One. By that it reduces losses in generators, transformers and cables, allowing a size down of these components for new installations or the possibility to add more drives to an existing installation without increasing transformer power.



## Built in Functional Safety

The U1000 comes with a built in dual-channel safe torque off (STO) function that meets the requirements of SIL3/Plc and offers an easy way to improve machine safety without the need for complex external wiring.



- ▶ Simple wiring
- ▶ Less components and higher reliability

## Engineering Tools for YASKAWA Inverter Drives

### DriveWorksEZ for easy Installation and reliable Operation

DriveWorksEZ® adds programmable functions that can tailor the U1000 matrix converters to the machine without the help of external controllers such as a PLC. This provides the user with easy access to the power of the inverters through an icon-based, graphical programming environment.



#### Benefits

- ▶ PLC or other external controllers not necessary
- ▶ Easy to use
- ▶ Constant scan cycle of 1 ms
- ▶ Easy to learn graphical programming with online monitoring
- ▶ Higher reliability and less cost by lower number of components

#### Example projects

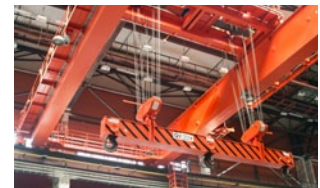
Economically optimized water skiing facility

- ▶ No additional I/Os necessary
- ▶ No PLC required - reduced the system cost to less than 50% of the initial estimate



#### Efficient brake sequence

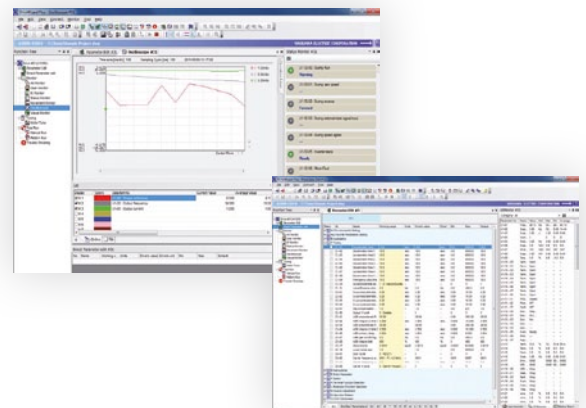
- ▶ Flexible sequence for mechanical brake of hoists
- ▶ Avoids brake wear and unsafe operation



### DriveWizard Plus for easy Engineering

Manage the unique settings for all your drives right on your PC. An indispensable tool for drive setup and maintenance. Edit parameters, access all monitors, create customized operation sequences, and observe drive performance with the oscilloscope function.

- ▶ All in one tool for parameter management, drive setup, monitoring, and fault diagnostics
- ▶ Convenient PC-based drive-setup, monitoring and diagnostic functions
- ▶ Built-in scope function
- ▶ Online and offline parameter editing



## For a wide Range of Industries

The U1000 Matrix Converter Unit saves energy and thereby money by reusing braking energy and providing a clean power supply. The maximum effect can be realized in applications with large-inertia loads, 4-quadrant loads, long-term energy feedback and quick braking.



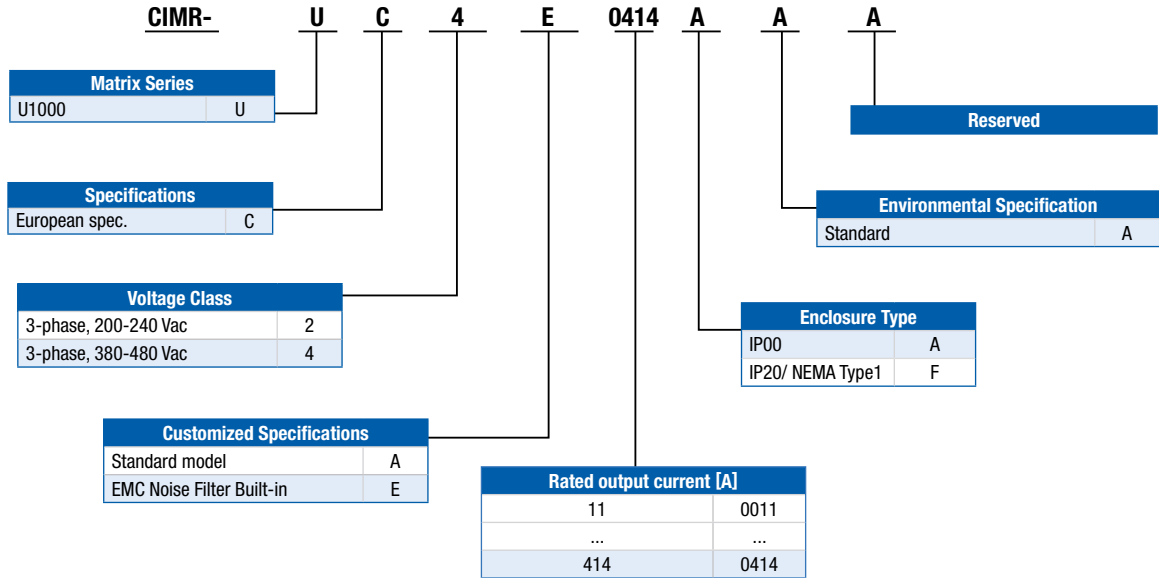
- ▶ Elevators and escalators
- ▶ Cranes and hoists
- ▶ Centrifugal separators
- ▶ Winders
- ▶ Presses
- ▶ Eccentrics

## Communication Options

- ▶ RS-422/485 (MEMOBUS/Modbus at 115.2 kbps) standard on all models
- ▶ Option cards available for all major fieldbuses



## Model Number Key for the U1000 Matrix Converter



U1000 Model	Input Current [A]	Rated Output Current [A]	Input Current [A]	Rated Output Current [A]	Carrier Frequency	Max. Output Freq. [Hz]
200 V Class CIMR-UC2A□□□AAA						
0028	25	28	20	22	4 to 10 kHz	400
0042	38	42	25	28		
0054	49	54	38	42		
0068	62	68	49	54		
0081	74	81	62	68		
0104	95	104	74	81		
0130	118	130	95	104		
0154	140	154	118	130		
0192	175	192	140	154		
0248	226	248	175	192		

U1000 Model	Input Current [A]	Rated Output Current [A]	Input Current [A]	Rated Output Current [A]	Carrier Frequency	Max. Output Freq. [Hz]
400 V Class CIMR-UC4A□□□AAA						
0011	10	11	8.7	9.6	4 to 10 kHz	400
0014	13	14	10	11		
0021	19	21	13	14		
0027	25	27	19	21		
0034	31	34	25	27		
0040	36	40	31	34		
0052	47	52	36	40		
0065	59	65	47	52		
0077	70	77	59	65		
0096	87	96	70	77		
0124	113	124	87	96		
0156	142	156	113	124		
0180	164	180	142	156		
0216	197	216	164	180		
0240	218	240	197	216		
0302	275	302	218	240		
0361	329	361	275	302		
0414	377	414	329	361		



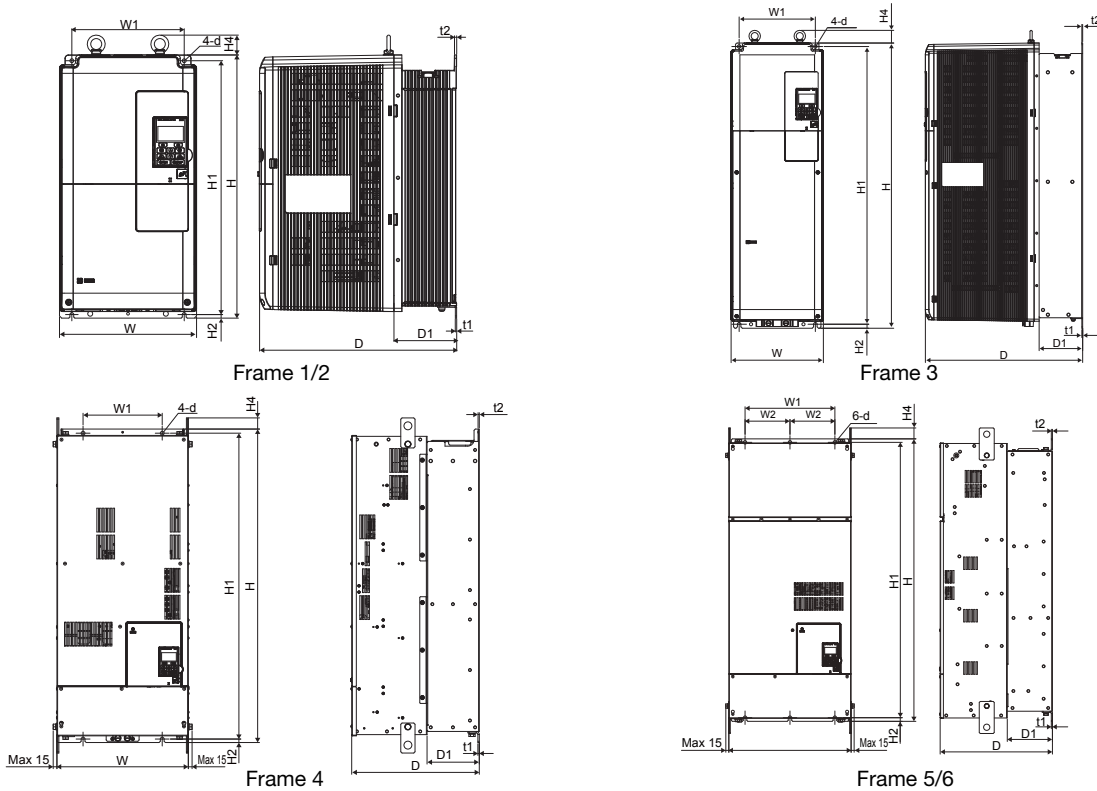
## Options

	Item	Description	Model Code
Input / Output	▶ Analogue Monitor	<b>2 channel analogue output option</b> -10 to +10 VDC (Res. 1/2048)	AO-A3
	▶ Digital Output	<b>8 channel digital output option</b> 6 photo couplers (48 V, 50 mA or less), 2 relay contact outputs max 250 VAC/30 VDC, 1 A	DO-A3
	▶ Analogue Input	<b>3 channel analogue input option</b> -10 to +10 VDC (20 k $\Omega$ , Res. 1/8192), 4 to 20 mA (500 $\Omega$ , Res. 1/6554)	AI-A3
	▶ Digital Input	<b>1 channel digital input option</b> 16 bit binary, 2 digit BCD + sign signal + set signal, +24 V (isolated), 8 mA 2 relay contact outputs max 250 VAC/30 VDC, 1 A	DI-A3
Communication	▶ Communication Interface Unit	CANopen	SI-S3
		CC-Link	SI-C3
		DeviceNET	SI-N3
		EtherCAT	SI-ES3
		EtherNET/IP	SI-EN3 / SI-END3
		MECHATROLINK-II	SI-T3
		MECHATROLINK-III	SI-ET3
		Modbus TCP/IP	SI-EM3
		POWERLINK	SI-EL3
		PROFIBUS-DP	SI-P3
PROFINET	SI-EP3		
Speed Feedback	▶ Open Collector Type	Phase A, B, and Z pulse (complementary type), max. 50 kHz	PG-B3
	▶ Line Driver Type	Phase A, B, and Z pulse (differential pulse) (RS-422), max. 300 kHz, pulse monitor output	PG-X3
Others	▶ USB Copy Unit	USB converter for PC Tool usage and copy unit for easy parameter setup duplication and backup in one	JVOP-181
	▶ IP65 Operator Mounting Frame	Provides a simple way of installing the LCD Remote Operator of the drive on a cabinet wall or door	JVOP-V11001
	▶ DriveWizard Plus	Software used for parametrization	
	▶ IP20/NEMA Kit	Frame 1: <b>EZZ022745A</b> , Frame 2: <b>EZZ022745B</b> , Frame 3: <b>EZZ022745C</b> , Frame 4: <b>EZZ022745D</b> , Frame 5: <b>EZZ022745E</b> , Frame 6: <b>EZZ022745F</b>	

## Specifications

Operating Environment	▶ Ambient Temperature	-10 to +50 °C (open chassis)
	▶ Humidity	95% RH or less (non condensating)
	▶ Storage Temperature	-20 to +60 °C (short-term temperature during transportation)
	▶ Altitude	Up to 1000 meters (output derating required above 1000 m, max. 3000 m)
	▶ Shock	10 to 20 Hz: 9.8 m/s <sup>2</sup> ; 20 to 55 Hz: 5.9 m/s <sup>2</sup> , (UC2A0028 - UC2A0081, UC4A0011 - UC4A0077) 2.0 m/s <sup>2</sup> (UC2A0104 - UC2A0248, UC4A0096 - UC4A0414)
	▶ Protective Design	IP00 Open Type enclosure standard, IP20/NEMA Type 1 Kit optional
▶ Standards	UL508C, IEC/EN 61800-3, IEC/EN 61800-5-1, ISO/EN 13849-1 Cat.3 PLe, IEC/EN 61508 SIL3	
Power Ratings	▶ Input Voltage/ range	200 to 240 Vac 50/60 Hz (-15% to +10%), 380 to 480 Vac 50/60 Hz (-15% to +10%)
	▶ Rated Input Frequency	50/60 Hz $\pm$ 3%
	▶ Output Frequency Range	0 - 400 Hz
	▶ Input Power Factor	0.98 min (for rated operation)
	▶ Overload Capability	Heavy Duty: 150% for 1 min, Normal Duty: 120% for 1 min

## Models with Open-Chassis IP00/IP20



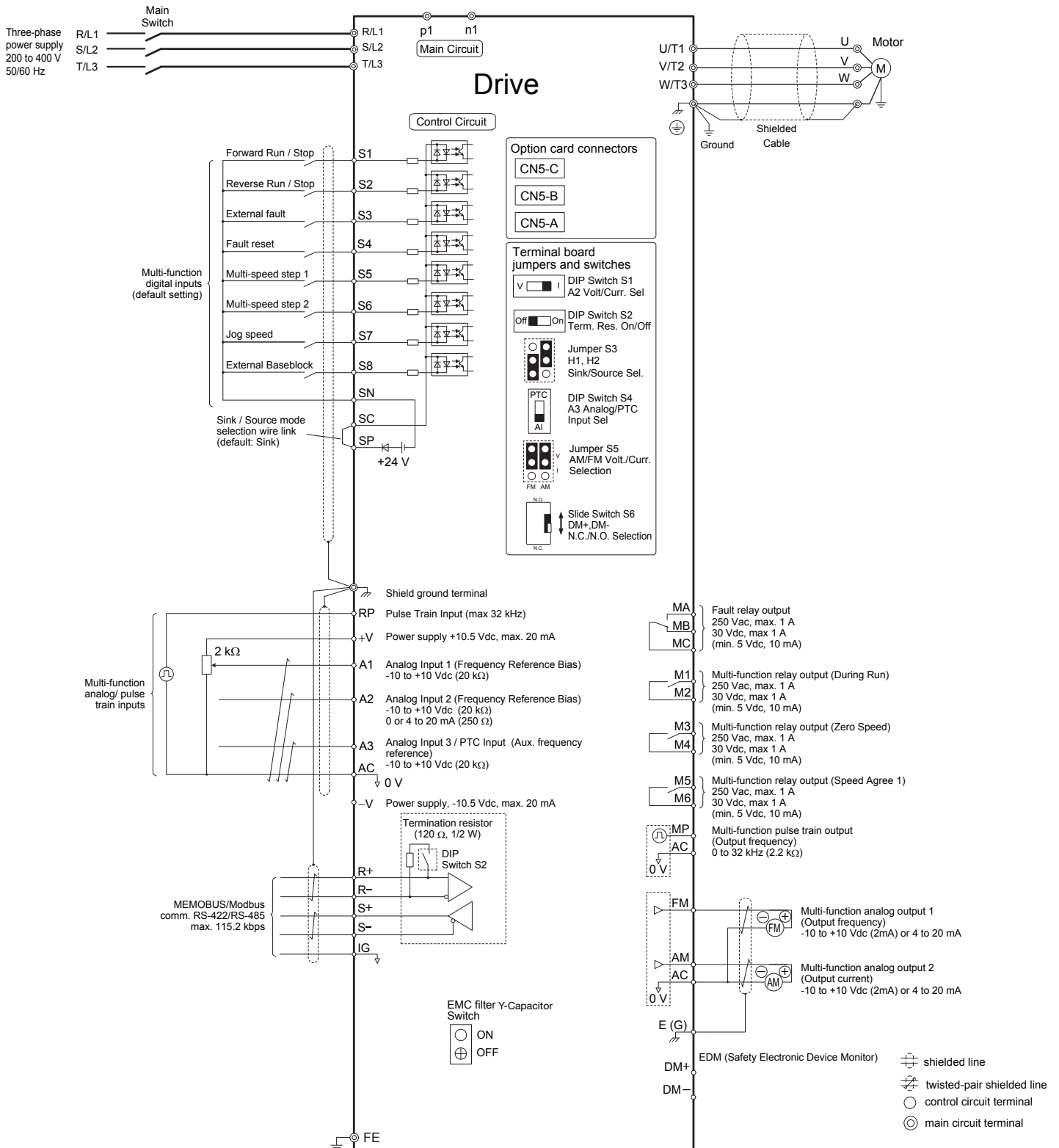
### U1000 Matrix Converter 200 V

Model No	Rated Output [A]		Frame	Dimensions [mm]											Weight [kg] w. built in EMC Filter		Weight [kg] standard model																						
	Normal Duty	Heavy Duty		W	H (IP00)	H (IP20)	D	W1	H1	H2	H4	D1	d	IP00	IP20	IP00	IP20																						
0028	28	22	1	250	480	524	360	205	463	6.5	40	100	7	21	22.5	20	21.5																						
0042	42	28												33	35	32	34																						
0054	54	42												2	264	650	705	420	218	629	11.5	40	115.5	10	36	38	35	37											
0068	68	54																							3	264	816	885	450	218	795	11.5	40	124.5	10	63	65	60	62
0081	81	68																																		63	65	60	62
0104	104	81	4	415	990	1107	403	250	966	11.0	40	165	12	115	118	110	113																						
0130	130	104												115	118	110	113																						
0154	154	130	5	490	1132	1320	450	360	1104	14.5	49	181	14	181	185	176	180																						
0192	192	154												181	185	176	180																						
0248	248	192												181	185	176	180																						

### U1000 Matrix Converter 400 V

Model No	Rated Output [A]		Frame	Dimensions [mm]											Weight [kg] w. built in EMC Filter		Weight [kg] standard model																						
	Normal Duty	Heavy Duty		W	H (IP00)	H (IP20)	D	W1	H1	H2	H4	D1	d	IP00	IP20	IP00	IP20																						
0011	11	9.6	1	250	480	524	360	205	463	6.5	40	100	7	21	22.5	20	21.5																						
0014	14	11												21	22.5	20	21.5																						
0021	21	14												2	264	650	705	420	218	629	11.5	40	115.5	10	33	35	32	34											
0027	27	21																							36	38	35	37											
0034	34	27																							3	264	816	885	450	218	795	11.5	40	124.5	10	63	65	60	62
0040	40	34																																		63	65	60	62
0052	52	40												4	415	990	1107	403	250	966	11	40	165	12	115	118	110	113											
0065	65	52																							115	118	110	113											
0077	77	65												5	490	1132	1320	450	360	1104	14.5	49	181	14	181	185	176	180											
0096	96	77																							181	185	176	180											
0124	124	96	181	185	176	180																																	
0156	156	124	6	695	1132	1460	450	560	1102	14.5	65	178	14	267	278	259	270																						
0180	180	156												267	278	259	270																						
0216	216	180																																					
0240	240	216																																					
0302	302	240																																					
0361	361	302																																					
0414	414	361																																					

## Standard Connection Diagram





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