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Rexroth Frequency Converter

EFC 3610 / EFC 5610

Quick Start Guide
R912005856

Edition 15



Edition	Release Date	Notes
DOK-RCON03-EFC-X610***-QU07-EN-P	2016.03	Added new functions
DOK-RCON03-EFC-X610***-QU08-EN-P	2016.06	Added new functions
DOK-RCON03-EFC-X610***-QU09-EN-P	2017.01	Added new functions
DOK-RCON03-EFC-X610***-QU10-EN-P	2017.04	Added cold plate models
DOK-RCON03-EFC-X610***-QU11-EN-P	2017.06	Added new functions
DOK-RCON03-EFC-X610***-QU12-EN-P	2017.12	Added new functions
DOK-RCON03-EFC-X610***-QU13-EN-P	2019.04	Added new functions
DOK-RCON03-EFC-X610***-QU14-EN-P	2021.12	Contents upgrade
DOK-RCON03-EFC-X610***-QU15-EN-P	2023.06	Contents upgrade

Introduction of this Documentation

This **Quick Start Guide** is derived from the **Operating Instructions** which includes the product data in details.

The illustrations in this manual are representative examples only and may differ from the product you ordered.

- This manual is subject to change without notice due to product improvements or specification changes, and to enhance the convenience of the manual.

⚠ WARNING **Personal injury and property damage caused by incorrect application, installation or operation!**

Never work with or control the product before reading through

- **Safety Instructions** in the standard delivery
- Safety descriptions in the **Operating Instructions**

Reference

For documentation available in other type or language, please consult your local sales partner or check www.boschrexroth.com/efcx610.

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1 Mechanical Installation

1.1 Visual Check

After unpacking the frequency converter, perform a thorough visual check.

Check the following:

- **The right device has been supplied**
- **The device has no damage**
- **No transport damage such as scratches, cracks or dents**

If you find any deviation from one of the above points, please contact your **Bosch Rexroth** sales partner.

1.2 Ambient Conditions

If it is to function perfectly, the frequency converter must be installed in an environment matching the data provided below.

Rated ambient temperature	-10...45 °C
Derating / ambient temperature	1.5 % / 1 °C (45...55 °C)
Rated altitude	≤ 1,000 m
Derating / altitude	1 % / 100 m (1,000...4,000 m)
Relative humidity	≤ 90 % (No condensation)
Degrees of protection	IP 20 (Control cabinet mounting)
Degrees of pollution	2 (EN 50178)

Tab. 1-1: Ambient conditions

1.3 Figures and Dimensions

1.3.1 Standard Models

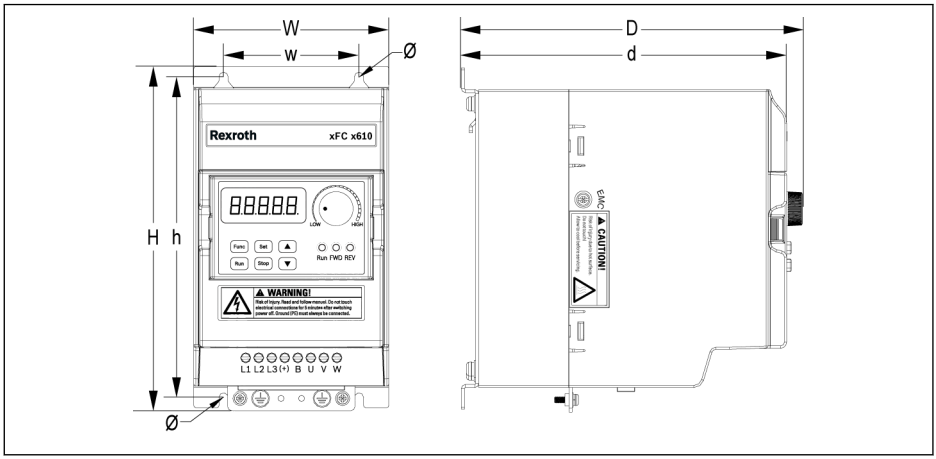


Fig. 1-1: EFC x610 0K40...4K00 dimensions figure (1P 200 VAC / 3P 380 VAC)

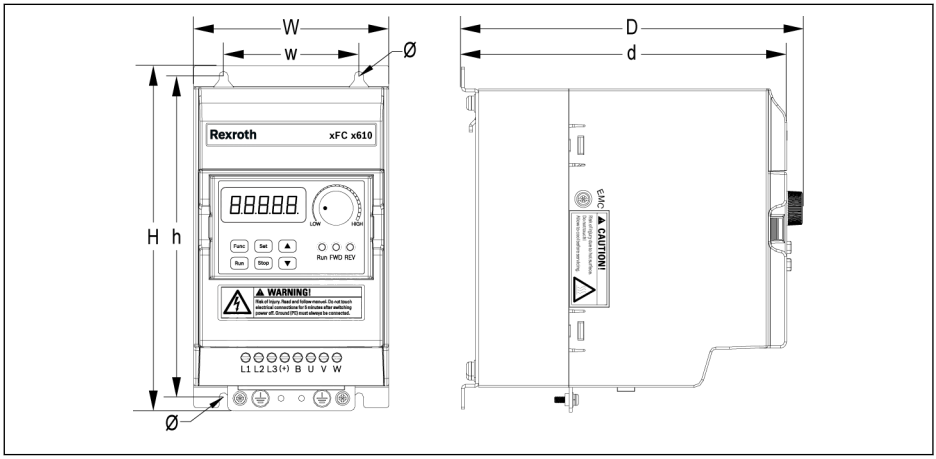


Fig. 1-2: EFC x610 0K40...2K20 dimensions figure (3P 200 VAC)

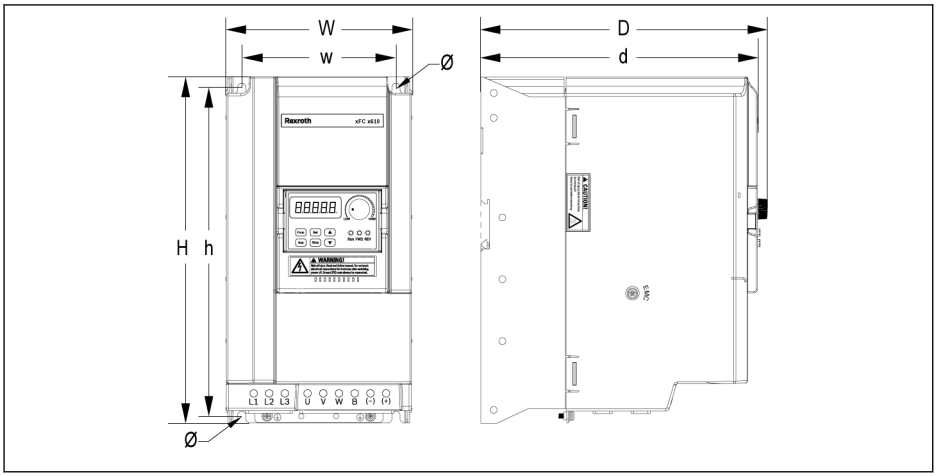


Fig. 1-3: EFC x610 3K00...11K0 dimensions figure (3P 200 VAC)

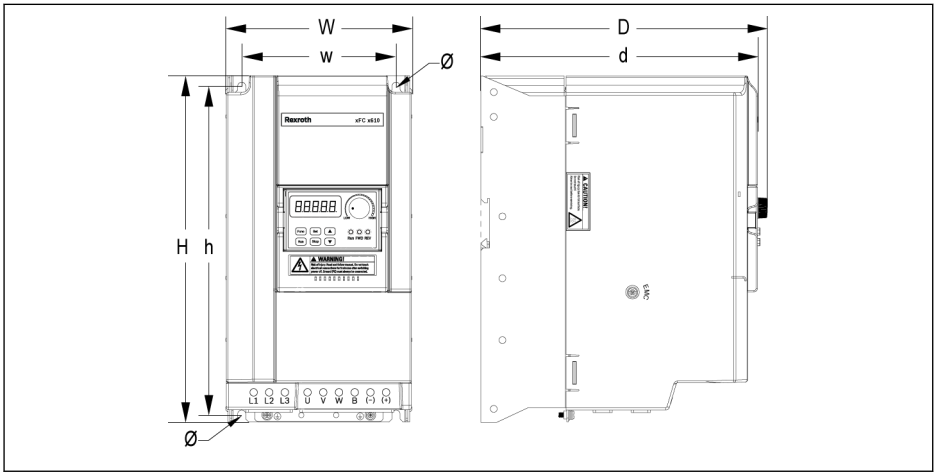


Fig. 1-4: EFC x610 5K50...22K0 dimensions figure (3P 380 VAC)

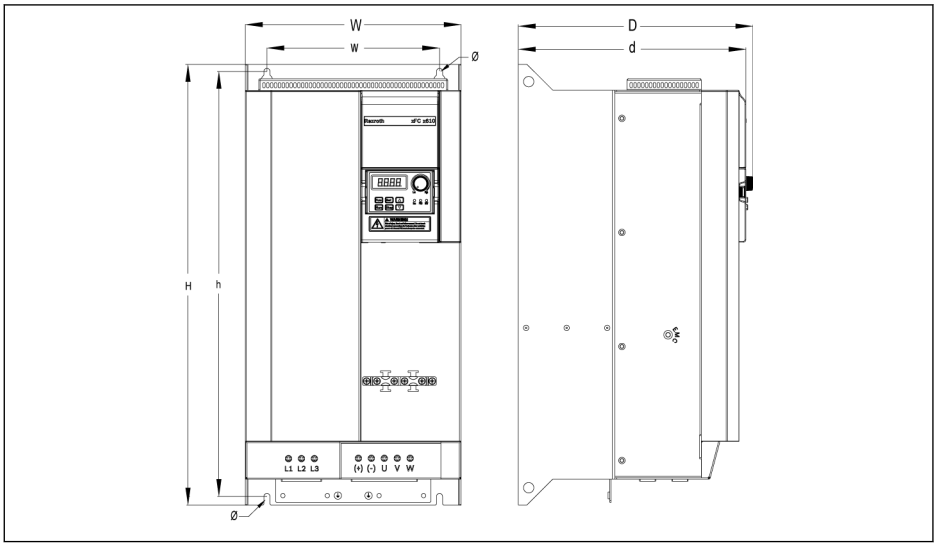


Fig. 1-5: EFC 5610 30K0...37K0 dimensions figure (3P 380 VAC)

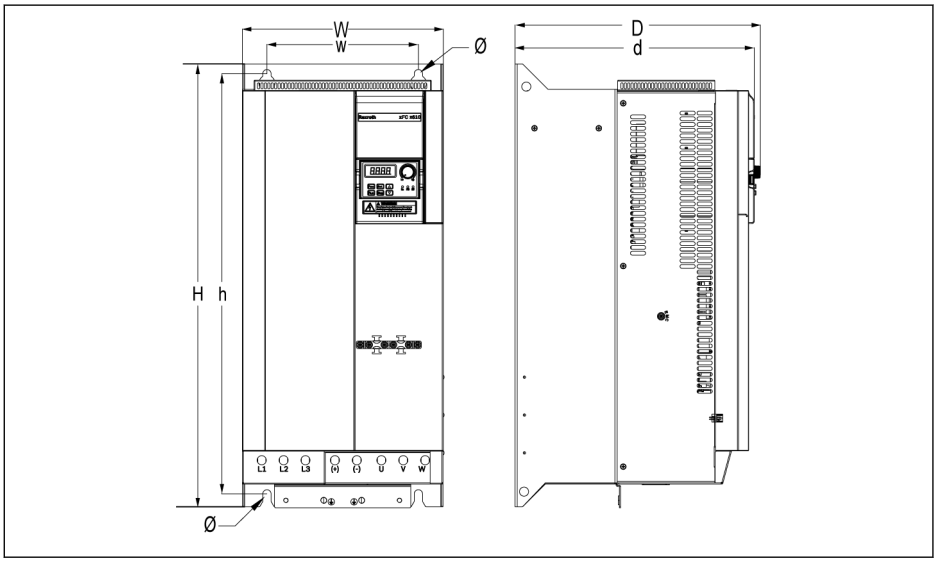


Fig. 1-6: EFC 5610 45K0...55K0 dimensions figure (3P 380 VAC)

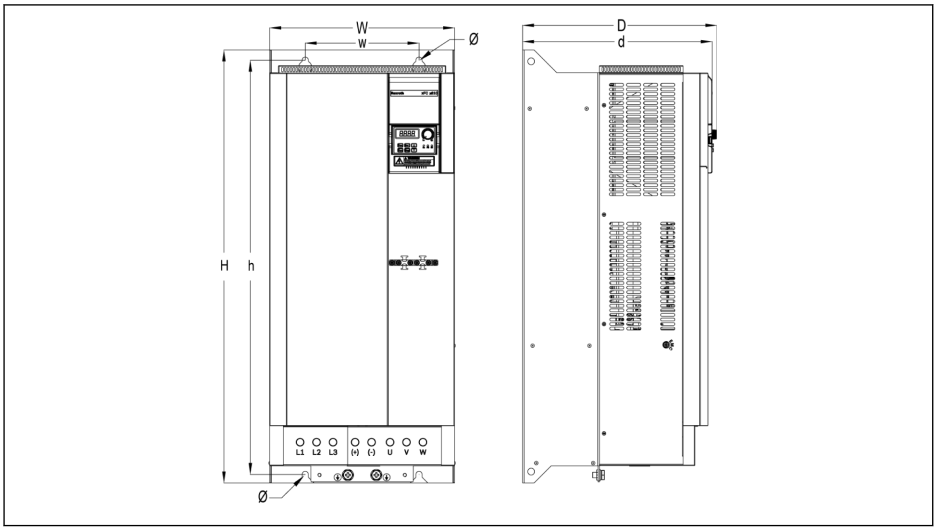


Fig. 1-7: EFC 5610 75K0...90K0 dimensions figure (3P 380 VAC)

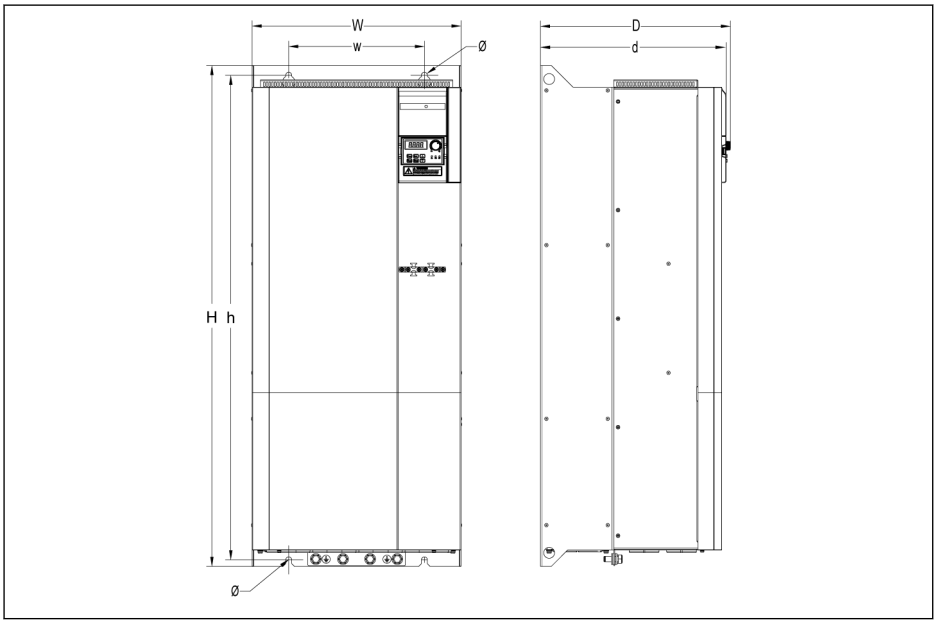


Fig. 1-8: EFC 5610 110K...132K dimensions figure (3P 380 VAC)

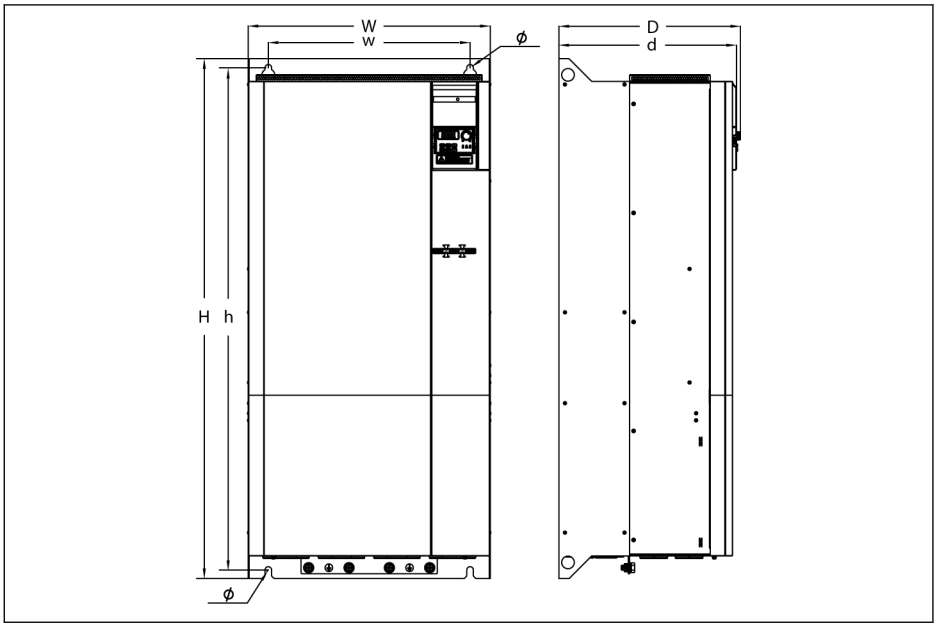


Fig. 1-9: EFC 5610 160K dimensions figure (3P 380 VAC)

Frame	Model①	Dimensions [mm]							Screw size②	Net weight [kg]
		W	H	D④	w	h	d④	Ø		
B	0K40	95	166	167	66	156	159	4.5	M4	1.5
B	0K75	95	166	167	66	156	159	4.5	M4	1.5
C	1K50	95	206	170	66	196	162	4.5	M4	1.9
D	2K20	120	231	175	80	221	167	4.5	M4	2.6

Tab. 1-2: EFC x610 1P 200 VAC dimensions

Frame	Model①	Dimensions [mm]							Screw size②	Net weight [kg]
		W	H	D④	w	h	d④	Ø		
B③	0K40	95	166	167	66	156	159	4.5	M4	1.5
C③	0K75	95	206	170	66	196	162	4.5	M4	1.9
D③	1K50	120	231	175	80	221	167	4.5	M4	2.6
D③	2K20	120	231	175	80	221	167	4.5	M4	2.6
E③	3K00	130	243	233	106	228	225	6.5	M6	3.9
E③	4K00	130	243	233	106	228	225	6.5	M6	4.3

Frame	Model①	Dimensions [mm]							Screw size②	Net weight [kg]
		W	H	D④	w	h	d④	Ø		
F③	5K50	150	283	233	125	265	225	6.5	M6	5.7
F③	7K50	150	283	233	125	265	225	6.5	M6	6.4
G③	11K0	165	315	241	140	300	233	6.5	M6	8.5

Tab. 1-3: EFC x610 3P 200 VAC dimensions

Frame	Model①	Dimensions [mm]							Screw size②	Net weight [kg]
		W	H	D④	w	h	d④	Ø		
B	0K40	95	166	167	66	156	159	4.5	M4	1.5
B	0K75	95	166	167	66	156	159	4.5	M4	1.5
C	1K50	95	206	170	66	196	162	4.5	M4	1.9
C	2K20	95	206	170	66	196	162	4.5	M4	1.9
D	3K00	120	231	175	80	221	167	4.5	M4	2.6
D	4K00	120	231	175	80	221	167	4.5	M4	2.6
E	5K50	130	243	233	106	228	225	6.5	M6	3.9
E	7K50	130	243	233	106	228	225	6.5	M6	4.3
F	11K0	150	283	233	125	265	225	6.5	M6	5.7
F	15K0	150	283	233	125	265	225	6.5	M6	6.4
G	18K5	165	315	241	140	300	233	6.5	M6	8.0
G	22K0	165	315	241	140	300	233	6.5	M6	8.5
H③	30K0	250	510	272	200	492	264	7.0	M6	27.5
H③	37K0	250	510	272	200	492	264	7.0	M6	29.5
I③	45K0	265	585	325	200	555	317	11.0	M10	39.0
I③	55K0	265	585	325	200	555	317	11.0	M10	42.0
J③	75K0	325	760	342	200	727	334	11.0	M10	54.0
J③	90K0	325	760	342	200	727	334	11.0	M10	61.0
K③	110K	385	923	350	250	893	342	11.0	M10	71.7
K③	132K	385	923	350	250	893	342	11.0	M10	76.6
L③	160K	480	1030	360	400	995	352	13.0	M12	108.0

Tab. 1-4: EFC x610 3P 380 VAC dimensions

- ①: The complete type code for frequency converter is:
  EFCX610-xKxx-xPx-MDA-xx-NNNNN-xxNN, see **"Appendix: Type Coding"** in the **Operating Instructions**.
  E.g., type code for EFC 5610 5K50 (3P 380 VAC model) is:
  EFC5610-5K50-3P4-MDA-7P-NNNNN-NNNN.
- ②: 4 screws are needed for mounting of EFC x610.
- ③: **ONLY** available with EFC 5610.
- ④: Add **35 mm** to dimension **D** and **d** when extension module is used and installed.

1.3.2 Cold Plate Models

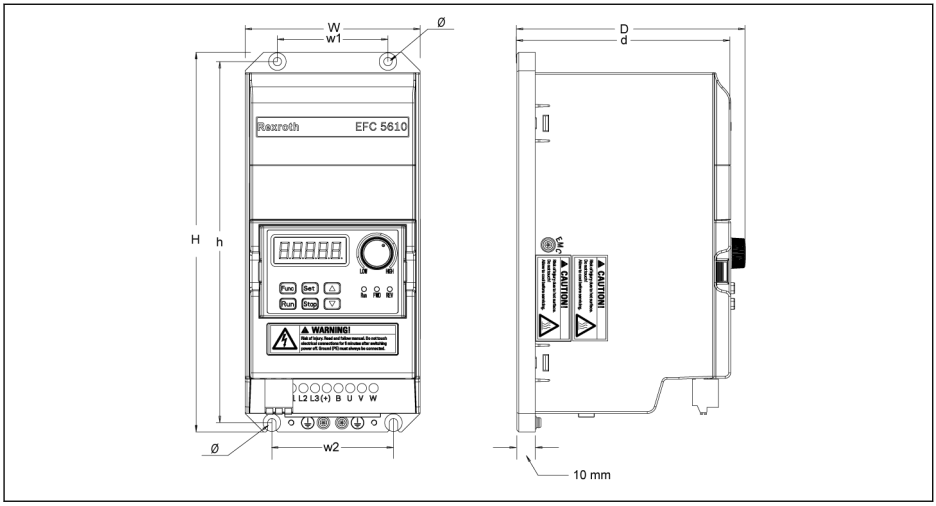


Fig. 1-10: EFC 5610 0K40...4K00 dimensions figure (cold plate, 1P 200 VAC / 3P 380 VAC)

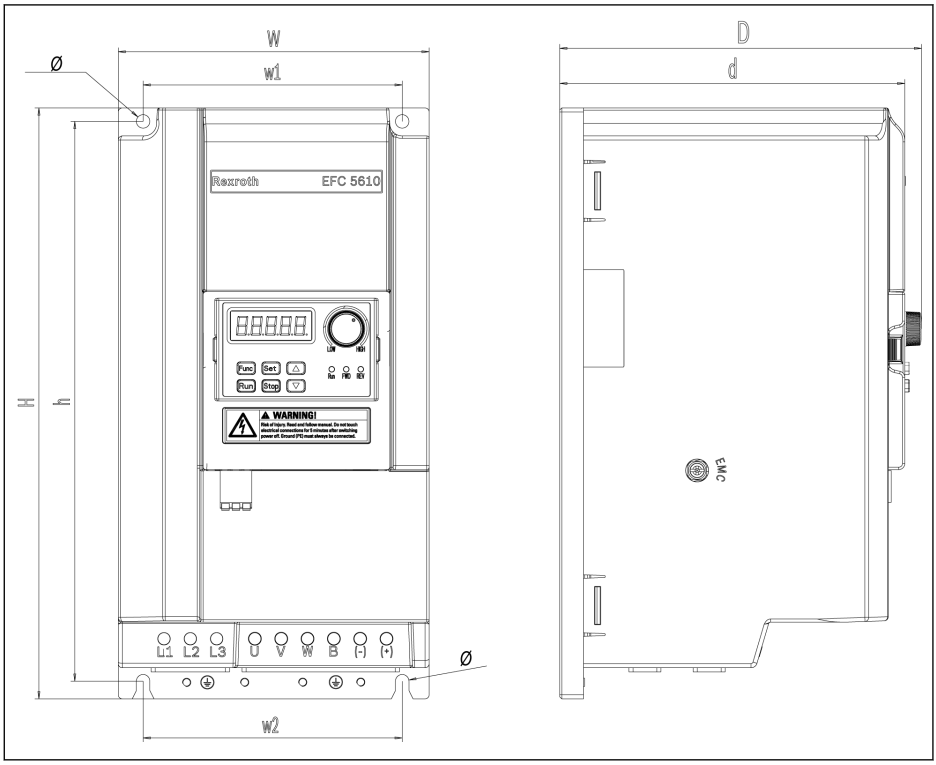


Fig. 1-11: EFC 5610 5K50...15K0 dimensions figure (cold plate, 3P 380 VAC)

Frame	Model①	Dimensions [mm]								Screw size②	Net weight [kg]
		W	H	D	w1	w2	h	d	Ø		
B	0K40	95	166	124	60	66	156	116	4.5	M4	1.0
B	0K75	95	166	124	60	66	156	116	4.5	M4	1.0
C	1K50	95	206	124	60	66	196	116	4.5	M4	1.2
D	2K20	120	231	124	60	66	221	116	4.5	M4	1.5

Tab. 1-5: EFC 5610 1P 200 VAC dimensions (cold plate models)

Frame	Model①	Dimensions [mm]								Screw size②	Net weight [kg]
		W	H	D	w1	w2	h	d	Ø		
B	0K40	95	166	124	60	66	156	116	4.5	M4	1.1
B	0K75	95	166	124	60	66	156	116	4.5	M4	1.1

Frame	Model①	Dimensions [mm]								Screw size②	Net weight [kg]
		W	H	D	w1	w2	h	d	Ø		
C	1K50	95	206	124	60	66	196	116	4.5	M4	1.4
C	2K20	95	206	124	60	66	196	116	4.5	M4	1.4
D	3K00	120	231	124	60	66	221	116	4.5	M4	1.8
D	4K00	120	231	124	60	66	221	116	4.5	M4	1.8
E	5K50	130	245	175	106	106	230	167	6.5	M6	3.5
E	7K50	130	245	175	106	106	230	167	6.5	M6	3.5
F	11K0	150	285	175	125	125	270	167	6.5	M6	5
F	15K0	150	285	175	125	125	270	167	6.5	M6	5

Tab. 1-6: EFC 5610 3P 380 VAC dimensions (cold plate models)

1.4 Installation

1.4.1 Installation Conditions

The frequency converter must be installed vertically.

If one frequency converter is arranged above another, make sure the upper limit of air temperature into the inlet is not exceeded (see **"Technical Data"** in the **Operating Instructions**). An air guide is recommended between the frequency converters to prevent the rising hot air being drawn into the upper frequency converter if the upper limit of air temperature is exceeded.

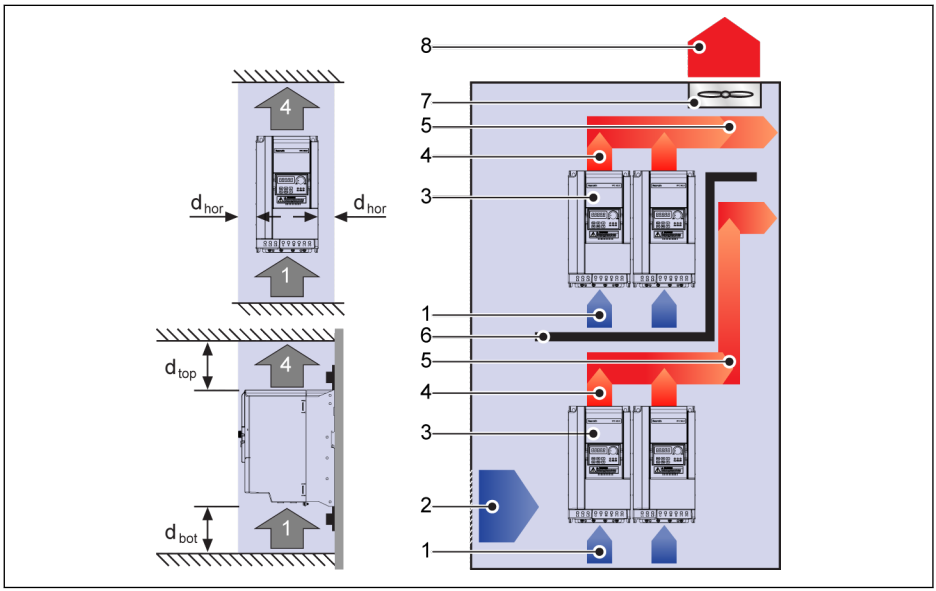


Fig. 1-12: Mounting distance and arrangement

d_{hor} (Distance horizontal):

d_{hor} = 0 mm (0K40...22K0); d_{hor} = 10 mm (30K0...160K)

d_{top} (Minimum top distance):

d_{top} = 125 mm (0K40...90K0); d_{top} = 400 mm (110K...160K)

d_{bot} (Minimum bottom distance):

d_{bot} = 125 mm (0K40...90K0); d_{bot} = 400 mm (110K...160K)

1: Air inlet at frequency converter; 2: Air inlet at control cabinet

3: Frequency converter; 4: Air outlet at frequency converter

5: Heated air conveying direction; 6: Air guide in control cabinet

7: Fan in control cabinet; 8: Discharge of heated air

1.4.2 Installation Instructions for Cold Plate Models

Use of Thermal Compound Paste

To use the thermal compound paste, the surface of heatsink and cold plate must be free from dust, dirt, oil and particles.

In addition, the heatsink surface must meet the following three conditions:

- Minimum surface flatness: 50 µm (DIN EN ISO 1101)
- Maximum surface roughness: 6 µm (DIN EN ISO 4287)
- Maximum peak-valley height of the surface: 10 µm (DIN EN ISO 4287)



It is recommended to use P12 thermal compound paste from Wacker Chemie. It should be applied evenly. The maximum thickness is 100 µm.

Mount the Module to Heatsink

After the use of thermal paste, tighten four M4 fastening screws by following procedure.

1. Fix the screws with 0.5 Nm (hand tight, crosswise) in the sequence:
   1 -> 2 -> 3 -> 4

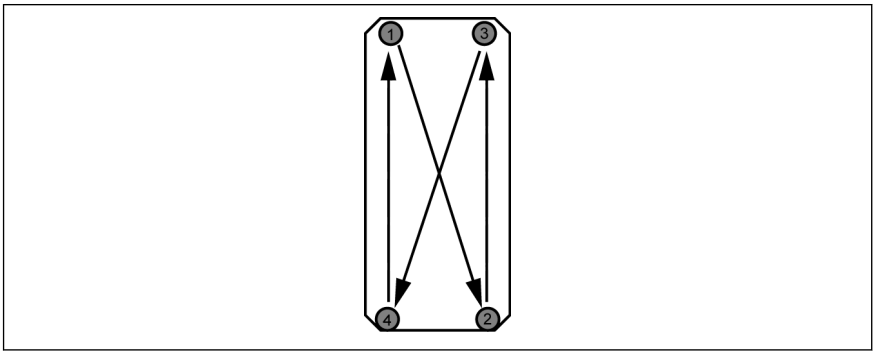


Fig. 1-13: Tightening sequence to mount the module to the heatsink

2. Tighten the screws with 2.0...2.5 Nm in the same sequence (crosswise):
   1 -> 2 -> 3 -> 4



Tighten the screws with specified torques. Failure to do so, may inhibit drive cooling and cause possible damage to the drive.

1.4.3 Extension Card Module Mounting

NOTICE

Please make sure the power supply has been switched off before mounting the extension card module onto the frequency converter.

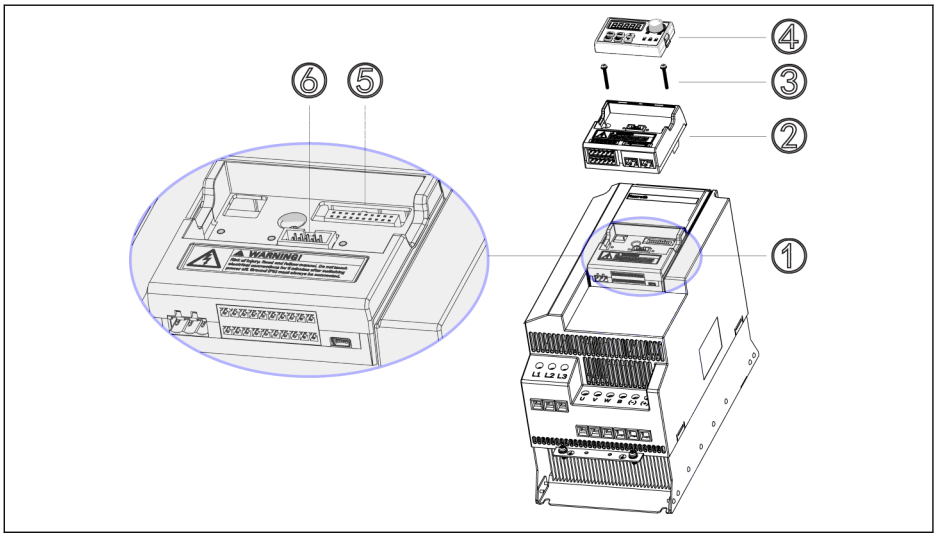


Fig. 1-14: Extension card module mounting

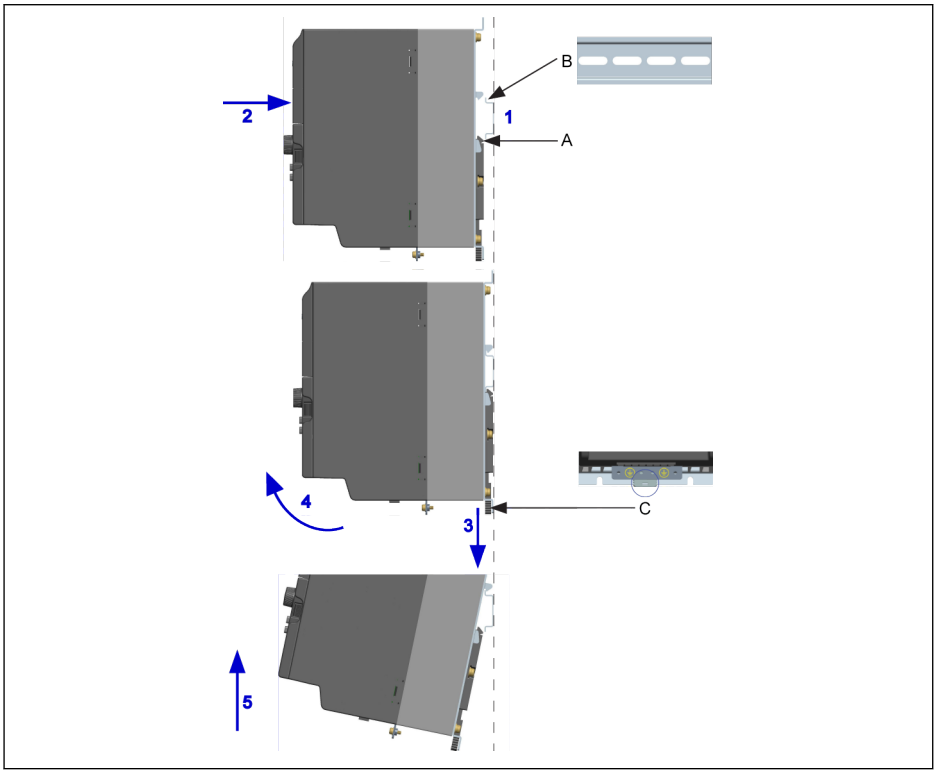
1. Remove operating panel ④ from Control & Terminal module ①.
2. Mount extension card module with extension cards ② into Control & Terminal module ①.
3. Tighten two screws ③ (Screw torque to 0.4 Nm) to fix carrier for option modules ② in Control & Terminal module ①.
4. Push operating panel ④ into carrier for option modules ②.

⑤: Control & Terminal module connector
⑥: Connector for operating panel

1.4.4 DIN Rail Mounting

Besides wall mounting with screws, below models (does not include cold plate models) also provide DIN rail mounting.

- 1P 200 VAC: 0K40...2K20
- 3P 200 VAC: 0K40...4K00
- 3P 380 VAC: 0K40...7K50



A Mounting buckle
B Mounting rail
C Disassembly handle

Fig. 1-15: DIN rail mounting and disassembly

Mounting steps:

1: Hold the frequency converter and keep component A and the lower edge of component B at the same position level.

2: Push the frequency converter horizontally till a buckle sound indicates a successful mounting.

Disassembly steps:

3: Pull down component C and hold it.

4: Rotate the frequency converter to an appropriate angle as the arrow indicates.

5: Lift the frequency converter upwards.

2 Electric Installation

2.1 Overview of Electric Connections

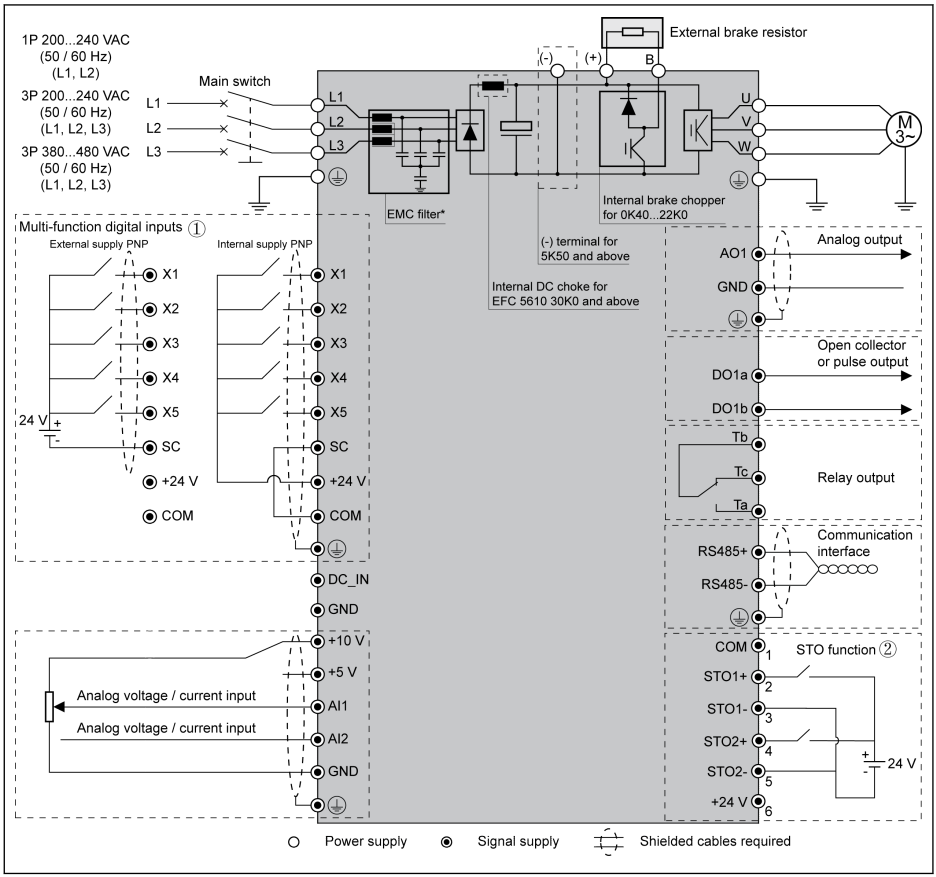


Fig. 2-1: Wiring diagram

- Information on cable size, fuse, screw torque, see **chapter 2.2**.
- Information on terminals, see **chapter 2.3**.
- ①: NPN modes, see **chapter 2.3.2**.
- ②: STO (Safe Torque Off) function only available on EFC 5610 models. See **Operating Instructions** for details.
- *****: Can be disconnected by disassembly of a screw. See **Operating Instructions** for details.
- Pulse input can **ONLY** be set via 'Multi-function digital input X5'.
- When analog current input function is applied, the supply voltage of analog input terminal can not exceed +5 V.

2.2 Cable Specifications

2.2.1 Power Connection

Cable specification for international without USA / Canada

- Use copper wires specified for 90 ℃ or above.
- Insulation based on IEC60364-5-52.
- Cable with concentric shielding must be used.
- According to IEC61800-5-1, PE cable must be at least 10 mm^2 or a double PE cable must be used.
- *: If additional labels available with the terminals of 0K40...7K50, please refer to the torque data on labels.

EFC x610 Model	Fuse (gG)	Power cables installation mode			PE Cable	Torque / Screw
		B1	B2	E		
	[A]	[mm^2]			[mm^2]	[N·m / lbf·in] (Mx)
0K40	10.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
0K75	16.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
1K50	25.0	4.0	4.0	2.5	10.0 4.0*2	0.8* / 7.0 (M3)
2K20	32.0	6.0①	6.0①	4.0	10.0 6.0*2	0.8* / 7.0 (M3)

Tab. 2-1: 1P 200 VAC fuse and cable dimensions for international without USA / Canada

①: Stranded with ferrule without plastic sleeve.

EFC x610 Model	Fuse (gG)	Power cables installation mode			PE Cable	Torque / Screw
		B1	B2	E		
	[A]	[mm^2]			[mm^2]	[N·m / lbf·in] (Mx)
0K40	10.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
0K75	10.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)

EFC x610 Model	Fuse (gG)	Power cables installation mode			PE Cable	Torque / Screw
		B1	B2	E		
	[A]	[mm²]			[mm²]	[N·m / lbf·in] (Mx)
1K50	20.0	4.0	4.0	2.5	10.0 4.0*2	0.8* / 7.0 (M3)
2K20	20.0	4.0	4.0	2.5	10.0 4.0*2	0.8* / 7.0 (M3)
3K00	32.0	6.0	6.0	4.0	10.0 6.0*2	1.2* / 10.5 (M4)
4K00	40.0	6.0	10.0	6.0	10.0 6.0*2	1.2* / 10.5 (M4)
5K50	50.0	10.0	10.0	10.0	10.0	1.2 / 15.0 (M4)
7K50	50.0	10.0	10.0	10.0	10.0	1.2 / 15.0 (M4)
11K0	100.0	25.0	35.0	25.0	25.0	3.73 / 33.0 (M5)

Tab. 2-2: 3P 200 VAC fuse and cable dimensions for international without USA / Canada

EFC x610 Model	Fuse (gG)	Power cables installation mode			PE Cable	Torque / Screw
		B1	B2	E		
	[A]	[mm²]			[mm²]	[N·m / lbf·in] (Mx)
0K40	6.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
0K75	10.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
1K50	10.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
2K20	16.0	2.5	2.5	2.5	10.0 2.5*2	0.8* / 7.0 (M3)
3K00	20.0	4.0	4.0	2.5	10.0 4.0*2	0.8* / 7.0 (M3)
4K00	20.0	4.0	4.0	2.5	10.0 4.0*2	0.8* / 7.0 (M3)
5K50	32.0	6.0	6.0	4.0	10.0 6.0*2	1.2* / 10.5 (M4)
7K50	40.0	6.0	10.0	6.0	10.0 6.0*2	1.2* / 10.5 (M4)
11K0	50.0	10.0	10.0	10.0	10.0	1.2 / 15.0 (M4)
15K0	50.0	10.0	10.0	10.0	10.0	1.2 / 15.0 (M4)

EFC x610 Model	Fuse (gG)	Power cables installation mode			PE Cable	Torque / Screw
		B1	B2	E		
	[A]	[mm²]			[mm²]	[N·m / lbf·in] (Mx)
18K5	80.0	25.0	25.0	16.0	16.0	3.73 / 33.0 (M5)
22K0	100.0	25.0	35.0	25.0	25.0	3.73 / 33.0 (M5)
30K0	125.0	35.0	50.0	35.0	25.0	3.80 / 33.6 (M6)
37K0	125.0	35.0	50.0	35.0	35.0	3.80 / 33.6 (M6)
45K0	160.0	50.0	70.0	50.0	35.0	31.1 / 275.0 (5/16 in)
55K0	200.0	70.0	95.0	70.0	50.0	31.1 / 275.0 (5/16 in)
75K0	250.0	120.0	150.0	95.0	95.0	31.1 / 275.0 (5/16 in)
90K0	250.0	120.0	150.0	95.0	95.0	31.1 / 275.0 (5/16 in)
110K	315.0	120.0	150.0	120.0	95.0	15.0 / 132.7 (M10)①
		95.0*2	95.0*2	95.0*2		8.0 / 70.8 (M8)②
132K	315.0	185.0	240.0	185.0	120.0	15.0 / 132.7 (M10)①
		95.0*2	95.0*2	95.0*2		8.0 / 70.8 (M8)②
160K	400.0	120*2	150*2	120*2	150.0	15.0 / 132.7 (M10)②

Tab. 2-3: 3P 380 VAC fuse and cable dimensions for international without USA / Canada



① and ②: According to the actual situation, single cable or double cable can be selected as the power cable of model 110K and above. ① is the torque and screw of single cable and ② is the torque and screw of double cable.

Cable specification for USA / Canada

- The data listed in the table below are only used to select fuse and cable dimensions for USA / Canada.
- Must use copper wires of 75 ℃ or above according to UL 61800-5-1.
- It is recommended to use shielded cables to connect the motor.
- *: If additional labels available with the terminals of 0K40...7K50, please refer to the torque data on labels.

EFC x610 Model	Fuse (Class J) [A]	Power cables [AWG]	PE Cable [AWG]	Torque / Screw [N·m / lbf·in] (Mx)
0K40	10.0	14	8	0.8* / 7.0 (M3)
0K75	15.0	14	8	0.8* / 7.0 (M3)
1K50	25.0	10	8	0.8* / 7.0 (M3)
2K20	30.0	10	8	0.8* / 7.0 (M3)

Tab. 2-4: 1P 200 VAC fuse and cable dimensions for USA / Canada

EFC x610 Model	Fuse (Class J) [A]	Power cables [AWG]	PE Cable [AWG]	Torque / Screw [N·m / lbf·in] (Mx)
0K40	10.0	14	8	0.8* / 7.0 (M3)
0K75	10.0	14	8	0.8* / 7.0 (M3)
1K50	20.0	12	8	0.8* / 7.0 (M3)
2K20	20.0	12	8	0.8* / 7.0 (M3)
3K00	30.0	8	8	1.2* / 10.5 (M4)
4K00	40.0	8	8	1.2* / 10.5 (M4)
5K50	50.0	6	8	1.76 / 15.6 (M4)
7K50	60.0	6	6	1.76 / 15.6 (M4)
11K0	100.0	2	4	3.73 / 33.0 (M5)

Tab. 2-5: 3P 200 VAC fuse and cable dimensions for USA / Canada

EFC x610 Model	Fuse (Class J) [A]	Power cables [AWG]	PE Cable [AWG]	Torque / Screw [N·m / lbf·in] (Mx)
0K40	6.0	14	8	0.8* / 7.0 (M3)
0K75	10.0	14	8	0.8* / 7.0 (M3)
1K50	10.0	14	8	0.8* / 7.0 (M3)
2K20	15.0	14	8	0.8* / 7.0 (M3)

EFC x610 Model	Fuse (Class J) [A]	Power cables [AWG]	PE Cable [AWG]	Torque / Screw [N·m / lbf·in] (Mx)
3K00	20.0	12	8	0.8* / 7.0 (M3)
4K00	20.0	12	8	0.8* / 7.0 (M3)
5K50	30.0	8	8	1.2* / 10.5 (M4)
7K50	40.0	8	8	1.2* / 10.5 (M4)
11K0	50.0	6	8	1.2 / 15.0 (M4)
15K0	60.0	6	6	1.2 / 15.0 (M4)
18K5	80.0	4	6	3.73 / 33.0 (M5)
22K0	100.0	2	4	3.73 / 33.0 (M5)
30K0	100.0	2	4	3.8 / 33.6 (M6)
37K0	125.0	1	3	3.8 / 33.6 (M6)
45K0	150.0	1 / 0	1	31.1 / 275.0 (5/16 in)
55K0	175.0	2 / 0	1 / 0	31.1 / 275.0 (5/16 in)
75K0	225.0	4 / 0	3 / 0	31.1 / 275.0 (5/16 in)
90K0	250.0	250 kcmil	3 / 0	31.1 / 275.0 (5/16 in)
110K	300.0	400 kcmil	3 / 0	15.0 / 132.7 (M10)①
		3 / 0 * 2		8.0 / 70.8 (M8)②
132K	350.0	500 kcmil	250 kcmil	15.0 / 132.7 (M10)①
		250 kcmil * 2		8.0 / 70.8 (M8)②
160K	450.0	350 kcmil * 2	350 kcmil	15.0 / 132.7 (M10)②

Tab. 2-6: 3P 380 VAC fuse and cable dimensions for USA / Canada

① and ②: According to the actual situation, single cable or double cable can be selected as the power cable of model 110K and above. ① is the torque and screw of single cable and ② is the torque and screw of double cable.

2.2.2 Control Signal Connection

The following requirements are applicable to signal connection:

- Flexible cables with wire end sleeves
- Cable cross-section: 0.2...1.0 mm^2
- Cable cross-section for connectors with insulation sleeves: 0.25...1.0 mm^2
- Analog inputs AI1, AI2, EAI, +10 V, +5 V and GND: use shielded cables
- Digital inputs X1...X5, EX1...EX4, SC, +24 V and COM: use shielded cables
- Analog outputs AO1, EAO and GND: use shielded cables
- RS485 communication: use shielded twisted pair cables



- EAI, EX1...EX4 and EAO belong to I/O card.
- For STO wiring specification, see **Operating Instructions**.

Recommendations on cable insulation stripping:

Please strip the insulation of control cables according to the dimensions given below. Too long stripping may cause short circuit of adjacent cables; too short stripping may lead to cables becoming loose.

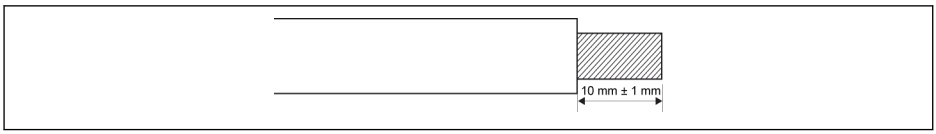


Fig. 2-2: Cable insulation stripping length



Please follow the steps below for wiring of control terminals.

Step 1: Switch off the frequency converter before performing wiring.

Step 2: Deactivate the control signals in the wiring process.

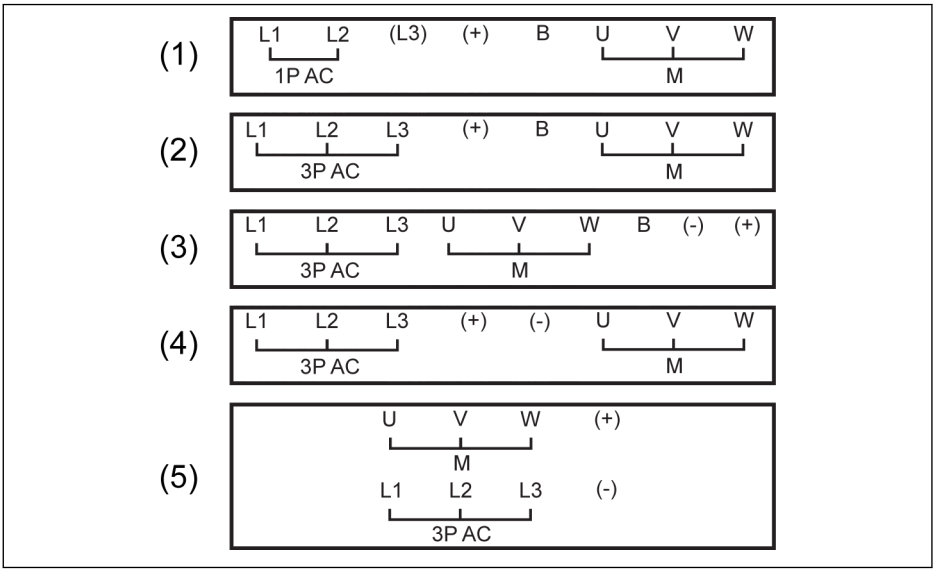
Step 3: Switch on the frequency converter.

Step 4: Set respective parameters.

Step 5: Activate respective control signals.

2.3 Terminals

2.3.1 Power Terminals



(1) 1P 200 VAC 0K40...2K20
(2) 3P 200 VAC 0K40...2K20 / 3P 380 VAC 0K40...4K00
(3) 3P 200 VAC 3K00...11K0 / 3P 380 VAC 5K50...22K0
(4) 3P 380 VAC 30K0...90K0
(5) 3P 380 VAC 110K...160K
1P AC: Single phase AC power supply
3P AC: Three phases AC power supply
M: For three phases motor connection

Fig. 2-3: Power terminals

Terminal	Description
L1, L2	Mains supply input terminals
U, V, W	Converter output terminals
B	External brake resistor terminal
(+) ①	DC positive bus terminal

Tab. 2-7: 1P 200 VAC power terminals description

Terminal	Description
L1, L2, L3	Mains supply input terminals
U, V, W	Converter output terminals
B	External brake resistor terminal

Terminal	Description
(-) ①	DC negative bus terminal
(+) ①	DC positive bus terminal

Tab. 2-8: 3P 200 / 380 VAC power terminals description

⚠ WARNING

①: Detailed descriptions on (-) and (+) in the **Operating Instructions** must be read through and followed before any operation on these two terminals.

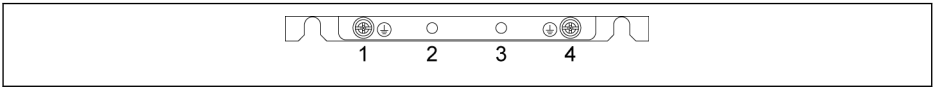


Fig. 2-4: Grounding and PE terminals

1. Grounding terminal for mains cables
2. Reserved for PE / shielding adapter (Order additionally)
3. Reserved for PE / shielding adapter (Order additionally)
4. Grounding terminal for motor cables

2.3.2 Control Terminals

Control terminals figure

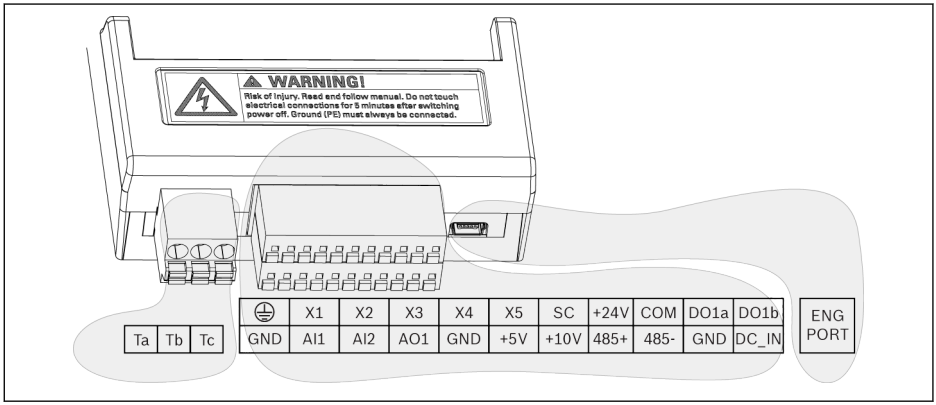


Fig. 2-5: Control circuit terminals

⚠ CAUTION **The frequency converter might be damaged!**

Please make sure that the power supply of the frequency converter has been switched off before plugging or unplugging the connector.

The terminal block is **ONLY** for wiring convenience, which **CANNOT** be used for fixing the cables. Additional measures need to be taken by users for cable fixing purpose.

Control terminals description

Digital inputs

Terminal	Signal function	Description	Signal requirement
X1...X5	Multi-function digital inputs	See Group E1	Inputs via opto-electric couplers: 24 VDC, 8 mA / 12 VDC, 4 mA Pulse input: Max. 50.0 kHz
X5 (multiplex)	Pulse input		
SC	Shared connection	Shared connection for isolation opto-electric couplers	–
+24 V	Power supply for digital inputs	COM is reference Isolated from GND	Max. output current: 100 mA
COM			

Analog inputs

Terminal	Signal function	Description	Signal requirement
+10 V	Power supply for analog inputs	GND is reference	Max. output current: 30 mA
+5 V			Max. output current: 10 mA
AI1	Analog voltage input 1/ Analog current input 1	Analog voltage / current inputs are used as external frequency setting channels To switch between voltage and current or to set the input related functions, see Group E1	Voltage input range: 0/2...10 V Input impedance: 27 kΩ Resolution: 1/1,000 Current input range: 0/4...20 mA Input impedance: 250 Ω Resolution: 1/1,000
AI2	Analog voltage input 2/ Analog current input 2		
GND	Shared connection	Isolated from COM	–
⏚	Shielding connection	Connected with grounding terminals on heatsink internally	–

Digital outputs

Terminal	Signal function	Description	Signal requirement
DO1a	Open collector output or pulse output	See Group E2 COM is reference	Open collector output: Max. 30 VDC, 50 mA Pulse output Max. frequency: 32.0 kHz
DO1b			
Ta	Relay changeover contacts	See Group E2	Rated capacity: 240 VAC, 3 A; 30 VDC, 3 A
Tc			
Tb	Relay shared contact		

Analog outputs

Terminal	Signal function	Description	Signal requirement
AO1	Analog output	See Group E2	Voltage output: 0...10 V Maximum load current for voltage output: 5 mA Current output: 0...20 mA Maximum load resistance for current output: 500 Ω
GND	Shared connection	Isolated from COM	–

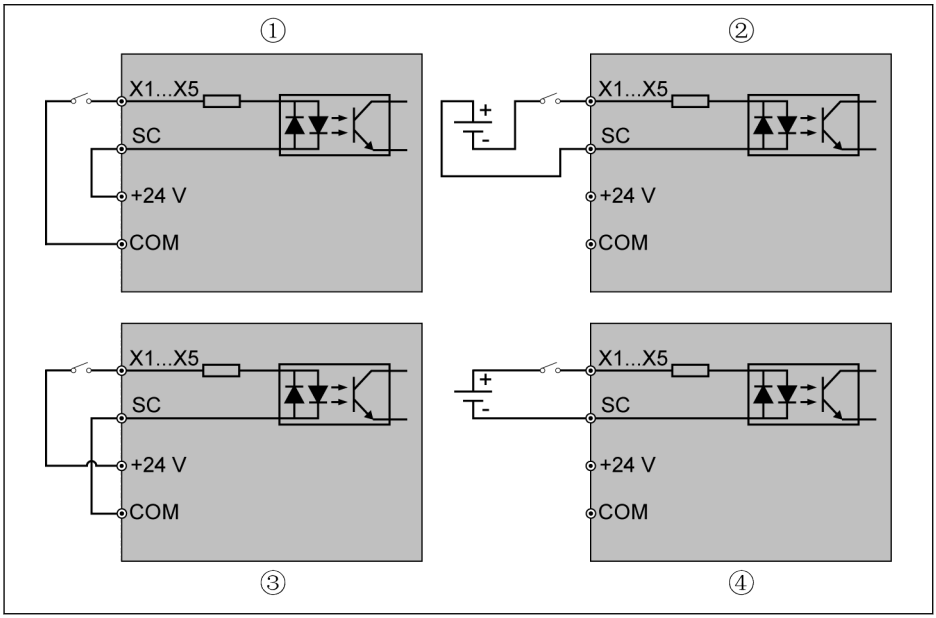
Modbus communication

Terminal	Signal function	Description	Signal requirement
485+	Positive differential signal	GND is reference	–
485-	Negative differential signal		

External control power supply

Terminal	Signal function	Description	Signal requirement
DC_IN	Auxiliary power supply for control board	External +24 V supply input for control and panel boards (**NOT** used for digital inputs)	Rated capacity: 24 V (-10...+15 %) 200 mA
GND	Shared connection	Isolated from COM	–

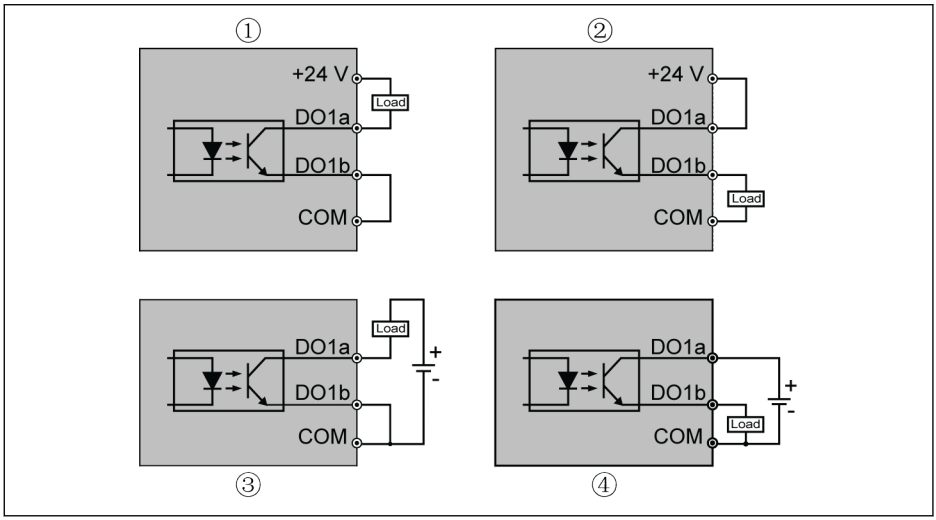
Digital input NPN / PNP wiring



① NPN wiring with internal power supply
② NPN wiring with external power supply
③ PNP wiring with internal power supply
④ PNP wiring with external power supply

Fig. 2-6: Digital input NPN / PNP wiring

Digital output DO1a, DO1b load pull-up / pull-down wiring



① Load pull-up wiring with internal power supply
② Load pull-down wiring with internal power supply
③ Load pull-up wiring with external power supply
④ Load pull-down wiring with external power supply

Fig. 2-7: Digital output DO1a, DO1b load pull-up / pull-down wiring

- For internal supply, **ONLY USE** terminal +24 V and **NEVER USE** terminal +10 V or +5 V!
- For external supply, its reference ground **MUST** be connected to terminal COM!

Analog input terminals (AI1, AI2, EAI, +10 V, +5 V, Earth and GND)

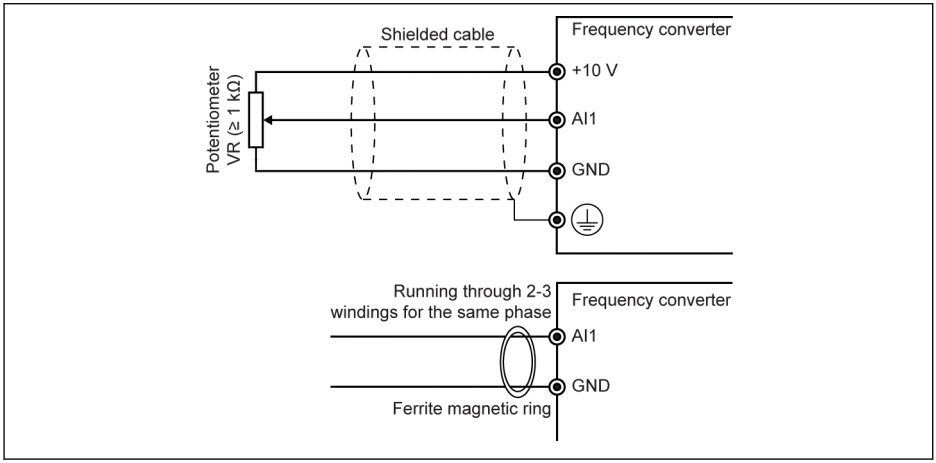
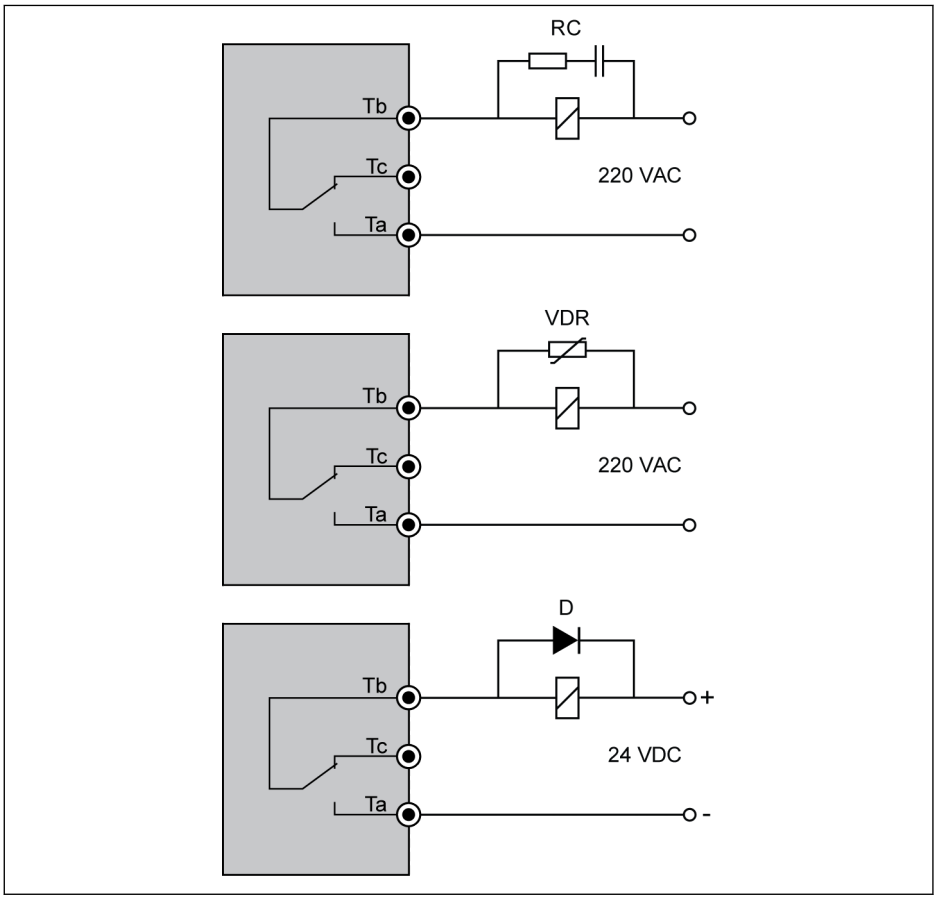


Fig. 2-8: Analog input terminals

- The figure for AI2 and +5 V is similar as the above figure.
- Incorrect operation may occur due to interference on the analog signal. In such cases, connect a ferrite magnetic ring at the input side of the analog signal, as shown above.
- The above figure is also valid for analog input EAI on I/O card.
- When analog current input function is applied, the supply voltage of analog input terminal can not exceed +5 V.

Relay output terminals

When relay output terminals are connected with inductive loads (relays, contactors, solenoid valves, motors, etc.), following noise suppression circuits need to be applied at the coils of the inductive loads, as close as possible to the inductive loads, in order to reduce the electromagnetic interference generated from inductive load action.



Tb Shared terminal
Tc Normally closed contact
Ta Normally open contact
RC RC filtering
VDR Varistor
D Diode

Fig. 2-9: Noise suppression circuits for relay output terminals

3 Start-up

3.1 LED Panel and Dust Cover

3.1.1 LED Panel

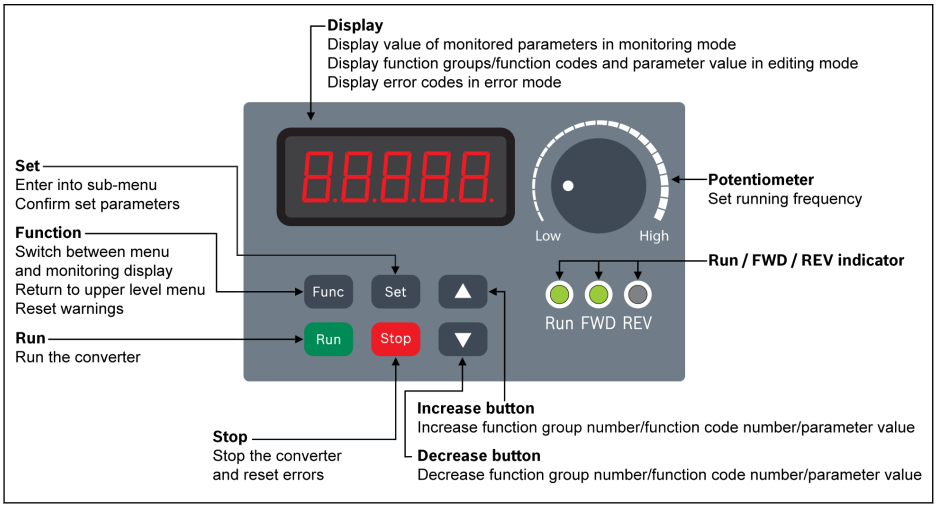


Fig. 3-1: LED panel

3.1.2 Dust Cover

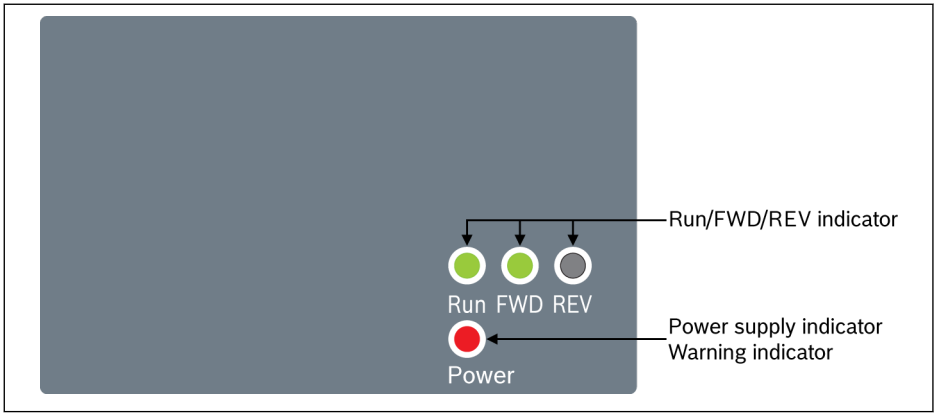


Fig. 3-2: Dust cover

Frequency Converter EFC x610 are available with **Dust Cover** instead of **LED Panel** on demand. To operate frequency converters with **Dust Cover**,

- Order one **LED Panel** additionally, and then set the frequency converters with **Parameter replication** function. See parameter b0.11.

3.1.3 LED Indicator

Mode	Run	FWD	REV	Power①
Power off	Off	Off	Off	Off
Ready	Off	Green / Off	Off / Green	Red
Run (FWD)	Green	Green	Off	Red
Run (REV)	Green	Off	Green	Red
Run pending DC-braking at start Direction change dead time	Blinks in green (Short green long dark)	Green / Off	Off / Green	Red
Deceleration stop phase DC-braking at stop	Blinks in green (Short dark long green)	Green / Off	Off / Green	Red
Warning with FWD	Green	Green	Off	Blinks in red (Short dark long red)
Warning with REV	Green	Off	Green	Blinks in red (Short dark long red)
Warning at stop	Off	Green / Off	Off / Green	Blinks in red (Short dark long red)
Error	Off	Green / Off	Off / Green	Blinks in red (Short red long dark)

Tab. 3-1: LED indicator status

- ①: Available on dust cover or when neither the LED panel nor the dust cover is installed.
- The frequency converter stops if FWD and REV commands are active at the same time.

3.1.4 Operating Descriptions

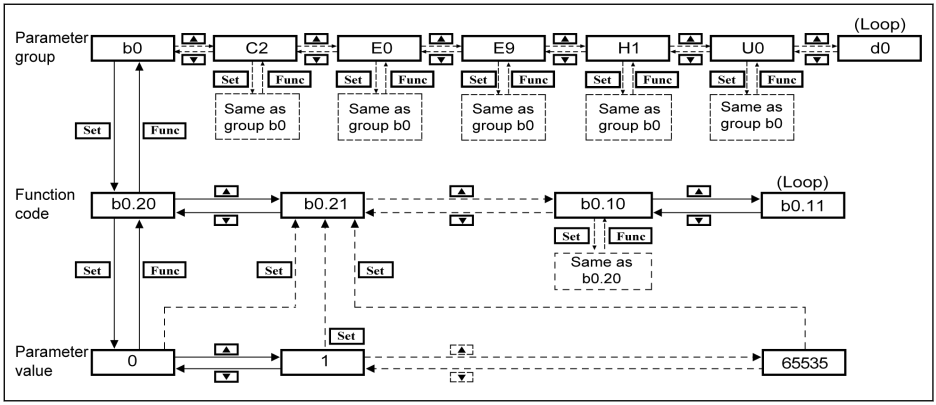


Fig. 3-3: Operating mode

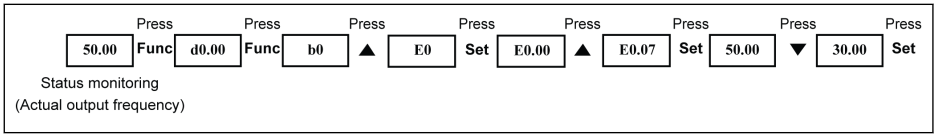


Fig. 3-4: Operating example

Digit Shifting Function is provided for fast parameter selection and modification. Please refer to the **Operating Instructions** for details.

3.2 LCD Panel

3.2.1 LCD Panel Introduction

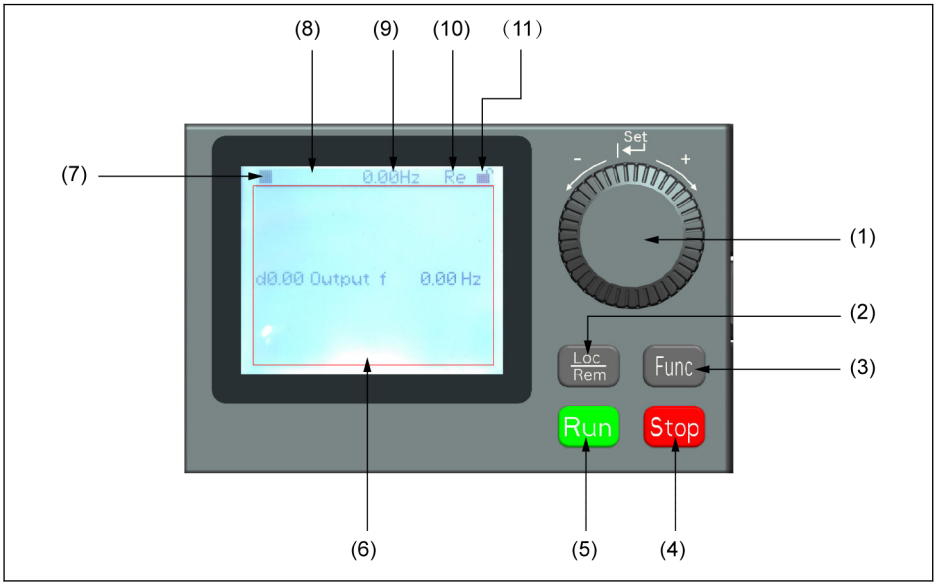


Fig. 3-5: LCD panel appearance

(1) Navigation button

1. Scroll between parameter and group code
2. Set the parameter value

(2) Loc / Rem button: Switch between "Remote" & "Local".

(3) Func button: Enter the parameter group screen and go back to previous screens.

(4) Stop button: Stop the frequency converter.

(5) Run button: Start the frequency converter.

(6) Text area: Used for displaying:

1. Parameter monitoring screen
2. Parameter group / Parameter code
3. Parameter name
4. Parameter value and unit
5. Other screens: Error / Warning display screen, welcome screen, customer information message screen

(7) Run / Stop status: It displays information regarding run / stop and forward / reverse state of the frequency converter. Details are shown in the table below.

Frequency converter status	Details
• Running at 0 Hz (set RefDir: FWD)	⏩: Blinking ⏪: Invisible ■: Invisible
• Running at 0 Hz (set RefDir: REV)	⏩: Invisible ⏪: Blinking ■: Invisible
• Frequency converter in RUN state (set RefDir: REV)	⏩: Invisible ⏪: Shown solid, not blinking ■: Invisible
• Frequency converter in RUN state (set RefDir: FWD)	⏩: Shown solid, not blinking ⏪: Invisible ■: Invisible

Tab. 3-2: Frequency converter status

(8) Error / Warning information: Error / Warning code will be displayed in this sector. Please refer to chapter 4 "Diagnosis" on page 92 for details.

(9) Permanent monitoring: By default, its display as "Actual output frequency" is set by parameter U2.09. Value and unit of parameter will be displayed.

(10) Re / Lo: **Re** stands for 'Remote' and **Lo** for 'Local'. Its display is set via **Loc / Rem** button or parameter U2.03.

(11) Panel Locked / Unlocked: Panel can be locked by the following ways:

- Setting [U2.02] to '1', or
- Pressing **Func** button with **Loc** button for longer than 3 s.

Panel can be unlocked by the following ways:

- Setting [U2.02] to '0' (only in communication mode), or
- Pressing **Func** button with **Loc** button for longer than 3 s.

3.2.2 Operating Example

Please follow the steps below to set parameter [b0.10] to '1: Restore to default settings' through LCD panel.

1. Press **Func** button.
2. Rotate **Navigation button** to select parameter group b0.
3. Press **Navigation button** and rotate it to select parameter b0.10.
4. Press **Navigation button** and rotate it to select parameter value '1: Restore to default settings'.
5. Press **Navigation button** to finish setting.

3.3 Start-up Procedure

3.3.1 Checking before Power-on

Ambient conditions	See chapter 1.2 "Ambient Conditions" on page 1
Installation conditions	See chapter 1.4 "Installation" on page 12
Wiring	See chapter 2 "Electric Installation" on page 16 EMC requirements must be observed , see details in **Operating Instructions** All switches must be switched off All loads must be disconnected

Tab. 3-3: Checking before Power-on

3.3.2 Checking after Power-on

LED panel	**0.00** is displayed
Dust cover	Power indicator is red, see chapter 3.1.2 "Dust Cover" on page 34 and chapter 3.1.3 "LED Indicator" on page 35

Tab. 3-4: Checking after Power-on

3.3.3 Checking Start-up Parameters

Set [b0.00] = '3: Start-up parameters', and then check all start-up parameters. For terminology and abbreviation in the above table, see chapter 3.4.1 "Terminology and Abbreviation in Parameter List" on page 45.

Code	Name	Setting range	Default	Min.	Attri.
C0.05	Carrier frequency	0K40...22K0: 1...15 kHz 30K0...160K: 1...12 kHz	0K40...4K00: 6k 5K50...22K0 (HD): 6k 5K50...22K0 (ND): 4k 30K0...90K0: 4k 110K...160K: 2k	1	Run
C1.05	Motor rated power	0.1...1,000.0 kW	DOM	0.1	Stop
C1.06	Motor rated voltage	0...480 V	DOM	1	Stop
C1.07	Motor rated current	0.01...655.00 A	DOM	0.01	Stop
C1.08	Motor rated frequency	5.00...400.00 Hz	50.00	0.01	Stop
C1.09	Motor rated speed	1...30,000 rpm	DOM	1	Stop
C2.00	V/f curve mode	0: Linear 1: Square 2: User-defined 3: V/f separation	0	–	Stop

Code	Name	Setting range	Default	Min.	Attri.
E0.00	First frequency setting source	0...21	0	–	Stop
E0.01	First run command source	0...2	0	–	Stop
E0.07	Digital setting frequency	0.00...[E0.09] Hz	50.00	0.01	Run
E0.08	Maximum output frequency	50.00...400.00 Hz	50.00	0.01	Stop
E0.09	Output frequency high limit	[E0.10]...[E0.08] Hz	50.00	0.01	Run
E0.10	Output frequency low limit	0.00...[E0.09] Hz	0.00	0.01	Run
E0.17	Direction control	0: Forward/Reverse 1: Forward only 2: Reverse only 3: Swap default direction	0	–	Stop
E0.25	Acceleration / Deceleration curve mode	0: Linear mode 1: S-curve	0	–	Stop
E0.26	Acceleration time	0.1...6,000.0 s	DOM	0.1	Run
E0.27	Deceleration time	0.1...6,000.0 s	DOM	0.1	Run
E0.35	Start mode	0: Start directly 1: DC-braking before start 2: Start with speed tracing 3: Automatic start / stop according to setting frequency	0	–	Stop
E0.50	Stop mode	0: Decelerating stop 1: Freewheeling stop 1 2: Freewheeling stop 2	0	–	Stop

Tab. 3-5: Start-up parameters

3.3.4 Control the Motor

Step	Operation	Description
1	Rotate the potentiometer counterclockwise (leftwards) to the greatest extent	Output frequency setting is 0.00
2	Press **<Run>** button	Control command active, 0.00 is displayed
3	Rotate the potentiometer clockwise (rightwards) slowly and till 5.00 is displayed **Observe the running status:** If the motor runs in the correct direction If the motor runs steadily If there is any abnormal noise or problem	The motor starts to run **Recommended operation:** Stop the motor immediately by switching off the power if any abnormality occurs Restart commissioning only after error causes have been removed
4	Rotate the potentiometer clockwise	The motor accelerates
5	Rotate the potentiometer counterclockwise	The motor decelerates
6	Press **<Stop>** button	Stop command active, the motor stops
7	Check parameters without load	Settings according to actual applications
8	Check parameters with load	Settings according to actual applications

Tab. 3-6: Motor controlling procedure

- EFC x610 has no internal contactor, and will be energized once the power supply is connected. When the **Run** button is pressed down (or 'Control by terminals' is activated), the frequency converter will generate output.
- By default, EFC x610 is set as:
  - The frequency converter is started or stopped by the operating panel control.
  - The output frequency is set by the potentiometer on the operating panel.
- After powering on, please confirm:
  - The setting frequency is displayed (no error display).
  - The monitoring parameter is consistent with the actual situation.
- By default, the frequency converter displays **Output frequency** in run status and **Setting frequency** in stop status as the monitoring parameters. You may change them to other parameters as described in parameters U1.00 and U1.10. The factory defaults are based on standard applications with standard motors.



For frequency converters with dust cover, it is recommended to install an LED panel to perform the above operations.

3.3.5 Motor Parameters Auto-Tuning

The application with asynchronous motor(ASM)

When SVC control is used or in the condition of V/f control demanding for higher control performance, motor parameter auto-tuning is necessary. Two modes of auto-tuning are available, static auto-tuning and rotational auto-tuning. The former mode is mainly used for V/f control and the latter is used **mainly** for SVC control.

Check and make sure the following points before auto-tuning:

- The motor is in standstill and not at high temperature.
- The power rating of the frequency converter is close to that of the motor.
- Set C1.05...C1.10 based on motor nameplate data. If the power factor data is unavailable on the nameplate, keep the default setting of C1.10.
- Set E0.08 according to motor parameters and actual application conditions.

 Disconnect the load from the motor shaft for rotational auto-tuning.

Set auto-tuning mode and start motor parameter auto-tuning:

Set the following parameter according to the control mode of the frequency converter and the application situation.

Code	Name	Setting range	Default	Min.	Attri.
C1.01	Motor parameter tuning	0...2	0	–	Stop

- 0: Inactive. The auto-tuning function is by default inactive.
- 1: Static auto-tuning. This mode is suggested to be used for V/f control. It can also be used for SVC control when the load cannot be disconnected.
- 2: Rotational auto-tuning (suggested to be used for SVC control)

Press the **<Run>** button on the operating panel to start auto-tuning. In the process of auto-tuning, a status code 'tUnE' will be displayed on the operating panel. When the auto-tuning process is complete, the status code disappears and the settings of the following parameters will be obtained automatically:

Static auto-tuning	Rotational auto-tuning	Parameters obtained by auto-tuning
√	√	C1.12: Motor rated slip frequency
–	√	C1.13: Motor inertia mantissa①
–	√	C1.14: Motor inertia exponent①
√	√	C1.20: Motor no-load current
√	√	C1.21: Stator resistance
√	√	C1.22: Rotor resistance
√	√	C1.23: Leakage inductance
√	√	C1.24: Mutual inductance

Static auto-tuning	Rotational auto-tuning	Parameters obtained by auto-tuning
–	√	C3.00: Speed loop proportional gain 1
–	√	C3.01: Speed loop integral time 1
√	√	C3.05: Current loop proportional gain
√	√	C3.06: Current loop integral time

Tab. 3-7: Parameters obtained by auto-tuning



①: Only applicable for EFC 5610.

The application with permanent magnetized synchronous motor (PMSM)

When SVC control is used for the control of PMSM, motor parameters auto-tuning function shall be adopted. Two modes of auto-tuning are available, i.e. static auto-tuning and rotational auto-tuning.

Before running parameter auto-tuning on synchronous motor, make sure to set both motor type C1.00 and motor nameplate parameters correctly.

Check and make sure the following points before auto-tuning:

- The motor is in standstill and not at high temperature.
- The power rating of the frequency converter is close to that of the motor.
- Set C1.05, C1.07, C1.09, C1.11 based on motor nameplate data.
- Set E0.08, E0.09 according to motor parameters and actual application conditions.



Disconnect the load from the motor shaft for rotational auto-tuning.

Set auto-tuning mode and start motor parameter auto-tuning:

Set the following parameter according to the control mode of the frequency converter and the application situation:

Code	Name	Setting range	Default	Min.	Attri.
C1.01	Motor parameter tuning	0...2	0	–	Stop

- 0: Inactive

  It's recommended to run static auto-tuning or rotational auto-tuning for PMSM.

- 1: Static auto-tuning

  Static auto-tuning shall be used when the motor load is not removable. It's necessary to input inertia value manually in order to achieve the best control effect.

- 2: Rotational auto-tuning

In condition the motor load is removable, it's recommended to move the load and the motor away and run rotational auto-tuning. This method allows the acquisition of all the motor and control parameters that are needed for the vector control and thus enable the best vector control effect.

Press the **<Run>** button on the operating panel when the setting is finished for auto-tuning. In the process of auto-tuning, a status code 'tUnE' will be displayed on the operating panel. When the auto-tuning process is completed, the status code disappears and the settings of the following parameters will be obtained automatically:

Static auto-tuning	Rotational auto-tuning	Parameters obtained by auto-tuning
–	√	C1.13: Motor inertia mantissa
–	√	C1.14: Motor inertia exponent
√	√	C1.20: Motor no-load current
√	√	C1.21: Stator resistance
√	√	C1.23: Leakage inductance
√	√	C3.05: Current loop proportional gain
√	√	C3.06: Current loop integral time
–	√	C3.00: Speed loop proportional gain 1
–	√	C3.01: Speed loop integral time 1

Tab. 3-8: Parameters obtained by auto-tuning

3.4 Parameter List

3.4.1 Terminology and Abbreviation in Parameter List

- **Code:** Function / parameter code, written in bx.xx, Cx.xx, Ex.xx, Fx.xx, Hx.xx, Ux.xx, dx.xx
- **Name:** Parameter name
- **Default:** Factory default
- **Min.:** Minimum setting step
- **Attri.:** Parameter attribute
  - **Run:** Parameter setting can be modified when the converter is in run or stop status.
  - **Stop:** Parameter setting can only be modified when the converter is in stop status.
  - **Read:** Parameter setting is read-only and cannot be modified.
- **DOM:** Depends on model
- **[bx.xx], [Cx.xx], [Ex.xx], [Fx.xx], [Hx.xx], [Ux.xx], [dx.xx]:** Function / parameter values

3.4.2 Group b: System Parameters

b0: Basic system parameters

Code	Name	Setting range	Default	Min.	Attri.
b0.00	Access authority setting	0: Basic parameters 1: Standard parameters 2: Advanced parameters 3: Start-up parameters 4: Modified parameters	0	–	Run
b0.09	Parameter initialization setting	1: Base device and non fieldbus options 2: Fieldbus options 3: Base device, non fieldbus and fieldbus options	1	–	Stop
b0.10	Parameter initialization	0: Inactive 1: Restore to default settings 2: Clear error and warning record	0	–	Stop
b0.11	Parameter copy	0: Inactive 1: Backup parameters to panel 2: Restore parameters from panel	0	–	Stop
b0.12	Parameter set selection	0: Parameter set 1 active 1: Parameter set 2 active	0	–	Stop
b0.20	User password	0...65,535	0	1	Run
b0.21	Manufacturer password	0...65,535	0	1	Run

3.4.3 Group C: Power Parameters

C0: Power control parameters

Code	Name	Setting range	Default	Min.	Attri.
C0.00	Control mode (EFC 5610 only)	0: V/f control 1: Sensorless vector control 2: Vector control with encoder (only for EFC5610)	0	–	Stop
C0.01	Normal / Heavy duty setting①	0: ND (Normal duty) 1: HD (Heavy duty)	1	–	Stop
C0.05	Carrier frequency	0K40...22K0: 1...15 kHz 30K0...160K: 1...12 kHz	0K40...4K00: 6k 5K50...22K0 (HD): 6k 5K50...22K0 (ND): 4k 30K0...90K0: 4k 110K...160K: 2k	1	Run
C0.06	Carrier frequency automatic adjustment	0: Inactive 1: Active 2: Fixed carrier frequency	1	–	Stop
C0.07	PWM mode	0: SVPWM 1: SVPWM with overmodulation 2: DPWM 3: DPWM with overmodulation	DOM	–	Run
C0.08	DPWM switchover frequency upper limit	8.00...400.00 Hz	12.00	0.01	Run
C0.10	Automatic voltage stabilization	0: Always active 1: Always inactive 2: Inactive only during deceleration	0	1	Stop
C0.11	Automatic voltage stabilization reference voltage	1P 200 VAC: 180...264 V	220	1	Stop
		3P 200 VAC: 180...264 V			
		3P 380 VAC: 323...528 V	380		

Code	Name	Setting range	Default	Min.	Attri.
C0.15	Brake chopper start voltage②	1P 200 VAC: 300...390 V	385	1	Stop
		3P 200 VAC: 300...390 V			
		3P 380 VAC: 600...785 V	770		
C0.16	Brake chopper duty cycle②	1...100 %	100	1	Stop
C0.23	Overvoltage suppression adjustment gain	0.00...10.00	1.00	0.01	Run
C0.24	Stall overvoltage hysteresis voltage	0...100 V	1P 200 VAC: 30	1	Stop
			3P 200 VAC: 30		
			3P 380 VAC: 50		
C0.25	Overvoltage prevention mode	0...4	3	–	Stop
C0.26	Stall overvoltage prevention level	1P 200 VAC: 300...390 V	385	1	Stop
		3P 200 VAC: 300...390 V			
		3P 380 VAC: 600...785 V	770		
C0.27	Stall overcurrent prevention level③	20.0 %...[C2.42]	150.0	0.1	Stop
C0.28	Phase loss protection mode	0...3	3	–	Run
C0.29	Converter overload pre-warning level	20.0...200.0 %	110.0	0.1	Stop
C0.30	Converter overload pre-warning delay	0.0...20.0 s	2.0	0.1	Stop
C0.40	Power loss ride-through mode	0: Inactive; 1: Output disabled 2: Regain kinetic energy 3: Regain kinetic energy, decelerate to stop	0	–	Stop
C0.41	Power loss ride-through recovery delay	0.10...30.00 s	0.50	0.01	Stop
C0.42	Power loss ride-through action voltage	1P 200 VAC: 216...366 V	240	1	Stop
		3P 200 VAC: 216...366 V			
		3P 380 VAC: 406...739 V	440		
C0.43	Power loss ride-through recover voltage	1P 200 VAC: 223...373 V	250	1	Stop
		3P 200 VAC: 223...373 V			
		3P 380 VAC: 413...746 V	450		
C0.44	Power loss ride-through deceleration to stop time	0.1...6,000.0 s	5.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
C0.45	Power loss ride-through control voltage	1P 200VAC: 226...373 V	250	1	Stop
		3P 200VAC: 226...373 V	250		
		3P 400VAC: 416...746 V	450		
C0.46	Power loss ride-through Limit voltage	1P 200VAC: 233...373 V	280	1	Stop
		3P 200VAC: 233...373 V	280		
		3P 400VAC: 423...746 V	500		
C0.47	Power loss ride-through switch frequency	0.00...400.00 Hz	5.00	0.01	Stop
C0.48	Power loss ride-through frequency deceleration rate	0...100 Hz/s	10	1	Stop
C0.50	Fan control	0: Automatically controlled 1: Always on 2: On when converter run	0	–	Run
C0.51	Fan total running time	0...65,535 h	0	1	Read
C0.52	Fan maintenance time	0...65,535 h (0: Inactive)	0	1	Stop
C0.53	Fan total running time reset	0: Inactive; 1: Active Resets to '0' after action is executed	0	–	Run

①: this parameter is only available with models of 5K50 and above.

②: the parameters are only available with models of 22K0 and below.

③: percentage of frequency converter rated current.

Setting range of C0.25:

0: Both disabled

1: Stall overvoltage protection enabled, resistor braking disabled

2: Stall overvoltage protection disabled, resistor braking enabled

3: Stall overvoltage protection enabled, resistor braking enabled

4: Reciprocating load mode

Setting range of C0.28:

0: Both input and output phase loss protection active

1: Only input phase loss protection active

2: Only output phase loss protection active

3: Both input and output phase loss protection inactive

C1: Motor and system parameters

Code	Name	Setting range	Default	Min.	Attri.
C1.00	Motor type	0: Asynchronous motor 1: Synchronous motor (only for EFC 5610)	0	–	Stop
C1.01	Motor parameter tuning	0: Inactive 1: Static auto-tuning 2: Rotational auto-tuning①	0	–	Stop
C1.02	Expert mode	0: Standard mode 1: Expert mode	0	–	Stop
C1.05	Motor rated power	0.1...1,000.0 kW	DOM	0.1	Stop
C1.06	Motor rated voltage	0...480 V	DOM	1	Stop
C1.07	Motor rated current	0.01...655.00 A	DOM	0.01	Stop
C1.08	Motor rated frequency	5.00...400.00 Hz	50.00	0.01	Stop
C1.09	Motor rated speed	1...60,000 rpm	DOM	1	Stop
C1.10	Motor rated power factor	0.00: Automatically identified 0.01...0.99: Power factor setting	0.00	0.01	Stop
C1.11	Motor poles①	2...256	4	1	Stop
C1.12	Motor rated slip frequency	0.00...60.00 Hz	DOM	0.01	Stop
C1.13	Motor inertia mantissa①	1...5,000	DOM	1	Stop
C1.14	Motor inertia exponent①	0...7	DOM	1	Stop
C1.15	Torque constant	0.01...200	DOM	0.01	Stop
C1.16	Back emf voltage constant	0.0 ... 6550.0 V/1000rpm	0.0	0.1	Read
C1.17	Motor rated torque	0.0...6553.5 N.m	DOM	0.1	Read
C1.20	Motor no-load current	0.00...[C1.07] A	DOM	0.01	Stop
C1.21	Stator resistance	0.00...200.00 Ω	DOM	0.01	Stop
C1.22	Rotor resistance	0.00...200.00 Ω	DOM	0.01	Stop
C1.23	Leakage inductance	0.00...600.00 mH	DOM	0.01	Stop
C1.24	Mutual inductance	0.0...6,000.0 mH	DOM	0.1	Stop
C1.25	Rotor leakage inductance	0.00...600.00 mH	DOM	0.01	Stop
C1.69	Motor thermal model protection setting	0: Inactive 1: Thermal model active 2: Current monitoring active	0	–	Stop

Code	Name	Setting range	Default	Min.	Attri.
C1.70	Motor overload pre-warning level	100.0...250.0 %	100.0	0.1	Run
C1.71	Motor overload pre-warning delay	0.0...20.0 s	2.0	0.1	Run
C1.72	Motor thermal sensor type	0: KTY84/130 2: PT100 3: PT1000 4: TDK G1551_8320 (NTC)	0	–	Stop
C1.73	Motor thermal sensor protection level	0.0...10.0	2.0	0.1	Stop
C1.74	Motor thermal model protection time constant	0.0...400.0 min	DOM	0.1	Stop
C1.75	Low speed derating frequency	0.10...300.00 Hz	25.00	0.01	Run
C1.76	Zero speed load	25.0...100.0 %	25.0	0.1	Run



①: **ONLY** for EFC 5610, and motor load must be decoupled before rotational auto-tuning.

C2: V/f control parameters

Code	Name	Setting range	Default	Min.	Attri.
C2.00	V/f curve mode	0: Linear 1: Square 2: User-defined 3: V/f separation	0	–	Stop
C2.01	V/f frequency 1	0.00...[C2.03] Hz	0.00	0.01	Stop
C2.02	V/f voltage 1①	0.0...120.0 %	0.0	0.1	Stop
C2.03	V/f frequency 2	[C2.01]...[C2.05] Hz	0.00	0.01	Stop
C2.04	V/f voltage 2①	0.0...120.0 %	0.0	0.1	Stop
C2.05	V/f frequency 3	[C2.03]...[E0.08] Hz	50.00	0.01	Stop
C2.06	V/f voltage 3①	0.0...120.0 %	100.0	0.1	Stop
C2.07	Slip compensation factor	0...200 %	0	1	Run
C2.08	V/f separation output voltage source selection	0: Panel potentiometer 1: Panel button setting 2: AI1 analog input 10: X5 pulse input 20: Communication (Modbus 0x7F0B/Fieldbus extension card H0.50) 22: Digital setting 23: Voltage PID control	22	–	Stop
C2.09	V/f separation output voltage digital setting	0.00...100.00 %	0.00	0.01	Run
C2.10	V/f separation output voltage acceleration time	0.0...6,000.0 s	0.0	0.1	Run
C2.11	V/f separation output voltage deceleration time	0.0...6,000.0 s	0.0	0.1	Run
C2.12	V/f separation stop mode selection	0: Voltage and frequency decelerates independently 1: Voltage decelerates to zero, then frequency decelerates to zero	0	–	Run
C2.13	V/f separation boost factor	0.00...100.00	0.00	0.01	Run
C2.20	0 Hz output mode	0: No output 1: Standard	1	1	Stop

Code	Name	Setting range	Default	Min.	Attri.
C2.21	Torque boost setting	0.0 %: Automatic boost 0.1...20.0 %: Manual boost	DOM	0.1	Run
C2.22	Automatic torque boost factor	0...320 %	50	1	Run
C2.23	Heavy load stabilization setting	0: Inactive 1: Active	1	–	Run
C2.24	Light load oscillation damping factor	0...5,000 %	300	1	Run
C2.25	Light load oscillation damping filter factor	10...2,000 %	30	1	Run
C2.40	Current limitation mode	0: Always inactive 1: Inactive at constant speed 2: Active at constant speed	2	–	Stop
C2.42	Current limitation level②	[C0.27]...250 %	150	1	Stop
C2.43	Current limitation proportional gain	0.000...10.000	DOM	0.001	Stop
C2.44	Current limitation integral time	0.001...10.000	DOM	0.001	Stop

①: percentage of motor rated voltage [C1.06].

②: percentage of frequency converter rated current.

C3*: Vector control parameters

Code	Name	Setting range	Default	Min.	Attri.
C3.00	Speed loop proportional gain 1	0.00...655.35	DOM	0.01	Run
C3.01	Speed loop integral time 1	0.01...655.35 ms	DOM	0.01	Run
C3.02	Speed loop proportional gain 2	0.00...655.35	DOM	–	Run
C3.03	Speed loop integral time 2	0.00...655.35 ms	DOM	–	Run
C3.04	Speed observer harmonics damping factor	0.10...20.00	0.66	0.01	Stop
C3.05	Current loop proportional gain	0.1...1,000.0	DOM	0.1	Run
C3.06	Current loop integral time	0.01...655.35 ms	DOM	0.01	Run
C3.10	Speed loop switching frequency 1	0.00...[C3.11]	4.00	0.01	Stop
C3.11	Speed loop switching frequency 2	[C3.10]...[C1.08]	6.00	0.01	Stop
C3.12	Speed observer mode	0: mode 1 (default) 1: mode 2	0	-	Stop
C3.13	Speed observer mode2 gain	1...10	1	1	Run
C3.20	Low speed torque limitation	1...200 %	100	1	Stop
C3.21	Encoder speed filter time	0...100.0	2.0	0.1	Stop
C3.22	Encoder commutation offset	0.0...360.0	360.0	0.1	Stop
C3.25	Speed monitor timeout	0.0...6553.5 s	5.0	0.1	Stop
C3.26	Speed monitor max. speed difference	0.00...655.35 Hz	10.00	0.01	Stop
C3.30	Maximum fieldweakening current factor for SM	1...95 %	75	1	Run
C3.38	Forward frequency limitation at torque control mode	0.00...[E0.09]	50.00	0.01	Run
C3.39	Reverse frequency limitation at torque control mode	0.00...[E0.09]	50.00	0.01	Run
C3.40	Torque control mode	0: Activated by digital inputs 1: Always active 2: Communication (Bit 8 of Modbus 0x7F00) (Bit 9 of extension card H0.00)	0	–	Stop

Code	Name	Setting range	Default	Min.	Attri.
C3.41	Torque reference channel	0: AI1 analog input 1: AI2 analog input 2: Panel potentiometer 3: EAI1 analog input 4: Pulse input via DI5 5: Parameter setting C3.46 6: Communication (Modbus 0x7F02/Fieldbus extension card H0.12) 7: EAI2 analog input	0	–	Stop
C3.42	Torque reference minimum value①	0.0 %...[C3.43]	0.0	0.1	Run
C3.43	Torque reference maximum value①	[C3.42]...200.0 %	150.0	0.1	Run
C3.44	Torque positive limit①	0.0...200.0 %	150.0	0.1	Run
C3.45	Torque negative limit①	0.0...200.0 %	150.0	0.1	Run
C3.46	Digital torque reference setting	0.0...200.0	150.0	0.1	Run
C3.47	Torque limitation reference selection at speed control mode	0: Parameter C3.44 and C3.45 1: AI1; 2: AI2 3: EAI1 analog input 4: Communication (Torque FWD limitation register: Modbus 0x7F03/Fieldbus extension card H0.14) (Torque REV limitation register: Modbus 0x7F04/Fieldbus extension card H0.15) 5: EAI2 analog input	0	-	Stop
C3.48	Speed limitation reference selection at torque control mode	0: Parameter C3.38 and C3.39 1: AI1; 2: AI2 3: EAI1 analog input 4: Communication (Speed limitation register: Modbus 0x7F05/Fieldbus extension card H0.16) 5: EAI2 analog input	0	-	Stop

Code	Name	Setting range	Default	Min.	Attri.
C3.49	Torque command ramp	0.0...5.0 s	0.0	0.1	Stop
C3.50	Initial angle detection current	50...150 %②	80	1	Stop
C3.51	Initial angle detection mode	0: No detection 1: Detection when first power on 2: Detection at every running	2	–	Stop
C3.52	SVC regulation area lower frequency	0.00...600.00 Hz	DOM	0.01	Stop
C3.53	SVC regulation area upper frequency	0.00...600.00 Hz	DOM	0.01	Stop
C3.54	SVC dampfactor enhance upper frequency	0.00...600.00 Hz	DOM	0.01	Stop
C3.55	SVC dampfactor enhance coefficient	1...20	1	1	Stop

①: percentage of motor rated torque.

②: percentage of motor rated current.



*: All parameters in Group C3 are **ONLY** for Frequency Converter EFC 5610.

3.4.4 Group E: Function Control Parameters

E0: Set point and control parameters

Code	Name	Setting range	Default	Min.	Attri.
E0.00	First frequency setting source	0...21	0	–	Stop
E0.01	First run command source	0...2	0	–	Stop
E0.02	Second frequency setting source	0...21	2	–	Stop
E0.03	Second run command source	0...2	1	–	Stop
E0.04	Frequency setting source combination	0...6	0	–	Stop
E0.06	Digital setting frequency saving mode	0...4	0	–	Stop
E0.07	Digital setting frequency	0.00...[E0.09] Hz	50.00	0.01	Run
E0.08	Maximum output frequency	50.00...400.00 Hz	50.00	0.01	Stop
E0.09	Output frequency high limit	[E0.10]...[E0.08] Hz	50.00	0.01	Run
E0.10	Output frequency low limit	0.00...[E0.09] Hz	0.00	0.01	Run
E0.11	Reverse running frequency	0.00...[E0.09] Hz	0.00	0.01	Stop
E0.15	Low speed running setting	0: Run with 0.00 Hz 1: Run with low limit frequency	0	–	Stop
E0.16	Low speed frequency hysteresis	0.00...[E0.10] Hz	0.00	0.01	Stop
E0.17	Direction control	0: Forward / Reverse 1: Forward only 2: Reverse only 3: Swap default direction	0	–	Stop
E0.18	Direction change dead time	0.0...60.0 s	1.0	0.1	Stop
E0.25	Acceleration / deceleration curve mode	0: Linear mode 1: S-curve	0	–	Stop
E0.26	Acceleration time	0.1...6,000.0 s	DOM	0.1	Run
E0.27	Deceleration time	0.1...6,000.0 s	DOM	0.1	Run
E0.28	S-curve starting phase factor	0.0...40.0 %	20.0	0.1	Stop
E0.29	S-curve stopping phase factor	0.0...40.0 %	20.0	0.1	Stop
E0.35	Start mode	0: Start directly 1: DC-braking before start 2: Start with speed tracing 3: Automatic start / stop according to setting frequency	0	–	Stop

Code	Name	Setting range	Default	Min.	Attri.
E0.36	Start frequency	0.00...50.00 Hz	0.05	0.01	Stop
E0.37	Start frequency holding time	0.0...20.0 s	0.0	0.1	Stop
E0.38	Start DC-braking time	0.0...20.0 s (0.0: Inactive)	0.0	0.1	Stop
E0.39	Start DC-braking current①	0.0...150.0 %	0.0	0.1	Stop
E0.41	Automatic start / stop frequency threshold	0.01...[E0.09] Hz	16.00	0.01	Stop
E0.42	Speed tracing voltage recovery ratio	0...20	10	1	Stop
E0.43	Speed tracing deceleration time	0.5...20.0 s	2.0	0.1	Stop
E0.45	Power loss restart mode	0: Inactive 1: Active for panel control 2: Active for digital input control	0	-	Stop
E0.46	Power loss restart delay	0.0...10.0 s	1.0	0.1	Stop
E0.47	Run command priority	0: High priority 1: Low priority	0	-	Stop
E0.50	Stop mode	0: Decelerating stop 1: Freewheeling stop 1 2: Freewheeling stop 2	0	-	Stop
E0.51	Stop DC-braking waiting time	0.00...100.00 s	0.00	0.01	Stop
E0.52	Stop DC-braking initial frequency	0.00...50.00 Hz	0.00	0.01	Stop
E0.53	Stop DC-braking time	0.0...20.0 s (0.0: Inactive)	0.0	0.1	Stop
E0.54	Stop DC-braking current①	0.0...150.0 %	0.0	0.1	Stop
E0.55	Overexcitation braking factor	1.00...2.00	1.10	0.01	Run
E0.56	Emergency stop action	0: Freewheeling stop 1: Decelerating stop	0	–	Stop
E0.57	Emergency stop deceleration time	0.1...6,000.0	5.0	0.1	Run
E0.60	Jog frequency	0.00...[E0.08] Hz	5.00	0.01	Run
E0.61	Jog acceleration time	0.1...6,000.0 s	5.0	0.1	Run
E0.62	Jog deceleration time	0.1...6,000.0 s	5.0	0.1	Run
E0.70	Skip frequency 1	0.00...[E0.09] Hz	0.00	0.01	Stop
E0.71	Skip frequency 2	0.00...[E0.09] Hz	0.00	0.01	Stop

Code	Name	Setting range	Default	Min.	Attri.
E0.72	Skip frequency 3	0.00...[E0.09] Hz	0.00	0.01	Stop
E0.73	Skip frequency range	0.00...30.00 Hz	0.00	0.01	Stop
E0.74	Skip window acceleration factor	1...100	1	1	Stop

①: percentage of frequency converter rated current.

Setting range of E0.00, E0.02:

0: Panel potentiometer
1: Panel button setting
2: AI1 analog input
3: AI2 analog input
4: EAI1 analog input
5: EAI2 analog input
10: X5 pulse input
11: Digital input Up / Down command
20: Communication
21: Multi-speed settings

Setting range of E0.01, E0.03:

0: Panel
1: Multi-function digital input
2: Communication

Setting range of E0.04:

0: No combination
1: First frequency setting + second frequency setting
2: First frequency setting - second frequency setting
3: First frequency setting x second frequency setting
4: Bigger one of 2 sources
5: Smaller one of 2 sources
6: Valid which channel is non-zero

Setting range of E0.06:

0: Not saved when powered off or stopped
1: Not saved when powered off; saved when stopped
2: Saved when powered off; not saved when stopped
3: Saved when powered off or stopped
4: Memorized automatically when stopped

E1: Input terminal parameters

Code	Name	Setting range	Default	Min.	Attri.
E1.00	X1 input	0...52	35	–	Stop
E1.01	X2 input		36	–	Stop
E1.02	X3 input		0	–	Stop
E1.03	X4 input		0	–	Stop
E1.04	X5 input	0...51	0	–	Stop
E1.15	2-wire/3-wire control mode	0...4	0	–	Stop
E1.16	Digital input Up / Down change rate	0.10...100.00 Hz/s	1.00	0.01	Run
E1.17	Digital input Up / Down initial frequency	0.00...[E0.09] Hz	0.00	0.01	Run
E1.25	Pulse input maximum frequency	0.0...50.0 kHz	50.0	0.1	Run
E1.26	Pulse input filter time	0.000...2.000 s	0.100	0.001	Run
E1.35	AI1 input mode	0: 0...20 mA	2	–	Run
E1.40	AI2 input mode	1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V	1	–	Run
E1.38	AI1 gain	0.00...10.00	1.00	0.01	Run
E1.43	AI2 gain	0.00...10.00	1.00	0.01	Run
E1.60	Motor temperature sensor channel	0: Inactive 1: AI1 analog input 2: AI2 analog input 3: EAI1 analog input 4: EAI2 analog input 5: TSI input (only for IO plus card)	0	–	Stop
E1.61	Broken wire protection	0: Inactive 1: Warning 2: Error	0	–	Stop
E1.62	broken threshold for motor temperature sensor	0.00...10.0	2.0	0.1	Stop
E1.68	Analog input curve setting	0...7	0	–	Run
E1.69	Analog input filter time	0.000...2.000 s	0.100	0.001	Run
E1.70	Input curve 1 minimum	0.0 %...[E1.72]	0.0	0.1	Run
E1.71	Input curve 1 minimum frequency	0.00...[E0.09] Hz	0.00	0.01	Run

Code	Name	Setting range	Default	Min.	Attri.
E1.72	Input curve 1 maximum	[E1.70]...100.0 %	100.0	0.1	Run
E1.73	Input curve 1 maximum frequency	0.00...[E0.09] Hz	50.00	0.01	Run
E1.75	Input curve 2 minimum	0.0 %...[E1.77]	0.0	0.1	Run
E1.76	Input curve 2 minimum frequency	0.00...[E0.09] Hz	0.00	0.01	Run
E1.77	Input curve 2 maximum	[E1.75]...100.0 %	100.0	0.1	Run
E1.78	Input curve 2 maximum frequency	0.00...[E0.09] Hz	50.00	0.01	Run

Setting range of E1.00...E1.04:

0: Inactive
1: Multi-speed control input 1
2: Multi-speed control input 2
3: Multi-speed control input 3
4: Multi-speed control input 4
10: Acceleration / deceleration time 1 activation
11: Acceleration / deceleration time 2 activation
12: Acceleration / deceleration time 3 activation
15: Freewheeling stop activation
16: Stop DC-braking activation
20: Frequency Up command
21: Frequency Down command
22: Up / Down command reset
23: Torque / speed control switch
25: 3-wire control
26: Simple PLC stop
27: Simple PLC pause
30: Second frequency setting source activation
31: Second run command source activation
32: Error signal N.O. contact input
33: Error signal N.C. contact input
34: Error reset
35: Forward running (FWD)
36: Reverse running (REV)
37: Forward jog
38: Reverse jog
39: Counter input
40: Counter reset

41: PID deactivation
46: User parameter set selection
47: Pulse input mode activation
48: Motor overheating error N.O. contact input
49: Motor overheating error N.C. contact input
50: Motor overheating warning N.O. contact input
51: Motor overheating warning N.C. contact input
52: Jog with Run Command Direction

Setting range of E1.15:

0: 2-wire forward / stop, reverse / stop
1: 2-wire forward / reverse, run / stop
2: 3-wire control mode 1
3: 3-wire control mode 2
4: 1-wire control

Setting range of E1.68:

0: AI1: curve1, AI2: curve1, pulse input: curve1
1: AI1: curve2, AI2: curve1, pulse input: curve1
2: AI1: curve1, AI2: curve2, pulse input: curve1
3: AI1: curve2, AI2: curve2, pulse input: curve1
4: AI1: curve1, AI2: curve1, pulse input: curve2
5: AI1: curve2, AI2: curve1, pulse input: curve2
6: AI1: curve1, AI2: curve2, pulse input: curve2
7: AI1: curve2, AI2: curve2, pulse input: curve2

E2: Output terminal parameters

Code	Name	Setting range	Default	Min.	Attri.
E2.01	DO1 output setting	0...25	1	–	Stop
E2.02	DO1 pulse output setting	0: Converter output frequency 1: Converter output voltage 2: Converter output current 3: Setting torque 4: Output torque	0	–	Stop
E2.03	Pulse output maximum frequency	0.1...32.0 kHz	32.0	0.1	Run
E2.15	Relay1 output selection	0...25	1	–	Stop
E2.20	DO1/relay1 output values from extension card fieldbus communication	Bit0: 0 (open collector is opened); 1(open collector is closed) Bit8: 0 (Tb_Ta is opened); 1(Tb_Ta is closed)	0	–	Run
E2.25	AO1 output mode	0: 0...10 V 1: 0...20 mA 3: 2...10 V 4: 4...20 mA	0	–	Run
E2.26	AO1 output setting	0: Output frequency 1: Setting frequency 2: Output current 4: Output voltage 5: Output power 6: AI1 analog input 7: AI2 analog input 8: EAI1 analog input 9: EAI2 analog input 11: Motor temperature sensor power supply 12: Parameter setting from communication② 13: Setting torque 14: Output torque	0	–	Run
E2.27	AO1 gain	0.00...10.00	1.00	0.01	Run

Code	Name	Setting range	Default	Min.	Attri.
E2.28	AO1 value in percentage from extension card fieldbus communication	0.00...100.00 %	0.00	0.01	Run
E2.40	Rated voltage	1P 200...240 VAC	220	1	Stop
		3P 200...240 VAC			
		3P 380...480 VAC	380		
E2.50	Output curve 1 minimum	0.0 %...[E2.52]	0.0	0.1	Run
E2.51	Output curve 1 minimum value	0.00...100.00 %	0.00	0.01	Run
E2.52	Output curve 1 maximum	[E2.50]...100.0 %	100.0	0.1	Run
E2.53	Output curve 1 maximum value	0.00...100.00 %	100.00	0.01	Run
E2.70	Frequency detection width	0.00...400.00 Hz	2.50	0.01	Run
E2.71	Frequency detection level FDT1	0.01...400.00 Hz	50.00	0.01	Run
E2.72	Frequency detection level FDT1 width	0.01...[E2.71] Hz	1.00	0.01	Run
E2.73	Frequency detection level FDT2	0.01...400.00 Hz	25.00	0.01	Run
E2.74	Frequency detection level FDT2 width	0.01...[E2.73] Hz	1.00	0.01	Run
E2.80	Counter middle value	0...[E2.81]	0	1	Run
E2.81	Counter target value	[E2.80]...9,999	0	1	Run

Setting range of E2.01 and E2.15:

0: Converter ready
1: Converter running
2: Converter DC-braking
3: Converter running at zero speed
4: Speed arrival
5: Frequency level detection signal (FDT1)
6: Frequency level detection signal (FDT2)
7: Simple PLC stage complete
8: Simple PLC cycle complete
10: Converter undervoltage
11: Converter overload pre-warning
12: Motor overload pre-warning
13: Converter stop by external error
14: Converter error
15: Converter OK
16: Counter target value arrival

17: Counter middle value arrival

18: PID reference engineering value arrival

19: Pulse output mode enable(only available with DO1 output selection)

20: Torque control mode

21: Parameter setting from communication①

25: Converter error or warning



①:

- For parameter E2.01, the relationship between the output of '21: Parameter setting from communication' and the communication mode is as follow:
  - For modbus mode, when bit0 of register 0x7F08 is '0', open collector is opened; when bit0 is '1', open collector is closed.
  - For other fieldbus mode, the output is defined by bit0 of parameter E2.20.
- For parameter E2.15, the relationship between the output of '21: Parameter setting from communication' and the communication mode is as follow:
  - For modbus mode, when bit8 of register 0x7F08 is '0', Tb_Ta is opened; when bit8 is '1', Tb_Ta is closed.
  - For other fieldbus mode, the output is defined by bit8 of parameter E2.20.

②:

- For parameter E2.26, the relationship between the output of '12: Parameter setting from communication' and the communication mode is as follow:
  - For modbus mode, the output is defined by register 0x7F06. The value range of register is 0.00 %...100.00 % (It means percentage of maximum analog output value).
  - For other fieldbus mode, the output is defined by parameter E2.28.

E3: Multi-speed and simple PLC parameters

Code	Name	Setting range	Default	Min.	Attri.
E3.00	Simple PLC running mode	0: Inactive 1: Stop after selected cycle 2: Continuously cycling 3: Run last stage after selected cycle 4: Continuous cycling without decelerating to 0.00 Hz	0	–	Stop
E3.01	Simple PLC time multiplier	1...60	1	1	Stop
E3.02	Simple PLC cycle number	1...1,000	1	1	Stop
E3.10	Acceleration time 2	0.1...6,000.0 s	10.0	0.1	Run
E3.11	Deceleration time 2	0.1...6,000.0 s	10.0	0.1	Run
E3.12	Acceleration time 3	0.1...6,000.0 s	10.0	0.1	Run
E3.13	Deceleration time 3	0.1...6,000.0 s	10.0	0.1	Run
E3.14	Acceleration time 4	0.1...6,000.0 s	10.0	0.1	Run
E3.15	Deceleration time 4	0.1...6,000.0 s	10.0	0.1	Run
E3.16	Acceleration time 5	0.1...6,000.0 s	10.0	0.1	Run
E3.17	Deceleration time 5	0.1...6,000.0 s	10.0	0.1	Run
E3.18	Acceleration time 6	0.1...6,000.0 s	10.0	0.1	Run
E3.19	Deceleration time 6	0.1...6,000.0 s	10.0	0.1	Run
E3.20	Acceleration time 7	0.1...6,000.0 s	10.0	0.1	Run
E3.21	Deceleration time 7	0.1...6,000.0 s	10.0	0.1	Run
E3.22	Acceleration time 8	0.1...6,000.0 s	10.0	0.1	Run
E3.23	Deceleration time 8	0.1...6,000.0 s	10.0	0.1	Run
E3.40	Multi-speed frequency 1	0.00...[E0.09] Hz	0.00	0.01	Run
E3.41	Multi-speed frequency 2	0.00...[E0.09] Hz	0.00	0.01	Run
E3.42	Multi-speed frequency 3	0.00...[E0.09] Hz	0.00	0.01	Run
E3.43	Multi-speed frequency 4	0.00...[E0.09] Hz	0.00	0.01	Run
E3.44	Multi-speed frequency 5	0.00...[E0.09] Hz	0.00	0.01	Run
E3.45	Multi-speed frequency 6	0.00...[E0.09] Hz	0.00	0.01	Run
E3.46	Multi-speed frequency 7	0.00...[E0.09] Hz	0.00	0.01	Run
E3.47	Multi-speed frequency 8	0.00...[E0.09] Hz	0.00	0.01	Run
E3.48	Multi-speed frequency 9	0.00...[E0.09] Hz	0.00	0.01	Run
E3.49	Multi-speed frequency 10	0.00...[E0.09] Hz	0.00	0.01	Run
E3.50	Multi-speed frequency 11	0.00...[E0.09] Hz	0.00	0.01	Run
E3.51	Multi-speed frequency 12	0.00...[E0.09] Hz	0.00	0.01	Run

Code	Name	Setting range	Default	Min.	Attri.
E3.52	Multi-speed frequency 13	0.00...[E0.09] Hz	0.00	0.01	Run
E3.53	Multi-speed frequency 14	0.00...[E0.09] Hz	0.00	0.01	Run
E3.54	Multi-speed frequency 15	0.00...[E0.09] Hz	0.00	0.01	Run
E3.59	Stage 0 frequency source	0: Digital setting frequency 1: AI1 analog input 2: AI2 analog input 3: EAI1 analog input 4: X5 pulse input 5: Communication 6: Panel potentiometer 7: Digital input up/down command 8: EAI2 analog input	0	–	Stop
E3.60	Stage 0 action	011, 012, 013, 014, 015, 016 ,017, 018, 021, 022, 023, 024, 025, 026, 027, 028, 031, 032, 033, 034, 035, 036, 037, 038, 041, 042, 043, 044, 045, 046, 047, 048, 051, 052, 053, 054, 055, 056, 057, 058, 061, 062, 063, 064, 065, 066, 067, 068, 071, 072, 073, 074, 075, 076, 077, 078, 081, 082, 083, 084, 085, 086, 087, 088, 111, 112, 113, 114, 115, 116, 117, 118, 121, 122, 123, 124, 125, 126, 127, 128, 131, 132, 133, 134, 135, 136, 137, 138, 141, 142, 143, 144, 145, 146, 147, 148, 151, 152, 153, 154, 155, 156, 157, 158, 161, 162, 163, 164, 165, 166, 167, 168, 171, 172, 173, 174, 175, 176, 177, 178, 181, 182, 183, 184, 185, 186, 187, 188	011	–	Stop
E3.62	Stage 1 action		011	–	Stop
E3.64	Stage 2 action		011	–	Stop
E3.66	Stage 3 action		011	–	Stop
E3.68	Stage 4 action		011	–	Stop
E3.70	Stage 5 action		011	–	Stop
E3.72	Stage 6 action		011	–	Stop
E3.74	Stage 7 action		011	–	Stop
E3.76	Stage 8 action		011	–	Stop
E3.78	Stage 9 action		011	–	Stop
E3.80	Stage 10 action		011	–	Stop
E3.82	Stage 11 action		011	–	Stop
E3.84	Stage 12 action		011	–	Stop
E3.86	Stage 13 action		011	–	Stop
E3.88	Stage 14 action		011	–	Stop
E3.90	Stage 15 action		011	–	Stop
E3.61	Stage 0 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.63	Stage 1 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.65	Stage 2 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.67	Stage 3 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.69	Stage 4 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.71	Stage 5 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.73	Stage 6 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.75	Stage 7 running time	0.0...6,000.0 s	20.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
E3.77	Stage 8 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.79	Stage 9 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.81	Stage 10 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.83	Stage 11 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.85	Stage 12 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.87	Stage 13 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.89	Stage 14 running time	0.0...6,000.0 s	20.0	0.1	Stop
E3.91	Stage 15 running time	0.0...6,000.0 s	20.0	0.1	Stop

E4: PID control parameters

Code	Name	Setting range	Default	Min.	Attri.
E4.00	PID reference channel	0...10	0	–	Stop
E4.01	PID feedback channel	0: AI1 analog input 1: AI2 analog input 2: X5 pulse input 3: EAI1 analog input 4: Encoder card speed 5: EAI2 analog input	0	–	Stop
E4.02	PID reference / feedback factor	0.01...100.00	1.00	0.01	Run
E4.03	PID engineering analog reference	0.00...10.00	0.00	0.01	Run
E4.04	PID engineering speed reference	0...30,000 rpm	0	1	Run
E4.05	PID feedback polarity	0: Positive; 1: Negative	0	–	Stop
E4.15	Proportional gain - P	0.000...60.000	1.500	0.001	Run
E4.16	Integral time - Ti	0.00...100.00 s (0.00: no integral)	1.50	0.01	Run
E4.17	Derivative time - Td	0.00...100.00 s (0.00: no derivative)	0.00	0.01	Run
E4.18	Sampling period - T	0.01...100.00 s	0.50	0.01	Run
E4.19	PID feed forward dynamic limit	0.00...100.00 %	10.00	0.01	Run
E4.20	PID feed forward minimum value	0.00...100.00 %	0.00	0.01	Run
E4.30	PID deadband	0.0...20.0 %	2.0	0.1	Run
E4.31	PID regulation mode	0, 1	0	–	Run
E4.32	PID engineering value detection width	0.01...100.00 %	1.00	0.01	Run
E4.33	PID feed forward settings	0: Inactive; 1: Active	0	–	Stop

Setting range of E4.00:

0: Inactive; 1: Panel potentiometer; 2: Panel button

3: AI1 analog input; 4: AI2 analog input; 5: X5 pulse input

6: EAI1 analog input; 7: Communication; 8: Analog reference E4.03

9: Speed reference E4.04; 10: EAI2 analog input

Setting range of E4.31:

0: Stop integral regulation when frequency arrives at upper / lower limit

1: Continue integral regulation when frequency arrives at upper / lower limit

E5: Extended function parameters

Code	Name	Setting range	Default	Min.	Attri.
E5.01	High resolution output current filter time	5...500 ms	40	1	Run
E5.02	User-defined speed scaling factor	0.01...100.00	1.00	0.01	Run
E5.05	Pump dry protection threshold	0.0 %...[E5.08]	30.0	0.1	Run
E5.06	Pump dry protection delay	0.0...300.0 s (0.0: Inactive)	0.0	0.1	Run
E5.07	Pump dry protection delay at start-up	0.0...300.0 s	30.0	0.1	Run
E5.08	Pump leakage protection threshold	0.0...100.0 %	50.0	0.1	Run
E5.09	Pump leakage protection delay	0.0...600.0 s (0.0: Inactive)	0.0	0.1	Run
E5.10	Pump leakage protection delay at start-up	0.0...600.0 s	60.0	0.1	Run
E5.15	Sleep level	0.00...[E0.09] Hz	0.00	0.01	Run
E5.16	Sleep delay	0.0...3,600.0 s	60.0	0.1	Run
E5.17	Sleep boost time	0.0...3,600.0 s	0.0	0.1	Run
E5.18	Sleep boost amplitude	0.0...100.0 %	0.0	0.1	Run
E5.19	Wake up level	0.0...100.0 %	0.0	0.1	Run
E5.20	Wake up delay	0.0...60.0 s	0.5	0.1	Run

E8: Standard communication parameters

Code	Name	Setting range	Default	Min.	Attri.
E8.00	Communication protocol	0: Modbus 1: Extension card	0	–	Stop
E8.01	Communication error detection time	0.0...60.0 s (0.0: Inactive)	0.0	0.1	Stop
E8.02	Communication error protection mode	0: Freewheeling stop 1: Keep running 2: Emergency stop	1	–	Stop
E8.03	Communication process data loss behavior	0: Decelerating stop 1: Freewheeling stop 2: Keep running 3: Keep running without warning	0	–	Stop
E8.10	Modbus baud rate	0: 1,200 bps 1: 2,400 bps 2: 4,800 bps 3: 9,600 bps 4: 19,200 bps 5: 38,400 bps	3	–	Stop
E8.11	Modbus data format	0...3	0	–	Stop
E8.12	Modbus local address	1...247	1	1	Stop
E8.13	Modbus level / edge sensitivity selection	0: Level sensitive 1: Edge sensitive	1	–	Stop

Setting range of E8.11:

0: N, 8, 1 (1 start bit, 8 data bits, 1 Stop bit, no parity)

1: E, 8, 1 (1 start bit, 8 data bits, 1 Stop bit, even parity)

2: O, 8, 1 (1 start bit, 8 data bits, 1 Stop bit, odd parity)

3: N, 8, 2 (1 start bit, 8 data bits, 2 Stop bits, no parity)

E9: Protection and error parameters

Code	Name	Setting range	Default	Min.	Attri.
E9.00	Automatic error reset attempts	0...3 (0: Inactive)	0	–	Stop
E9.01	Automatic error reset interval	0.1...60.0 s	10.0	0.1	Stop
E9.02	Automatic error reset attempts restart time	0...65,535	0	1	Stop
E9.04	Diagnosis setting	0...FFFF	0	1	Stop
E9.05	Last error type	–	–	–	Read
E9.06	Second last error type	–	–	–	Read
E9.07	Third last error type	–	–	–	Read
E9.10	Output frequency at last error	–	–	0.01	Read
E9.11	Setting frequency at last error	–	–	0.01	Read
E9.12	Output current at last error	–	–	0.1	Read
E9.13	Output voltage at last error	–	–	1	Read
E9.14	DC-bus voltage at last error	–	–	1	Read
E9.15	Power module temperature at last error	–	–	1	Read
E9.50	Last warning type	–	0	–	Read
E9.51	Second last warning type	–	0	–	Read
E9.52	Third last warning type	–	0	–	Read
E9.97	Last error detail	00000...FFFFF	0	–	Read
E9.98	Second last error detail	00000...FFFFF	0	–	Read
E9.99	Third last error detail	00000...FFFFF	0	–	Read

E9.04 Diagnosis setting:

- 0000: UE-1 (by default)
- 0001: no error

Value range of E9.05...E9.07:

0: No error
1: OC-1, overcurrent at constant speed
2: OC-2, overcurrent during acceleration
3: OC-3, overcurrent during deceleration
4: OE-1, overvoltage at constant speed
5: OE-2, overvoltage during acceleration
6: OE-3, overvoltage during deceleration
8: UE-1, undervoltage during run
9: SC, surge current or short circuit

10: IPH.L, input phase loss
11: OPH.L, output phase loss
12: ESS-, soft start error
20: OL-1, converter overload
21: OH, converter over temperature
23: FF, fan failure
24: Pdr, pump dry
25: CoL-, command value lost
26: StO-r, STO request
27: StO-E, STO error
30: OL-2, motor overload
31: Ot, motor over temperature
32: t-Er, motor parameter tuning error
33: AdE-, synchronous motor angle detection error
34: EnCE-, encoder connection error
35: SPE-, speed control loop error
38: AibE, analog input broken wire detection
39: EPS-, DC_IN power supply error
40: dir1, forward running lock error
41: dir2, reverse running lock error
42: E-St, terminal error signal
43: FFE-, firmware version mismatch
44: rS-, Modbus communication error
45: E.Par, parameter settings invalid
46: U.Par, unknown parameter restore error
48: idA-, internal communication error
49: idP-, internal parameter error
50: idE-, converter internal error
51: OCd-, extension card internal error
52: OCc, extension card PDOs configuration error
54: PcE-, remote control communication error
55: PbrE, parameter backup / restore error
56: PrEF, parameter restore error after firmware update
60: APE-, application firmware error
61: APE1, application error 1
62: APE2, application error 2

63: APE3, application error 3
64: APE4, application error 4
65: APE5, application error 5
70: EIbE, Encoder input broken wire error
71:EPOE, Encoder phase order error
72:RDOS, Signal amplitude error
73:RLOT, Signal phase error
901:FCd-, Host communication timed out
902:FPC-, Fieldbus process data configuration erroneous
903:FtL-, RPDO Telegram Loss
904:FIn-, Communication platform initialization failed
905:FnC-, Fieldbus network configuration invalid
906:FCE-, Communication platform critical error
907:FnF-, Communication platform firmware corrupted
908:Fdi-, Fieldbus data Invalid

Value range of E9.50...E9.52:

0: No warning
6: PLE, pump leakage
7: OE-4, overvoltage during stop
31: Ot, motor over temperature
403: C-dr, communication disconnection
408: Aib-, analog input broken wire detection
409: FLE, fan maintenance period expired
410: OCi, communication data exceeds value range
411: UH-A, under Temperature warning
420: APF1, ASF customer warning 1
421: APF2, ASF customer warning 2
422: APF3, ASF customer warning 3
423: APF4, ASF customer warning 4
424: APF5, ASF customer warning 5
430: USdc, UnSupported Device Configuration
440: SLi-, speed limited by maximum Voltage
900: iSt, invalid State Transition
903: FtL, RPDO Telegram Loss
908: Fdi, option card process data invalid

3.4.5 Group F0: ASF Parameters

Code	Name	Setting range	Default	Min.	Attri.
F0.01	ASF version	–	–	–	Read
F0.02	ASF identifier	0x0001 ... 0x0FFF	–	–	Read
F0.03	ASF API required version	–	–	–	Read
F0.06	ASF trial time left	0...65,535	–	–	Read
F0.07	ASF API version	–	–	–	Read
F0.10	ASF status	0x0000H...0xFFFFH	–	1	Read
F0.20	ASF Command 1	–	0	–	Read
F0.21	ASF Command 2	–	0	–	Read
F0.22	ASF Command 3	–	0	–	Read
F0.23	ASF Command 4	–	0	–	Read
F0.24	ASF Command 5	–	0	–	Read
F0.25	ASF Command 6	–	0	–	Read
F0.26	ASF Command 7	–	0	–	Read
F0.27	ASF Command 8	–	0	–	Read

3.4.6 Group H: Extension Card Parameters

H0: Extension card general parameters

Code	Name	Setting range	Default	Min.	Attri.
H0.00	Control word	00000...0FFFF	00000	1	Run
H0.01	Status word	-	00000	-	Read
H0.02	Extended status word	-	0x00000	1	Read
H0.03	STO safety status word	bit 0: STO-A bit 1: STO-r bit 2: STO-E bit 3...15: Reserved Modbus register: 0x7FA2	00000	-	Read
H0.10	Frequency command	0.00...655.35	0.00	0.01	Run
H0.12	Torque control reference from fieldbus	0.0...6553.5	0.0	0.1	Run
H0.14	FWD torque limitation reference from fieldbus	0.0...6553.5	0.0	0.1	Run
H0.15	REV torque limitation reference from fieldbus	0.0...6553.5	0.0	0.1	Run
H0.16	Speed limitation at torque control mode from fieldbus	0.00...655.35	0.00	0.01	Run
H0.18	Opt 1 active interface version	–	–	0.01	Read
H0.19	Opt 2 active interface version	–	–	0.01	Read
H0.20	Extension card 1 type	0: None	0	–	Read
H0.30	Extension card 2 type	1: PROFIBUS card 2: CANopen card 3: MEP (Multi-Ethernet) 7: ABZ encoder card 8: I/O card 9: Relay card 10: IO plus card 11: Resolver card	0	–	Read
H0.23	Extension card 1 firmware version	–	–	0.01	Read
H0.33	Extension card 2 firmware version	–	–	0.01	Read
H0.50	Fieldbus voltage command	0.00...100.00 %	0.00	0.01	Run

H1: Communication card parameters

Code	Name	Setting range	Default	Min.	Attri.
H1.00	PROFIBUS local address	0...126	1	1	Stop
H1.01	Present baud rate	0: None 1: 9.6 kbps 2: 19.2 kbps 3: 45.45 kbps 4: 93.75 kbps 5: 187.5 kbps 6: 500 kbps 7: 1,500 kbps 8: 3,000 kbps 9: 6,000 kbps 10: 12,000 kbps	–	–	Read
H1.02	Present telegram type	1: PPO1 2: PPO2 3: PPO3 4: PPO4 5: PPO5 6 : PPO6 7: PPO7 8: PPO8	–	–	Read

Code	Name	Setting range	Default	Min.	Attri.
H1.10	Output PZD 1①	0: Not used	1	1	Stop
H1.11	Output PZD 2	1: Control word	2	1	Stop
H1.12	Output PZD 3	2: Frequency command	0	1	Stop
H1.13	Output PZD 4	3: Empty PZD	0	1	Stop
H1.14	Output PZD 5	4: ASF command 1	0	1	Stop
H1.15	Output PZD 6	5: ASF command 2	0	1	Stop
H1.16	Output PZD 7	6: ASF command 3	0	1	Stop
H1.17	Output PZD 8	7: ASF command 4	0	1	Stop
H1.18	Output PZD 9	8: ASF command 5	0	1	Stop
H1.19	Output PZD 10	9: ASF command 6 10: ASF command 7 11: ASF command 8 12: Torque command 13: Forward torque limit 14: Reverse torque limit 15: Speed limit in torque mode 16: DO1/relay1 output values (see parameter E2.20) 17: AO1 value in percentage (see parameter E2.28) 18: EDO values (see parameter H8.23) 19: EAO value in percentage (see parameter H8.28) 20: Relay card output values (see parameter H9.10) 21: V/f separation voltage command in percentage (see parameter H0.50) 22: Acceleration time 23: Deceleration time	0	1	Stop

Code	Name	Setting range	Default	Min.	Attri.
H1.30	Input PZD 1②	0: Not used 1: Status word 2: Extended status word 3: Empty PZD 100: d0.00 (Output frequency) 101...199: d0.01...d0.99 (Monitoring values)	1	1	Stop
H1.31	Input PZD 2		100	1	Stop
H1.32	Input PZD 3		0	1	Stop
H1.33	Input PZD 4		0	1	Stop
H1.34	Input PZD 5		0	1	Stop
H1.35	Input PZD 6		0	1	Stop
H1.36	Input PZD 7		0	1	Stop
H1.37	Input PZD 8		0	1	Stop
H1.38	Input PZD 9		0	1	Stop
H1.39	Input PZD 10		0	1	Stop



①: Output PZD 1...Output PZD 10 are the process data containers for data transferring from PROFIBUS master to slave.

②: Input PZD 1...Input PZD 10 are the process data containers for data transferring from PROFIBUS slave to master.

H8: I/O card parameters

Code	Name	Setting range	Default	Min.	Attri.
H8.00	EX1 input	0...52	0	–	Stop
H8.01	EX2 input		0	–	Stop
H8.02	EX3 input		0	–	Stop
H8.03	EX4 input		0	–	Stop
H8.04	EX5 input		0	–	Stop
H8.05	EAI1 input mode	0: 0...20 mA 1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V 5: -10...10 V	0	–	Stop
H8.06	EAI1 input polarity setting	0...3	1	–	Stop
H8.07	EAI1 dead zone filter value	0.0...30.0 %	0.0	0.1	Run
H8.09	EAI1 filter time	0.000...2.000	0.100	0.001	Run
H8.10	EAI1 gain	0.00...10.00	1.00	0.01	Run
H8.15	EAI1 curve minimum	-120.0 %...[H8.17]	0.0	0.1	Run
H8.16	EAI1 curve minimum value	-[E0.09]...[E0.09] Hz	0.0	0.1	Run
H8.17	EAI1 curve maximum	[H8.15]...120.0 %	100.0	0.1	Run
H8.18	EAI1 curve maximum value	-[E0.09]...[E0.09] Hz	50.0	0.1	Run
H8.20	EDO1 output selection	0...25	1	–	Stop
H8.21	Extended relay output selection		1	–	Stop
H8.22	EDO2 output selection		1	–	Stop
H8.23	Extended digital output value from extension card fieldbus communication	Bit0: EDO1 (IO / IO plus card) Bit1: EDO2 (IO plus card) Bit8: Erelay (IO card)	0	–	Stop
H8.25	EAO output mode	0: 0...10 V 1: 0...20 mA 2: -10...10 V (only for IO plus card) 3: 2...10 V 4: 4...20 mA	0	–	Run

Code	Name	Setting range	Default	Min.	Attri.
H8.26	EAO output selection	0: Output frequency 1: Set frequency 2: Output current 4: Output voltage 5: Output power 6: AI1 analog input 7: AI2 analog input 8: EAI1 analog input 9: EAI2 analog input 11: Motor temperature sensor power 12: Parameter setting from communication② 13: Setting torque 14: Output torque	0	–	Run
H8.27	EAO gain	0.00...10.00	1.00	0.01	Run
H8.28	EAO value in percentage from extension card fieldbus communication	0.00...100.00%	0.00	0.01	Stop
H8.30	EAI2 input mode	0: 0...20 mA 1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V 5: -10...10 V	0	–	Stop
H8.31	EAI2 input polarity setting	0: Polarity inactive 1: Polarity active without direction control 2: Polarity active with direction control 3: Combination direction control	1	–	Stop
H8.32	EAI2 filter time	0.000...2.000	0.100	0.001	Run
H8.33	EAI2 gain	0.00...10.00	1.00	0.01	Run
H8.34	EAI2 curve minimum	-120.0 %...[H8.36]	0.0	0.1	Run
H8.35	EAI2 curve minimum value	-[E0.09]...[E0.09]	0.0	0.1	Run
H8.36	EAI2 curve maximum	[H8.34]...120.0 %	100.0	0.1	Run

Code	Name	Setting range	Default	Min.	Attri.
H8.37	EAI2 curve maximum value	-[E0.09]...[E0.09]	50.0	0.1	Run
H8.38	EAI2 dead zone filter value	0.0...30.0 %	0.0	0.1	Run
H8.39	EAO curve minimum	-100.0 %...[H8.41]	0.0	0.1	Run
H8.40	EAO curve minimum value	-100.0...100.0 %	0.00	0.01	Run
H8.41	EAO curve maximum	[H8.39]...100.0 %	100.0	0.1	Run
H8.42	EAO curve maximum value	-100.0...100.0 %	100.0	0.1	Run
H8.87	I/O card output channel diagnosis	0: Inactive 1: EAO diagnosis 2: EDO diagnosis 3: ERO diagnosis/EDO2 diagnosis 4: All output diagnosis	1	–	Stop

Setting range of H8.00...H8.04:

0: No function assigned
1: Multi-speed control input 1
2: Multi-speed control input 2
3: Multi-speed control input 3
4: Multi-speed control input 4
10: Acceleration/deceleration time 1 activation
11: Acceleration/deceleration time 2 activation
12: Acceleration/deceleration time 3 activation
15: Freewheeling stop activation
16: Stop DC-braking activation
20: Frequency Up command
21: Frequency Down command
22: Up/Down command reset
23: Torque/Speed control switch
25: 3-wire control
26: Simple PLC stop
27: Simple PLC pause
30: Second frequency setting source activation
31: Second run command source activation
32: Error signal N.O. contact input
33: Error signal N.C. contact input
34: Error reset

35: Forward running (FWD)
36: Reverse running (REV)
37: Forward jog
38: Reverse jog
39: Counter input
40: Counter reset
41: PID deactivation
46: User parameter set selection
48: Motor overheating error N.O. contact input
49: Motor overheating error N.C. contact input
50: Motor overheating warning N.O. contact input
51: Motor overheating warning N.C. contact input
52: Jog with Run Command Direction

Setting range of H8.06:

0: Polarity inactive
1: Polarity active without direction control
2: Polarity active with direction control
3: Combination direction control

Setting range of H8.20, H8.21, H8.22:

0: Converter ready
1: Converter running
2: Converter DC-braking
3: Converter running at zero speed
4: Speed arrival
5: Frequency level detection signal (FDT1)
6: Frequency level detection signal (FDT2)
7: Simple PLC stage complete
8: Simple PLC cycle complete
10: Converter undervoltage
11: Converter overload pre-warning
12: Motor overload pre-warning
13: Converter stop by external error
14: Converter error
15: Converter OK
16: Counter target value arrival
17: Counter middle value arrival

18: PID reference engineering value arrival

19: Pulse output mode enable (only valid for DO1 output)

20: Torque control mode

21: Parameter setting from communication①

25: Converter error or warning

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①:

The relationship between the output of '21: Parameter setting from communication' and communication mode is as follow:

- For modbus mode,
  - The output of parameter H8.20 is defined by bit0 of register 0x7F09. When bit0 is '0', open collector is opened; when bit0 is '1', open collector is closed.
  - The output of parameter H8.21 is defined by bit8 of register 0x7F09. When bit8 is '0', ETb_ETa is opened; when bit8 is '1', ETb_ETa is closed.
  - The output of parameter H8.22 is defined by bit1 of register 0x7F09. When bit1 is '0', open collector is opened; when bit1 is '1', open collector is closed.
- For other fieldbus mode, the output is defined by parameter H8.23.

②:

The relationship between the output of '12: Parameter setting from communication' and communication mode is as follow:

- For modbus mode, the output is defined by register 0x7F07, the value range of register is 0.00 %...100.00 % (It means percentage of maximum analog output value).
- For other fieldbus mode, the output is defined by parameter H8.28.

H9: Relay card parameters

Code	Name	Setting range	Default	Min.	Attri.
H9.00	Extended relay 1 output selection	0...25	0	–	Stop
H9.01	Extended relay 2 output selection		0	–	Stop
H9.02	Extended relay 3 output selection		0	–	Stop
H9.03	Extended relay 4 output selection		0	–	Stop
H9.10	Relay output setting value	Relay1 is defined by bit0, when bit0 is '0', R1b_R1a is opened; when bit0 is '1', R1b_R1a is closed Relay2 is defined by bit1, when bit1 is '0', R2b_R2a is opened; when bit1 is '1', R2b_R2a is closed Relay3 is defined by bit2, when bit2 is '0', R3b_R3a is opened; when bit2 is '1', R3b_R3a is closed Relay4 is defined by bit3, when bit3 is '0', R4b_R4a is opened; when bit3 is '1', R4b_R4a is closed	0	–	Run
H9.97	Relay card output channel diagnosis	0: Inactive 1: Relay1 diagnosis 2: Relay2 diagnosis 3: Relay3 diagnosis 4: Relay4 diagnosis 5: All output diagnosis	0	–	Stop

Setting range of H9.00...H9.03:

0: Converter ready
1: Converter running
2: Converter DC-braking
3: Converter running at zero speed
4: Speed arrival
5: Frequency level detection signal (FDT1)
6: Frequency level detection signal (FDT2)
7: Simple PLC stage complete
8: Simple PLC cycle complete
10: Converter undervoltage

11: Converter overload pre-warning

12: Motor overload pre-warning

13: Converter stop by external error

14: Converter error

15: Converter OK

16: Counter target value arrival

17: Counter middle value arrival

18: PID reference engineering value arrival

20: Torque control mode

21: Parameter setting from communication①

25: Converter error or warning



①:

The relationship between output of '21: Parameter setting from communication' and communication mode is as follow:

- For modbus mode,
  - The output of parameter H9.00 is defined by bit0 of register 0x7F0A. When bit0 is '0', R1b_R1a is opened; when bit0 is '1', R1b_R1a is closed.
  - The output of parameter H9.01 is defined by bit1 of register 0x7F0A. When bit1 is '0', R2b_R2a is opened; when bit1 is '1', R2b_R2a is closed.
  - The output of parameter H9.02 is defined by bit2 of register 0x7F0A. When bit2 is '0', R3b_R3a is opened; when bit2 is '1', R3b_R3a is closed.
  - The output of parameter H9.03 is defined by bit3 of register 0x7F0A. When bit3 is '0', R4b_R4a is opened; when bit3 is '1', R4b_R4a is closed.
- For other fieldbus mode, the output is defined by parameter H9.10.

3.4.7 Group U: Panel Parameters

U0: General panel parameters

Code	Name	Setting range	Default	Min.	Attri.
U0.00	Direction control by panel	0: Forward; 1: Reverse	0	–	Run
U0.01	Stop button control	0: Active only for panel control 1: Valid for all control methods	1	–	Run
U0.99	Panel firmware version	00.00...99.99	–	0.01	Read

U1: LED panel parameters

Code	Name	Setting range	Default	Min.	Attri.
U1.00	Run monitoring display	0...99	0	–	Run
U1.10	Stop monitoring display		2	–	Run

0: Output frequency; 1: Actual speed

2: Setting frequency; 3: Setting speed

4: User-defined setting speed; 5: User-defined actual speed

6: Encoder frequency; 7: Encoder speed

9: V/f separation setting voltage; 10: Output voltage; 11: Output current

12: Output power; 13: DC-bus voltage

14: Energy saving counter kWh; 15: Energy saving counter MWh

16: Output torque; 17: Setting torque; 18: FWD speed limitation setting; 19: REV speed limitation setting

20: Power module temperature; 21: Actual carrier frequency

23: Power stage running time; 30: AI1 input

31: AI2 input; 33: I/O card EAI1 input; 34: I/O card EAI2 input

35: AO1 output; 37: I/O card EAO output;

38: I/O plus card TSI input signal value

40: Digital input 1; 43: I/O card digital input

45: DO1 output; 47: I/O card EDO1 output; 48: I/O card EDO2 output

50: Pulse input frequency; 55: Pulse output frequency

60: Relay output; 62: I/O card relay output

63: Relay card output; 70: PID reference engineering value

71: PID feedback engineering value; 80: ASF Display00

81: ASF Display01; 82: ASF Display02

83: ASF Display03; 84: ASF Display04

85: ASF Display05; 86: ASF Display06

87: ASF Display07; 88: ASF Display08; 89: ASF Display09
98: High resolution output current; 99: Firmware version

U2: LCD panel parameters

Code	Name	Setting range	Default	Min.	Attri.
U2.01	Backlight mode setting	0: Energy saving 1: Always on	1	–	Run
U2.02	Panel lock setting	0: Unlock 1: Lock	0	–	Run
U2.03	Remote / Local setting	0: Remote 1: Local	0	–	Stop
U2.04	Language selection	0: English 1: Chinese 2: Germany 3: French 4: Russian 5: Spanish 6: Portugal 7: Italian 8: Korean	0	–	Stop
U2.09	Permanent monitoring	0...99	0	–	Run
U2.10	Run monitoring items 1		0	–	Run
U2.20	Stop monitoring items 1		0	–	Run
U2.11	Run monitoring items 2	0...100	2	–	Run
U2.12	Run monitoring items 3		11	–	Run
U2.13	Run monitoring items 4		13	–	Run
U2.14	Run monitoring items 5		16	–	Run
U2.15	Run monitoring items 6		17	–	Run
U2.21	Stop monitoring items 2		2	–	Run
U2.22	Stop monitoring items 3		11	–	Run
U2.23	Stop monitoring items 4		13	–	Run
U2.24	Stop monitoring items 5		16	–	Run
U2.25	Stop monitoring items 6		17	–	Run

Setting range of U2.09...U2.25:
0: Actual output frequency; 1: Actual speed
2: Setting frequency; 3: Setting speed
4: User-defined setting speed; 5: User-defined output speed

9: V/f separation setting voltage; 10: Output voltage; 11: Output current
12: Output power; 13: DC-bus voltage
14: Energy saving counter kWh; 15: Energy saving counter MWh
16: Output torque; 17: Setting torque
20: Power module temperature; 21: Actual carrier frequency
23: Power stage running time; 30: AI1 input
31: AI2 input; 33: I/O card EAI1 input; 34: I/O card EAI2 input
35: AO1 output; 37: I/O card EAO output
38: I/O plus card TSI input signal value
40: Digital input 1; 43: I/O card digital input
45: DO1 output; 47: I/O card EDO1 output; 48: I/O card EDO2 output
50: Pulse input frequency; 55: Pulse output frequency
60: Relay output; 62: I/O card relay output
63: Relay card output; 70: PID reference engineering value
71: PID feedback engineering value; 80: ASF Display00
81: ASF Display01; 82: ASF Display02
83: ASF Display03; 84: ASF Display04
85: ASF Display05; 86: ASF Display06
87: ASF Display07; 88: ASF Display08
89: ASF Display09; 98: High resolution output current
99: Firmware version; 100: Inactive

3.4.8 Group d0: Monitoring Parameters

Code	Name	Minimum unit
d0.00	Output frequency	0.01 Hz
d0.01	Actual speed	1 rpm
d0.02	Setting frequency	0.01 Hz
d0.03	Setting speed	1 rpm
d0.04	User-defined setting speed	0.1
d0.05	User-defined output speed	0.1
d0.09	V/f separation setting voltage	0.01 V
d0.10	Output voltage	1 V
d0.11	Output current	0.1 A
d0.12	Output power	0.1 kW
d0.13	DC-bus voltage	1 V
d0.14	Energy saving counter kWh	0.1 kWh
d0.15	Energy saving counter MWh	1 MWh
d0.16	Output torque	0.1 %
d0.17	Setting torque	0.1 %
d0.18	FWD speed limitation setting	0.01 rpm
d0.19	REV speed limitation setting	0.01 rpm
d0.20	Power module temperature	1 °C
d0.21	Actual carrier frequency	1 kHz
d0.23	Power stage running time	1 h
d0.30	AI1 input	0.01 V / 0.01 mA
d0.31	AI2 input	0.01 V / 0.01 mA
d0.33	I/O card EAI1 input	0.01 V / 0.01 mA
d0.34	I/O card EAI2 input	0.01 V / 0.01 mA
d0.35	AO1 output	0.01 V / 0.01 mA
d0.37	I/O card EAO output	0.01 V / 0.01 mA
d0.38	I/O plus card TSI input signal value	0.001 V
d0.40	Digital input 1	–
d0.43	I/O card digital input	–
d0.45	DO1 output	–
d0.47	I/O card EDO1 output	–
d0.48	I/O card EDO2 output	–
d0.50	Pulse input frequency	0.01 kHz
d0.55	Pulse output frequency	0.1 kHz
d0.60	Relay output	–
d0.62	I/O card relay output	–

Code	Name	Minimum unit
d0.63	Relay card output	–
d0.70	PID reference engineering value	0.1
d0.71	PID feedback engineering value	0.1
d0.80	ASF Display00	–
d0.81	ASF Display01	–
d0.82	ASF display02	–
d0.83	ASF display03	–
d0.84	ASF display04	–
d0.85	ASF display05	–
d0.86	ASF display06	–
d0.87	ASF display07	–
d0.88	ASF display08	–
d0.89	ASF display09	–
d0.98	High resolution output current	0.01 A
d0.99	Firmware version	0.01

4 Diagnosis

4.1 Display of LED Characters

Character	A	b	C	d	E	F	H	I	L
Display									
Character	n	O	o	P	r	S	t	U	–
Display									–

Tab. 4-1: Display of LED characters

4.2 Status Code

Code	Description
8.8.8.8.8.	Displayed at power on, detecting the operating panel
'-' '--' '---' '----' '-----'	During parameter backup...
tUnE	Motor parameter tunning
PSLP	PID sleeping
-PF-	Modified parameters which are different from default value
-EP-	Parameters with invalid settings
PAr1	Parameter set switching from set 2 to set 1
PAr2	Parameter set switching from set 1 to set 2
StO-A	STO information message

4.3 Warning Code

Code	Description
P.oFF	Displayed only at power down / drop in stop state
S.Err	Parameter change blocked
C-dr	Communication disconnection
PrSE	Parameter setting contradiction
FLE	Fan maintenance period expired
noCP	No modified parameter
PLE	Pump leakage
Aib-	Analog input broken wire detection
OCi	Communication data exceeds value range
Fdi	Fieldbus process data invalid

Code	Description
APF1	Warning which can be thrown by the application, description in application manual
APF2	
APF3	
APF4	
APF5	
UH-A	Converter under temperature
SLi-	Speed limit
OE-4	Overvoltage during stop
Ot	Motor over temperature
USdc	Unsupported device configuration
iSt	Invalid state transition
FtL	RPDO telegram loss

4.4 Error Code

Nr.	Code	Name	Description
1	OC-1	Overcurrent at constant speed	Output current above limit at motor running at constant speed
2	OC-2	Overcurrent during acceleration	Output current above limit at motor accelerating
3	OC-3	Overcurrent during deceleration	Output current above limit at motor decelerating
4	OE-1	Overvoltage at constant speed	DC bus voltage above limit at motor running at constant speed
5	OE-2	Overvoltage during acceleration	DC bus voltage above limit at motor accelerating
6	OE-3	Overvoltage during deceleration	DC bus voltage above limit at motor decelerating
8	UE-1	Undervoltage during run	DC bus voltage below limit at converter running
9	SC	Surge current or short circuit	Output current sharp increase or short circuit occurs on motor cable or converter power module has internal error
10	IPH.L	Input phase loss	Mains cable disconnected or input imbalance occurs
11	OPH.L	Output phase loss	Motor cable disconnected or output imbalance occurs
12	ESS-	Soft start error	Soft start circuit is not working properly
20	OL-1	Converter overload	Converter load is above limit for too long
21	OH	Converter over temperature	Converter temperature is too high
23	FF	Fan failure	Converter fan is not working properly
24	Pdr	Pump dry	PID feedback is excessively low when converter running at output frequency high limit
25	CoL-	Command value lost	Command value from panel is lost
26	StO-r	STO request	STO function is activated correctly in running mode, after re-energized input channels and reset the device, the device goes to normal state
27	StO-E	STO error	STO function is activated incorrectly, it happens if one channel is energized but the other is deenergized
30	OL-2	Motor overload	Motor load is above limit for too long
31	Ot	Motor over temperature	Motor temperature is above limit for too long
32	t-Er	Motor parameter tuning error	Error occurs during motor parameter auto-tuning
33	AdE-	Synchronous motor angle detection error	Error occurs during synchronous motor angle detection
34	EnCE-	encoder connection error	error occures during encoder connection
35	SPE-	Speed control loop error	The speed loop difference is outside [C3.26] over a time of [C3.25]

Nr.	Code	Name	Description
38	AibE	Analog input broken wire detection	Analog input wire is disconnected
39	EPS-	DC_IN power supply error	DC_IN power supply voltage is out of range 20...28 V
40	dir1	Forward running lock error	Direction can only be forward but command is reverse
41	dir2	Reverse running lock error	Direction can only be reverse but command is forward
42	E-St	Terminal error signal	Error signal is received from digital inputs
43	FFE-	Firmware version mismatch	Firmware version of panel or extension card does not match that of control board
44	rS-	Modbus communication error	Modbus communication is not working properly
45	E.Par	Parameter settings invalid	Parameter settings are invalid after firmware update or extension card removed
46	U.Par	Unknown parameter restore error	An unknown parameter is skipped during parameter restore
48	idA-	Internal communication error	Internal error caused by communication interference or circuit connection problem
49	idP-	Internal parameter error	Internal error caused by parameter handling
50	idE-	Converter internal error	Converter has internal error, contact with service
51	OCd-	Extension card internal error	Extension card was successfully detected by the device at startup, but the communication failed afterwards
52	OCc	Extension card PDOs configuration error	Process data configuration error for field bus communication
53	Fdi-	no valid process data	No valid process data is received from remote communication server
54	PcE-	Remote control communication error	Error if communication to IndraWorks/ConverterWorks is lost during remote control
55	PbrE	Parameter backup / restore error	Error occurs during parameter backup and restore operation
56	PrEF	Parameter restore error after firmware update	Error occurs if parameter settings cannot be restored after firmware update
60	APE-	Application firmware error	Error message if the application firmware was not loaded correctly or trail use is over
61	APE1	Application error 1	Error which can be thrown by the application, description in application manual
62	APE2	Application error 2	
63	APE3	Application error 3	
64	APE4	Application error 4	
65	APE5	Application error 5	

Notes

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R912005856

DOK-RCON03-EFC-X610***-QU15-EN-P