

IVS B

Installation and operating instructions

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1 Quick Guide

1.1 Safety

1.1.1 Warnings

⚠WARNING

High Voltage Warning

The voltage of the Adjustable frequency drive is dangerous whenever it is connected to line power. Incorrect installation of the motor or Adjustable frequency drive may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

⚠WARNING

Electrical Hazard

Touching the electrical parts may be fatal - even after the equipment has been disconnected from line power. Also make sure that other voltage inputs have been disconnected (linkage of DC intermediate circuit). Be aware that there may be high voltage on the DC link even when the LEDs are turned off. Before touching any potentially live parts of the Adjustable frequency drive, wait at least as stated in the table below:

Voltage (V)	Power range (HP/kW)	Min. waiting time (minutes)
3 x 200	0.34–5 [0.25–3.7]	4
3 x 200	7.5–15 [5.5–11]	15
3 x 400	0.5–10 [0.37–7.5]	4
3 x 400	15–125 [11–90]	15
3 x 600	3–10 [2.2–7.5]	4
3 x 600	15–125 [11–90]	15

Table 1.1

CAUTION

Leakage Current:

The ground leakage current from the Adjustable frequency drive exceeds 3.5 mA. According to IEC 61800-5-1, a reinforced protective ground connection must be ensured by means of a min. 0.016 in² [10 mm²] Cu or an additional PE wire - with the same cable cross-section as the line power wiring - must be terminated separately.

Residual Current Device:

This product can cause a DC current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also Armstrong Application Note on RCD, MN90GXYY.

Protective grounding of the Adjustable frequency drive and the use of RCDs must always follow national and local regulations.

Motor thermal protection:

Motor overload protection is possible by setting Parameter 1-90 Motor thermal protection to the value Electronic Thermal Relay (ETR) trip.

⚠WARNING

Installation at high altitudes

For altitudes above 6,600 feet [2 km], please contact Armstrong regarding PELV.

1.1.2 Safety Instructions

- Make sure the Adjustable frequency drive is properly grounded.
- Do not remove AC line input connections, motor connections or other power connections while the Adjustable frequency drive is connected to power.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- The ground leakage current exceeds 3.5 mA.
- The [OFF] key is not a safety switch. It does not disconnect the Adjustable frequency drive from line power.

1.2 Introduction

1.2.1 Available Literature

This quick guide contains the basic information necessary for installing and running the Adjustable frequency drive.

1.2.2 Approvals

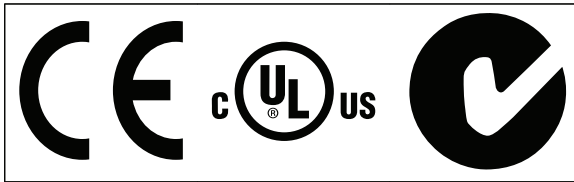


Table 1.2

1.2.3 IT Line Power

CAUTION

IT Line Power

Installation on an isolated line power source, i.e., IT line power.

Max. supply voltage allowed when connected to line power: 440 V (3 x 380–480 V units).

On IP20 200–240 V 0.34–15 hp [0.25–11 kW] and 380–480 V IP20 0.5–30 hp [0.37–22 kW], open the RFI switch by removing the screw on the side of the Adjustable frequency drive when at IT grid.

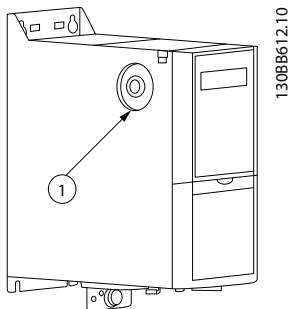


Figure 1.1 IP20 200–240 V 0.34–15 hp [0.25–11 kW], IP20 0.5–30 hp [0.37–22 kW] 380–480 V.

1: EMC screw

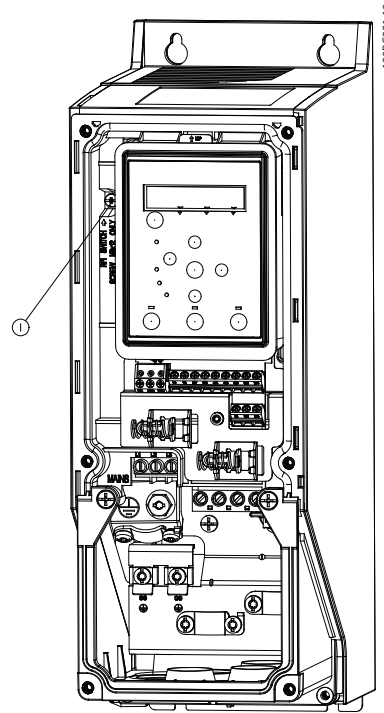


Figure 1.2 IP54 400 V 1–25 hp [0.75–18.5 kW]

1: EMC screw

On all units, set par. 14-50 RFI filter to OFF when operating in IT line power.

CAUTION

If reinserted, only use M3 x 12 screw.

1.2.4 Avoid Unintended Start

While the Adjustable frequency drive is connected to line power, the motor can be started/stopped using digital commands, bus commands, references or via the LCP.

- Disconnect the Adjustable frequency drive from line power whenever personal safety considerations make it necessary to avoid unintended start of any motors.
- To avoid unintended start, always activate the [OFF] key before changing parameters.

1.2.5 Disposal Instructions



Equipment containing electrical components may not be disposed of together with domestic waste.

It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

Table 1.3

Voltage (V)	Power range (HP/kW)	Min. waiting time (minutes)
3 x 200	0.34–5 [0.25–3.7]	4
3 x 200	7.5–60 [5.5–45]	15
3 x 400	0.5–10 [0.37–7.5]	4
3 x 400	15–125 [11–90]	15
3 x 600	3–10 [2.2–7.5]	4
3 x 600	15–125 [11–90]	15

Table 1.4

1.3 Installation

1.3.1 Before Starting Repair Work

1. Disconnect IVS-B from line power (and external DC supply, if present.)
2. Wait as long as indicated in the table below for the DC link to discharge:

3. Remove motor cable

1.3.2 Side-by-Side Installation

The Adjustable frequency drive can be mounted side-by-side and requires the clearance above and below for cooling.

Frame	IP class	Power			Clearance above/ below (mm/inch)
		3 x 200–240 V	3 x 380–480 V	3 x 525–600 V	
H1	IP20	0.25–1.5 kW/0.33–2 HP	0.37–1.5 kW/0.5–2 HP		100/4
H2	IP20	2.2 kW/3 HP	2.2–4 kW/3–5.4 HP		100/4
H3	IP20	3.7 kW/5 HP	5.5–7.5 kW/7.5–10 HP		100/4
H4	IP20	5.5–7.5 kW/7.5–10 HP	11–15 kW/15–20 HP		100/4
H5	IP20	11 kW/15 HP	18.5–22 kW/25–30 HP		100/4
H6	IP20	15–18.5 Kw/20–25 HP	30–45 kW/40–60 HP	22–30 kW/30–40 HP	200/7.9
H7	IP20	22–30 kW/30–40 HP	55–75 kW/100–120 HP	45–55 kW/60–100 HP	200/7.9
H8	IP20	37–45 kW/50–60 HP	90 kW/125 HP	75–90 kW/120–125 HP	225/8.9
H9	IP20			2.2–7.5 kW/3–10 HP	100/4
H10	IP20			11–15 kW/15–20 HP	200/7.9

Table 1.5

NOTE!

With IP21/Nema Type1 option kit mounted, a distance of 2 in [50 mm] between the units is required.

1.3.3 Dimensions

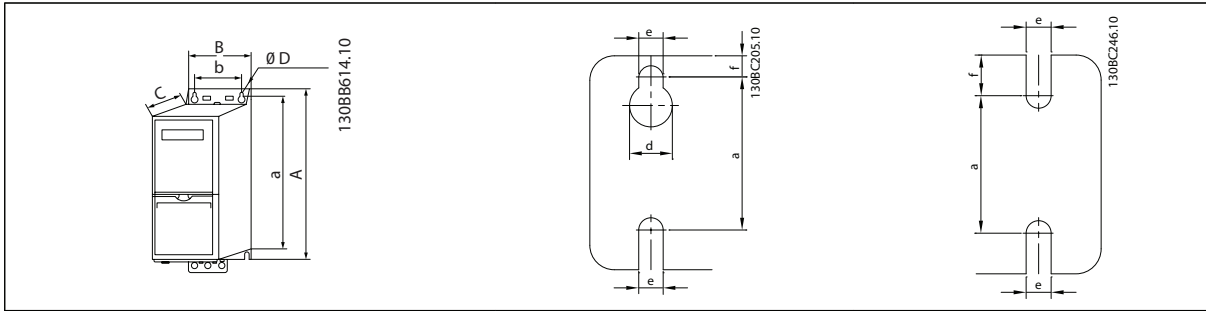


Table 1.6

Enclosure		Power (hp [kW])			Height (in [mm])		Width (in [mm])		Depth (in [mm])	Mounting hole (in [mm])			Max. Weight	
Frame	IP Class	3 x 200–240 V	3 x 380–480 V	3 x 525–600 V	A	"A incl Decoupling Plate"	a	B	b	C	d	e	f	lbs [kg]
H1	IP20	0.34–2 hp [0.25–1.5 kW]	0.5–2 hp [0.37–1.5 kW]		17.68 [195]	10.75 [273]	7.21 [183]	2.95 [75]	2.21 [56]	6.61 [168]	9	0.18 [4.5]	0.21 [5.3]	4.63 [2.1]
H2	IP20	3 hp [2.2 kW]	3–5 hp [2.2–4 kW]		8.94 [227]	11.93 [303]	8.35 [212]	3.54 [90]	2.56 [65]	7.48 [190]	0.43 [11]	0.22 [5.5]	0.29 [7.4]	7.5 [3.4]
H3	IP20	4 hp [3.7 kW]	7.5–10 hp [5.5–7.5 kW]		10.04 [255]	12.95 [329]	9.45 [240]	3.94 [100]	2.91 [74]	8.11 [206]	0.43 [11]	0.22 [5.5]	0.32 [8.1]	9.92 [4.5]
H4	IP20	7.5–10 hp [5.5–7.5 kW]	15–20 hp [11–15 kW]		11.65 [296]	14.13 [359]	10.83 [275]	5.32 [135]	4.13 [105]	9.49 [241]	0.5 [12.6]	0.28 [7]	0.33 [8.4]	17.42 [7.9]
H5	IP20	15 hp [11 kW]	25–30 hp [18.5–22 kW]		11.15 [334]	15.83 [402]	12.36 [314]	5.91 [150]	4.72 [120]	10.04 [255]	0.5 [12.6]	0.28 [7]	0.34 [8.5]	20.94 [9.5]
H6	IP20	20–25 hp [15–18.5 kW]	40–60 hp [30–45 kW]	30–40 hp [22–30 kW]	20.4 [518]	23.43/25 [595/635] (60 hp [45 kW])	19.49 [495]	9.41 [239]	7.87 [200]	9.53 [242]	-	0.34 [8.5]	0.59 [15]	54 [24.5]
H7	IP20	30–40 hp [22–30 kW]	75–100 hp [55–75 kW]	60–75 hp [45–55 kW]	21.65 [550]	24.8/27.17 [630/690] (100 hp [75 kW])	20.51 [521]	12.32 [313]	10.63 [270]	13.19 [335]	-	0.34 [8.5]	0.67 [17]	79.37 [36]
H8	IP20	50–60 hp [37–45 kW]	125 hp [90 kW]	100–125 hp [75–90 kW]	26 [660]	31.5 [800]	24.84 [631]	14.76 [375]	13 [330]	13.19 [335]	-	8.5	17	112.44 [51]
H9	IP20			3–10 hp [2.2–7.5 kW]	10.59 [269]	14.72 [374]	10.19 [257]	5.19 [130]	4.33 [110]	8.07 [205]	0.43 [11]	0.22 [5.5]	9	14.6 [6.6]

Enclosure		Power (hp [kW])		Height (in [mm])		Width (in [mm])		Depth (in [mm])	Mounting hole (in [mm])			Max. Weight	
H10	IP20		15–20 hp [11–15 kW]	15.71 [399]	16.5 [419]	14.96 [380]	6.5 [165]	5.51 [140]	9.76 [248]	0.47 [12]	0.27 [6.8]	0.3 [7.5]	26.5 [12]
I2	IP54		1–5 hp [0.75–4.0 kW]	13.07 [332]	-	12.54 [318.5]	4.53 [115]	2.91 [74]	8.82 [225]	0.43 [11]	0.22 [5.5]	0.35 [9]	11.69 [5.3]
I3	IP54		7.5–10 hp [5.5–7.5 kW]	14.49 [368]	-	13.94 [354]	5.32 [135]	3.5 [89]	9.33 [237]	0.47 [12]	0.26 [6.5]	0.37 [9.5]	15.87 [7.2]
I5	IP54		15–25 hp [11–18.5 kW]	19 [480]	-	17.87 [454]	9.53 [242]	8.27 [210]	10.24 [260]	0.75 [19]	0.35 [9]	0.35 [9]	50.71 [23]
I6	IP54		30–50 hp [22–37 kW]	25.59 [650]	-	24.57 [624]	9.53 [242]	8.27 [210]	10.24 [260]	0.75 [19]	0.35 [9]	0.35 [9]	59.53 [27]
I7	IP54		60–75 hp [45–55 kW]	26.77 [680]	-	25.51 [648]	12.13 [308]	10.71 [272]	12.21 [310]	0.75 [19]	0.35 [9]	0.39 [9.8]	99.21 [45]
I8	IP54		100–125 hp [75–90 kW]	30.32 [770]	-	29.1 [739]	14.57 [370]	11.15 [334]	13.19 [335]	0.75 [19]	0.35 [9]	0.39 [9.8]	143.3 [65]

Table 1.7

The dimensions are only for the physical units, but when installing in an application it is necessary to add space for free air passage both above and below the units. The amount of space for free air passage is listed in *Table 1.8*:

Enclosure		Clearance needed for free air passage (in [mm])	
Frame	IP class	Above unit	Below unit
H1	0.8 [20]	3.94 [100]	3.94 [100]
H2	0.8 [20]	3.94 [100]	3.94 [100]
H3	0.8 [20]	3.94 [100]	3.94 [100]
H4	0.8 [20]	3.94 [100]	3.94 [100]
H5	0.8 [20]	3.94 [100]	3.94 [100]
H6	0.8 [20]	7.87 [200]	7.87 [200]
H7	0.8 [20]	7.87 [200]	7.87 [200]
H8	0.8 [20]	8.82 [225]	8.82 [225]
H9	0.8 [20]	3.94 [100]	3.94 [100]
H10	0.8 [20]	7.87 [200]	7.87 [200]
I2	2.13 [54]	3.94 [100]	3.94 [100]
I3	2.13 [54]	3.94 [100]	3.94 [100]
I5	2.13 [54]	7.87 [200]	7.87 [200]
I6	2.13 [54]	7.87 [200]	7.87 [200]
I7	2.13 [54]	7.87 [200]	7.87 [200]
I8	2.13 [54]	8.82 [225]	8.82 [225]

Table 1.8 Clearance needed for free air passage (in [mm])

1.3.4 Electrical Installation in General

All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. Copper conductors required, (167° F [75°C]) recommended.

Power (HP [kW])				Torque (Nm)					
Frame	IP class	3 x 200–240 V	3 x 380–480 V	Line	Motor	DC connection	Control terminals	Ground	Relay
H1	IP20	0.34–2 [0.25–1.5]	0.5–2 [0.37–1.5]	1.4	0.8	0.8	0.5	0.8	0.5
H2	IP20	3 [2.2]	3–5 [2.2–4]	1.4	0.8	0.8	0.5	0.8	0.5
H3	IP20	5 [3.7]	7.5–10 [5.5–7.5]	1.4	0.8	0.8	0.5	0.8	0.5
H4	IP20	7.5–10 [5.5–7.5]	15–20 [11–15]	1.2	1.2	1.2	0.5	0.8	0.5
H5	IP20	15 [11]	15–30 [18.5–22]	1.2	1.2	1.2	0.5	0.8	0.5
H6	IP20	20–25 [15–18]	40–60 [30–45]	4.5	4.5	-	0.5	3	0.5
H7	IP20	30–40 [22–30]	75 [55]	10	10	-	0.5	3	0.5
H7	IP20	-	100 [75]	14	14	-	0.5	3	0.5
H8	IP20	50–60 [37–45]	90	24 ²	24 ²	-	0.5	3	0.5

Table 1.9

Power (HP [kW])			Torque (Nm)					
Frame	IP class	3 x 380–480 V	Line	Motor	DC connection	Control terminals	Ground	Relay
I2	IP54	1–5 [0.75–4.0]	1.4	0.8	0.8	0.5	0.8	0.5
I3	IP54	7.5–10 [5.5–7.5]	1.4	0.8	0.8	0.5	0.8	0.5
I5	IP54	15–25 [11–18.5]	1.8	1.8	-	0.5	3	0.6
I6	IP54	30–50 [22–37]	4.5	4.5	-	0.5	3	0.6
I7	IP54	60–75 [45–55]	10	10	-	0.5	3	0.6
I8	IP54	100–125 [75–90]	14/24 ¹	14/24 ¹	-	0.5	3	0.6

Table 1.10

Power (HP [kW])			Torque (Nm)					
Frame	IP class	3 x 525–600 V	Line	Motor	DC connection	Control terminals	Ground	Relay
H9	IP20	3–10 [2.2–7.5]	1.8	1.8	not recommended	0.5	3	0.6
H10	IP20	15–20 [11–15]	1.8	1.8	not recommended	0.5	3	0.6
H6	IP20	30–40 [22–30]	4.5	4.5	-	0.5	3	0.5
H7	IP20	60–75 [45–55]	10	10	-	0.5	3	0.5
H8	IP20	100–125 [75–90]	14/24 ¹	14/24 ¹	-	0.5	3	0.5

Table 1.11 Details of Tightening Torques

¹ Cable dimensions $\leq 0.147^2$ [95 mm²]

² Cable dimensions $> 0.147^2$ [95 mm²]

1.3.5 Connecting to Line Power and Motor

The Adjustable frequency drive is designed to operate all standard three-phased asynchronous motors. For maximum cross-section on wires, please see section 1.6 *General Specifications*.

- Use a shielded/armored motor cable to comply with EMC emission specifications, and connect this cable to both the decoupling plate and the motor metal.
 - Keep motor cable as short as possible to reduce the noise level and leakage currents.
 - For further details on mounting of the decoupling plate, please see instruction MI02QXYX
 - Also see *EMC-Correct Installation* in the Design Guide, MG18CXYY.
1. Mount the ground wires to the ground terminal.
 2. Connect the motor to terminals U, V and W.
 3. Mount line power supply to terminals L1, L2 and L3 and tighten.

H1-H5 Frame
 IP20 200–240 V 0.34–15 hp [0.25–11 kW] and IP20 380–480 V 0.5–30 hp [0.37–22 kW].

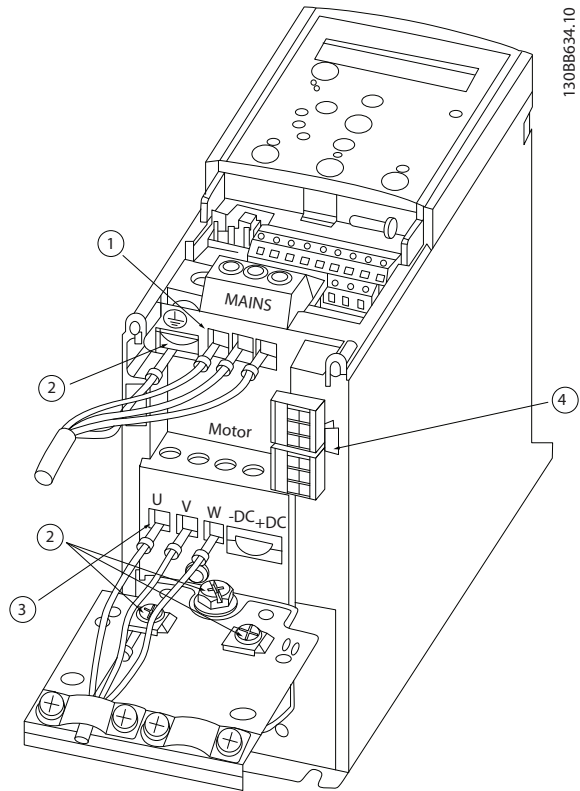


Figure 1.3

1	Line
2	Ground
3	Motor
4	Relays

Table 1.12

H6 Frame

IP20 380–480 V 40–60 hp [30–45 kW]
 IP20 200–240 V 20–25 hp [15–18.5 kW]
 IP20 525–600 V 30–40 hp [22–30 kW]

H7 Frame

IP20 380–480 V 75–100 hp [55–75 kW]
 IP20 200–240 V 30–40 hp [22–30 kW]
 IP20 525–600 V 60–75 hp [45–55 kW]

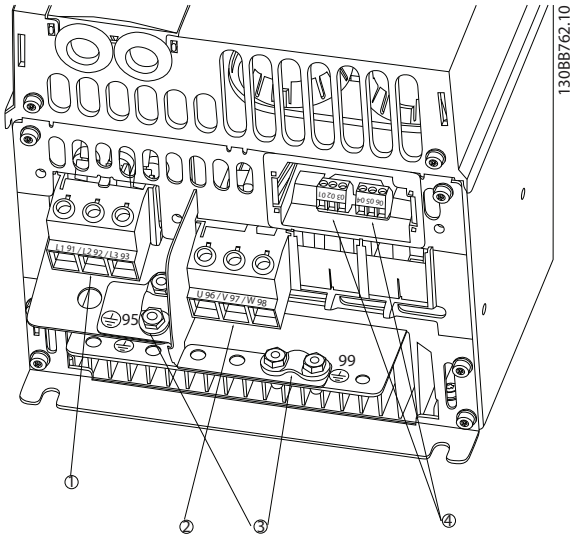


Figure 1.4

1	Line
2	Motor
3	Ground
4	Relays

Table 1.13

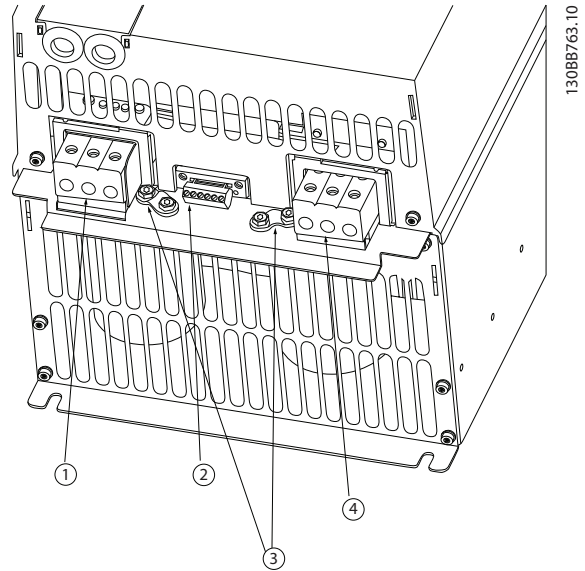


Figure 1.5

1	Line
2	Relays
3	Ground
4	Motor

Table 1.14

H8 Frame

IP20 380-480 V 125 hp [90 kW]

IP20 200-240 V 50-60 hp [37-45 kW]

IP20 525-600 V 100-125 hp [75-90 kW]

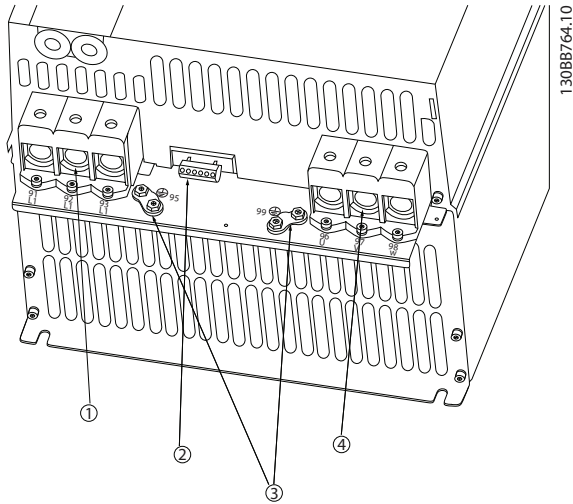


Figure 1.6

1	Line
2	Relays
3	Ground
4	Motor

Table 1.15

H9 Frame

IP20 600 V 3-10 hp [2.2-7.5 kW]

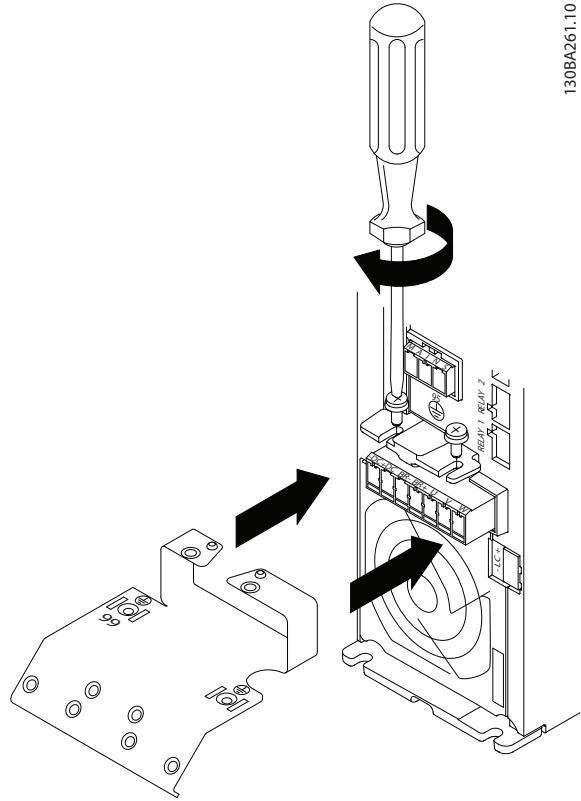


Figure 1.7

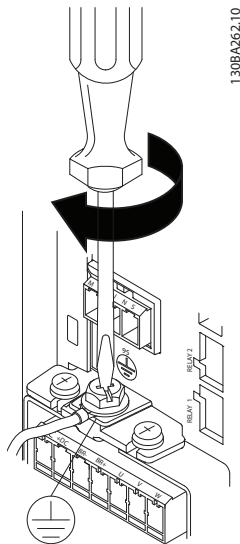
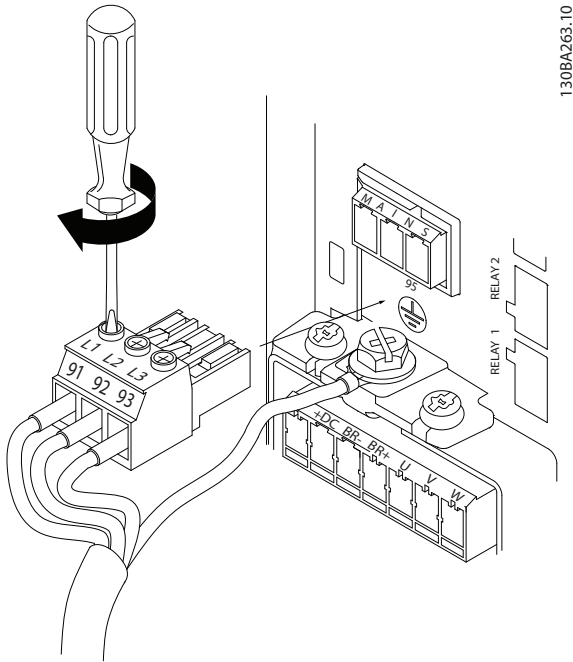


Figure 1.8

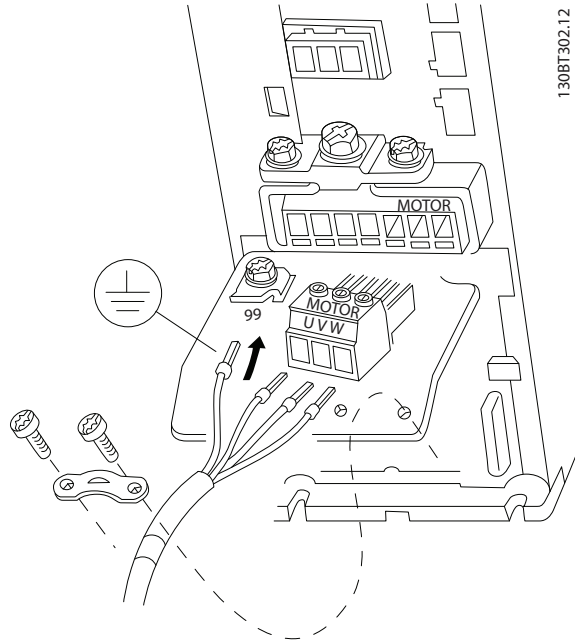
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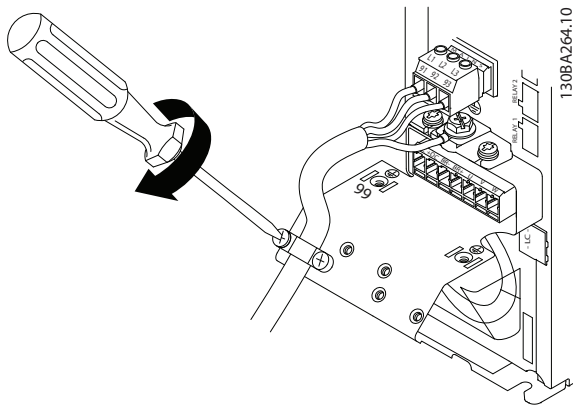
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Figure 1.9



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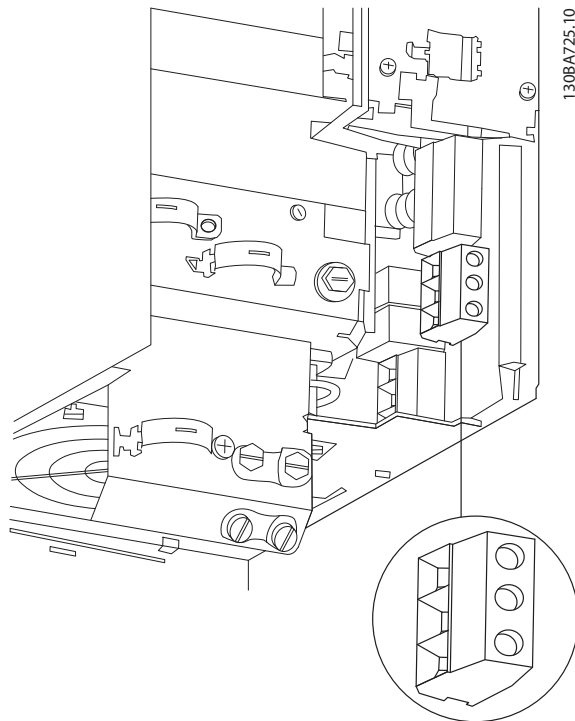
Figure 1.11



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Figure 1.10

H10 Frame
IP20 600 V 15-20 hp [11-15 kW]

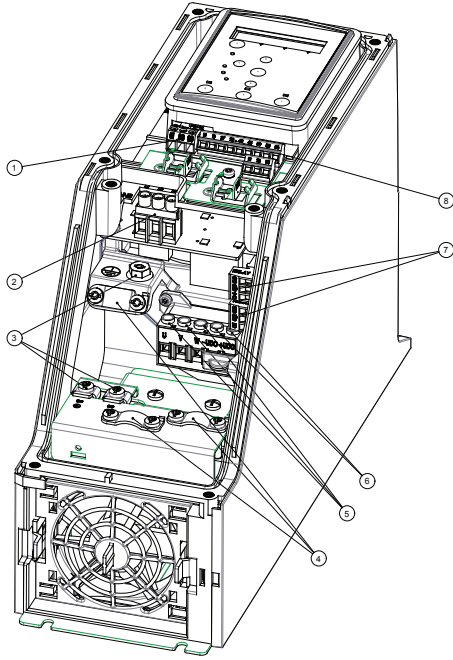


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Figure 1.12

I2 Frame

IP54 380–480 V 1–5 hp [0.75–4.0 kW]



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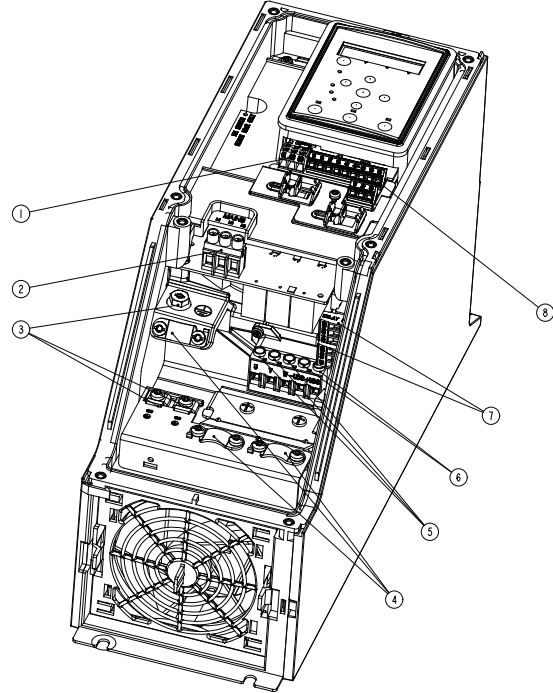
Figure 1.13

1	RS 485
2	Line in
3	Ground
4	Wire clamps
5	Motor
6	UDC
7	Relays
8	I/O

Table 1.16

I3 Frame

IP54 380–480 V 75–100 hp [5.5–7.5 kW]



1.386(C)20110

Figure 1.14

1	RS 485
2	Line in
3	Ground
4	Wire clamps
5	Motor
6	UDC
7	Relays
8	I/O

Table 1.17

IP54 I2-I3 frame

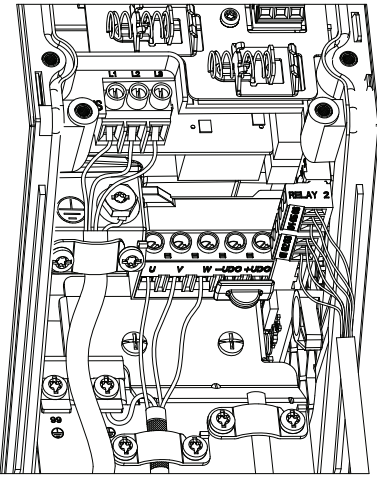


Figure 1.15

I6 Frame

IP54 380-480 V 30-50 hp [22-37 kW]

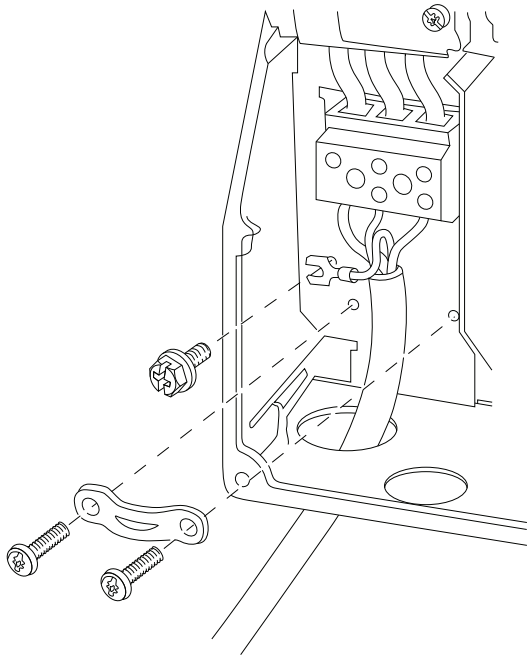


Figure 1.16

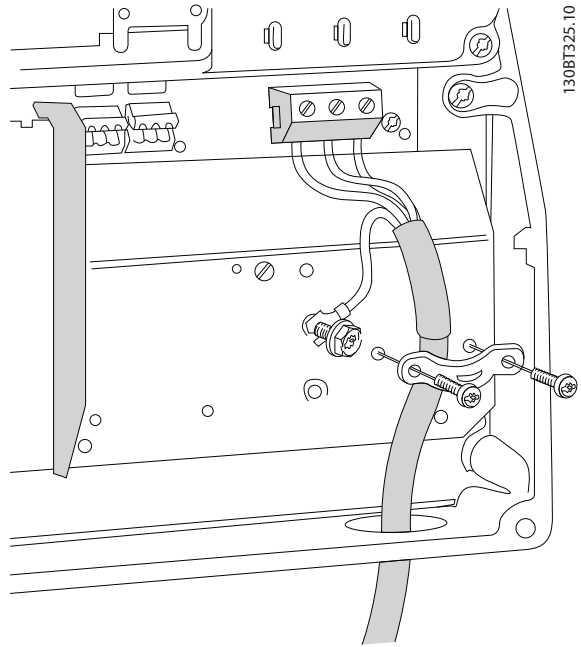


Figure 1.17

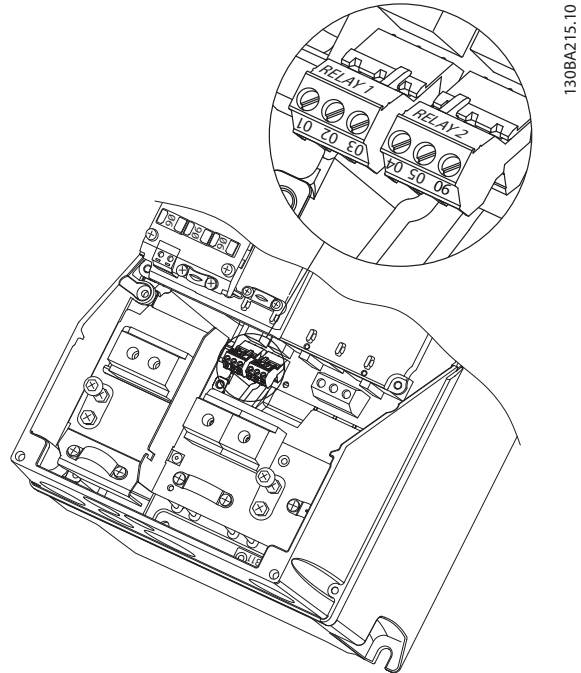


Figure 1.18

I7, I8 Frame

IP54 380-480 V 60-75 hp [45-55 kW]

IP54 380-480 V 100-125 hp [75-90 kW]

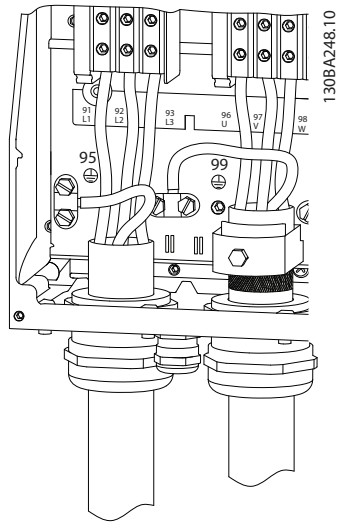


Figure 1.19

1.3.6 Fuses

Branch circuit protection

In order to protect the installation from electrical and fire hazards, all branch circuits in an installation, switch gears, machines etc., must be protected from short-circuits and overcurrents according to national/international regulations.

Short circuit protection

Armstrong recommends using the fuses mentioned in the following tables to protect service personnel or other equipment in case of an internal failure in the unit or short-circuit on DC link. The Adjustable frequency drive provides full short circuit protection in case of a short-circuit on the motor.

Overcurrent protection

Provide overload protection to avoid overheating of the cables in the installation. Overcurrent protection must always be carried out according to national regulations. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 A_{rms} (symmetrical), 480 V maximum.

Non UL compliance

If UL/cUL is not to be complied with, Armstrong recommends using the fuses mentioned in *Table 1.18*, which will ensure compliance with IEC 61800-5-1: In case of malfunction, not following the fuse recommendation may result in damage to the Adjustable frequency drive.

Power HP [kW]	Circuit Breaker		Fuse				
	UL	Non-UL	UL	Bussman		Non-UL	
			Bussman n	Bussman n	Bussman n	Bussman n	Max fuse Type G
			Type RK5	Type RK1	Type J	Type T	Type G
3 x 200–240 V IP20							
0.34 [0.25]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
0.5 [0.37]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
1 [0.75]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
2 [1.5]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
3 [2.2]			FRS-R-15	KTN-R15	JKS-15	JIN-15	16
5 [3.7]			FRS-R-25	KTN-R25	JKS-25	JIN-25	25
7.5 [5.5]			FRS-R-50	KTN-R50	JKS-50	JIN-50	50
10 [7.5]			FRS-R-50	KTN-R50	JKS-50	JIN-50	50
15 [11]			FRS-R-80	KTN-R80	JKS-80	JIN-80	65
20 [15]	Cutler-Hammer EGE3100FFG	Moeller NZMB1-A125	FRS-R-100	KTN-R100			125
25 [18.5]			FRS-R-100	KTN-R100			125
30 [22]	Cutler-Hammer JGE3150FFG	Moeller NZMB1-A160	FRS-R-150	KTN-R150			160
40 [30]			FRS-R-150	KTN-R150			160
50 [37]	Cutler-Hammer JGE3200FFG	Moeller NZMB1-A200	FRS-R-200	KTN-R200			200
60 [45]			FRS-R-200	KTN-R200			200
3 x 380–480 V IP20							
0.5 [0.37]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
1 [0.75]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
2 [1.5]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
3 [2.2]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
4 [3]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
5.4 [4]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
7.5 [5.5]			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
10 [7.5]			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
15 [11]			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
20 [15]			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
25 [18.5]			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
30 [22]			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
40 [30]	Cutler-Hammer EGE3125FFG	Moeller NZMB1-A125	FRS-R-80	KTS-R80	JKS-R80	JJS-R80	80
50 [37]			FRS-R-100	KTS-R100	JKS-R100	JJS-R100	100
60 [45]			FRS-R-125	KTS-R125	JKS-R125	JJS-R125	125
75 [55]	Cutler-Hammer JGE3200FFG	Moeller NZMB1-A200	FRS-R-150	KTS-R150	JKS-R150	JJS-R150	150
100 [75]			FRS-R-200	KTS-R200	JKS-R200	JJS-R200	200
125 [90]	Cutler-Hammer JGE3250FFG	Moeller NZMB2-A250	FRS-R-250	KTS-R250	JKS-R250	JJS-R250	250

Table 1.18

Power HP [kW]	Circuit Breaker		Fuse				
	UL	Non-UL	UL	Bussman			Non-UL
			Bussman n Type RK5	Bussman n Type RK1	Bussman n Type J	Bussman n Type T	Max fuse Type G
3 x 525–600 V IP20							
2.2				KTS-R20			20
4 [3]				KTS-R20			20
5.5				KTS-R20			20
10 [7.5]				KTS-R20			30
11				KTS-R30			35
20 [15]				KTS-R30			35
30 [22]	Cutler-Hammer	Cutler-Hammer	FRS-R-80	KTN-R80			80
40 [30]	EGE3080FFG	EGE3080FFG	FRS-R-80	KTN-R80			80
60 [45]	Cutler-Hammer	Cutler-Hammer	FRS-R-125	KTN-R125			125
75 [55]	JGE3125FFG	JGE3125FFG	FRS-R-125	KTN-R125			125
100 [75]	Cutler-Hammer	Cutler-Hammer	FRS-R-200	KTN-R200			200
125 [90]	JGE3200FAG	JGE3200FAG	FRS-R-200	KTN-R200			200
3 x 380–480 V IP54							
0.75							
1.5							
2.2							
3							
4							
5.5							
7.5							
11							
15							
18.5							
22							125
30	Moeller NZMB1-A125						125
37							125
45	Moeller NZMB2-A160						160
55							160
75	Moeller NZMB2-A250						200
90							200

Table 1.19 Fuses

1.3.7 EMC-compliant Electrical Installation

General points to be observed to ensure EMC-compliant electrical installation.

- Use only shielded/armored motor cables and shielded/armored control cables.
- Connect the shield to ground at both ends.
- Avoid installation with twisted shield ends (pigtailed), since this ruins the shielding effect at

high frequencies. Use the cable clamps provided instead.

- It is important to ensure good electrical contact from the installation plate through the installation screws to the metal cabinet of the Adjustable frequency drive.
- Use star-washers and galvanically grounding plates.
- Do not use shielded/armored motor cables in the installation cabinets.

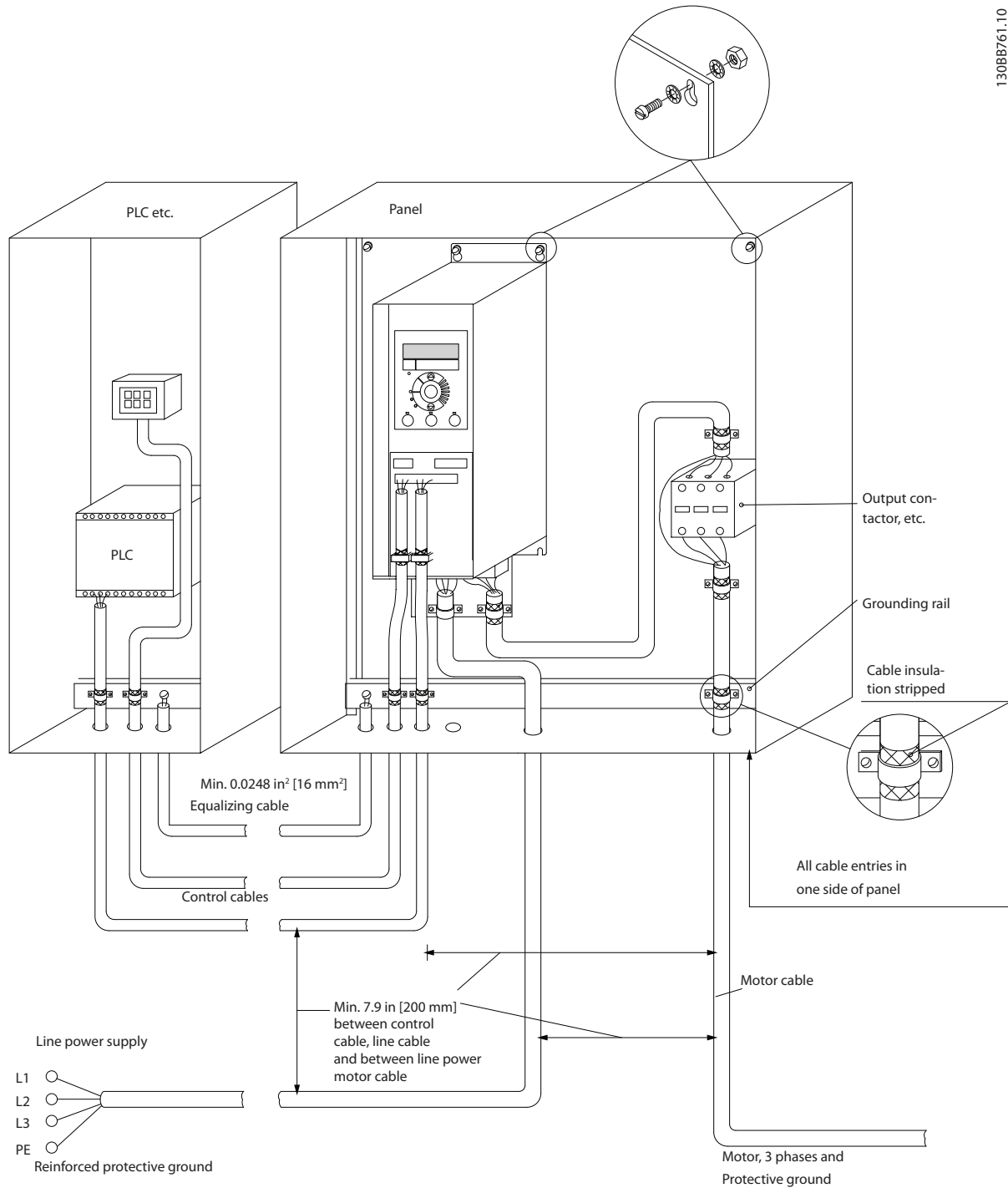


Figure 1.20 EMC-compliant Electrical Installation

For North America, use metal conduits instead of shielded cables.

1.3.8 Control Terminals

IP20 200–240 V 0.34–15 hp [0.25–11 kW] and IP20 380–480 V 0.5–30 hp [0.37–22 kW]:

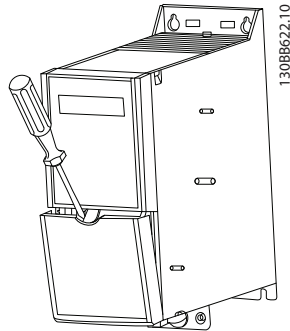


Figure 1.21 Location of Control Terminals

1. Place a screwdriver behind the terminal cover to activate snap.
2. Tilt the screwdriver outwards to open the cover.

IP20 380–480V 40–125 hp [30–90kW].

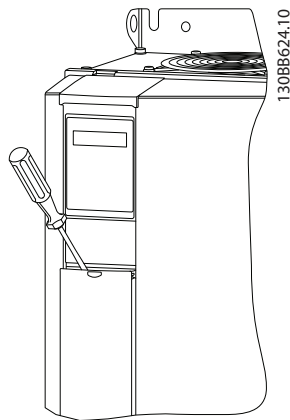


Figure 1.22

1. Place a screwdriver behind the terminal cover to activate snap.
2. Tilt the screwdriver outwards to open the cover.

Digital input 18, 19 and 27 mode is set in 5-00 *Digital Input Mode* (PNP is default value) and digital input 29 mode is set in 5-03 *Digital Input 29 Mode* (PNP is default value).

IP54 400 V 1–10 hp [0.75–7.5 kW]

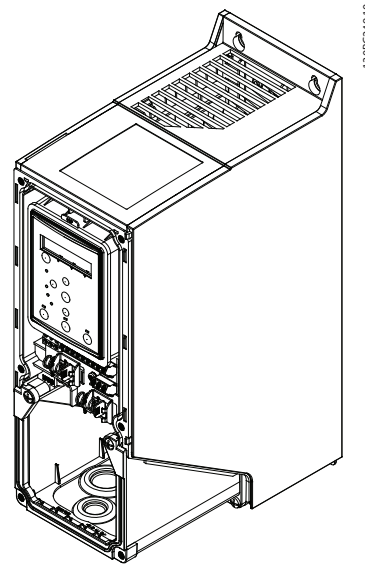


Figure 1.23

1. Remove the front cover.

Control terminals:

Figure 1.24 shows all control terminals of the Adjustable frequency drive. Applying Start (term. 18), connection between terminal 12-27 and an analog reference (term. 53 or 54 and 55) make the Adjustable frequency drive run.

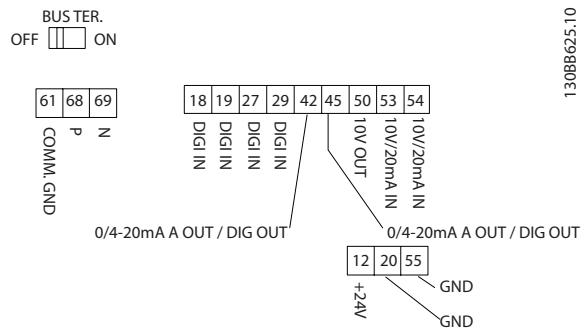


Figure 1.24 Control Terminals

1.3.9 Electrical Overview

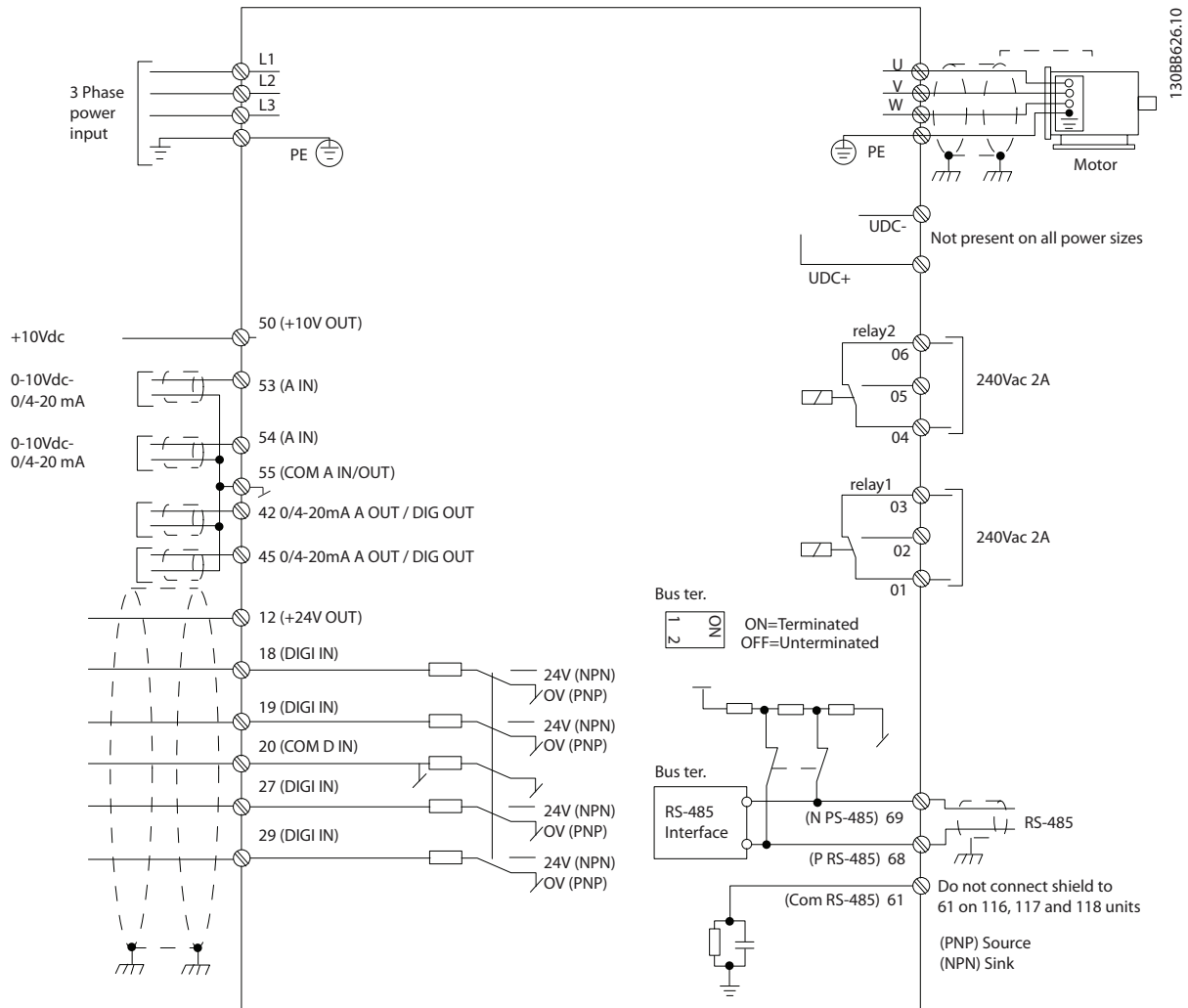


Figure 1.25

NOTE!

Please note there is no access to UDC- and UDC+ on the following units:

IP20 380–480 V 40–125 hp [30–90 kW]

IP20 200–240 V 20–60 hp [15–45 kW]

IP20 525–600 V 3–125 hp [2.2–90 kW]

IP54 380–480 V 30–125 hp [22–90 kW]

1.4 Programming

1.4.1 Programming with the Local Control Panel (LCP)

NOTE!

The Adjustable frequency drive can also be programmed from a PC via RS485 com-port by installing the MCT-10 Set-up Software.

1.4.2 Local Control Panel (LCP)

The following instructions are valid for the IVS-B LCP. The LCP is divided into four functional sections.

- A. Alphanumeric display
- B. Menu key
- C. Navigation keys and LEDs
- D. Operation keys and LEDs

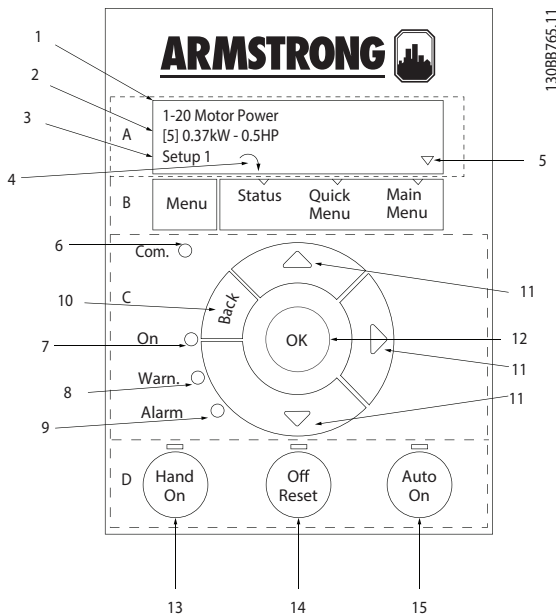


Figure 1.26

A. Alpha Numeric Display

The LCD display is back-lit with 2 alpha-numeric lines. All data is displayed on the LCP.

Certain information can be read from the display.

1	Parameter number and name.
2	Parameter value.
3	Set-up number shows the active set-up and the edit set-up. If the same set-up acts as both the active and edit set-up, only that set-up number is shown (factory setting). When the active and edit set-up differ, both numbers are shown in the display (Set-up 12). The flashing number indicates the edit set-up.
4	Motor direction is shown to the bottom left of the display – indicated by a small arrow pointing either clockwise or counter-clockwise.
5	The triangle indicates if the LCP is in status quick menu or main menu.

Table 1.20

B. Menu Key

Use the menu key to select between status quick menu or main menu.

C. Navigation keys and LEDs

6	Com led: Flashes when bus communication is communicating.
7	Green LED/On: Control section is working.
8	Yellow LED/Warn.: Indicates a warning.
9	Flashing Red LED/Alarm: Indicates an alarm.
10	[Back]: For moving to the previous step or layer in the navigation structure
11	Arrows [▲] [▼]: For navigating between parameter groups, parameters and within parameters. Can also be used for setting local reference.
12	[OK]: For selecting a parameter and for accepting changes to parameter settings

Table 1.21

D. Operation keys and LEDs

13	[Hand On]: Starts the motor and enables control of the Adjustable frequency drive via the LCP. NOTE! Please note that terminal 27 Digital Input (5-12 Terminal 27 Digital Input) has coast inverse as default setting. This means that [Hand On] will not start the motor if there is no 24 V to terminal 27, so please connect terminal 12 to terminal 27.
14	[Off/Reset]: Stops the motor (off). If in alarm mode the alarm will be reset.
15	[Auto On]: Adjustable frequency drive is controlled either via control terminals or serial communication.

Table 1.22

At power-up

At the first power-up, the user is asked to choose the preferred language. Once selected, this screen will never be shown again in the following power-ups, but the language can still be changed in *0-01 Language*.

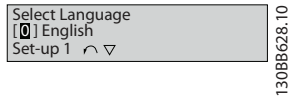


Figure 1.27

1.4.3 The Start-up Wizard for Open-loop Applications

The built-in “wizard” menu guides the installer through the setup of the drive in a clear and structured manner in order to set up an open-loop application. An open-loop application is here an application with a start signal, analog reference (voltage or current) and optionally also relay signals (but no feedback signal from the process applied).

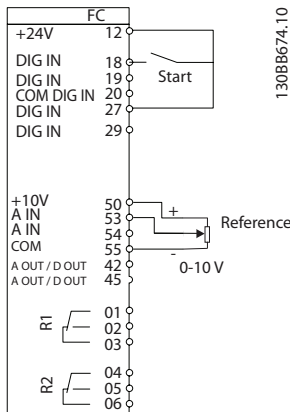


Figure 1.28

The wizard will initially be shown after power-up until any parameter has been changed. The wizard can always be accessed again through the Quick Menu. Press [OK] to start the wizard. If [BACK] is pressed, the IVS-B will return to the status screen.

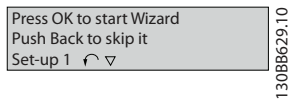
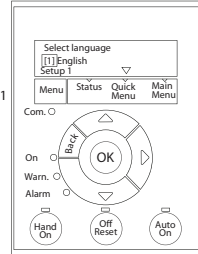


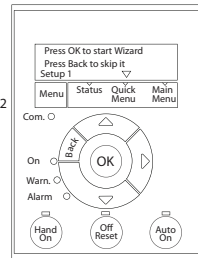
Figure 1.29

At power up the user is asked to choose the preferred language.

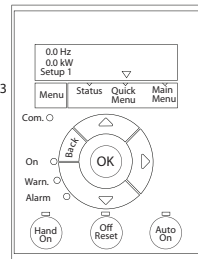


Power Up Screen

The next screen will be the Wizard screen.



Wizard Screen



Status Screen

The Wizard can always be reentered via the Quick Menu!

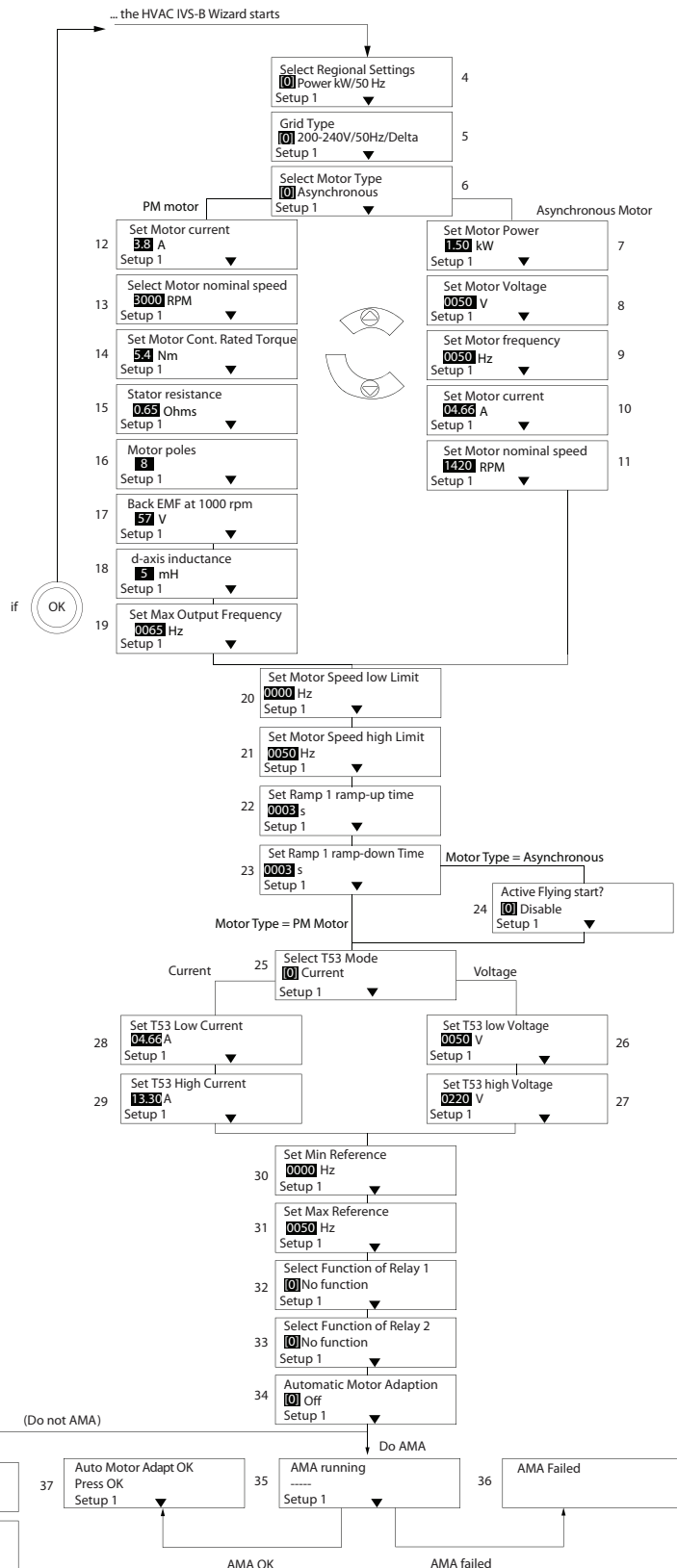


Figure 1.30

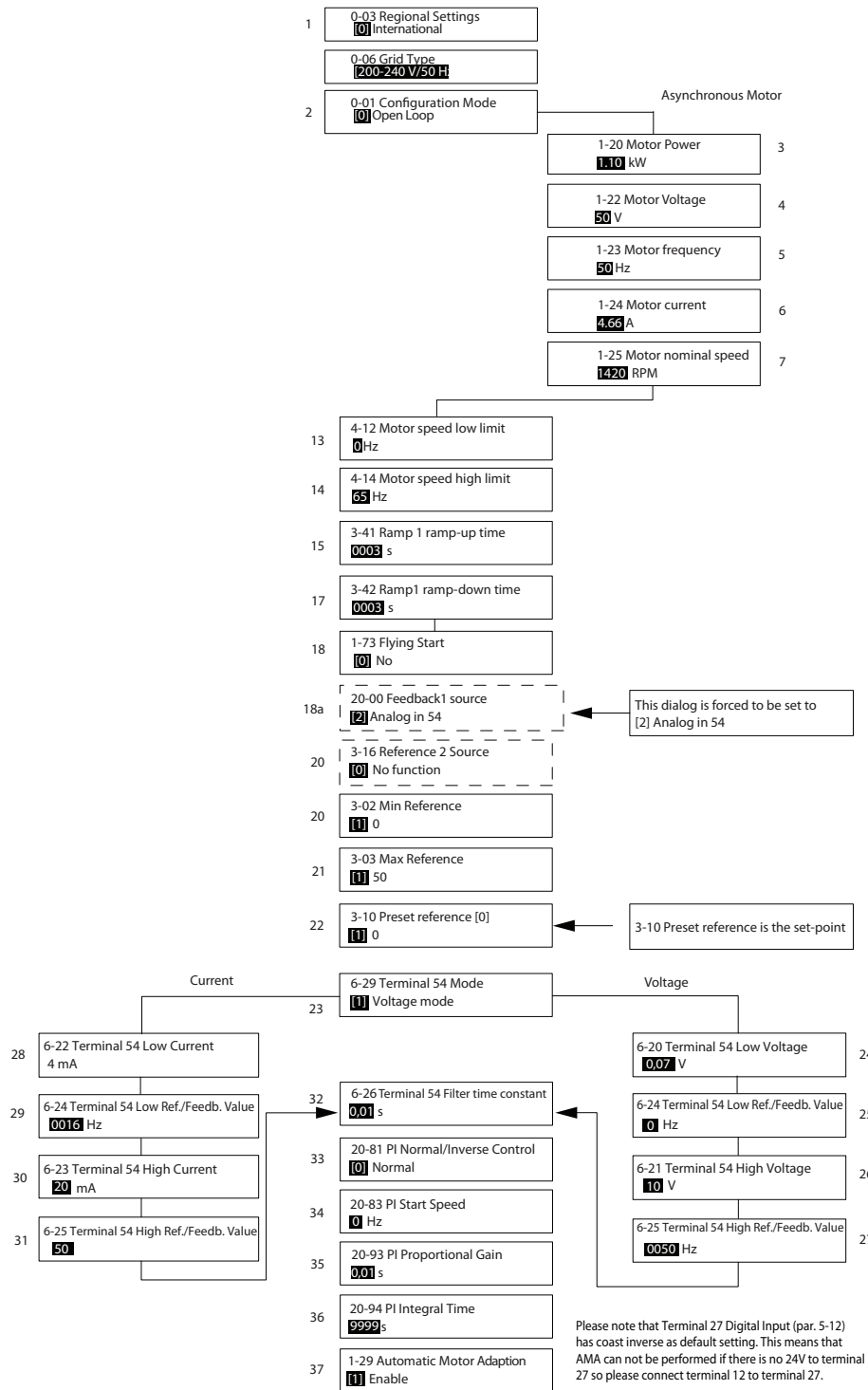
The IVS-B Start-up Wizard for Open-loop Applications

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
0-06 Grid Type	[0] 200–240 V/50 Hz/IT grid [1] 200–240 V/50 Hz/Delta [2] 200–240 V/50 Hz [10] 380–440 V/50 Hz/IT grid [11] 380–440 V/50 Hz/Delta [12] 380–440 V/50 Hz [20] 440–480 V/50 Hz/IT grid [21] 440–480 V/50 Hz/Delta [22] 440–480 V/50 Hz [30] 525–600 V/50 Hz/IT grid [31] 525–600 V/50 Hz/Delta [32] 525–600 V/50 Hz [100] 200–240 V/60 Hz/IT grid [101] 200–240 V/60 Hz/Delta [102] 200–240 V/60 Hz [110] 380–440 V/60 Hz/IT grid [111] 380–440 V/60 Hz/Delta [112] 380–440 V/60 Hz [120] 440–480 V/60 Hz/IT grid [121] 440–480 V/60 Hz/Delta [122] 440–480 V/60 Hz [130] 525–600 V/60 Hz/IT grid [131] 525–600 V/60 Hz/Delta [132] 525–600 V/60 Hz	Size related	Select operating mode for restart upon reconnection of the drive to AC line voltage after power-down
1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0–400 Hz	0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0.0–400 Hz	65 Hz	Enter the maximum limit for high speed
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 s	Size related	Ramp-up time from 0 to rated 1-23 Motor Frequency
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated 1-23 Motor Frequency to 0
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the Adjustable frequency drive to catch a spinning motor, i.e., fan applications
6-19 Terminal 53 mode	[0] Current [1] Voltage	1	Select if terminal 53 is used for current or voltage input.
6-10 Terminal 53 Low Voltage	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
6-11 Terminal 53 High Voltage	0–10 V	10 V	Enter the voltage that corresponds to the high reference value.
6-12 Terminal 53 Low Current	0–20 mA	4	Enter the current that corresponds to the low reference value.

No & Name	Range	Default	Function
6-13 Terminal 53 High Current	0-20 mA	20	Enter the current that corresponds to the high reference value.
3-02 Minimum Reference	-4,999–4,999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	-4,999–4,999	50	The maximum reference is the lowest obtainable by summing all references.
5-40 Function Relay [0] Function relay	See <i>5-40 Function Relay</i>	Alarm	Select the function to control output relay 1.
5-40 Function Relay [1] Function relay	See <i>5-40 Function Relay</i>	Drive running	Select the function to control output relay 2.
1-29 Automatic Motor Adaption (AMA)	See <i>1-29 Automatic Motor Adaption (AMA)</i>	Off	Performing an AMA optimizes motor performance

Table 1.23

Closed-loop Set-up Wizard



1308C245.10

Figure 1.31

Closed-loop Set-up Wizard

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
0-06 Grid Type	[0]-[[132] Please see start-up wizard for open-loop application	Size selected	Select operating mode for restart upon reconnection of the Adjustable frequency drive to AC line voltage after power-down
1-20 Motor power	0.125–150 hp [0.09–110 kW]	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0–400 Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0.1–400 Hz	65 Hz	Enter the maximum limit for high speed
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 s	Size related	Ramp-up time from 0 to rated motor frequency parameter 1-23
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated motor frequency parameter 1-23 to 0
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the drive to catch a spinning motor.
3-02 Minimum Reference	-4,999–4,999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	-4,999–4,999	50	The maximum reference is the highest value obtainable by summing all references.
3-10 Preset Reference	-100–100%	0	Enter the setpoint.
6-29 Terminal 54 mode	[0] Current [1] Voltage	1	Select if terminal 54 is used for current or voltage input
6-20 Terminal 54 Low Voltage	0–10 V	0.07V	Enter the voltage that corresponds to the low reference value.
6-21 Terminal 54 High Voltage	0–10 V	10V	Enter the voltage that corresponds to the low high reference value.
6-22 Terminal 54 Low Current	0–20 mA	4	Enter the current that corresponds to the high reference value.
6-23 Terminal 54 High Current	0–20 mA	20	Enter the current that corresponds to the high reference value.
6-24 Terminal 54 Low Ref./ Feedb. Value	-4,999–4,999	0	Enter the feedback value that corresponds to the voltage or current set in parameter 6-20/6-22
6-25 Terminal 54 High Ref./ Feedb. Value	-4,999–4,999	50	Enter the feedback value that corresponds to the voltage or current set in parameter 6-21/6-23
6-26 Terminal 54 Filter Time Constant	0–10 s	0.01	Enter the filter time constant.
20-81 PI Normal/Inverse control	[0] Normal [1] Inverse	0	Select <i>Normal</i> [0] to set the process control to increase the output speed when the process error is positive. Select <i>Inverse</i> [1] to reduce the output speed.
20-83 PI Start Speed	0–200 Hz	0	Enter the motor speed to be attained as a start signal for commencement of PI control.
20-93 PI Proportional Gain	0–10	0.01	Enter the process controller proportional gain. Quick control is obtained at high amplification. However if amplification is too great, the process may become unstable.
20-94 PI Integral Time	0.1–999.0 s	999.0 s	Enter the process controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action.
1-29 Automatic Motor Adaption (AMA)		Off	Performing an AMA optimizes motor performance

Table 1.24

Motor Set-up

The Quick Menu Motor Set-up guides you through the needed motor parameters.

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
0-06 Grid Type	[0]-[132] Please see start-up wizard for open-loop application	Size selected	Select operating mode for restart upon reconnection of the Adjustable frequency drive to AC line voltage after power-down
1-20 Motor power	0.12–110 kW/ 0.16–150 HP	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0–400 Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0–400 Hz	65	Enter the maximum limit for high speed
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 s	Size related	Ramp-up time from 0 to rated motor frequency <i>1-23 Motor Frequency</i>
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated motor frequency <i>1-23 Motor Frequency</i> to 0

No & Name	Range	Default	Function
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the Adjustable frequency drive to catch a spinning motor

Table 1.25**Changes Made**

Changes Made lists all parameters changed since factory setting. Only the changed parameters in current edit-setup are listed in changes made.

If the parameter's value is changed back to the factory setting value from another different value, the parameter will NOT be listed in Changes Made.

1. Press [Menu] key to enter the Quick Menu until indicator in display is placed above Quick Menu.
2. Press [▲] [▼] to select either IVS-B wizard, closed-loop set-up, motor set-up or changes made, then press [OK].
3. Press [▲] [▼] to browse through the parameters in the Quick Menu.
4. Press [OK] to select a parameter.
5. Press [▲] [▼] to change the value of a parameter setting.
6. Press [OK] to accept the change.
7. Press either [Back] twice to enter "Status", or press [Menu] once to enter "Main Menu".

The Main Menu accesses all parameters.

1. Press [Menu] key until indicator in display is placed above "Main Menu".
2. Use [▲] [▼] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Use [▲] [▼] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Use [▲] [▼] to set/change the parameter value.

1.5.1 Parameter Overview

Parameter Overview			
0-** Operation / Display	0-11 Programming Set-up	0.00–1,000,000.0, * 0.00	[7] 0.75 kW–1.00 HP
0-0* Basic Settings	[1] Set-up 1	0-32 Custom Readout Max Value	[8] 1.10 kW–1.50 HP
0-01 Language	[2] Set-up 2	0.00–1,000,000.0, * 100.00	[9] 1.50 kW–2.00 HP
*[0] English	*[9] Active Set-up	0-37 Display Text 1	[10] 2.20 kW–3.00 HP
[1] Deutsch	0-12 Link Set-ups	0-38 Display Text 2	[11] 3.00 kW–4.00 HP
[2] Francais	[0] Not linked	0-39 Display Text 3	[12] 3.70 kW–5.00 HP
[3] Dansk	*[20] Linked	0-4* LCP Keypad	[13] 4.00 kW–5.40 HP
[4] Espanol	0-3* LCP Readout	0-40 [Hand on] Key on LCP	[14] 5.50 kW–7.50 HP
[5] Italiano	0-30 Custom Readout Unit	[0] Disabled	[15] 7.50 kW–10.0 HP
[28] Portuguese	[0] None	*[1] Enabled	[16] 11.00 kW–15.00 HP
[255] No Text	*[1] %	0-42 [Auto on] Key on LCP	[17] 15.00 kW–20 HP
0-03 Regional Settings	[5] PPM	[0] Disabled	[18] 18.5 kW–25 HP
*[0] International	[10] 1/Min	*[1] Enabled	[19] 22 kW–30 HP
[1] US	[11] RPM	0-44 [Off / Reset] Key on LCP	[20] 30 kW–40 HP
0-04 Operating State at Power-up	[12] Pulse/s	[0] Disable All	[21] 37 kW–50 HP
*[0] Resume	[20] l/s	*[1] Enable All	[22] 45 kW–60 HP
[1] Forced stop, ref=old	[21] l/min	[7] Enable Reset Only	[23] 55 kW–75 HP
0-06 GridType	[22] l/h	0-5* Copy/Save	[24] 75 kW–100 HP
[0] 200–240 V/50 Hz/IT grid	[23] m3/s	0-50 LCP Copy	[25] 90 kW–120 HP
[1] 200–240 V/50 Hz/Delta	[24] m3/min	*[0] No copy	[26] 110 kW–150 HP
[2] 200–240 V/50 Hz	[25] m3/h	[1] All to LCP	1-22 Motor Voltage
[10] 380–440 V/50 Hz/IT grid	[30] kg/s	[2] All from LCP	50–1,000 V
[11] 380–440 V/50 Hz/Delta	[31] kg/min	[3] Size indep. from LCP	1-23 Motor Frequency
[12] 380–440 V/50 Hz	[32] kg/h	0-51 Set-up Copy	20–400, *(50) Hz
[20] 440–480 V/50 Hz/IT grid	[33] t/min	*[0] No copy	1-24 Motor Current
[21] 440–480 V/50 Hz/Delta	[34] t/h	[1] Copy from set-up 1	0.01–(26.00), [A]
[22] 440–480 V/50 Hz	[40] m/s	[2] Copy from set-up 2	1-25 Motor Nominal Speed
[30] 525–600 V/50 Hz/IT grid	[41] m/min	[9] Copy from Factory Setup	100–6,000 rpm,
[31] 525–600 V/50 Hz/Delta	[45] m	0-6* Password	1-29 Automatic Motor Adaption (AMA)
[32] 525–600 V/50 Hz	[60] Degree Celsius	0-60 Main Menu Password	*[0] Off
[100] 200–240 V/60 Hz/IT grid	[70] mbar	0–999, * 0	[1] Enable Complete AMA
[101] 200–240 V/60 Hz/Delta	[71] bar	1-** Load and Motor	[2] Enable Reduced AMA
[102] 200–240 V/60 Hz	[72] Pa	1-0* General Settings	1-3* Adv. Motor Data I
[110] 380–440 V/60 Hz/IT grid	[73] kPa	1-00 Configuration Mode	1-30 Stator Resistance (Rs)
[111] 380–440 V/60 Hz/Delta	[74] m Wg	*[0] Open-loop	0.000–99.990 ohm
[112] 380–440 V/60 Hz	[80] kW	[3] Close-loop	1-33 Stator Leakage Reactance (X1)
[120] 440–480 V/60 Hz/IT grid	[120] GPM	1-01 Motor Control Principle	0.000–999.900 ohm
[121] 440–480 V/60 Hz/Delta	[121] gal/s	[0] U/f	1-35 Main Reactance (Xh)
[122] 440–480 V/60 Hz	[122] gal/min	*[1] VVC+	0.00–999.90 ohm
[130] 525–600 V/60 Hz/IT grid	[123] gal/h	1-03 Torque Characteristics	1-39 Motor Poles
[131] 525–600 V/60 Hz/Delta	[124] CFM	*[1] Variable torque	2–100, * 4
[132] 525–600 V/60 Hz	[127] ft3/h	[3] Auto Energy Optim.	1-4* Adv. Motor Data II
0-07 Auto DC Braking IT	[140] ft/s	1-06 Clockwise Direction	1-42 Motor Cable Length
[0] Off	[141] ft/min	*[0] Normal	0–150, * 50m
*[1] On	[160] Degree Fahr	[1] Inverse	1-43 Motor Cable Length Feet
0-1* Set-up Operations	[170] psi	1-20 Motor Power	0–431, * 144
0-10 Active Set-up	[171] lb/in2	[2] 0.12 kW–0.16 HP	1-5* Load Indep. Setting
*[1] Set-up 1	[172] in WG	[3] 0.18 kW–0.25 HP	
[2] Set-up 2	[173] ft WG	[4] 0.25 kW–0.33 HP	
[9] Multi Set-up	[180] HP	[5] 0.37 kW–0.50 HP	
	0-31 Custom Readout Min Value	[6] 0.55 kW–0.75 HP	

Table 1.26

Parameter Overview			
1-50 Motor Magnetization at Zero Speed 0–300, * 100% 1-52 Min Speed Normal Magnetizing [Hz] 0.0–10.0, * 0.0 1-55 U/f Characteristic - U 0–999 V, *0V 1-56 U/f Characteristic - F 0–400 Hz, *(0) 1-6* Load Depend. Setting 1-62 Slip Compensation -400–399%, * 0% 1-63 Slip Compensation Time Constant 0.05–5.00 s, * 0.10 1-64 Resonance Dampening 0–500%, * 100 1-65 Resonance Dampening Time Constant 0.001–0.050 s, * 0.005 1-7* Start Adjustments 1-71 Start Delay 0.0–10.0 s, * 0.0 1-72 Start Function [0] DC Hold/delay time *[2] Coast/delay time 1-73 Flying Start *[0] Disabled [1] Enabled 1-8* Stop Adjustments 1-80 Function at Stop *[0] Coast [1] DC hold/MotorPreheat 1-82 Min Speed for Function at Stop [Hz] 0.0–20.0 Hz, * 0.0 1-9* Motor Temperature 1-90 Motor Thermal Protection *[0] No protection [1] Thermistor warning [2] Thermistor trip [3] ETR warning 1 [4] ETR trip 1 1-93 Thermistor Resource *[0] None [1] Analog input 53 [6] Digital input 29 2-** Brakes 2-0* DC Brake 2-00 DC Hold/Motor Preheat Current 0–160%, * 50 2-01 DC Brake Current	0–150%, * 50 2-02 DC Braking Time 0.0–60.0 s, * 10.0 2-04 DC Brake Cut-in Speed 0.0–400.0 Hz, * 0.0 2-1* Brake Energy Funct. 2-17 Over-voltage Control [0] Disabled *[2] Enabled 3-** Reference / Ramps 3-0* Reference Limits 3-02 Minimum Reference (-4,999.000)–4,999.000, * 0.000 3-03 Maximum Reference (-4,999.000)–4,999.000, * 50.000 3-1* References 3-10 Preset Reference -100.00–100.00%, * 0.00 3-11 Jog Speed [Hz] 0.0–400.0 Hz, * 5.0 3-14 Preset Relative Reference -100.00–100.00, * 0.00 3-15 Reference Resource 1 [0] No function *[1] Analog in 53 [2] Analog in 54 [11] Local bus reference 3-16 Reference 2 Resource [0] No function [1] Analog in 53 *[2] Analog in 54 [11] Local bus reference 3-17 Reference 3 Resource [0] No function [1] Analog in 53 [2] Analog in 54 *[11] Local bus reference 3-4* Ramp 1 3-41 Ramp 1 Ramp-up Time 0.05–3,600.00 s, *Size related 3-42 Ramp 1 Ramp-down Time 0.05–3,600.00 s, *Size related 3-5* Ramp 2 3-51 Ramp 2 Ramp-up Time 0.05–3,600.00 s, *Size related 3-52 Ramp 2 Ramp-down Time 0.05–3,600.00 s, *Size related 3-8* Other Ramps 3-80 Jog Ramp Time 0.05–3,600.00 s, *Size related 3-81 Quick Stop Ramp Time 0.05–3,600.00 s, *Size related	4-** Limits / Warnings 4-1* Motor Limits 4-10 Motor Speed Direction [0] Clockwise *[2] Both directions 4-12 Motor Speed Low Limit [Hz] 0.0–400 Hz, * 0.0 Hz 4-14 Motor Speed High Limit [Hz] 0.1–400 Hz, * 65.0 Hz 4-18 Current Limit 0–300%, * 110 4-19 Max Output Frequency 0.0–400.0 Hz, * 65.0 4-4* Adj. Warnings 2 4-40 Warning Freq. Low 0.0–400.0 Hz, *400.0 4-41 Warning Freq. High 0.0–400.0 Hz, *400.0 4-5* Adj. Warnings 4-50 Warning Current Low 0.00–194.00 A, * 0.00 4-51 Warning Current High 0.00–194.00 A, * 194.00 4-54 Warning Reference Low -4,999.000–4,999.000, *-4,999.000 4-55 Warning Reference High -4,999.000–4,999.000, *4,999.000 4-56 Warning Feedback Low -4,999.000–4,999.000, *-4,999.000 4-57 Warning Feedback High -4,999.000–4,999.000, *4,999.000 4-58 Missing Motor Phase Function [0] Off *[1] On 4-6* Speed Bypass 4-61 Bypass Speed From [Hz] 0.0–400.0, * 0.0 4-63 Bypass Speed To [Hz] 0.0–400.0, * 0.0 4-64 Semi-Auto Bypass Set-up *[0] Off [1] Enable 5-** Digital In/Out 5-0* Digital I/O mode 5-00 Digital Input Mode *[0] PNP [1] NPN 5-03 Digital Input 29 Mode *[0] PNP [1] NPN	5-1* Digital Inputs 5-10 Terminal 18 Digital Input [0] No operation [1] Reset [2] Coast inverse [3] Coast and reset inverse [4] Quick stop inverse [5] DC brake inverse [6] Stop inverse [7] External Interlock *[8] Start [9] Latched start [10] Reversing [11] Start reversing [14] Jog [16] Preset ref bit 0 [17] Preset ref bit 1 [18] Preset ref bit 2 [19] Freeze reference [20] Freeze output [21] Speed up [22] Slow [23] Set-up select bit 0 [34] Ramp bit 0 [37] Fire mode [52] Run permissive [53] Hand Start [54] Auto start [60] Counter A (up) [61] Counter A (down) [62] Reset Counter A [63] Counter B (up) [64] Counter B (down) [65] Reset Counter B 5-11 Terminal 19 Digital Input See par. 5-10, *[0] No operation 5-12 Terminal 27 Digital Input See par. 5-10, *[2] Coast inverse 5-13 Terminal 29 Digital Input See par. 5-10, *[14 Jog] 5-3* Digital Outputs 5-34 On Delay, Digital Output 0.00–600.00 s, *0.01 s 5-35 Off Delay, Digital Output 0.00–600.00 s, *0.01 s 5-4* Relays 5-40 Function Relay *[0] No operation [1] Control ready [2] Drive ready [3] Drive ready/remote control [4] Enable / no warning

Table 1.27

Parameter Overview			
[5] Drive running	0.00–600.00 s, *0.01 s	6-25 Terminal 54 High Ref./Feedb. Value	[65] Comparator 5
[6] Running/no warning	5-42 Off Delay, Relay	-4,999.000 - 4,999.000, * 50.000	[70] Logic rule 0
[7] Run in range/no warning	0.00–600.00 s, *0.01 s	6-26 Terminal 54 Filter Time Constant	[71] Logic rule 1
[8] Run on ref/no warning	5-5* Pulse Input	0.01–10.00, * 0.01	[72] Logic rule 2
[9] Alarm	5-9* Bus Controlled	6-29 Terminal 54 mode [0]	[73] Logic rule 3
[10] Alarm or warning	5-90 Digital and Relay Bus Control	Current mode	[74] Logic rule 4
[12] Out of current range	0–0xFFFFFFFF, * 0	[0] Current mode	[75] Logic rule 5
[13] Below current, low	6-** Analog In/Out	*[1] Voltage mode	[80] SL digital output A
[14] Above current, high	6-0* Analog I/O Mode	6-7* Analog Output 45	[81] SL digital output B
[16] Below frequency, low	6-00 Live Zero Timeout Time	6-70 Terminal 45 Mode	[82] SL digital output C
[17] Above frequency, high	1–99s, * 10	*[0] 0-20 mA	[83] SL digital output D
[19] Below feedback, low	6-01 Live Zero Timeout Function	[1] 4-20 mA	[160] No alarm
[20] Above feedback, high	*[0] Off	[2] Digital Output	[161] Running reverse
[21] Thermal warning	[1] Freeze output	6-71 Terminal 45 Analog Output	[165] Local ref. active
[22] Ready, no thermal warning	[2] Stop	*[0] No operation	[166] Remote ref. active
[23] Remote, ready, no thermal warning	[3] Jogging	[100] Output frequency	[167] Start command act.
[24] Ready, Voltage OK	[4] Max. speed	[101] Reference	[168] Drive in hand mode
[25] Reverse	[5] Stop and trip	[102] Feedback	[169] Drive in auto mode
[26] Bus OK	6-1* Analog Input 53	[103] Motor current	[193] Sleep Mode
[35] External Interlock	6-10 Terminal 53 Low Voltage	[106] Power	[194] Broken Belt Function
[36] Control word bit 11	0.00–10.00 V, * 0.07	[139] Bus Control	[196] Fire Mode
[37] Control word bit 12	6-11 Terminal 53 High Voltage	6-72 Terminal 45 Digital Output	[198] Bypass Mode
[45] Bus Control	0.00–10.00 V, * 10.00	*[0] No operation	6-73 Terminal 45 Output Min Scale
[60] Comparator 0	6-12 Terminal 53 Low Current	[1] Control ready	0.00–200.00%, * 0.00
[61] Comparator 1	0.00–20.00, * 4.00 mA	[2] Drive ready	6-74 Terminal 45 Output Max Scale
[62] Comparator 2	6-13 Terminal 53 High Current	[3] Drive ready/remote control	0.00–200.00%, * 100.00
[63] Comparator 3	0.00–20.00, * 20.00 mA	[4] Standby / no warning	6-76 Terminal 45 Output Bus Control
[64] Comparator 4	6-14 Terminal 53 Low Ref./Feedb. Value	[5] Drive running	0.00–100.00%, * 0.00
[65] Comparator 5	-4,999.000–4,999.000, * 0.000	[6] Running / no warning	6-9* Analog Output 42
[70] Logic rule 0	6-15 Terminal 53 High Ref./Feedb. Value	[7] Run in range/no warning	6-90 Terminal 42 Mode
[71] Logic rule 1	-4,999.000 - 4,999.000, * 50.000	[8] Run on ref/no warning	*[0] 0-20 mA
[72] Logic rule 2	6-16 Terminal 53 Filter Time Constant	[9] Alarm	[1] 4-20 mA
[73] Logic rule 3	0.01–10.00 s, * 0.01	[10] Alarm or warning	[2] Digital Output
[74] Logic rule 4	6-19 Terminal 53 mode	[12] Out of current range	6-91 Terminal 42 Analog Output
[75] Logic rule 5	[0] Current mode	[13] Below current, low	*[0] No operation
[80] SL digital output A	*[1] Voltage mode	[14] Above current, high	[100] Output frequency
[81] SL digital output B	6-2* Analog Input 54	[21] Thermal warning	[101] Reference
[82] SL digital output C	6-20 Terminal 54 Low Voltage	[22] Ready, no thermal warning	[102] Feedback
[83] SL digital output D	0.00–10.00V, * 0.07	[23] Remote, ready, no thermal warning	[103] Motor current
[160] No alarm	6-21 Terminal 54 High Voltage	[24] Ready, Voltage OK	[105] TorquereltoRated
[161] Running reverse	0.00–10.00V, * 10.00	[25] Reverse	[106] Power
[165] Local ref. active	6-22 Terminal 54 Low Current	[26] Bus OK	[139] Bus Control
[166] Remote ref. active	0.00–20.00, * 4.00mA	[35] External Interlock	6-92 Terminal 42 Digital Output
[167] Start command act.	6-23 Terminal 54 High Current	[45] Bus Control	*[0] No operation
[168] Drive in hand mode	0.00–20.00, * 20.00mA	[60] Comparator 0	[1] Control ready
[169] Drive in auto mode	6-24 Terminal 54 Low Ref./Feedb. Value	[61] Comparator 1	[2] Drive ready
[193] Sleep Mode	-4,999.000–4,999.000, * 0.000	[62] Comparator 2	[3] Drive ready/remote control
[194] Broken Belt Function		[63] Comparator 3	[4] Enable / no warning
[196] Fire Mode		[64] Comparator 4	
[198] Drive Bypass			
5-41 On Delay, Relay			

Table 1.28

Parameter Overview			
[5] Drive running	8-01 Control Site	[0] Digital input	8-81 Bus Error Count
[6] Running / no warning	*[0] Digital and ctrl.word	[1] Bus	0-65536, * 0
[7] Run in range/no warning	[1] Digital only	[2] Logic AND	8-82 Slave Message Rcvd
[8] Run on ref/no warning	[2] Control word only	*[3] Logic OR	0-65536, * 0
[9] Alarm	8-02 Control Source	8-51 Quick Stop Select	8-83 Slave Error Count
[10] Alarm or warning	[0] None	[0] Digital input	0-65536, * 0
[12] Out of current range	*[1] FC Port	[1] Bus	8-84 Slave Message Sent
[13] Below current, low	8-03 Control Timeout Time	[2] Logic AND	0-65536, * 0
[14] Above current, high	0.1-6,500.0s, * 1.0	*[3] Logic OR	8-85 Slave Timeout Errors
[21] Thermal warning	8-04 Control Timeout Function	8-52 DC Brake Select	0-65536, * 0
[22] Ready, no thermal warning	*[0] Off	[0] Digital input	8-88 Reset FC port Diagnostics
[23] Remote, ready, no thermal warning	[1] Freeze output	[1] Bus	*[0] Do not reset
[24] Ready, Voltage OK	[2] Stop	[2] Logic AND	[1] Reset counter
[25] Reverse	[3] Jogging	*[3] Logic OR	8-9* Bus Feedback
[26] Bus OK	[4] Max. speed	8-53 Start Select	8-94 Bus feedback 1
[35] External Interlock	[5] Stop and trip	[0] Digital input	-32768-32767, * 0
[45] Bus Control	[20] N2 Override Release	[1] Bus	13-** Smart Logic
[60] Comparator 0	8-06 Reset Control Word Timeout	[2] Logic AND	13-0* SLC Settings
[61] Comparator 1	*[0] No function	*[3] Logic OR	13-00 SL Controller Mode
[62] Comparator 2	[1] Do reset	8-54 Reversing Select	*[0] Off
[63] Comparator 3	8-3* FC Port Settings	[0] Digital input	[1] On
[64] Comparator 4	8-30 Protocol	[1] Bus	13-01 Start Event
[65] Comparator 5	*[0] FC	[2] Logic AND	[0] False
[70] Logic rule 0	[2] Modbus RTU	*[3] Logic OR	[1] True
[71] Logic rule 1	[3] Metasys N2	8-55 Set-up Select	[2] Running
[72] Logic rule 2	[4] FLN	[0] Digital input	[3] In range
[73] Logic rule 3	[5] BACNet	[1] Bus	[4] On reference
[74] Logic rule 4	8-31 Address	[2] Logic AND	[7] Out of current range
[75] Logic rule 5	1-247, * 1	*[3] Logic OR	[8] Below I _{low}
[80] SL digital output A	8-32 FC Port Baud Rate	8-56 Preset Reference Select	[9] Above I _{high}
[81] SL digital output B	[0] 2400 Baud	[0] Digital input	[16] Thermal warning
[82] SL digital output C	[1] 4,800 Baud	[1] Bus	[17] Mains out of range
[83] SL digital output D	*[2] 9,600 Baud	[2] Logic AND	[18] Reversing
[160] No alarm	[3] 19,200 Baud	*[3] Logic OR	[19] Warning
[161] Running reverse	[4] 38,400 Baud	8-7* Bacnet	[20] Alarm (trip)
[165] Local ref. active	[5] 57,600 Baud	8-70 BACnet Device Instance	[21] Alarm (trip lock)
[166] Remote ref. active	[6] 76,800 Baud	0-0x400000UL	[22] Comparator 0
[167] Start command act.	[7] 115,200 Baud	* 1	[23] Comparator 1
[168] Drive in hand mode	8-33 FC Port Parity	8-72 MS/TP Maxmaster	[24] Comparator 2
[169] Drive in auto mode	*[0] Even Parity, 1 Stop Bit	0-127, * 127	[25] Comparator 3
[193] Sleep Mode	[1] Odd Parity, 1 Stop Bit	8-73 MS/TP Max Info Frames	[26] Logic rule 0
[194] Broken Belt Function	[2] No Parity, 1 Stop Bit	1-65534, * 1	[27] Logic rule 1
[196] Fire Mode	[3] No Parity, 2 Stop Bits	8-74 "I am" Service	[28] Logic rule 2
[198] Drive Bypass	8-35 Minimum Response Delay	*[0] Send at power-up	[29] Logic rule 3
6-93 Terminal 42 Output Min Scale	0.001-0.500s, * 0.010	[1] Continuously	[33] Digital input 18
0.00-200.00%, * 0.00	8-36 Max Response Delay	8-75 Initialization Password	[34] Digital input 19
6-94 Terminal 42 Output Max Scale	0.100-10.000s, *5.000	8-8* FC Port Diagnostics	[35] Digital input 27
0.00-200.00%, * 100.00	8-37 Max Inter-char delay	8-80 Bus Message Count	[36] Digital input 29
6-96 Terminal 42 Output Bus Control	0.025-0.025s, * 0.025	0-65536, * 0	*[39] Start command
0.00-100.00%, * 0.00	8-5* Digital/Bus		[40] Drive stopped
8-** Comm. and Options	8-50 Coasting Select		[41] Reset trip
8-0* Comm. General Settings			[42] Auto reset trip

Table 1.29

Parameter Overview			
[43] Key Ok	13-42 Logic Rule Boolean 2	14-01 Switching Frequency	14-29 Service Code
[44] Key Reset	See par. 13-01, *[0] False	[0] Ran3	0 -0x7FFFFFFF, * 0
[47] Key Up	13-43 Logic Rule Operator 2	[1] Ran5	14-3* Current Limit Ctrl.
[48] Key Down	See par. 13-41, *[0] Disabled	[2] 2.0 kHz	14-4* Energy Optimizing
[50] Comparator 4	13-44 Logic Rule Boolean 3	[3] 3.0 kHz	14-40 VT Level
[51] Comparator 5	See par. 13-01, *[0] False	[4] 4.0 kHz	40-90%, * 90%
[60] Logic rule 4	13-5* States	[5] 5.0 kHz	14-41 AEO Minimum Magnetization
[83] Broken belt	13-51 SL Controller Event	[6] 6.0 kHz	40-75%, * 66
13-02 Stop Event	See par. 13-01, *[0] False	[7] 8.0 kHz	14-5* Environment
See par. 13-02, *[40] Drive stopped	13-52 SL Controller Action	[8] 10.0 kHz	14-50 RFI Filter
13-03 Reset SLC	*[0] Disabled	[9] 12.0kHz	[0] Off
*[0] Do not reset	[1] No action	[10] 16.0kHz	*[1] On
[1] Reset SLC	[2] Select set-up 1	14-03 Overmodulation	14-51 DC Link Voltage Compensation
13-1* Comparators	[3] Select set-up 2	[0] Off	[0] Off
13-10 Comparator Operand	[10] Select preset ref 0	*[1] On	*[1] On
*[0] Disabled	[11] Select preset ref 1	14-08 Damping Gain Factor	14-52 Fan Control
[1] Reference	[12] Select preset ref 2	0-100%, * 96	*[0] Auto
[2] Feedback	[13] Select preset ref 3	14-1* Line power on/off	[4] Auto Low temp env
[3] Motor speed	[14] Select preset ref 4	14-12 Function at Mains Imbalance	14-53 Fan Monitor
[4] Motor current	[15] Select preset ref 5	*[0] Trip	[0] Disabled
[6] Motor power	[16] Select preset ref 6	[1] Warning	*[1] Warning
[7] Motor voltage	[17] Select preset ref 7	[2] Disabled	[2] Trip
[8] DC link voltage	[18] Select ramp 1	[3] Derate	14-55 Output Filter
[12] Analog in 53	[19] Select ramp 2	14-2* Reset Functions	*[0] No Filter
[13] Analog in 54	[22] Run	14-20 Reset Mode	[1] Sine-Wave Filter
[20] Alarm number	[23] Run reverse	*[0] Manual reset	[3] Sine-wave Filter with Feedback
[30] Counter A	[24] Stop	[1] Automatic reset x 1	14-63 Min Switch Frequency
[31] Counter B	[25] Qstop	[2] Automatic reset x 2	1-16kHz, * 1
13-11 Comparator Operator	[26] DC Brake	[3] Automatic reset x 3	15-** Drive Information
[0] Less Than	[27] Coast	[4] Automatic reset x 4	15-0* Operating Data
*[1] Approx. Equal	[28] Freeze output	[5] Automatic reset x 5	15-00 Operating Hours
[2] GreaterThan	[29] Start timer 0	[6] Automatic reset x 6	0-2147483647, * 0
13-12 Comparator Value	[30] Start timer 1	[7] Automatic reset x 7	15-01 Running Hours
-9,999.0-9,999.0, * 0.0	[31] Start timer 2	[8] Automatic reset x 8	0-2147483647, * 0
13-2* Timers	[32] Set digital out A low	[9] Automatic reset x 9	15-02 kWh Counter
13-20 SL Controller Timer	[33] Set digital out B low	[10] Automatic reset x 10	0-65535, * 0
0.00-3,600.00, * 0.00	[34] Set digital out C low	[11] Automatic reset x 15	15-03 Power-ups
13-4* Logic Rules	[35] Set digital out D low	[12] Automatic reset x 20	0-2147483647, * 0
13-40 Logic Rule Boolean 1	[38] Set digital out A high	[13] Infinite auto reset	15-04 Overtemps
See par. 13-01, *[0] False	[39] Set digital out B high	14-21 Automatic Restart Time	0-65535, * 0
13-41 Logic Rule Operator 1	[40] Set digital out C high	0-600s, * 10	15-05 Over Volts
*[0] Disabled	[41] Set digital out D high	14-22 Operation Mode	0-65535, * 0
[1] AND	[60] Reset Counter A	*[0] Normal operation	15-06 Reset kWh Counter
[2] OR	[61] Reset Counter B	[2] Initialization	*[0] Do not reset
[3] AND NOT	[70] Start timer 3	14-27 Action At Inverter Fault	[1] Reset counter
[4] OR NOT	[71] Start timer 4	[0] Off	15-07 Reset Running Hours Counter
[5] NOT AND	[72] Start timer 5	*[1] On	*[0] Do not reset
[6] NOT OR	[73] Start timer 6	14-28 Production Settings	[1] Reset counter
[7] NOT AND NOT	[74] Start timer 7	*[0] No action	
[8] NOT OR NOT	[100] Reset Alarm	[1] Service reset	
	14-** Special Functions	[3] Software Reset	
	14-0* Inverter Switching		

Table 1.30

Parameter Overview			
15-3* Fault Log	16-30 DC Link Voltage	16-91 Alarm Word 2	22-** Appl. functions
15-30 Fault Log: Error Code 0-255, * 0	0-65535, * 0	0-0xFFFFFFFFFUL, * 0	22-4* Sleep mode
15-4* Drive Identification	16-34 Heatsink Temp.	16-92 Warning Word	22-40 Minimum Run Time
15-40 FC Type	0-255, * 0	0-0xFFFFFFFFFUL, * 0	0-600 s, * 10
15-41 Power Section	16-35 Inverter Thermal	16-93 Warning Word 2	22-41 Minimum Sleep Time
15-42 Voltage	0-255%, * 0	0-0xFFFFFFFFFUL, * 0	0-600 s, * 10
15-43 Software Version	16-36 Inv. Nom. Current	16-94 Ext. Status Word	22-43 Wake-Up Speed [Hz]
15-44 OrderedTypeCode	0.00-655.35, * 0.00	0-0xFFFFFFFFFUL, * 0	0.0-400.0, * 100.0
15-46 Adjustable Frequency Drive	16-37 Inv. Max. Current	16-95 Ext. Status Word 2	22-44 Wake-Up Ref./FB difference
Ordering No	0.00 - 655.35	0-0xFFFFFFFFFUL, * 0	0-100%, * 10
15-47 Power Card Ordering No	16-38 SL Controller State	18-**Extended Motor Data	22-45 Setpoint Boost
15-48 LCP ID No	0-255, * 0	18-1* Firemode Log	-100 - 100%, * 0
15-49 Software ID Control Card	16-5* Ref. and Feedb.	18-10 Firemode log: Event	22-46 Maximum Boost Time
15-50 Software ID Power Card	16-50 External Reference	0-255, *0	0-600 s, * 60
15-51 Adjustable Frequency Drive Serial Number	-200.0-200.0%, * 0.0	20-** FC Closed-loop	22-47 Sleep Speed [Hz]
15-53 Power Card Serial Number	16-52 Feedback	20-0* Feedback	0.0-400.0, * 0.0
16-** Data Readouts	16-6* Inputs and Outputs	20-00 Feedback 1 Source	22-6* Broken Belt Detection
16-0* General Status	16-60 Digital input	*[0] No function	22-60 Broken Belt Detection
16-00 Control Word	0-65535, * 0	[1] Analog in 53	*[0] Off
0-65535, * 0	16-61 Terminal 53 Setting	[2] Analog in 54	[1] Warning
16-01 Reference [Unit]	*[0] Current mode	[100] Bus Feedback 1	[2] Trip
-4,999.000-4,999.000, * 0.000	[1] Voltage mode	20-01 Feedback 1 Conversion	22-61 Broken Belt Torque
16-02 Reference	16-62 Analog Input 53	*[0] Linear	5-100%, * 10
% -200.0-200.0, * 0.0	0.00-10.00, * 1.00	[1] Square root	22-62 Broken Belt Delay
16-03 Status Word	16-63 Terminal 54 Setting	20-8* PI Basic Setting	0-600 s, * 10
0-65535, * 0	*[0] Current mode	20-81 Process PI Normal/ Inverse Control	24-** Appl. functions 2
16-05 Main Actual Value [%]	[1] Voltage mode	*[0] Normal	24-0* Fire mode
-200.00-200.00, * 0.00	16-64 Analog Input 54	[1] Inverse	24-00 Fire Mode Function
16-09 Custom Readout	0.00-20.00, * 1.00	20-83 Process PI Start Speed [Hz]	*[0] Disabled
0.00-9,999.00, * 0.00	16-65 Analog Output 42 [mA]	0.0-200.0, * 0.0	[1] Enabled Run Forward
16-1* Motor Status	0.00-20.00, * 0.00	20-84 On Reference Bandwidth	[2] Enabled Run Reverse
16-10 Power [kW]	16-61 Digital Output	0-200%, * 5	[3] Enable-Coast
0.000-4.294, 967.500, *0.000	16-72 Counter A	20-9* PI Controller	[4] Enabled - Run Fwd/Rev
16-11 Power [HP]	-32768-32767, * 0	20-91 PI Anti Windup	24-05 Fire Mode Preset Reference
0.000-2.294, 967.500 *0.000	16-73 Counter B	[0] Off	-100-100%, * 0
16-3* Drive Status	-32768-32767, * 0	*[1] On	24-09 Fire Mode Alarm Handling
	16-79 Analog output 45	20-93 PI Proportional Gain	*[1] Trip, Critical Alarms
	20 - 20mA, * 0	0.00 - 10.00, * 0.01	[2] Trip, All Alarms/Test
	16-8* Serial communication bus / FC Port	20-94 PI Integral Time	24-1* Drive Bypass
		0.10-9,999.00s, * 9,999.00	24-10 Drive Bypass Function
	16-86 FC Port REF 1	20-97 Process PI Feed Forward Factor	*[0] Disabled
	-32768-32767, * 0	0-400%, * 0	[2] Enabled (Fire Mode only)
	16-9* Diagnosis Readouts		24-11 Bypass Delay Timer
	16-90 Alarm Word		0-600 s, * 0
	0-0xFFFFFFFFFUL, * 0		

Table 1.31

1.6 Warnings and Alarms

Fault number	Alarm/Warning Bit Number	Fault text	Warning	Alarm	Trip locked	Cause of problem
2	16	Live zero error	X	X		Signal on terminal 53 or 54 is less than 50% of value set in par. 6-10, 6-12, 6-20 or 6-22. See also parameter group 6-0X
4	14	Mains ph. loss	X	X	X	Missing phase on supply side or too high voltage imbalance. Check supply voltage. See parameter 14-12
7	11	DC overvolt	X	X		Intermediate circuit voltage exceeds the limit.
8	10	DC undervolt	X	X		Intermediate circuit voltage drops below the "voltage warning low" limit.
9	9	Inverter overload	X	X		More than 100% load for too long.
10	8	Motor ETR over	X	X		Motor is too hot due to more than 100% load for too long. See parameter 1-90
11	7	Motor th over	X	X		The thermistor or the thermistor connection is disconnected. See parameter 1-90.
13	5	Overcurrent	X	X	X	Inverter peak current limit is exceeded.
14	2	Ground Fault		X	X	Discharge from output phases to ground.
16	12	Short Circuit		X	X	Short-circuit in the motor or on the motor terminals.
17	4	Ctrl.word TO	X	X		No communication to Adjustable frequency drive. See parameter group 8-0X
24	50	Fan Fault	X	X		The fan is not working (Only on 400 V 40–125 hp [30–90 kW] units).
30	19	U phase loss		X	X	Motor phase U is missing. Check the phase. See parameter 4-58.
31	20	V phase loss		X	X	Motor phase V is missing. Check the phase. See parameter 4-58.
32	21	W phase loss		X	X	Motor phase W is missing. Check the phase. See parameter 4-58.
38	17	Internal fault		X	X	Contact your local Armstrong supplier.
44	28	Ground Fault		X	X	Discharge from output phases to ground.
47	23	Control Voltage Fault	X	X	X	24 V DC may be overloaded.
48	25	VDD1 Supply Low		X	X	Control voltage low. Please contact your local Armstrong supplier.
50		AMA Calibration failed		X		Contact your local Armstrong supplier.
51	15	AMA Unom,Inom		X		The setting of motor voltage, motor current and motor power is presumably wrong. Check the settings.
52		AMA low Inom		X		The motor current is too low. Check the settings.
53		AMA big motor		X		The motor is too big for the AMA to be carried out
54		AMA small mot		X		The motor is too small for the AMA to be carried out
55		AMA par. range		X		The parameter values found from the motor are outside acceptable range.
56		AMA user interrupt		X		The AMA has been interrupted by the user
57		AMA timeout		X		Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistances Rs and Rr are increased. In most cases, however, this is not critical.

Fault number	Alarm/Warning Bit Number	Fault text	Warning	Alarm	Trip locked	Cause of problem
58		AMA internal	X	X		Contact your local Armstrong supplier.
59	25	Current limit	X			The current is higher than the value in par. 4-18 Current Limit
60	44	External Interlock		X		External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the Adjustable frequency drive (via serial communication, digital I/O, or by pressing reset button on keypad).
66	26	Heatsink Temperature Low	X			This warning is based on the temperature sensor in the IGBT module (Only on 400 V 40–125 hp [30–90 kW] units).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card is either too hot or too cold.
79		Illegal power section configuration	X	X		Internal fault. Contact your local Armstrong supplier.
80	29	Drive initialized		X		All parameter settings are initialized to default settings.
87	47	Auto DC Braking	X			The drive is auto DC braking
95	40	Broken Belt	X	X		Torque is below the torque level set for no load, indicating a broken belt. See parameter group 22-6.
200		Fire Mode	X			Fire mode has been activated.
202		Fire Mode Limits Exceeded	X			Fire mode has suppressed one or more warranty voiding alarms.
250		New spare part		X	X	The power or switch mode power supply has been exchanged. (Only on 400 V 40–125 hp [30–90 kW] units). Contact your local Armstrong supplier.
251		New Typecode		X	X	The Adjustable frequency drive has a new type code (Only on 400 V 40–125 hp [30–90 kW] units). Contact your local Armstrong supplier.

Table 1.32

1.7 General Specifications

1.7.1 Line Power Supply 3 x 200–240 V AC

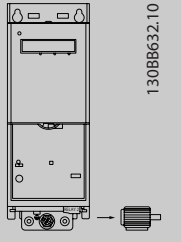
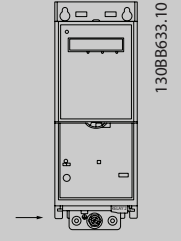

Adjustable frequency drive	PK2 5	PK3 7	PK7 5	P1K 5	P2K 2	P3K 7	P5K 5	P7K 5	P11 K	P15K	P18 K	P22K	P30 K	P37K	P45 K	
Typical shaft output (kW)	0.25	0.37	0.75	1.5	2.2	3.7	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37.0	45.0	
Typical shaft output (hp)	0.33	0.5	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0	
IP20 frame	H1	H1	H1	H1	H2	H3	H4	H4	H5	H6	H6	H7	H7	H8	H8	
Max. cable size in terminals (line power, motor) [mm ² /AWG]	4/10	4/1 0	4/10	4/1 0	4/10	4/10	16/6	16/6	16/6	35/2	35/2	50/1	50/1	95/0	120/ (4/0)	
Output current																
104° F [40°C] ambient temperature																
 130BB632.10	Continuous (3 x 200–240V) [A]	1.5	2.2	4.2	6.8	9.6	15.2	22.0	28.0	42.0	59.4	74.8	88.0	115.0	143.0	170.0
	Intermittent (3 x 200–240V) [A]	1.7	2.4	4.6	7.5	10.6	16.7	24.2	30.8	46.2	65.3	82.3	96.8	126.5	157.3	187.0
Max. input current																
 130BB633.10	Continuous (3 x 200–240V) [A]	1.1	1.6	2.8	5.6	8.6/7 .2	14.1 /	21.0/ 18.0	28.3/ 24.0	41.0/ 38.2	52.7	65.0	76.0	103.7	127.9	153.0
	Intermittent (3 x 200–240V) [A]	1.2	1.8	3.1	6.2	9.5/7 .9	15.5 /	23.1/ 19.8	31.1/ 26.4	45.1/ 42.0	58.0	71.5	83.7	114.1	140.7	168.3
Max. electrical fuses	See 1.3.6 Fuses															
Estimated power loss HP [W], Best case/typical ¹⁾	0.01 6/0. 019 [12/ 14]	0.02 0/0. 024 [15/ 18]	0.02 8/0. 035 [21/ 26]	0.06 4/0. 080 [48/ 60]	0.10 7/0.1 037 [80/1 02]	0.13 0/0. 161 [97/ 120]	0.244 / 0.274 [182/ 204]	0.307 / 0.359 [229/ 268]	0.495 / 0.518 [369/ 386]	0.687 [512]	0.882 [658]	1.078 [804]	1.361 [1,01 5]	1.957 [1,45 9]	1.810 [1,35 0]	
Weight enclosure IP20 [lb/kg]	4.41 [2.]	4.41 [2.0]	4.41 [2.0]	4.63 [2.1]	7.5 [3.4]	9.92 [4.5]	17.42 [7.9]	17.42 [7.9]	20.94 [9.5]	54 [24.5]	54 [24.5]	79.4 [36.0]	79.4 [36.0]	112.4 4 [51.0]	112.4 4 [51.0]	
Efficiency [%], Best case/Typical 1	97.0 / 96.5	97.3 / 96.8	98.0 / 97.6	97.6 / 97.0	97.1/ 96.3	97.9 / 97.4	97.3/ 97.0	98.5/ 97.1	97.2/ 97.1	97.0	96.9	96.8	97.0	96.5	97.3	
Output current																
122° F [50°C] ambient temperature																
 130BB633.10	Continuous (3 x 200–240 V) [A]	1.5	1.9	3.5	6.8	9.6	13.0	19.8	23.0	33.0	53.5	66.6	79.2	103.5	128.7	153.0
	Intermittent (3 x 200–240 V) [A]	1.7	2.1	3.9	7.5	10.6	14.3	21.8	25.3	36.3	58.9	73.3	87.1	113.9	141.6	168.3

Table 1.33

1) At rated load conditions

1.7.2 Line Power Supply 3 x 380–480 V AC

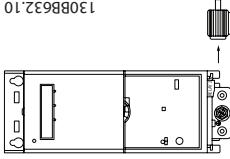
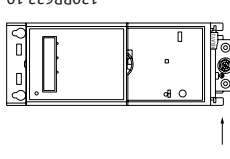
Adjustable frequency drive		PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Typical shaft output (kW)		0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37.0	45.0	55.0	75.0	90.0	
Typical shaft output (hp)		0.5	1.0	2.0	3.0	4.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0	
IP20 frame		H1	H1	H1	H2	H2	H2	H3	H3	H4	H4	H5	H5	H6	H6	H6	H7	H7	H8	
Max. cable size in terminals (line power, motor) [mm ² /AWG]		4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	16/6	16/6	16/6	16/6	35/2	35/2	35/2	50/1	95/0	120/2 50MC M	
Output current																				
		104° F [40°C] ambient temperature																		
 <p>130BB632.10</p>		Continuous (3 x 380–440 V)[A]	1.2	2.2	3.7	5.3	7.2	9.0	12.0	15.5	23.0	31.0	37.0	42.5	61.0	73.0	90.0	106.0	147.0	177.0
		Intermittent (3 x 380–440 V) [A]	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34.0	40.7	46.8	67.1	80.3	99.0	116.0	161.0	194.0
		Continuous (3 x 440–480 V)[A]	1.1	2.1	3.4	4.8	6.3	8.2	11.0	14.0	21.0	27.0	34.0	40.0	52.0	65.0	80.0	105.0	130.0	160.0
		Intermittent (3 x 440–480 V) [A]	1.2	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4	44.0	57.2	71.5	88.0	115.0	143.0	176.0
		Max. input current																		
 <p>130BB633.10</p>		Continuous (3 x 380–440 V) [A]	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9	35.2	41.5	57.0	70.0	84.0	103.0	140.0	166.0
		Intermittent (3 x 380–440 V) [A]	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9	38.7	45.7	62.7	77.0	92.4	113.0	154.0	182.0
		Continuous (3 x 440–480 V) [A]	1.0	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3	34.6	49.2	60.6	72.5	88.6	120.9	142.7
		Intermittent (3 x 440–480 V) [A]	1.1	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2	32.2	38.1	54.1	66.7	79.8	97.5	132.9	157.0
		Max. electrical fuses																		
See 5.1.4 Fuses																				

Table 1.34

Adjustable frequency drive																		
	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Estimated power loss HP [W], Best case/typical ¹⁾	0.017/0 .020 [13/15]	0.022/ 0.028 [16/21]	0.062/ 0.076 [46/57]	0.062/ 0.078 [46/58]	0.089/0 .111 [66/83]	0.127/0 .158 [95/118]	0.139/ 0.176 [104/131]	0.213/ 0.266 [159/198]	0.333/ 0.367 [248/274]	0.473/ 0.508 [353/379]	0.553/ 0.612 [412/456]	0.637/ 0.701 [475/523]	1.046 [780]	1.198 [893]	1.556 [1,160]	1.515 [1,130]	1.958 [1,460]	2.387 [1,780]
Weight enclosure IP20 lbs [kg]	4.41 [2.0]	4.41 [2.0]	4.63 [2.1]	7.28 [3.3]	7.28 [3.3]	7.5 [3.4]	9.48 [4.3]	9.92 [4.5]	17.42 [7.9]	17.42 [7.9]	20.94 [9.5]	20.94 [9.5]	54 [24.5]	54 [24.5]	54 [24.5]	79.4 [36.0]	79.4 [36.0]	112.44 [51.0]
Efficiency %, Best case/Typical 1	97.8/97 .3	98.0/9 7.6	97.7/9 7.2	98.3/9 7.9	98.2/97 .8	98.0/97 .6	98.4/9 8.0	98.2/9 7.8	98.1/9 7.9	98.0/9 7.8	98.1/9 7.9	98.1/9 7.9	97.8 97.8	97.9 97.9	97.1 97.1	98.3 98.3	98.3 98.3	98.3 98.3
Output current																		
122° F [50°C] ambient temperature																		
Continuous (3 x 380-440 V) [A]	1.04	1.93	3.7	4.85	6.3	8.4	10.9	14.0	20.9	28.0	34.1	38.0	48.8	58.4	72.0	74.2	102.9	123.9
Intermittent (3 x 380-440 V) [A]	1.1	2.1	4.07	5.4	6.9	9.2	12.0	15.4	23.0	30.8	37.5	41.8	53.7	64.2	79.2	81.6	113.2	136.3
Continuous (3 x 440-480 V) [A]	1.0	1.8	3.4	4.4	5.5	7.5	10.0	12.6	19.1	24.0	31.3	35.0	41.6	52.0	64.0	73.5	91.0	112.0
Intermittent (3 x 440-480 V) [A]	1.1	2.0	3.7	4.8	6.1	8.3	11.0	13.9	21.0	26.4	34.4	38.5	45.8	57.2	70.4	80.9	100.1	123.2

Table 1.35

1.7.3 Line Power Supply 3 x 380–480 V AC

Adjustable frequency drive		PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Typical shaft output (kW)		0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5	22.0	30.0	37.0	45.0	55.0	75.0	90.0	
Typical shaft output (hp)		1.0	2.0	3.0	4.0	5.0	7.5	10.0	15.0	20	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0	
IP54 frame		12	12	12	12	12	13	13	15	15	15	16	16	16	17	17	18	18	
Max. cable size in terminals (line power, motor) [mm ² /AWG]		4/10	4/10	4/10	4/10	4/10	4/10	4/10	10/7	10/7	10/7	35/2	35/2	35/2	50/1	50/1	95/ (3/0)	120/ (4/0)	
Output current																			
104° F [40°C] ambient temperature																			
Continuous (3 x 380–440 V) [A]		2.2	3.7	5.3	7.2	9.0	12.0	15.5	24	32	37.5	44.0	61.0	73.0	90.0	106.0	147.0	177.0	
	Intermittent (3 x 380–440 V) [A]	2.4	4.1	5.8	7.9	9.9	13.2	17.1	26.2	35.2	41.3	48.4	67.1	80.3	99.0	116.6	161.7	194.7	
Continuous (3 x 440–480 V) [A]		2.1	3.4	4.8	6.3	8.2	11.0	14.0	21	27	34	40.0	52.0	65.0	80.0	105.0	130.0	160.0	
	Intermittent (3 x 440–480 V) [A]	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4	44.0	57.2	71.5	88.0	115.5	143.0	176.0	
Max. input current																			
Continuous (3 x 380–440 V) [A]		2.1	3.5	4.7	6.3	8.3	11.2	15.1	22	29	34	41.8	57.0	70.3	84.2	102.9	140.3	165.6	
	Intermittent (3 x 380–440 V) [A]	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.2	31.9	37.3	46.0	62.7	77.4	92.6	113.1	154.3	182.2	
Continuous (3 x 440–480 V) [A]		1.8	2.9	3.9	5.3	6.8	9.4	12.6	19	25	31	36.0	49.2	60.6	72.5	88.6	120.9	142.7	
	Intermittent (3 x 440–480 V) [A]	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.9	27.5	34.1	39.6	54.1	66.7	79.8	97.5	132.9	157.0	
Max. electrical fuses																			

Table 1.36

Adjustable frequency drive		PK75	P1K5	PK2K2	PK3K0	PK4K0	PK5K5	PK7K5	PK11K	PK15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Estimated power loss HP [W], Best case/typical ¹⁾		29.122 [21,716]	0.062/0 .076 [46/57]	0.062/0 .078 [46/58]	0.089/0 .111 [66/83]	0.127/0 .158 [95/118]	0.139/0 .176 [104/131]	0.213/0 .266 [159/198]	0.325 [242]	0.442 [330]	0.531 [396]	0.665 [496]	0.984 [734]	0.945 [705]	1.243 [927]	1.442 [1,075]	1.911 [1,425]	1.970 [1,469]	
Weight enclosure IP54 lbs [kg]		11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	15.87 [7.2]	15.87 [7.2]	50.71 [23]	50.71 [23]	50.71 [23]	59.53 [27]	59.53 [27]	59.53 [27]	99.21 [45]	99.21 [45]	143.3 [65]	143.3 [65]	
Efficiency %, Best case/Typical 1		98.0/97 .6	97.7/97 .2	98.3/97 .9	98.2/97 .8	98.0/97 .6	98.4/98 .0	98.2/97 .8	98	98	98	98.0	97.8	98.3	98.3	98.3	98.3	98.5	
Output current																			
122° F [50°C] ambient temperature																			
Continuous (3 x 380–440 V) [A]		1.93	3.7	4.85	6.3	8.4	10.9	14.0	19.2	25.6	30	35.2	48.8	58.4	63.0	74.2	102.9	123.9	
Intermittent (3 x 380–440 V) [A]		2.1	4.07	5.4	6.9	9.2	12.0	15.4	21.2	28.2	33	38.7	53.9	64.2	69.3	81.6	113.2	136.3	
Continuous (3 x 440–480 V) [A]		1.8	3.4	4.4	5.5	7.5	10.0	12.6	16.8	21.6	27.2	32.0	41.6	52.0	56.0	73.5	91.0	112.0	
Intermittent (3 x 440–480 V) [A]		2.0	3.7	4.8	6.1	8.3	11.0	13.9	18.5	23.8	30	35.2	45.8	57.2	61.6	80.9	100.1	123.2	

Table 1.37

1.7.4 Line Power Supply 3 x 525–600 V AC

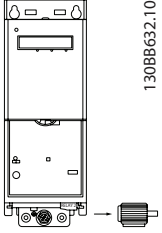
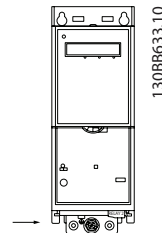
Adjustable frequency drive	P2K2	P3K0	P5K5	P7K5	P11K	P15K	P22K	P30K	P45K	P55K	P75K	P90K	
Typical shaft output (kW)	2.2	3.0	5.5	7.5	11.0	15.0	22.0	30.0	45.0	55.0	75.0	90.0	
Typical shaft output (hp)	3.0	4.0	7.5	10.0	15.0	20.0	30.0	40.0	60.0	70.0	100.0	125.0	
IP20 frame	H9	H9	H9	H9	H10	H10	H6	H6	H7	H7	H8	H8	
Max. cable size in terminals (line power, motor) [mm ² /AWG]	4/10	4/10	4/10	4/10	10/8	10/8	35/2	35/2	50/1	50/1	95/0	120/ (4/0)	
Output current													
 130BB632.10	104° F [40°C] ambient temperature												
	Continuous (3 x 525–550 V) [A]	4.1	5.2	9.5	11.5	19.0	23.0	36.0	43.0	65.0	87.0	105.0	137.0
	Intermittent (3 x 525–550 V) [A]	4.5	5.7	10.5	12.7	20.9	25.3	39.6	47.3	71.5	95.7	115.5	150.7
	Continuous (3 x 551–600 V) [A]	3.9	4.9	9.0	11.0	18.0	22.0	34.0	41.0	62.0	83.0	100.0	131.0
	Intermittent (3 x 551–600 V) [A]	4.3	5.4	9.9	12.1	19.8	24.2	37.4	45.1	68.2	91.3	110.0	144.1
Max. input current													
 130BB633.10	Continuous (3 x 525–550 V) [A]	3.7	5.1	8.7	11.9	16.5	22.5	33.1	45.1	66.5	81.3	109.0	130.9
	Intermittent (3 x 525–550 V) [A]	4.1	5.6	9.6	13.1	18.2	24.8	36.4	49.6	73.1	89.4	119.9	143.9
	Continuous (3 x 551–600 V) [A]	3.5	4.8	8.3	11.4	15.7	21.4	31.5	42.9	63.3	77.4	103.8	124.5
	Intermittent (3 x 551–600 V) [A]	3.9	5.3	9.2	12.5	17.3	23.6	34.6	47.2	69.6	85.1	114.2	137.0
Max. electrical fuses													
Estimated power loss HP [W], Best case/typical ¹⁾	0.011 [8.4]	0.150 [112.0]	0.239 [178.0]	0.321 [239.0]	0.483 [360.0]	0.675 [503.0]	0.814 [607.0]	1.100 [820.0]	1.303 [972.0]	1.585 [1,182.0]	1.718 [1,281.0]	1.927 [1,437.0]	
Weight enclosure IP54 lbs [kg]	14.6 [6.6]	14.6 [6.6]	14.6 [6.6]	14.6 [6.6]	25.35 [11.5]	25.35 [11.5]	54 [24.5]	54 [24.5]	79.4 [36.0]	79.4 [36.0]	112.4 [51.0]	112.4 [51.0]	
Efficiency [%], Best case/Typical 1	97.0	97.0	97.0	97.0	97.0	97.0	97.5	97.5	98.0	98.0	98.4	98.5	
Output current													
	122° F [50°C] ambient temperature												
	Continuous (3 x 525–550 V) [A]	2.9	3.6	6.7	8.1	13.3	16.1	25.2	30.1	45.5	60.9	73.5	95.9
	Intermittent (3 x 525–550 V) [A]	3.2	4.0	7.4	8.9	14.6	17.7	27.7	33.1	50.0	67.0	80.9	105.5
	Continuous (3 x 551–600 V) [A]	2.7	3.4	6.3	7.7	12.6	15.4	23.8	28.7	43.3	58.1	70.0	91.7
Intermittent (3 x 551–600 V) [A]	3.0	3.7	6.9	8.5	13.9	16.9	26.2	31.6	47.7	63.9	77.0	100.9	

Table 1.38

1.7.5 EMC Test Results

The following test results have been obtained using a system with a Adjustable frequency drive, a shielded control cable, a control box with potentiometer, as well as a motor shielded cable.

RFI Filter Type	Conduct emission. Maximum shielded cable length (m)						Radiated emission			
	Industrial environment				Housing, trades and light industries		Industrial environment		Housing, trades and light industries	
	EN 55011 Class A2		EN 55011 Class A1		EN 55011 Class B		EN 55011 Class A1		EN 55011 Class B	
	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter
H4 RFI filter (Class A1)										
0.34–15 hp [0.25–11 kW] 3 x 200–240 V IP20			25	50		20	Yes	Yes		-
0.5–30 hp [0.37–22 kW] 3 x 380–480 V IP20			25	50		20	Yes	Yes		-
H2 RFI filter (Class A2)										
20–60 hp [15–45 kW] 3 x 200–240 V IP20	25						No		-	
40–125 hp [30–90 kW] 3 x 380–480 V IP20	25						No		-	
1–25 [0.75–18.5 kW] 3 x 380–480 V IP54	25						Yes			
30–125 hp [22–90 kW] 3 x 380–480 V IP54	25						No		-	
H3 RFI filter (Class A1/B)										
20–60 hp [15–45 kW] 3 x 200–240 V IP20			50		20		Yes		-	
40–125 hp [30–90 kW] 3 x 380–480 V IP20			50		20		Yes		-	

RFI Filter Type	Conduct emission. Maximum shielded cable length (m)					Radiated emission				
1–25 [0.75–18.5 kW] 3 x 380–480 V IP54			25			10		Yes		
30–125 hp [22–90 kW] 3 x 380–480 V IP54			50			10		Yes	-	

Table 1.39

Protection and features

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the Adjustable frequency drive trips in case of overtemperature.
- The Adjustable frequency drive is protected against short-circuits between motor terminals U, V, W.
- If a motor phase is missing, the Adjustable frequency drive trips and issues an alarm.
- If a line phase is missing, the Adjustable frequency drive trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the Adjustable frequency drive trips if the intermediate circuit voltage is too low or too high.
- The Adjustable frequency drive is protected against ground faults on motor terminals U, V, W.

Line power supply (L1, L2, L3)

Supply voltage	200–240 V \pm 10%
Supply voltage	380–480 V \pm 10%
Supply voltage	525–600 V \pm 10%
Supply frequency	50/60 Hz
Max. imbalance temporary between line phases	3.0% of rated supply voltage
True Power Factor (λ)	\geq 0.9 nominal at rated load
Displacement Power Factor ($\cos\phi$) near unity	(> 0.98)
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H1-H5, I2, I3	Max. twice/min.
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H6-H8, I6-I8	Max. once/min.
Environment according to EN 60664-1	overvoltage category III/pollution degree 2
The unit is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 240/480 V maximum.	

Motor output (U, V, W)

Output voltage	0–100% of supply voltage
Output frequency	0–200 Hz (VVC ^{Plus}), 0–400 Hz (u/f)
Switching on output	Unlimited
Ramp times	0.05–3,600 sec.

Cable lengths and cross-sections

Max. motor cable length, shielded/armored (EMC-compliant installation)	See 1.7.5 EMC Test Results
Max. motor cable length, unshielded/unarmored	164 ft [50 m]
Max. cross-section to motor, line power*	
Cross-section DC terminals for filter feedback on enclosure frame H1-H3, I2, I3	4 mm ² /11 AWG
Cross-section DC terminals for filter feedback on enclosure frame H4-H5	16 mm ² /6 AWG
Maximum cross-section to control terminals, rigid wire	2.5 mm ² /14 AWG
Maximum cross-section to control terminals, flexible cable	2.5 mm ² /14 AWG

Minimum cross-section to control terminals 0.05 mm²/30 AWG

*See tables for line power supply for more information

Digital inputs:

Programmable digital inputs	4
Terminal number	18, 19, 27, 29
Logic	PNP or NPN
Voltage level	0-24 V DC
Voltage level, logic '0' PNP	< 5 V DC
Voltage level, logic '1' PNP	> 10 V DC
Voltage level, logic '0' NPN	> 19 V DC
Voltage level, logic '1' NPN	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, R _i	Approx. 4 k
Digital input 29 as thermistor input	Fault: > 2.9 kΩ and no fault: < 800Ω

Analog inputs

Number of analog inputs	2
Terminal number	53, 54
Terminal 53 mode	Parameter 6-19: 1 = voltage, 0 = current
Terminal 54 mode	Parameter 6-29: 1 = voltage, 0 = current
Voltage level	0-10 V
Input resistance, R _i	approx. 10 kΩ
Max. voltage	20 V
Current level	0/4 to 20 mA (scalable)
Input resistance, R _i	<500Ω
Max. current	29 mA

Analog output

Number of programmable analog outputs	2
Terminal number	42, 45 ¹⁾
Current range at analog output	0/4-20 mA
Max. load to common at analog output	500 Ω
Max. voltage at analog output	17 V
Accuracy on analog output	Max. error: 0.4% of full scale
Resolution on analog output	10 bit

1) Terminal 42 and 45 can also be programmed as digital outputs.

Digital output

Number of digital outputs	2
Terminal number	42, 45 ¹⁾
Voltage level at digital output	17 V
Max. output current at digital output	20 mA
Max. load at digital output	1 kΩ

1) Terminals 42 and 45 can also be programmed as analog output.

Control card, RS485 serial communication

Terminal number	68 (P, TX+, RX+), 69 (N, TX-, RX-)
Terminal number	61 Common for terminals 68 and 69

Control card, 24 V DC output:

Terminal number	12
Max. load enclosure frame H1-H8, I2-I8	80 mA

Relay output

Programmable relay output	2
Relay 01 and 02	01-03 (NC), 01-02 (NO), 04-06 (NC), 04-05 (NO)
Max. terminal load (AC-1) ¹⁾ on 01-02/04-05 (NO) (Resistive load)	250 V AC, 3A
Max. terminal load (AC-15) ¹⁾ on 01-02/04-05 (NO) (Inductive load @ $\cos\phi$ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 01-02/04-05 (NO) (Resistive load)	30 V DC, 2A
Max. terminal load (DC-13) ¹⁾ on 01-02/04-05 (NO) (Inductive load)	24 V DC, 0.1A
Max. terminal load (AC-1) ¹⁾ on 01-03/04-06 (NC) (Resistive load)	250 V AC, 3A
Max. terminal load (AC-15) ¹⁾ on 01-03/04-06 (NC) (Inductive load @ $\cos\phi$ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 01-03/04-06 (NC) (Resistive load)	30 V DC, 2A
(NC) (Resistive load)	Min. terminal load on 01-03 (NC), 01-02 (NO) 24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1	Overvoltage category III/pollution degree 2
1) IEC 60947 parts 4 and 5.	

Control card, 10V DC output

Terminal number	50
Output voltage	10.5 V \pm 0.5 V
Max. load	25 mA

All inputs, outputs, circuits, DC supplies and relay contacts are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Surroundings

Enclosure	IP20
Enclosure kit available.	IP21, TYPE 1
Vibration test	1.0 g
Max. relative humidity	5–95% (IEC 60721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 60721-3-3), coated (standard) frame H1-H5	Class 3C3
Aggressive environment (IEC 60721-3-3), non-coated frame H6-H10	Class 3C2
Aggressive environment (IEC 60721-3-3), coated (optional) frame H6-H10	Class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	See max. output current at 104°/122° F [40°/50°C] in the tables line power supply

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	32° F [0°C]
Minimum ambient temperature at reduced performance, enclosure frame H1-H5	-4° F [-20°C]
Minimum ambient temperature at reduced performance, enclosure frame H6-H10	14° F [-10°C]
Temperature during storage/transport	-22°–+149°/158° F [-30°–+65°/70°C]
Maximum altitude above sea level without derating	3,280 ft [1,000 m]
Maximum altitude above sea level with derating	9,842 ft [3,000 m]
Derating for high altitude, see section on special conditions	
Safety standards	EN/IEC 61800-5-1, UL 508C
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
	EN 61800-3, EN 61000-3-12, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6
EMC standards, Immunity	61000-4-5, EN 61000-4-6

1.8 Special Conditions

1.8.1 Derating for Ambient Temperature and Switching Frequency

The ambient temperature measured over 24 hours should be at least 41° F [5°C] lower than the max. ambient temperature. If the Adjustable frequency drive is operated at high ambient temperature, the continuous output current should be decreased.

1.8.2 Derating for Low Air Pressure

The cooling capability of air is decreased at low air pressure. For altitudes above 6,600 feet [2,000 m], please contact Armstrong regarding PELV. Below 3,281 ft [1,000 m] altitude no de-rating is necessary, but above 3,281 ft [1,000 m] the ambient temperature or the maximum output current should be decreased. Decrease the output by 1% per 328 ft [100 m] altitude above 3,281 ft [1,000 m] or reduce the max. ambient temperature by 1° per 656 ft [200 m].

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