Emotron FDU 2.0
Variable Speed Drive

Data Sheet

English

emotron®

DEDICATED DRIVE

Emotron FDU 2.0 Variable Speed Drive

Electrical specifications related to model

Table 1 Typical motor power at mains voltage 400 V

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame size
		Power @400V [kW]	Rated current [A]	Power @400V [kW]	Rated current [A]	
FDU48-003	3.0	0.75	2.5	0.55	2.0	B
FDU48-004	4.8	1.5	4.0	1.1	3.2	
FDU48-006	7.2	2.2	6.0	1.5	4.8	
FDU48-008	9.0	3	7.5	2.2	6.0	
FDU48-010	11.4	4	9.5	3	7.6	
FDU48-013	15.6	5.5	13.0	4	10.4	
FDU48-018	21.6	7.5	18.0	5.5	14.4	
FDU48-026	31	11	26	7.5	21	C
FDU48-031	37	15	31	11	25	
FDU48-037	44	18.5	37	15	29.6	
FDU48-046	55	22	46	18.5	37	
FDU40-060	73	30	61	22	49	X2
FDU40-073	89	37	74	30	59	
FDU48-090	108	45	90	37	72	E
FDU48-109	131	55	109	45	87	
FDU48-146	175	75	146	55	117	
FDU48-175	210	90	175	75	140	
FDU48-210	252	110	210	90	168	F
FDU48-250	300	132	250	110	200	
FDU48-300	360	160	300	132	240	G
FDU48-375	450	200	375	160	300	
FDU48-430	516	220	430	200	344	H
FDU48-500	600	250	500	220	400	
FDU48-600	720	315	600	250	480	I
FDU48-650	780	355	650	315	520	
FDU48-750	900	400	750	355	600	
FDU48-860	1032	450	860	400	688	J
FDU48-1000	1200	500	1000	450	800	
FDU48-1200	1440	630	1200	500	960	K
FDU48-1500	1800	800	1500	630	1200	

* Available during limited time and as long as allowed by drive temperature.

Table 2 Typical motor power at mains voltage 460 V

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame size
		Power @460 V [hp]	Rated current [A]	Power @460V [hp]	Rated current [A]	
FDU48-003	3.0	1	2.5	1	2.0	B
FDU48-004	4.8	2	4.0	1.5	3.2	
FDU48-006	7.2	3	6.0	2	4.8	
FDU48-008	9.0	3	7.5	3	6.0	
FDU48-010	11.4	5	9.5	3	7.6	
FDU48-013	15.6	7.5	13.0	5	10.4	
FDU48-018	21.6	10	18.0	7.5	14.4	
FDU48-026	31	15	26	10	21	C
FDU48-031	37	20	31	15	25	
FDU48-037	46	25	37	20	29.6	
FDU48-046	55	30	46	25	37	
FDU50-060	73	40	61	30	49	X2
FDU48-090	108	60	90	50	72	E
FDU48-109	131	75	109	60	87	
FDU48-146	175	100	146	75	117	
FDU48-175	210	125	175	100	140	
FDU48-210	252	150	210	125	168	F
FDU48-250	300	200	250	150	200	
FDU48-300	360	250	300	200	240	G
FDU48-375	450	300	375	250	300	
FDU48-430	516	350	430	250	344	H
FDU48-500	600	400	500	350	400	
FDU48-600	720	500	600	400	480	I
FDU48-650	780	550	650	400	520	
FDU48-750	900	600	750	500	600	
FDU48-860	1032	700	860	550	688	J
FDU48-1000	1200	800	1000	600	800	
FDU48-1200	1440	1000	1200	700	960	K
FDU48-1500	1800	1250	1500	750	1200	

* Available during limited time and as long as allowed by drive temperature.

Table 3 Typical motor power at mains voltage 525 V

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame size
		Power @525V [kW]	Rated current [A]	Power @525V [kW]	Rated current [A]	
FDU52-003	3.0	1.1	2.5	1.1	2.0	B
FDU52-004	4.8	2.2	4.0	1.5	3.2	
FDU52-006	7.2	3	6.0	2.2	4.8	
FDU52-008	9.0	4	7.5	3	6.0	
FDU52-010	11.4	5.5	9.5	4	7.6	
FDU52-013	15.6	7.5	13.0	5.5	10.4	
FDU52-018	21.6	11	18.0	7.5	14.4	
FDU52-026	31	15	26	11	21	C
FDU52-031	37	18.5	31	15	25	
FDU52-037	44	22	37	18.5	29.6	
FDU52-046	55	30	46	22	37	
FDU50-060	73	37	61	30	49	X2
FDU69-090	108	55	90	45	72	F69
FDU69-109	131	75	109	55	87	
FDU69-146	175	90	146	75	117	
FDU69-175	210	110	175	90	140	
FDU69-210	252	132	210	110	168	H69
FDU69-250	300	160	250	132	200	
FDU69-300	360	200	300	160	240	
FDU69-375	450	250	375	200	300	
FDU69-430	516	300	430	250	344	I69
FDU69-500	600	315	500	300	400	
FDU69-600	720	400	600	315	480	J69
FDU69-650	780	450	650	355	520	
FDU69-750	900	500	750	400	600	K69
FDU69-860	1032	560	860	450	688	
FDU69-1000	1200	630	1000	500	800	

* Available during limited time and as long as allowed by drive temperature.

Table 4 Typical motor power at mains voltage 575 V

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame size
		Power @575 V [hp]	Rated current [A]	Power @575V [hp]	Rated current [A]	
FDU69-090	108	75	90	60	72	F69
FDU69-109	131	100	109	75	87	
FDU69-146	175	125	146	100	117	
FDU69-175	210	150	175	125	140	
FDU69-210	252	200	210	150	168	H69
FDU69-250	300	250	250	200	200	
FDU69-300	360	300	300	250	240	
FDU69-375	450	350	375	300	300	
FDU69-430	516	400	430	350	344	I69
FDU69-500	600	500	500	400	400	
FDU69-600	720	600	600	500	480	J69
FDU69-650	780	650	650	550	520	
FDU69-750	900	750	750	600	600	K69
FDU69-860	1032	850	860	700	688	
FDU69-1000	1200	1000	1000	850	800	

* Available during limited time and as long as allowed by drive temperature.

Table 5 Typical motor power at mains voltage 690 V

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame size
		Power @690 V [kW]	Rated current [A]	Power @690V [kW]	Rated current [A]	
FDU69-090	108	90	90	75	72	F69
FDU69-109	131	110	109	90	87	
FDU69-146	175	132	146	110	117	
FDU69-175	210	160	175	132	140	
FDU69-210	252	200	210	160	168	H69
FDU69-250	300	250	250	200	200	
FDU69-300	360	315	300	250	240	
FDU69-375	450	355	375	315	300	
FDU69-430	516	450	430	315	344	I69
FDU69-500	600	500	500	355	400	
FDU69-600	720	600	600	450	480	J69
FDU69-650	780	630	650	500	520	
FDU69-750	900	710	750	600	600	K69
FDU69-860	1032	800	860	650	688	
FDU69-900	1080	900	900	710	720	
FDU69-1000	1200	1000	1000	800	800	

* Available during limited time and as long as allowed by drive temperature.

General electrical specifications

Table 6 General electrical specifications

General

Mains voltage:	FDU40	230-415V +10%/-15% (-10% at 230 V)
	FDU48	230-480V +10%/-15% (-10% at 230 V)
	FDU50/52	440-525V +10%/-15%
	FDU69	500-690V +10%/-15%
Mains frequency:		45 to 65 Hz
Input power factor:		0.95
Output voltage:		0–Mains supply voltage:
Output frequency:		0–400 Hz
Output switching frequency:		3 kHz (adjustable 1,5-6 kHz)
Efficiency at nominal load:		97% for models 003 to 018 98% for models 026 to 046 97.5% for models 060 to 073 98% for models 090 to 1500

Control signal inputs:
Analogue (differential)

Analogue Voltage/current:	0-±10 V/0-20 mA via software setting
Max. input voltage:	+30 V/30 mA
Input impedance:	20 kΩ (voltage) 250 Ω (current)
Resolution:	11 bits + sign
Hardware accuracy:	1% type + 1 ½ LSB fsd
Non-linearity	1½ LSB

Digital:

Input voltage:	High>9 VDC Low<4 VDC
Max. input voltage:	+30 VDC
Input impedance:	<3.3 VDC: 4.7 kΩ ≥3.3 VDC: 3.6 kΩ
Signal delay:	≤8 ms

Control signal outputs
Analogue

Output voltage/current:	0-10 V/0-20 mA via software setting
Max. output voltage:	+15 V @5 mA cont.
Short-circuit current (∞):	+15 mA (voltage) +140 mA (current)
Output impedance:	10 Ω (voltage)
Resolution:	10 bit
Maximum load impedance for current	500 Ω
Hardware accuracy:	1.9% type fsd (voltage), 2.4% type fsd (current)
Offset:	3 LSB
Non-linearity:	2 LSB

Digital

Output voltage:	High>20 VDC @50 mA, >23 VDC open Low<1 VDC @50 mA
Shortcircuit current(∞):	100 mA max (together with +24 VDC)

Relays

Contacts	0,1 - 2 A/U_{max} 250 VAC or 42 VDC

References

+10VDC	+10 VDC @10 mA Shortcircuit current +30 mA max
-10VDC	-10 VDC @10 mA
+24VDC	+24 VDC Short-circuit current +100 mA max (together with Digital Outputs)

Operation at higher temperatures

Most Emotron variable speed drives are made for operation at maximum of 40°C ambient temperature. However, for most models, it is possible to use the VSD at higher temperatures with little loss in performance. Table 7 shows ambient temperatures as well as derating for higher temperatures.

Table 7 Ambient temperature and derating 400–690 V types

Model	IP20		P54	
	Max temp.	Derating: possible	Max temp.	Derating: possible
FDU**-003 to FDU**-046	–	–	40°C	-2.5%/°C to max +10°C
FDU**-060 to FDU40-073	40°C	-2.5%/°C to max +10°C	35°C	-2.5%/°C to max +10°C
FDU48-090 to FDU48-250 FDU69-090 to FDU69-175	–	–	40°C	-2.5%/°C to max +5°C
FDU48-300 to FDU48-1500 FDU69-210 to FDU69-1000	40°C	-2.5%/°C to max +5°C	40°C	-2.5%/°C to max +5°C

Example

In this example we have a motor with the following data that we want to run at the ambient temperature of 45°C:

Voltage 400 V
Current 68 A
Power 37 kW

Select variable speed drive

The ambient temperature is 5 °C higher than the maximum ambient temperature. The following calculation is made to select the correct VSD model.

Derating is possible with loss in performance of 2.5%/°C.

Derating will be: 5 X 2.5% = 12.5%

Calculation for model FDU40-073
73 A - (12.5% X 73) = 63.875A; this is not enough.

Calculation for model FDU48-090
90 A - (12.5% X 90) = 78.75 A

In this example we select the FDU48-090.

Operation at higher switching frequency

Table 8 shows the switching frequency for the different VSD models. With the possibility of running at higher switching frequency you can reduce the noise level from the motor.

Table 8 Switching frequency

Models 400 to 690 V	Standard Switching frequency	Range
FDU**-003 to FDU**-073	3 kHz	1,5 – 6 kHz
FDU**-90 bis FDU**-1500	3 kHz	1,5 – 6 kHz

Dimensions and Weights

The table below gives an overview of the dimensions and weights. The models 300 to 1500 consist of 2, 3, 4 or 6 parallelled modules built into a standard cabinet.

Table 9 Mechanical specifications, FDU40, FDU48, FDU50, FDU52

Models	Frame size	Dim. H x W x D [mm] IP20	Dim. H x W x D [mm] IP54	Weight IP20 [kg]	Weight IP54 [kg]
003 to 018	B	–	350(416)x 203 x 200	–	12.5
026 to 046	C	–	440(512) x 178 x 292	–	24
060 to 073	X2	530(590) x 220 x 270	530(590) x 220 x 270	26	26
90 to 109	E	–	950 x 285 x 314	–	56
146 to 175	E	–	950 x 285 x 314	–	60
210 to 250	F	–	950 x 345 x 314	–	74
300 to 375	G	1036 x 500 x 390	2330 x 600 x 500	140	270
430 to 500	H	1036 x 500 x 450	2330 x 600 x 600	170	305
600 to 750	I	1036 x 730 x 450	2330 x 1000 x 600	248	440
860 to 1000	J	1036 x 1100 x 450	2330 x 1200 x 600	340	580
1200 to 1500	K	1036 x 1560 x 450	2330 x 2000 x 600	496	860

Table 10 Mechanical specifications, FDU69

Models	Frame size	Dim. H x W x D [mm] IP20	Dim. H x W x D [mm] IP54	Weight IP20 [kg]	Weight IP54 [kg]
90 to 175	F69	–	1090 x 345 x 314	–	77
210 to 375	H69	1176 x 500 x 450	2330 x 600 x 600	176	311
430 to 500	I69	1176 x 730 x 450	2330 x 1000 x 600	257	449
600 to 650	J69	1176 x 1100 x 450	2330 x 1200 x 600	352	592
750 to 1000	K69	1176 x 1560 x 450	2330 x 2000 x 600	514	878

Environmental conditions

Table 11 Operation

Parameter	Normal operation
Nominal ambient temperature	0°C–40°C See table, see Table 7 for different conditions
Atmospheric pressure	86–106 kPa
Relative humidity, non-condensing	0–90%
Contamination, according to IEC 60721-3-3	No electrically conductive dust allowed. Cooling air must be clean and free from corrosive materials. Chemical gases, class 3C2. Solid particles, class 3S2.
Vibrations	According to IEC 600068-2-6, Sinusodial vibrations: • 10<f<57 Hz, 0.075 mm • 57<f<150 Hz, 1g
Altitude	0–1000 m, with derating 1%/100 m of rated current up to 2000 m.

Table 12 Storage

Parameter	Storage condition
Temperature	-20 to +60 °C
Atmospheric pressure	86–106 kPa
Relative humidity, non-condensing	0– 90%

Drawings

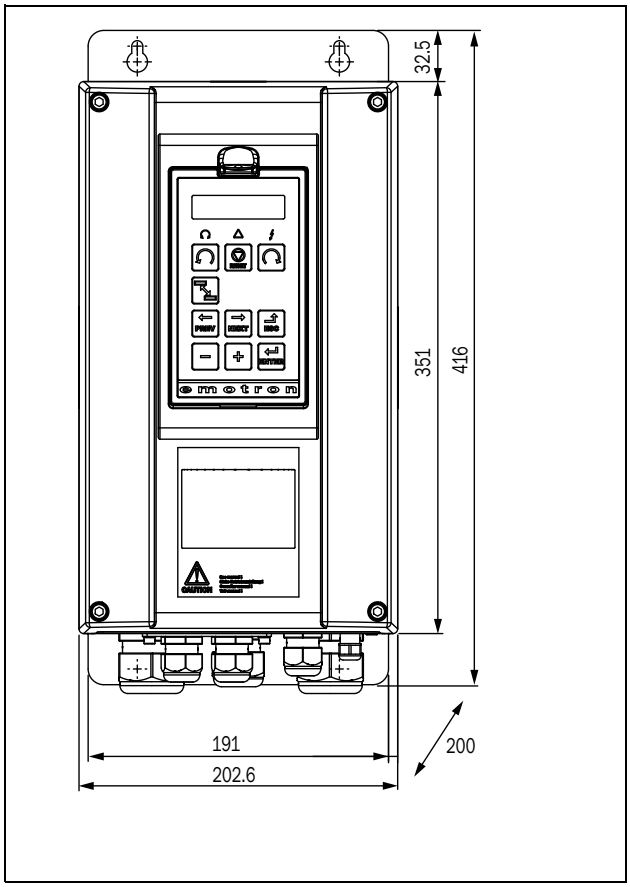

Fig. 1 FDU48/52: Model 003 – 018 (B)

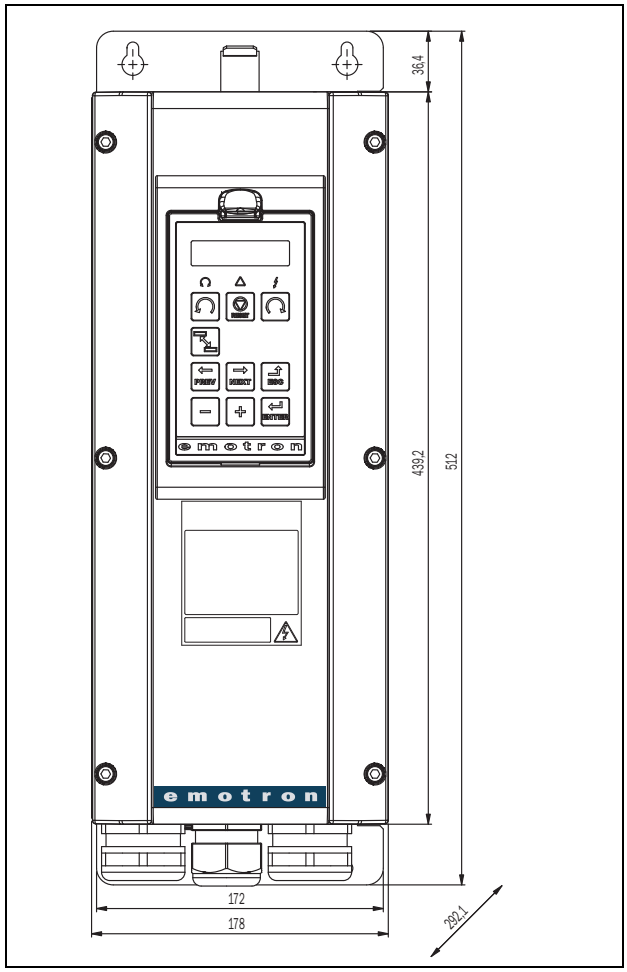

Fig. 2 FDU48/52: Model 026 – 046 (C)

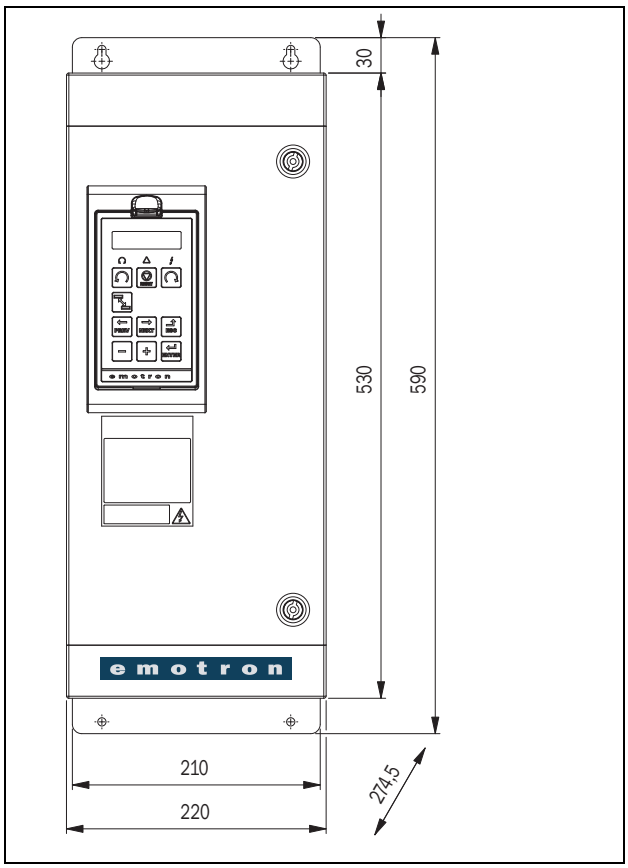

Fig. 3 FDU40/50: Model 060 – 073 (X2)

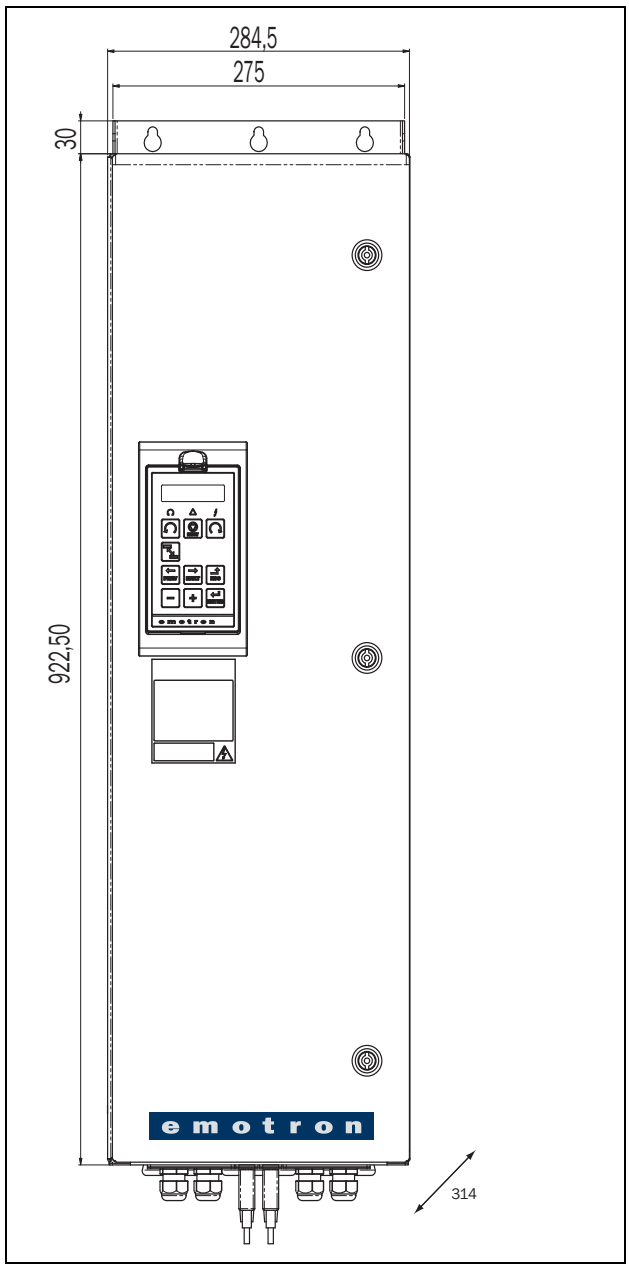

Fig. 4 FDU48: Model 090 – 175 (E)

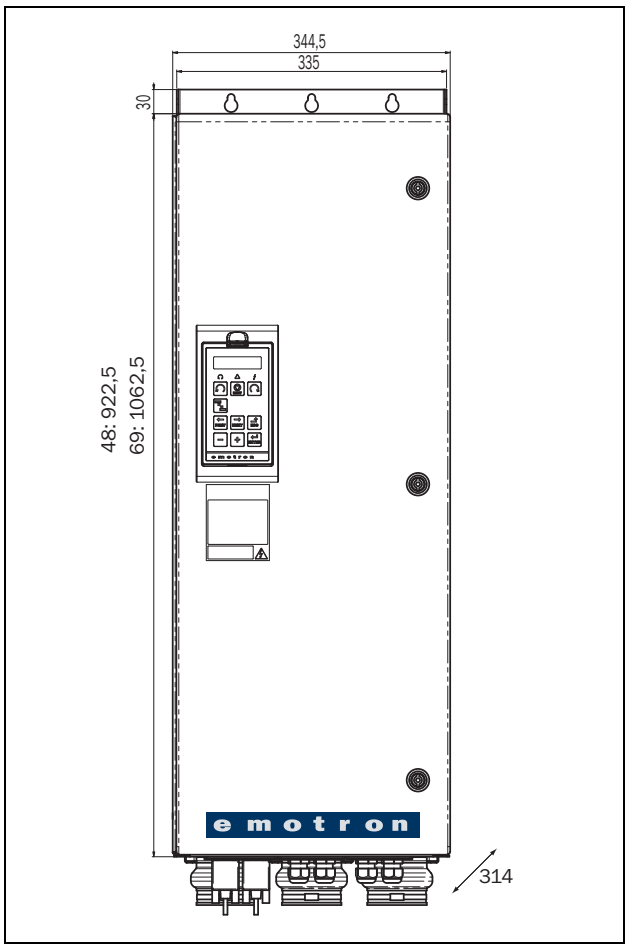

Fig. 5 FDU48: Model 210 – 250 (F)
FDU69: Model 090 – 175 (F69)

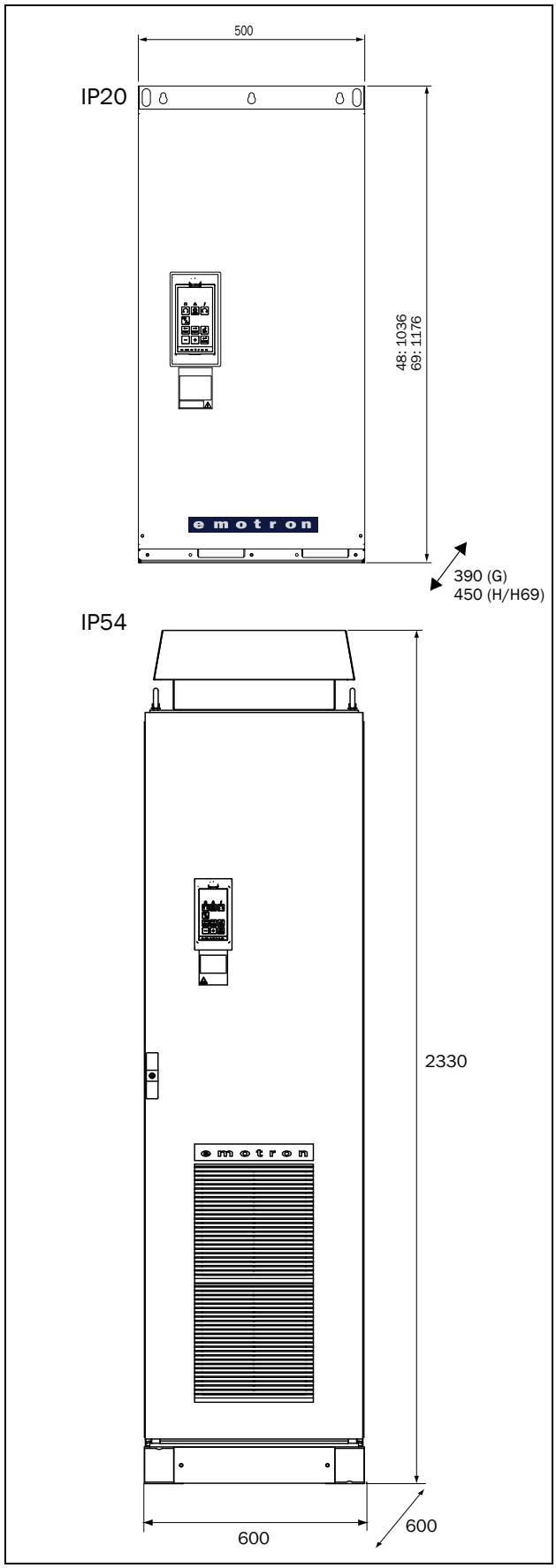

Fig. 6 FDU48: Model 300 – 500 (G and H)
FDU69: Model 210 – 375 (H69)

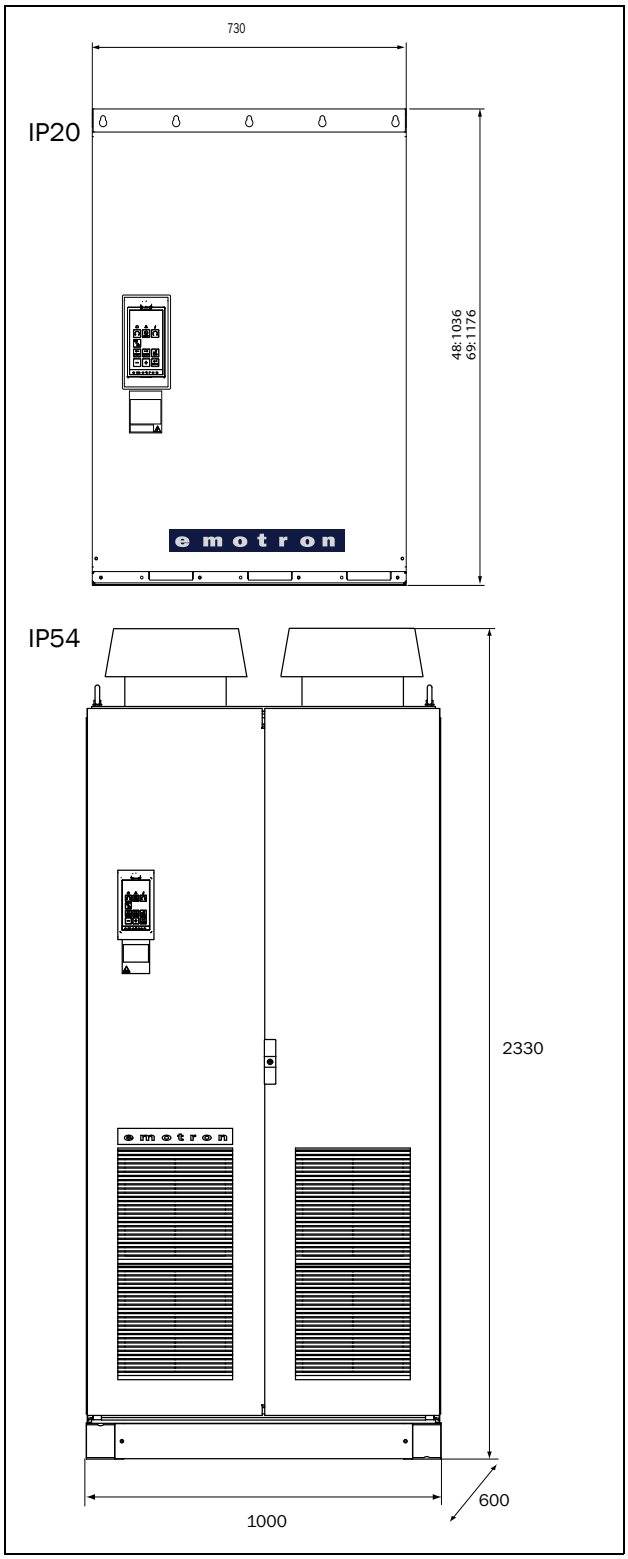

Fig. 7 FDU48: Model 600 – 750 (I)
FDU69: Model 430 – 500 (I69)

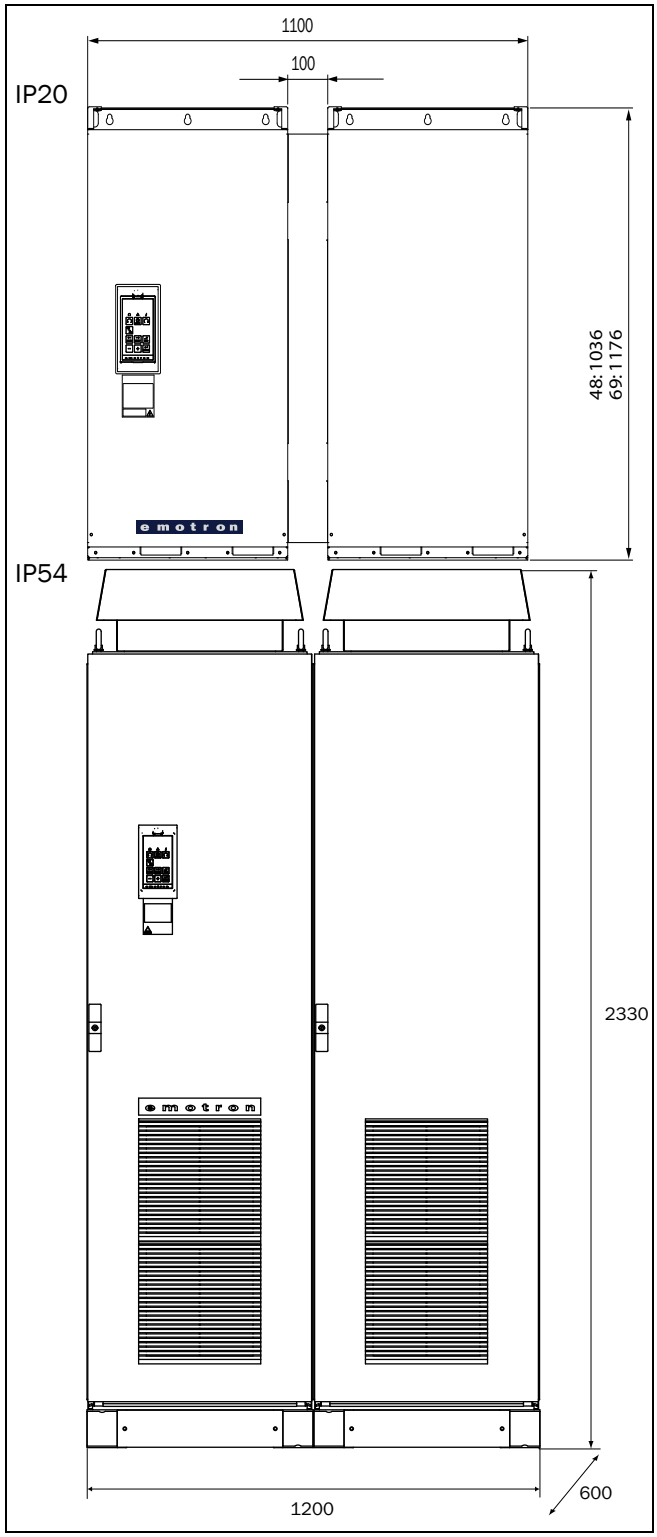

Fig. 8 FDU48: Model 860 – 1000 (J)
FDU69: Model 600 – 650 (J69)

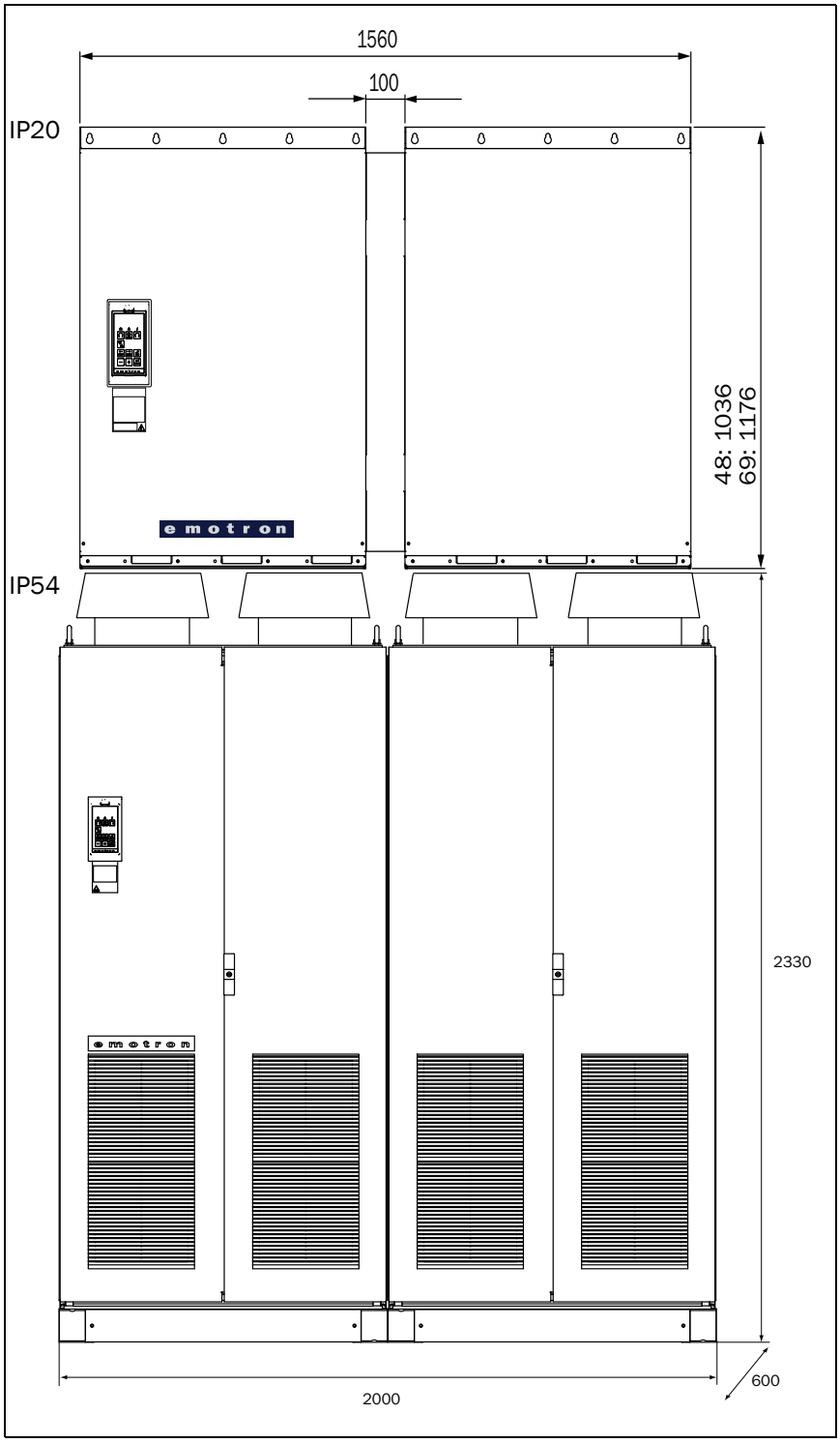

Fig. 9 FDU48: Model 1200 – 1500 (K)
FDU69: Model 750 – 1000 (K69)

Fuses, cable cross-sections and glands

Use mains fuses of the type gL/gG conforming to IEC 269 or installation cut-outs with similar characteristics. Check the equipment first before installing the glands. In due time only metric glands will be used.

Max. Fuse = maximum fuse value that still protects the VSD and upholds warranty.

NOTE: The dimensions of fuse and cable cross-section are dependent on the application and must be determined in accordance with local regulations.

NOTE: The dimensions of the power terminals used in the models 300 to 1500 can differ depending on customer specification.

Table 13 Fuses, cable cross-sections and glands

Model	Nominal input current [A]	Maximum value fuse [A]	Cable cross section connector range [mm^2] for			Cable glands (clamping range [mm])	
			mains/ motor	Brake	PE	mains / motor	Brake
FDU**-003	2.2	4	0.5–10	0.5–10	1.5–16	M32 opening M20 + reducer (6–12)	M25 opening M20 + reducer (6–12)
FDU**-004	3.5	4					
FDU**-006	5.2	6					
FDU**-008	6.9	8				M32 (12–20)/ M32 opening M25+reducer (10-14)	M25 (10–14)
FDU**-010	8.7	10					
FDU**-013	11.3	12				M32 (16–25)/ M32 (13–18)	
FDU**-018	15.6	20					
FDU**-026	22	25	2.5 - 16	2.5 - 16	6 - 35	M32 (15–21)	M25
FDU**-031	26	35					
FDU**-037	31	35				M40 (19–28)	M32
FDU**-046	38	50					
FDU**-060	51	63	4–16	4–16	4–16	M40 (19–28)	M40 (27–34)
FDU**-073	64	80	4–35		4–35		
FDU**-090	78	100	16 - 95	16 - 95	16-95 (16-70)[1]	FDU48: Ø30-45 cable entry or M63 FDU69: Ø27-66 cable entry	
FDU**-109	94	100					
FDU**-146	126	160	35 - 150	16 - 95	35-150 (16-70)[1]		
FDU**-175	152	160					
FDU**-210	182	200	FDU48: 35-240 FDU69: 35-150	FDU48: 35-150 FDU69: 16-95	FDU48: 35-240 (95-185)[1] FDU69: 35-150 (16-70)[1]	FDU48: Ø27-66 cable entry	
FDU**-250	216	250					
FDU**-300	260	300	FDU48: (2x)35-240 FDU69: (2x)35-150		frame	---	–
FDU**-375	324	355					
FDU**-430	372	400	FDU48: (2x)35-240 FDU69: (3x)35-150		frame	–	–
FDU**-500	432	500					
FDU**-600	520	630	FDU48: (3x)35-240 FDU69: (4x)35-150		frame	–	–
FDU**-650	562	630					
FDU**-750	648	710	FDU48: (3x)35-240 FDU69: (6x)35-150		frame	–	–
FDU**-860	744	800	FDU48: (4x)35-240 FDU69: (6x)35-150		frame	–	–
FDU**-900	795	900					
FDU**-1000	864	1000					
FDU**-1200	1037	1250	FDU48: (6x)35-240		frame	–	–
FDU**-1500	1296	1500					

Note: For models 003 to 046 cable glands are optional.

1. Values are valid when brake chopper electronics are built in.

Control signals

Table 14

Terminal X1	Name:	Function (Default):	Signal:	Type:
1	+10 V	+10 VDC Supply voltage	+10 VDC, max 10 mA	output
2	AnIn1	Process reference	0 -10 VDC or 0/4–20 mA bipolar: -10 - +10 VDC or -20 - +20 mA	analogue input
3	AnIn2	Off	0 -10 VDC or 0/4–20 mA bipolar: -10 - +10 VDC or -20 - +20 mA	analogue input
4	AnIn3	Off	0 -10 VDC or 0/4–20 mA bipolar: -10 - +10 VDC or -20 - +20 mA	analogue input
5	AnIn4	Off	0 -10 VDC or 0/4–20 mA bipolar: -10 - +10 VDC or -20 - +20 mA	analogue input
6	-10 V	-10VDC Supply voltage	-10 VDC, max 10 mA	output
7	Common	Signal ground	0V	output
8	DigIn 1	RunL	0-8/24 VDC	digital input
9	DigIn 2	RunR	0-8/24 VDC	digital input
10	DigIn 3	Off	0-8/24 VDC	digital input
11	+24 V	+24VDC Supply voltage	+24 VDC, 100 mA, see note	output
12	Common	Signal ground	0 V	output
13	AnOut 1	Speed	0 ±10 VDC or 0/4– +20 mA	analogue output
14	AnOut 2	Torque	0 ±10 VDC or 0/4– +20 mA	analogue output
15	Common	Signal ground	0 V	output
16	DigIn 4	Off	0-8/24 VDC	digital input
17	DigIn 5	Off	0-8/24 VDC	digital input
18	DigIn 6	Off	0-8/24 VDC	digital input
19	DigIn 7	Off	0-8/24 VDC	digital input
20	DigOut 1	Ready	24 VDC, 100 mA	digital output
21	DigOut 2	No Trip	24 VDC, 100 mA	digital output
22	DigIn 8	RESET	0-8/24 VDC	digital input
Terminal X2				
31	N/C 1	Relay 1 output Trip, active when the VSD is in a TRIP condition N/C is opened when the relay is active (valid for all relays) N/O is closed when the relay is active (valid for all relays)	potential free change over 2 A/250 VAC/AC1	relay output
32	COM 1			
33	N/O 1			
41	N/C 2	Relay 2 Output Run, active when the VSD is ready to start	potential free change over 2 A/250 VAC/AC1	relay output
42	COM 2			
43	N/O 2			
Terminal X3				
51	COM 3	Relay 3 Output Off	potential free change over 2 A/250 VAC/AC1	relay output
52	N/O 3			

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DEDICATED DRIVE

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Emotron AB 01-3825-01r5 2009-04-15