



# Emotron FDU and VFX 2.0

AC drives with protection class IP20 and IP21

7.5 - 132 kW



Addendum to instruction manual

English

Software version 4.3X



## Addendum valid for Emotron FDU and Emotron VFX AC drives

This addendum is intended to be used together with the instruction manuals with document number:

01-5324-01 for Emotron FDU2.0 for software version 4.3x and

01-5325-01 for Emotron VFX2.0 for software version 4.3x

All chapter numbers in this addendum correspond to the chapter numbers in the above listed instruction manuals.

### New AC drive models with protection classes IP20 and IP21

The VFX/FDU models described in this addendum are:

48-025, 48-030, 48-036, and 48-045 (Size C2)

48-060, 48-072, and 48-088 (Size D2)

48-106, 48-142, and 48-171 (Size E2)

48-205 and 48-244 (Size F2)

### Mounting, Installation and Control connection

The contents of the addendum deals with the specifics for the new IP20 and IP21 versions, hence you will find technical data for the different models along with instructions for mounting and for connection of cables here. However, for information regarding operation, functionality, and description of the menu system, please refer to the main instruction manuals listed above.



IP20  
Size C2



IP21  
Size D2



IP21  
Size F2

## 2. Mounting

### 2.2.2. Mounting schemes

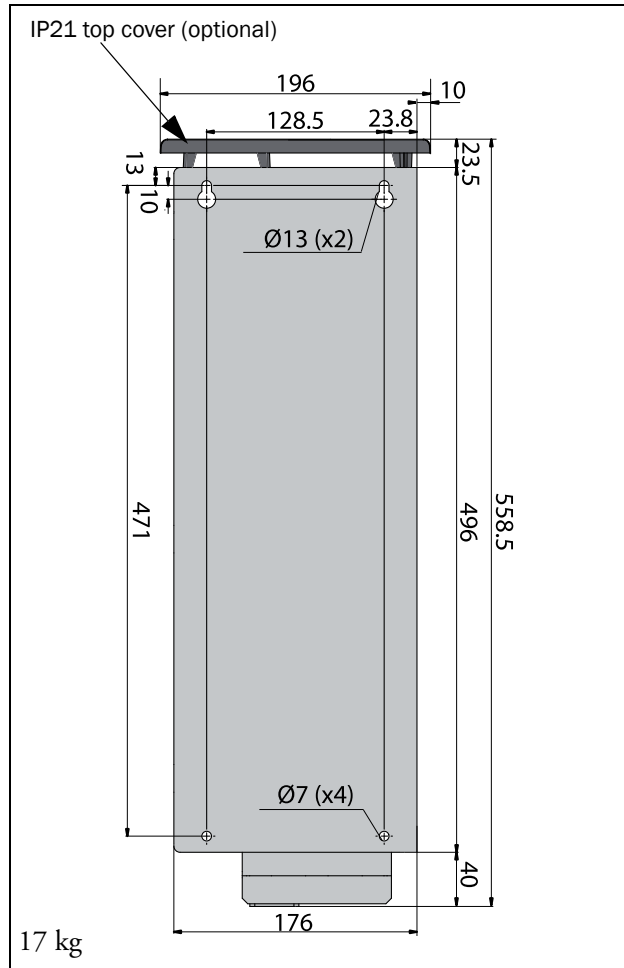


Fig. I Dimensions VFX/FDU model 48-025 to 48-045 (Size C2), backside view.

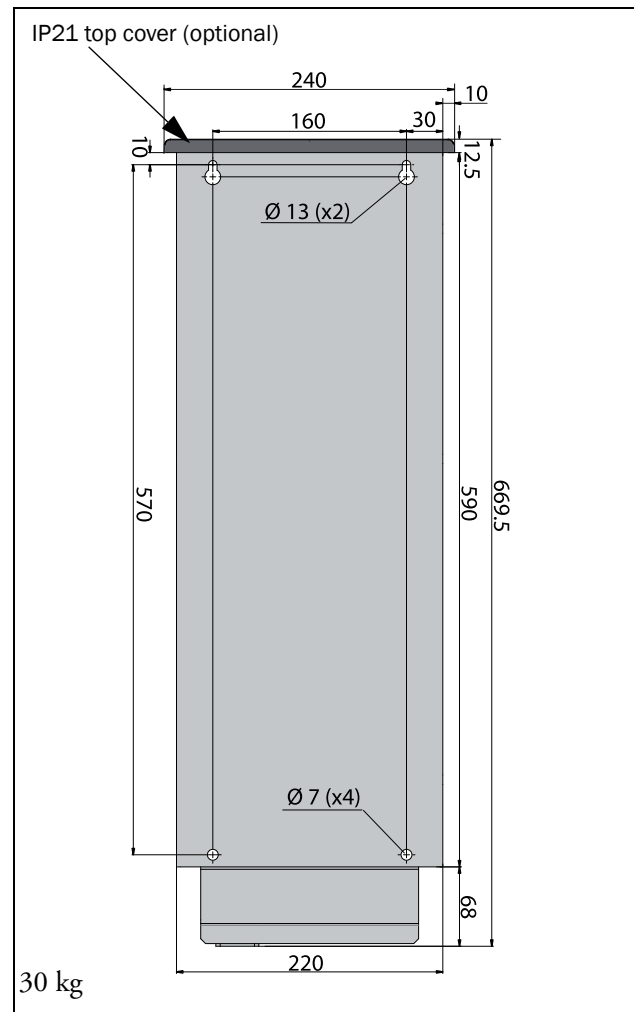


Fig. III Dimensions VFX/FDU model 48-060 to 48-088 (Size D2), backside view

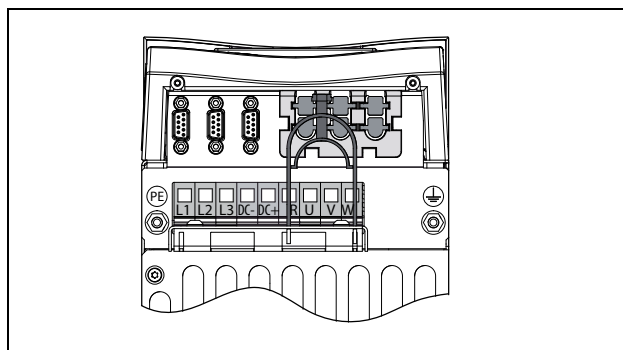


Fig. II Bottom view VFX/FDU model 48-025 to 48-045 (Size C2), with cable interface for mains, motor and control.

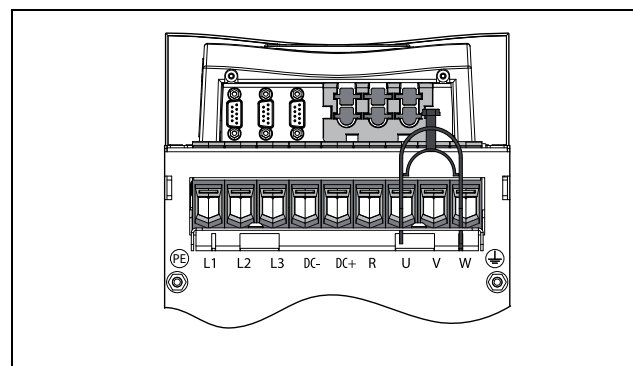


Fig. IV Bottom view VFX/FDU model 48-060 to 48-088 (Size D2), with cable interface for mains, motor and control.

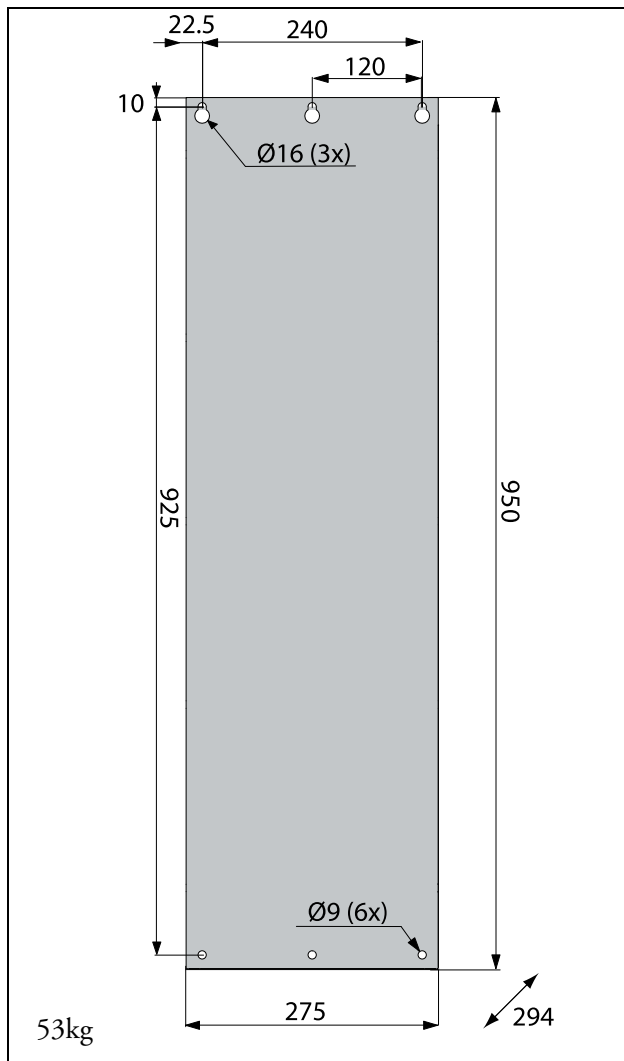


Fig. V Dimensions VFX/FDU model 48-106 to 48-171 (Size E2), backside view.

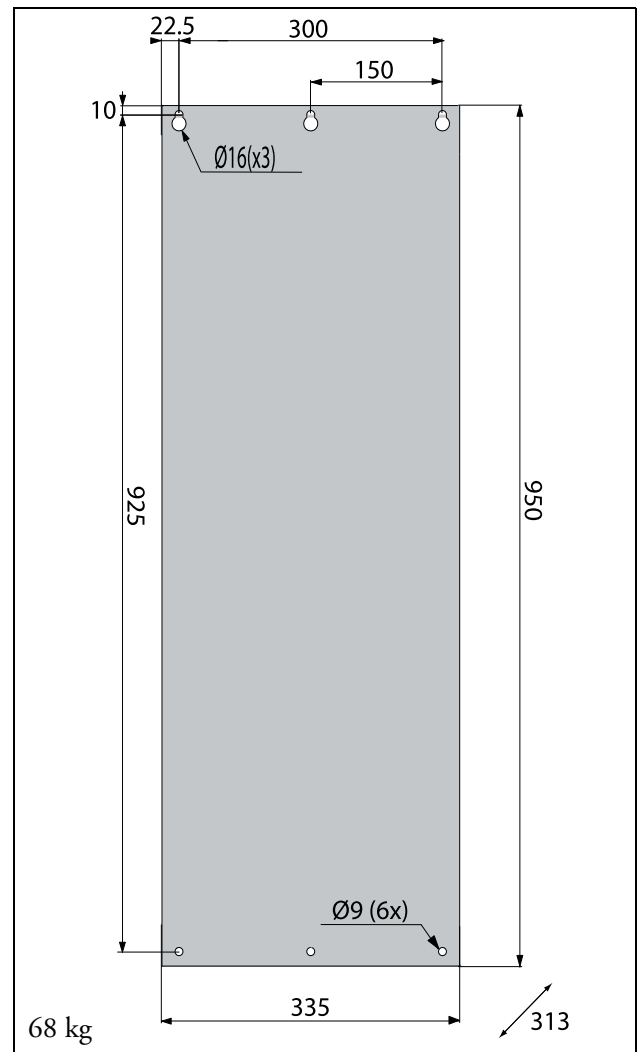


Fig. VII Dimensions VFX/FDU model 48-205 to 48-244 (Size F2), backside view.

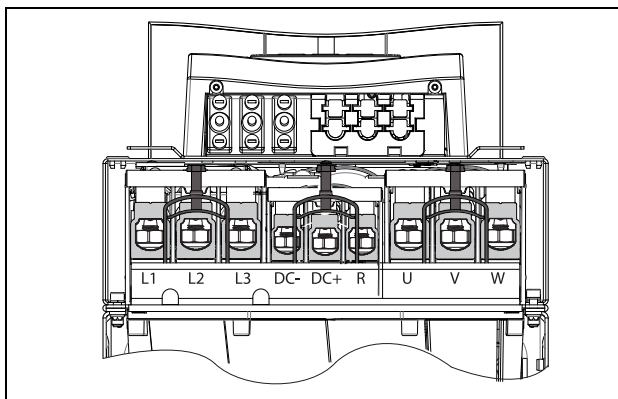


Fig. VI Bottom view VFX/FDU model 48-106 to 48-244 (Size E2 and F2), with cable interface for mains, motor and control. (principle drawing)

### 2.2.3. Recommended separation between two AC drives with IP21 top cover

For sizes C2 and D2, we recommend 50 mm free space between two AC drives with IP21 top cover. This to ensure adequate cooling and also to be able to remove the top cover if needed.

## 2.3 Cabinet mounting

### 2.3.1 Cooling

If the variable speed drive is installed in a cabinet, the rate of airflow supplied by the cooling fans must be taken into consideration.

VFX/FDU Model	Frame size	Flow rate [m <sup>3</sup> /hour]
48-025 to 48-030	C2	120
48-036 to 48-045	C2	170
48-060 to 48-088	D2	170
48-106 to 48-171	E2	510
48-205 to 48-244	F2	800

## 3. Installation

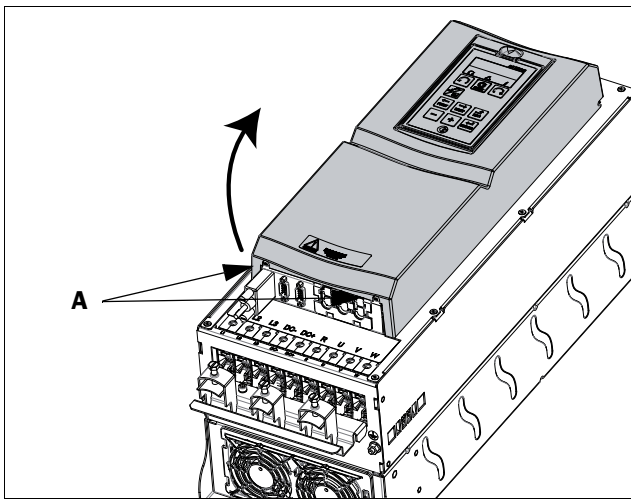


Fig. VIII Remove the top cover (principle drawing).

To be able to access all cable connections and terminals, first open and remove the front cover in following order.

- Loosen the two screws A (see Fig. VIII) at the bottom of the cover a couple of turns (you do not have to remove the screws).
- Swing out the lower part of the cover a bit and remove the cover downwards. Be careful, don't swing out the cover too much as this could damage the "lips" at the upper hinges.  
Now it is easy to access all terminals.

## 3.2 Cable connections

### 3.2.1 Mains cables

Dimension the mains and motor cables according to local regulations. The cable must be able to carry the AC drive load current.

The AC drive has as standard a built-in RFI mains filter that complies with category C3 which suits the Second Environment standard.

### Recommendations for selecting mains cables

- To fulfil EMC purposes it is not necessary to use screened mains cables.
- Use heat-resistant cables, +60°C or higher.
- Dimension the cables and fuses in accordance with local regulations and the nominal current of the motor. See Table XVI, page 13.
- The PE conductor cross-sectional area shall for cable size  $\leq 16 \text{ mm}^2$  be equal to the used phase conductors, for cable size above  $16 \text{ mm}^2$  but smaller or equal to  $35 \text{ mm}^2$  the PE conductor cross-sectional area shall be at least  $16 \text{ mm}^2$ . For cables  $>35 \text{ mm}^2$  the PE conductor cross-sectional area should be at least 50% of the used phase conductor.  
When the PE conductor in the used cable type is not in accordance with the above mentioned cross-sectional area requirements, a separate PE conductor should be used to establish this.
- The litz ground connection is only necessary if the mounting plate is painted. All the AC drives have an unpainted back and are therefore suitable for mounting on an unpainted mounting plate.

### Mains cable connection

Connect the mains cables according to the following figures.



#### WARNING!

**In order to work safely, the mains and motor protective earth must be connected to the designated earthing connections PE and  $\perp$  at the bottom of the IP20/21 drive unit.**

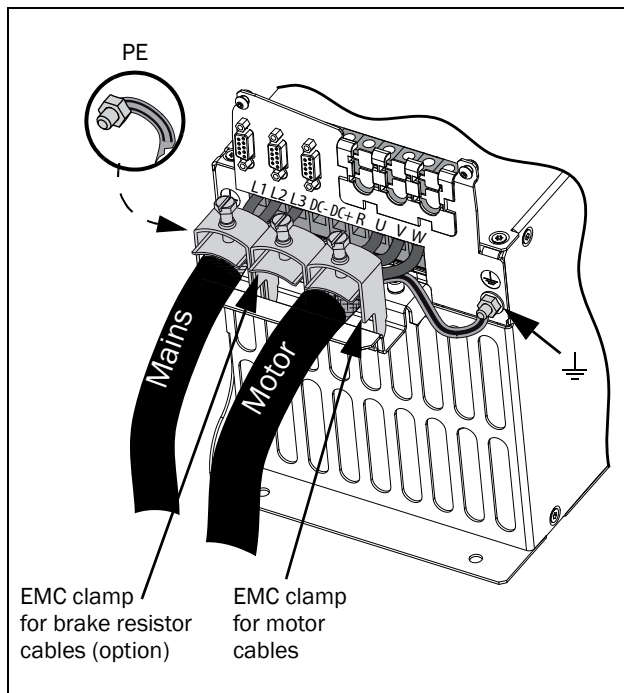


Fig. IX Cable connections VFX/FDU model 48-026 to 48-046 (Size C2).

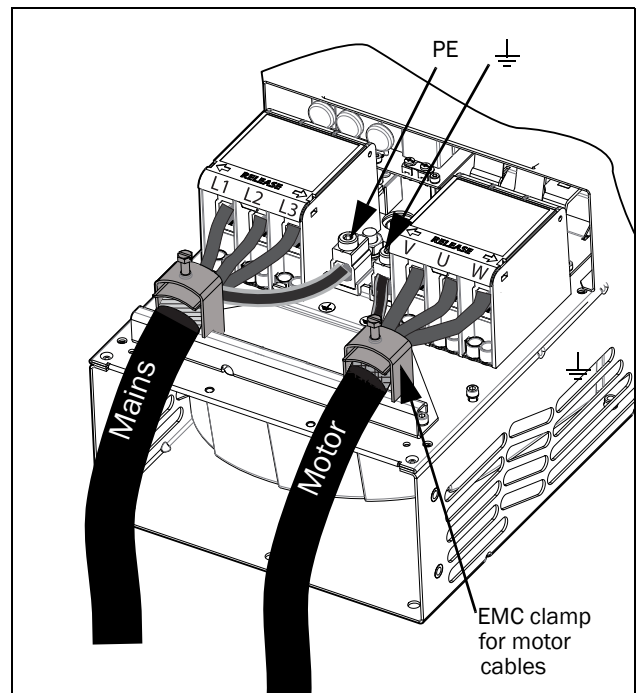


Fig. XI Cable connections VFX/FDU model 48-106 to 48-244 (Size E2 and F2) (principle drawing).

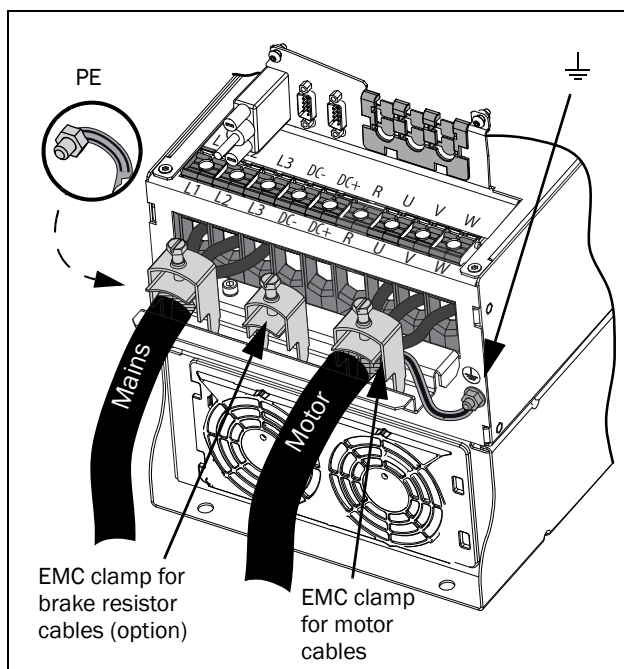


Fig. X Cable connections VFX/FDU model 48-060 to 48-088 (Size D2).

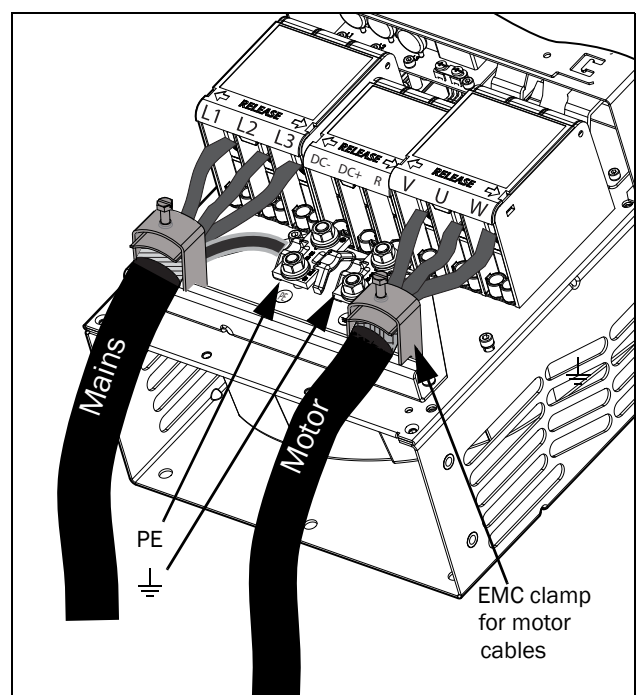



Fig. XII Cable connections VFX/FDU model 48-106 to 48-244 (Size E2 and F2) with the option terminals for DC-, DC+ and Brake (principle drawing)

Table I Mains and motor connections.

<b>L1, L2, L3</b> <b>PE</b>	Mains supply, 3 -phase Protective earth
<b>U, V, W</b> 	Motor output, 3-phase Motor earth
<b>DC-, DC+, R</b>	Brake resistor, DC-link connections (optional)

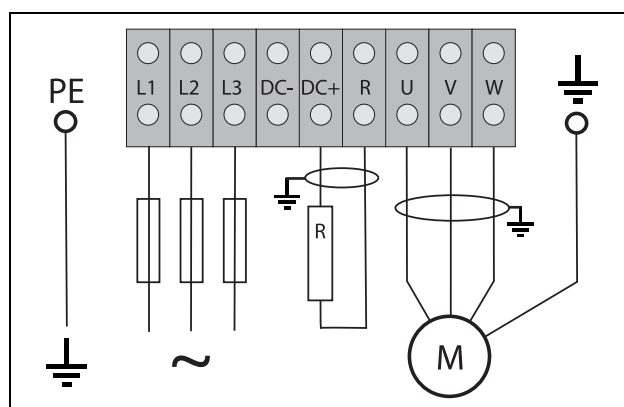



Fig. XIII Wiring example showing Protective earth, Motor earth and Brake Resistor connections

**NOTE: The brake and DC-link terminals are only fitted if the DC+/DC- option or Brake Chopper Option is built-in.**



**WARNING!**  
The Brake Resistor must be connected between terminals DC+ and R see Fig. XIII.



**WARNING!**  
In order to work safely, the mains protective earth must be connected to PE and the motor earth to .

### 3.2.2. Motor cables

To comply with the EMC emission standards the AC drive is provided with a RFI mains filter. The motor cables must be equipped with screen that is connected on both sides. In this way a so-called “Faraday cage” is created around the AC drive, motor cables and motor. The RFI currents are now fed back to their source (the IGBTs) so the system stays within the emission levels.

### Recommendations for selecting motor cables

- Use screened cables according to specification in Table I. Use symmetrical shielded cable; three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield.
- PE conductor cross-sectional area shall for cable size  $\leq 16\text{mm}^2$  be equal to the used phase conductors, for cable size above  $16\text{mm}^2$  but smaller or equal to  $35\text{mm}^2$  the PE conductor cross-sectional area shall be at least  $16\text{mm}^2$ . For cables  $>35\text{mm}^2$  the PE conductor cross-sectional area should be at least 50% of the used phase conductor.  
When the PE conductor in the used cable type is not in accordance with the above mentioned cross-sectional area requirements, a separate PE conductor should be used to establish this.
- Use heat-resistant cables,  $+60^\circ\text{C}$  or higher.
- Dimension the cables and fuses in accordance with the nominal output current of the motor. See Table XVI, page 13.
- Keep the motor cable between AC drive and motor as short as possible.
- The screening must be connected with a large contact surface of preferable  $360^\circ$  and always at both ends, to the motor housing and the AC drive housing. When painted mounting plates are used, do not be afraid to scrape away the paint to obtain as large contact surface as possible at all mounting points for items such as saddles and the bare cable screening. Relying just on the connection made by the screw thread is not sufficient.
- The litz ground connection is only necessary if the mounting plate is painted. All the AC drives have an unpainted back side and are therefore suitable for mounting on an unpainted mounting plate.

**NOTE: It is important that the motor housing has the same earth potential as the other parts of the machine.**

### Motor cable connection

Connect the motor cables according to U - U, V - V and W - W, see Fig. IX and Fig. X, page 5.



### 3.5 Stripping lengths

The recommended stripping lengths for motor and mains cables are given in the table below, with measures as indicated in fig. XIV.

Table II Stripping lengths for mains and motor cables.

VFX/FDU Model	Mains cable		Motor cable		
	a [mm]	b [mm]	a [mm]	b [mm]	c [mm]
48-025 to 48-045 (Size C2)	60	18	60	18	36
48-060 to 48-088 (Size D2)	90	18	90	18	36
48-106 to 48-171 (Size E2)	173	25	173	25	41
48-205 to 48-244 (Size F2)	178	32	178	32	46

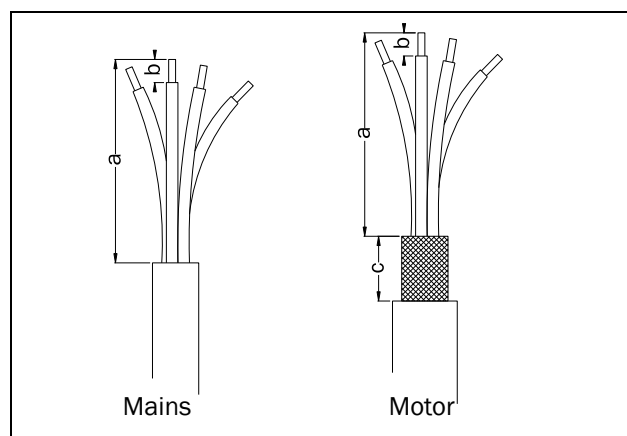


Fig. XIV Stripping lengths for cables.

#### 3.5.1 Dimension of cables and fuses

Please see “14.6/14.7 Fuses, cable cross-sections and glands” on page 13.

#### 3.5.2. Tightening torque for mains, motor and brake cables

Table III VFX/FDU model 48-025 to 48-045 (Size C2).

	Brake chopper	Mains/motor
Tightening torque, Nm	2.0	2.0

Table IV VFX/FDU model 48-060 to 48-088 (Size D2).

	Brake chopper	Mains/motor
Tightening torque, Nm	3	3

Table V VFX/FDU model 48-106 to 48-171 (Size E2).

Cable area mm <sup>2</sup>	Tightening torque, Nm	
	Brake chopper	Mains/motor
14 - 34	31	
35 - 126	42	
35 - 152	-	42

Table VI VFX/FDU model 48-205 to 48-244 (Size F2).

Cable area mm <sup>2</sup>	Tightening torque, Nm	
	Brake chopper	Mains/motor
21 - 34	31	
35 - 152	42	
153 - 250	-	56



# 4. Control Connections

## 4.5 Connecting the Control Signals

### 4.5.1 Cables

The standard control signal connections are suitable for stranded flexible wire up to 1.5 mm<sup>2</sup> and for solid wire up to 2.5 mm<sup>2</sup>.

**NOTE: The screening of control signal cables must comply with the immunity levels given in the EMC Directive (reduction of noise level).**

**NOTE: The control cables must be separated from motor and mains cables.**

Table VII Description of optional terminals in fig. XV and fig. XVI.

Terminals 78, 79	For connection of Motor PTC
Terminals A-, B+	For connection of 24V Stand-by Supply (only valid for size D2)

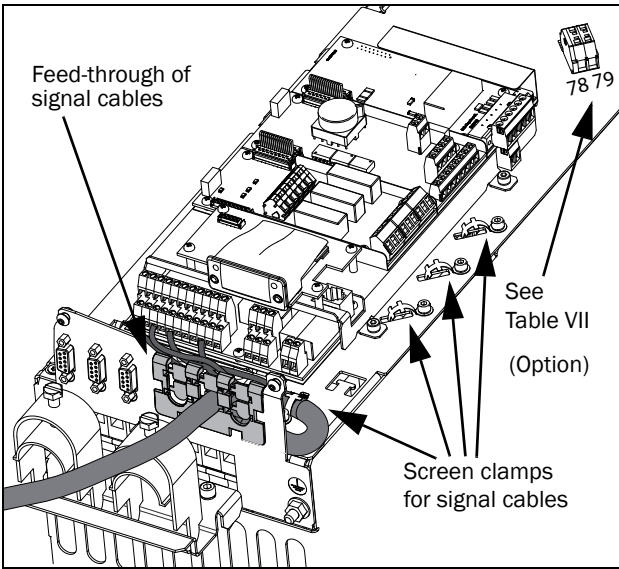


Fig. XV Connecting the control signals, VFX/FDU model 48-025 to 48-045 (Size C2).

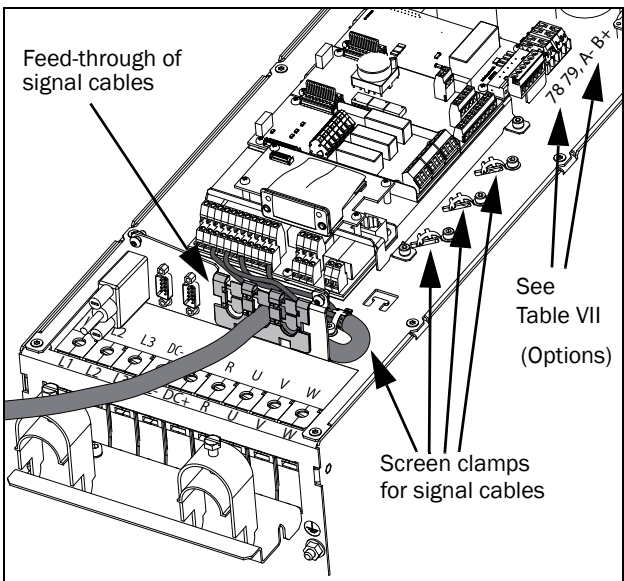


Fig. XVI Connecting the control signals, VFX/FDU model 48-060 to 48-088 (Size D2).

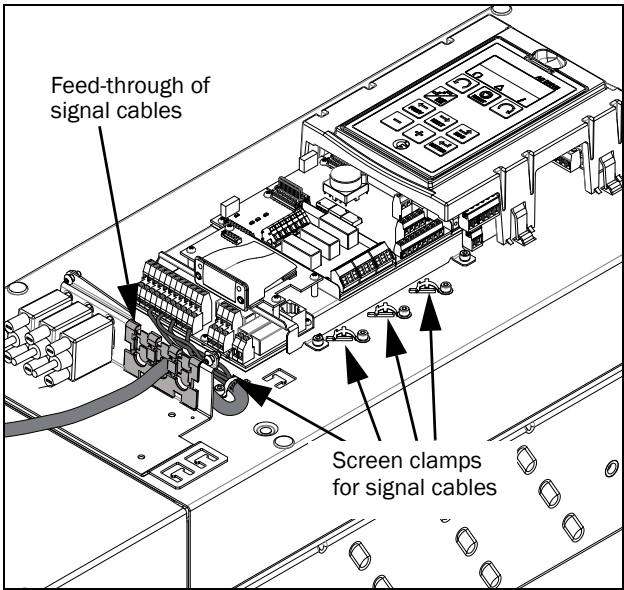


Fig. XVII Connecting the control signals, VFX/FDU model 48-106 to 48-244 (Size E2 and F2) (principle drawing)

## 13. Options

### 13.4 Brake chopper

Emotron VFX 2.0 and FDU 2.0 - IP20/21  
version

For other specifications, see the main manual for Emotron  
FDU/VFX.

Table 8 Brake resistor FDU and VFX 48 V types

Type	Rmin [ohm] if supply 380–415 V <sub>AC</sub>	Rmin [ohm] if supply 440–480 V <sub>AC</sub>
FDU/VFX-025	26	30
-030	26	30
-036	17	20
-045	17	20
-060	10	12
-072	10	12
-088	7.5	9
-106	3.8	4.4
-142	3.8	4.4
-171	3.8	4.4
-205	2.7	3.1
-244	2.7	3.1

## 14. Technical Data

### 14.1 Electrical specifications related to model

Emotron VFX 2.0 - IP20/21 version

Table IX 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]	
VFX48-025	38	11	25	7,5	20	C2
VFX48-030	45	15	30	11	24	
VFX48-036	54	18.5	36	15	29	
VFX48-045	68	22	45	18,5	36	
VFX48-060	90	30	60	22	48	D2
VFX48-072	108	37	72	30	58	
VFX48-088	132	45	88	37	70	
VFX48-106	127	55	106	45	85	E2
VFX48-142	170	75	142	55	114	
VFX48-171	205	90	171	75	137	
VFX48-205	246	110	205	90	164	F2
VFX48-244	293	132	244	110	195	

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

Emotron FDU 2.0 - IP20/21 version

Table X Typical motor power at mains voltage 400V.

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]	
FDU48-025	30	11	25	7,5	20	C2
FDU48-030	36	15	30	11	24	
FDU48-036	43	18.5	36	15	29	
FDU48-045	54	22	45	18,5	36	
FDU48-060	72	30	60	22	48	D2
FDU48-072	86	37	72	30	58	
FDU48-088	106	45	88	37	70	
FDU48-106	127	55	106	45	85	E2
FDU48-142	170	75	142	55	114	
FDU48-171	205	90	171	75	137	
FDU48-205	246	110	205	90	164	F2
FDU48-244	293	132	244	110	195	

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

## Emotron VFX 2.0 - IP20/21 version

Table XI 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 @460V [hp]	Rated current [A]	Power @460V [hp]	Rated current [A]	
VFX48-025	38	15	25	10	20	C2
VFX48-030	45	20	30	15	24	
VFX48-036	54	25	36	20	29	
VFX48-045	68	30	45	25	36	
VFX48-060	90	40	60	30	48	D2
VFX48-072	108	50	72	40	58	
VFX48-088	132	60	88	50	70	
VFX48-106	127	75	106	60	85	E2
VFX48-142	170	100	142	75	114	
VFX48-171	205	125	171	100	137	
VFX48-205	246	150	205	125	164	F2
VFX48-244	293	200	244	150	195	

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

## Emotron FDU 2.0 - IP20/21 version

Table XII Typical motor power at mains voltage 460V.

Model	Max. output current [A]*	Normal duty (120%, 1 min every 10 min)		Heavy duty (150%, 1 min every 10 min)		Frame Size
		Power @460V [hp]	Rated current [A]	Power @460V [hp]	Rated current [A]	
FDU48-025	30	15	25	10	20	C2
FDU48-030	36	20	30	15	24	
FDU48-036	43	25	36	20	29	
FDU48-045	54	30	45	25	36	
FDU48-060	72	40	60	30	48	D2
FDU48-072	86	50	72	40	58	
FDU48-088	106	60	88	50	70	
FDU48-106	127	75	106	60	85	E2
FDU48-142	170	100	142	75	114	
FDU48-171	205	125	171	100	137	
FDU48-205	246	150	205	125	164	F2
FDU48-244	293	200	244	150	195	

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

## 14.2 General electrical specifications

Table XIII General electrical specifications.

Mains voltage VFX/FDU48	230-480V +10%/-15% (-10% at 230 V)
Mains frequency:	45 - 65 Hz
Input power factor:	0.95
Output voltage:	0-Mains supply voltage
Output frequency:	0-400 Hz
Output switching frequency:	3 kHz (adjustable on Emotron FDU; 1,5 - 6 kHz)
Efficiency at nominal load:	98% for models 48-025 to 48-244

For other electrical specifications, see the main manual for Emotron FDU/VFX.

## 14.3 Operation at higher temperatures

The Emotron FDU/VFX IP20/21 version are made for operation at a maximum of 40°C ambient temperature. However, it is possible to use the AC drive at higher temperatures with reduced output rating. The table below shows the derating for higher temperatures.

Table XIV Ambient temperature and derating.

Model	IP20/IP21	
	Max temp.	Derating: possible
VFX/FDU48-025 to VFX/FDU48-244	40 °C	-1%/°C to max +15 °C (55 °C)

### Example

In this example we have a motor with the following data that we want to run at the ambient temperature of 55°C:

Voltage 400V  
Current 70 A  
Power 37 kW

### Select AC drive

The ambient temperature is 15°C higher than the maximum ambient temperature. The following calculation is made to select the correct AC drive model.

Derating is possible with loss in performance of 1%/°C.

Derating will be:  $15 \times 1\% = 15\%$

Calculation for model VFX/FDU 48-072:

$72 \text{ A} - (15\% \times 72 \text{ A}) = 61.2 \text{ A}$ ; this is not enough.

Calculation for model VFX/FDU 48-088:

$88 \text{ A} - (15\% \times 88 \text{ A}) = 74.8 \text{ A}$

In this example we select the VFX/FDU 48-088.

## 14.4/14.5 Dimen'sions and Weights

The table below gives an overview of the dimensions and weights of the Emotron FDU/VFX IP20/21 version .

The AC drives are available as wall mounted modules; with top cover (i.e. in compliance with IP21), or without top cover (in compliance with IP20). See fig. I and fig. III in section "2. Mounting". The IP20 version is optimised for cabinet mounting.

The protection classes IP20 and IP21 are defined according to the EN 60529 standard.

Table XV Mechanical specifications.

VFX/VDU Model	Frame size	Dim. H1 / H2 x W x D [mm] IP20*	Dim. H1 / H2 x W x D [mm] IP21**	Weight [kg] IP20 and IP21
48-025 to 48-045	C2	438 / 536 x 176 x 267	438 / 559 x 196 x 282	17
48-060 to 48-088	D2	545 / 658 x 220 x 291	545 / 670 x 240 x 307	30
48-106 to 48-171	E2	956 / 956 x 275 x 294	956 / 956 x 275 x 323	53
48-205 to 48-244	F2	956 / 956 x 335 x 294	956 / 956 x 335 x 323	68

H1 = Enclosure height.

H2 = Total height including cable interface.

\* without top cover

\*\* with top cover

## 14.6/14.7 Fuses, cable cross-sections and glands

### 14.6.1/14.7.1 According to IEC ratings

Use mains fuses of the type gL/gG conforming to IEC 269 or breakers with similar characteristics. Check the equipment first before installing the glands.

Max. value fuse = maximum fuse value that still protects the AC drive 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.**

Table XVI Fuses, cable cross-sections and glands.

VFX/VDU Model	Nominal input current [A]	Maximum value fuse [A]	Cable cross section connector range [mm <sup>2</sup> ] for		
			Mains / motor	Brake	PE
48-025	22	25	4 - 25		4 - 25 with cable shoe for M6 screw
48-030	26	35			
48-036	31	35			
48-045	38	50			
48-060	52	63	10 - 70		10 - 70 with cable shoe for M6 screw
48-072	64	80			
48-088	78	100			
48-106	94	100			
48-142	126	160	13 - 150	13 - 125	13 - 125 (16 - 70) <sup>1</sup>
48-171	152	160			13 - 150 (16 - 70) <sup>1</sup>
48-205	182	200			21 - 250 (95 - 185) <sup>1</sup>
48-244	216	250	21 - 250	13 - 150	21 - 250 (95 - 185) <sup>1</sup>

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

## 14.6.2/14.7.2 Fuses and cable dimensions according to NEMA ratings

Table XVII Types and fuses.

VFX/FDU Model	Input current [Arms]	Mains input fuses	
		Fuse Class J [A]	Ferraz-Shawmut type
48-025	22	25	AJT25
48-030	26	30	AJT30
48-036	31	35	AJT35
48-045	38	45	AJT45
48-060	52	60	AJT60
48-072	64	80	AJT80
48-088	78	100	AJT100
48-106	94	110	AJT110
48-142	126	150	AJT150
48-171	152	175	AJT175
48-205	182	200	AJT200
48-244	216	250	AJT250

Table XVIII Type cables cross-sections and glands.

VFX/FDU Model	Cable cross section connector				Cable type	
	Mains and motor		Brake			
	Range	Tightening torque [Nm] / [Lb-in]	Range	Tightening torque [Nm] / [Lb-in]		
48-025	AWG 12 - AWG 4	2 / 18	AWG 12 - AWG 4	2 / 18	Copper (Cu) 60 °C	
48-030						
48-036						
48-045						
48-060	AWG 8 - AWG 2/0	3 / 35	AWG 8 - AWG 2/0	3 / 35	Copper (Cu) 75 °C	
48-072						
48-088						
48-106	AWG 6 - 300 kcmil	31/275 (for AWG 6 - 2) 42/375 (for AWG 1 - 300 kcmil)	AWG 6 - 250 kcmil	31/275 (for AWG 6 - 2) 42/375 (for AWG 1 - 250 kcmil)		
48-142						
48-171						
48-205	AWG 4 - 500 kcmil	31/275 (for AWG 4 - 2) 42/375 (for AWG 1 - 300 kcmil) 56/500 (for 350 - 500 kcmil)	AWG 6 - 300 kcmil	31/275 (for AWG 6 - 2) 42/375 (for AWG 1 - 300 kcmil)		
48-244						





