

VLT® HVAC Basic Drive FC 101

1 Introduction

This operating guide provides necessary information for qualified personnel to install and commission the drive. Read and follow the instructions to use the drive safely and professionally.

	Do not dispose of equipment containing electrical components together with domestic waste. Collect it separately in accordance with local and currently valid legislation.
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2 Safety

Pay particular attention to the safety instructions and general warnings to avoid the risk of death, serious injury, and equipment or property damage.

⚠ WARNING	
HIGH VOLTAGE	Drives contain high voltage when connected to AC mains input, DC supply, or load sharing.
	• To avoid electric shock, the IP20 drive must be installed in a cabinet or with an IP21 conversion kit.
UNINTENDED START	The motor may start from control panel, I/O inputs, fieldbus, or VLT® Motion Control Tool MCT 10 at any time, when the drive is connected to the AC mains, DC supply, or load sharing.
LEAKAGE CURRENT	Leakage currents of the drive exceed 3.5 mA. Make sure that the minimum size of the ground conductor complies with the local safety regulations for high touch current equipment.
DISCHARGE TIME	The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.
	• Stop the motor, disconnect AC mains and permanent magnet type motors, and remove DC-link supplies, including battery backups, UPS, and DC-link connections to other drives.
	• Wait for the capacitors to discharge fully and measure it before performing any service or repair work.
	• The minimum waiting time is specified in the <i>table Discharge time</i> and is also visible on the nameplate on top of the drive.

Table 1: Discharge Time

Voltage [V]	Power range [kW (hp)]	Minimum waiting time (minutes)
3x200	0.25–3.7 (0.33–5)	4
3x200	5.5–45 (7–60)	15
3x400	0.37–7.5 (0.5–10)	4
3x400	11–90 (15–125)	15
3x600	2.2–7.5 (3–10)	4
3x600	11–90 (15–125)	15

NOTICE
GROUNDING DELTA OR IT GRID
The drive is not designed to operate on a grounded delta-leg or IT grid mains network.

3 Installation

NOTICE
• For drives of enclosure size H1–H5 & I2–I4, terminals +DC and -DC are protected by factory-installed load share terminal insert which must NOT be removed.
• DC terminals are not supported in drives of enclosure size H6–H10 & I6–I8.

- Verify that the items supplied and the information on the product label match the order, and identify the enclosure size. See *Figure Product Label* in the *Illustrations* section.
- Mount the drive on or against a solid, non-combustible mounting surface such as concrete or metal. Mounting dimensions are shown in *Figure Mechanical Dimensions* in the *Illustrations* section.
- Install the power cables. See *Figure Installing Ground, Mains, and Motor Cables* in the *Illustrations* section.
 - Attach the ground cables to the ground terminal.
 - Attach the motor cables to terminals U, V, and W, and tighten the screws according to the torques described in the design guide.
 - Attach the mains cables to terminals L1, L2, and L3, and tighten the screws according to the torques described in the design guide.
- Remove the terminal cover to access the control terminals. See *Figure Control Terminals* in the *Illustrations* section.
- Connect start (terminal 18) between terminals 12–27, and an analog reference (terminal 53 or 54, and 55). The digital input mode of terminal 18, 19, and 27 is set in parameter **5-00 Digital Input Mode ([0] PNP)** is the default value). Digital input 29 mode is set in parameter **5-03 Digital Input 29 Mode ([0] PNP)** is the default value).

4 Programming

4.1 Local Control Panel (LCP)

The drive can be programmed from the LCP or from a PC via the RS-485 COM port by installing the VLT® Motion Control Tool MCT 10. The LCP is divided into 4 functional sections.

- A. Display
- B. Menu key
- C. Navigation keys and indicator lights
- D. Operation keys and indicator lights

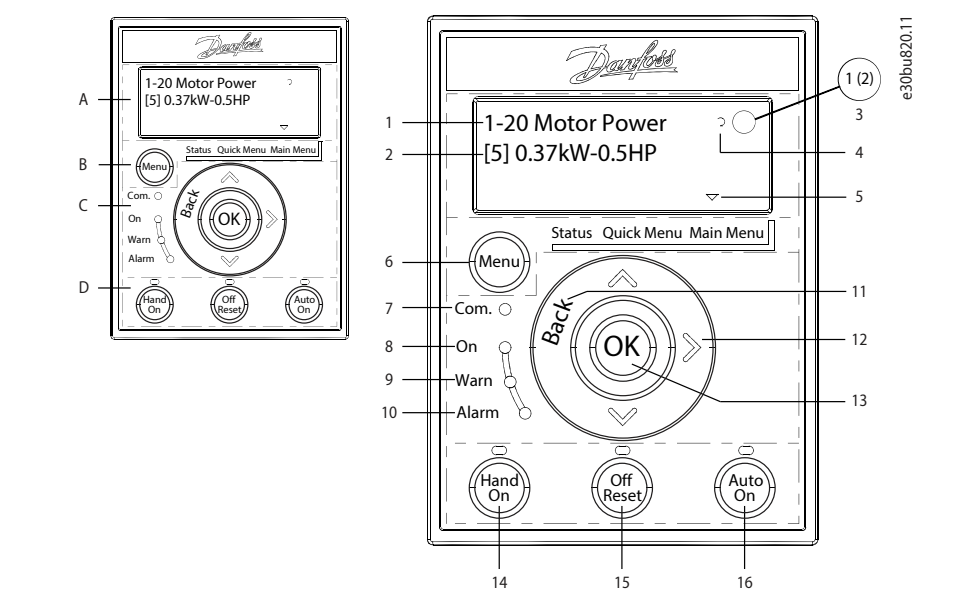


Figure 1: Local Control Panel (LCP 32)

A. Display

The graphical LCD-display is illuminated with clear white backlight and can show either 3 full lines (in programming mode), or 2 full and 2 ½ lines (in status mode). The following tables describe the information that can be read from the display.

Table 2: Legend to Section A

Number	Description
1	Parameter number and name.
2	Parameter value.
3	Setup number shows the active setup and the edit setup (only in the Status menu). The number outside brackets is active setup, and the number inside brackets is edit setup. For example, 1(2) means 1 is the active setup, and 2 is the edit setup.
4	Motor direction is indicated by a small arrow pointing either clockwise or counterclockwise.
5	The triangle indicates if the LCP is in Status, Quick Menu, or Main Menu.

B. Menu key

Table 3: Legend to Section B

Number	Description
6	[Menu] key navigates between Status, Quick Menu, or Main Menu.

C. Navigation keys and indicator lights

Table 4: Legend to Section C

Number	Description
7	Com. (yellow indicator): Flashes during bus communication.
8	On (green indicator): Shows the power on status.
9	Warn. (yellow indicator): Indicates a warning.
10	Alarm (red indicator): Indicates an alarm.
11	[Back]: For moving to the previous step or layer in the navigation structure.
12	Up arrow key, down arrow key, and right arrow key: For navigating among parameter groups and parameters, and within parameters. They can also be used for setting local reference.
13	[OK]: For selecting a parameter and for accepting changes to parameter settings.

D. Operation keys and indicator lights

Table 5: Legend to Section D

Number	Description
14	[Hand On]: Starts the motor and enables control of the drive via the LCP.
	NOTICE
	[2] <i>Coast inverse</i> is the default option for parameter 5-12 Terminal 27 Digital Input . If there is no 24 V supply to terminal 27, [Hand On] does not start the motor. Connect terminal 12 to terminal 27.
15	[Off/Reset]: Stops the compressor (Off). If in alarm mode, the alarm is reset.
16	[Auto On]: The drive is controlled either via control terminals or serial communication.

4.2 Automatic Motor Adaptation (AMA)

Via running AMA in VVC+ mode, the drive builds a mathematical model of the motor to optimize compatibility between drive and motor, and thus enhances the motor control performance.

- Set motor data according to the motor nameplate.
- If needed, set motor cable length in parameter **1-42 Motor Cable Length**.
- Select [1] **Enable Complete AMA** or [2] **Enable Reduced AMA** in parameter **1-29 Automatic Motor Adaption (AMA)**, and press [Hand On] to activate the AMA function. After a normal sequence, the display shows: Press [OK] to finish AMA.
- Press [OK], then the drive is ready for operation.

5 Troubleshooting

Table 6: Alarm/Warning Code List

Fault number	Warning/ alarm 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 the value set in parameter 6-10 Terminal

Table 6: Alarm/Warning Code List

Fault number	Warning/ alarm bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
						53 Low Voltage , parameter 6-12 Terminal 53 Low Current , parameter 6-20 Terminal 54 Low Voltage , or parameter 6-22 Terminal 54 Low Current . See also parameter group 6-0* Analog I/O Mode .
3	15/72	No Motor	X	X	–	No motor is connected to the output of the drive.
4	14	Mains Ph. Loss	X	X	X	Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See parameter 14-12 Function at Mains Imbalance .
7	11	DC overvolt	X	X	–	DC-link voltage exceeds the limit.
8	10	DC undervolt	X	X	–	DC-link voltage drops below the voltage warning low-limit.
9	9	Inverter Overld.	X	X	–	More than 100% load for a long time.
10	8	Motor ETR Overld.	X	X	–	The motor is too hot due to more than 100% load for a long time. See parameter 1-90 Motor Thermal Protection .
11	7	Motor Th. Overld.	X	X	–	Thermistor or thermistor connection is disconnected. See parameter 1-90 Motor Thermal Protection .
13	5	Over Current	X	X	X	Inverter peak current limit is exceeded.
14	2	Earth Fault	X	X	X	Discharge from output phases to ground.
16	12	Short Circuit	–	X	X	Short circuit in motor or on motor terminals.
17	4	Ctrl. Word TO	X	X	–	No communication to drive. See parameter group 8-0* General Settings .
18	42	Start Failed	–	X	–	Running speed is not reached within a specified time. A possible reason is a blocked rotor. Set parameter 1-78 Compressor Start Max Speed [Hz] and parameter 1-79 Compressor Start Max Time to Trip to adjust the speed and time expected.
24	50	Fan Fault	X	X	–	The heat sink cooling fan is not working.
30	19	U phase loss	–	X	X	Motor phase U is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function .
31	20	V phase loss	–	X	X	Motor phase V is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function .
32	21	W phase loss	–	X	X	Motor phase W is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function .
36	24	Mains Failure	X	X	–	This warning/alarm is only active if the supply voltage to the drive is lost and parameter 14-10 Mains Failure is not set to [0] No Function .
38	17	Internal Fault	–	X	X	Contact the local supplier.
44	48	Earth Fault DESAT	–	X	X	Discharge from output phases to ground, using the value of parameter 15-31 InternalFaultReason if possible.
46	33	Gate drive Voltage Fault	–	X	X	The control voltage is low. Contact the local supplier.
47	23	24 V Supply Low	X	X	X	24 V DC supply may be overloaded.
50	–	AMA calibration	–	X	–	Contact the local supplier.
51	15	AMA U _{nom} /I _{nom}	–	X	–	The setting of motor voltage, motor current, and motor power is wrong. Check the settings.
52	–	AMA low I _{nom}	–	X	–	The motor current is too low. Check the settings.
53	–	AMA big motor	–	X	–	The motor is too big to perform AMA.
54	–	AMA small mot	–	X	–	The motor is too small to perform AMA.
55	–	AMA par. range	–	X	–	The parameter values found from the motor are outside the acceptable range.
56	–	AMA interrupt	–	X	–	The AMA has been interrupted by the user.
57	–	AMA timeout	–	X	–	Try to start the AMA again several times, until the AMA is carried out.
58	–	AMA internal	–	X	–	Contact the local supplier.
59	25/57	Current Limit	X	X	–	The current is higher than the value in parameter 4-18 Current Limit .
60	44	External Inter-lock	–	X	–	External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the drive (via serial communication, digital I/O, or by pressing [Reset] key on the LCP).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card exceeds the upper or lower limits.
70	36	Illegal FC config	–	X	X	The control card and power card are not matched.
79	–	Illegal PS config	X	X	–	Internal fault. Contact the local 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.
92	37	No Flow	X	X	–	A no-flow condition has been detected in the system. Parameter 22-23 No-Flow Function is set for alarm.

Table 6: Alarm/Warning Code List- (continued)

Fault number	Warning/ alarm bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
93	38	Dry Pump	X	X	–	A dry-pump condition has been detected in the system. Parameter 22-26 Dry Pump Function is set for alarm.
94	39	End of Curve	X	X	–	An end-of-curve condition has been detected in the system. Parameter 22-50 End of Curve Function is set for alarm.
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* Broken Belt Detection .
99	54	Locked Rotor	–	X	–	The rotor is blocked.
101	47	Flow/Pressure info missing	–	X	–	Sensorless-pump table is missing or wrong. Download the sensorless-pump table again.
126	–	Motor Rotating	–	X	–	High back EMF voltage. Stop the rotor of the PM motor.
127	61	Back EMF too High	X	–	–	This warning applies to PM motors only. When the back EMF exceeds $90\% \times U_{inmax}$ (overvoltage threshold) and does not drop to normal level within 5 s, this warning is reported. The warning remains until the back EMF returns to a normal level.
159	36	Check Valve Failure	X	–	–	When the drive is not in operation, a broken check valve makes to the motor run in reverse. Parameter 22-04 Check Valve Monitor is set for warning.
200	–	Fire Mode	X	–	–	Fire mode has been activated.
202	–	Fire Mode Limits Exceeded	X	–	–	Fire mode has suppressed 1 or more warranty voiding alarms.
203	42	Multi Motor Underload	X	–	–	Missing motor in a multi-motor system, refer to parameter group 24-9* Multi-Motor Funct.
204	43	Multi Motor Overload	X	–	–	Locked rotor in a multi-motor system, refer to parameter group 24-9* Multi-Motor Funct.
250	35	New Spare part	–	X	X	The power or switch mode power supply has been exchanged. Contact the local supplier.
251	34	New Type code	–	X	X	The drive has a new type code. Contact the local supplier.

6 Specifications

Table 7: Mains Supply 3x200Y/115–240Y/139 V AC, 0.25–7.5 kW (0.33–10.0 hp), Enclosure Sizes H1–H4

Drive	PK25	PK37	PK75	P1K5	P2K2	P3K7	P5K5	P7K5
Typical shaft output [kW]	0.25	0.37	0.75	1.5	2.2	3.7	5.5	7.5
Typical shaft output [hp]	0.33	0.5	1.0	2.0	3.0	5.0	7.5	10.0
Protection rating IP20/Open Type	H1	H1	H1	H1	H2	H3	H4	H4
Maximum cable size in terminals (mains, motor) [m² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)
Output current 40 °C (104 °F) ambient temperature								
Continuous (3x200–240 V) [A]	1.5	2.2	4.2	6.8	9.6	15.2	22	28
Intermittent (3x200–240 V) [A]	1.7	2.4	4.6	7.5	10.6	16.7	24.2	30.8
Maximum input current								
Continuous (3x200Y/115–240Y/139 V) [A]	1.1	1.6	2.8	5.6	8.6/7.2	14.1/12	21/18	28.3/24
Intermittent (3x200Y/115–240Y/139 V) [A]	1.2	1.8	3.1	6.2	9.5/7.9	15.5/13.2	23.1/19.8	31.1/26.4
Weight enclosure protection rating IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.4 (7.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)
Output current 50 °C (122 °F) ambient temperature								
Continuous (3x200–240 V) [A]	1.5	1.9	3.5	6.8	9.6	13	19.8	23
Intermittent (3x200–240 V) [A]	1.7	2.1	3.9	7.5	10.6	14.3	21.8	25.3

Table 8: Mains Supply 3x200Y/115–240Y/139 V AC, 11.0–45.0 kW (15.0–60.0 hp), Enclosure Sizes H5–H8

Drive	P11K	P15K	P18K	P22K	P30K	P37K	P45K
Typical shaft output [kW]	11	15	18.5	22	30	37	45
Typical shaft output [hp]	15	20	25	30	40	50	60
Protection rating IP20/Open Type	H5	H6	H6	H7	H7	H8	H8
Maximum cable size in terminals (mains, motor) [m ² (AWG)]	16 (6)	35 (2)	35 (2)	50 (1)	50 (1)	95 (0)	120 (4/0)
Output current 40 °C (104 °F) ambient temperature							
Continuous (3x200–240 V) [A]	42	59.4	74.8	88	115	143	170
Intermittent (3x200–240 V) [A]	46.2	65.3	82.3	96.8	126.5	157.3	187
Maximum input current							
Continuous (3x200Y/115–240Y/139 V) [A]	41/38.2	52.7	65	76	103.7	127.9	153
Intermittent (3x200Y/115–240Y/139 V) [A]	45.1/42	58	71.5	83.7	114.1	140.7	168.3
Weight enclosure protection rating IP20 [kg (lb)]	9.5 (20.9)	24.5 (54)	24.5 (54)	36 (79.4)	36 (79.4)	51 (112.4)	51 (112.4)
Output current 50 °C (122 °F) ambient temperature							
Continuous (3x200–240 V) [A]	33	41.6	52.4	61.6	80.5	100.1	119
Intermittent (3x200–240 V) [A]	36.3	45.8	57.6	67.8	88.6	110.1	130.9

Table 9: Mains Supply 3x380Y/220–480Y/277 V AC, 0.37–15.0 kW (0.5–20.0 hp), Enclosure Sizes H1–H4

Drive	PK37	PK75	PK1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K
Typical shaft output [kW]	0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15
Typical shaft output [hp]	0.5	1.0	2.0	3.0	4.0	5.0	7.5	10	15	20
Protection rating IP20/Open Type	H1	H1	H1	H2	H2	H2	H3	H3	H4	H4
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)
Output current 40 °C (104 °F) ambient temperature										
Continuous (3x380–440 V)[A]	1.2	2.2	3.7	5.3	7.2	9.0	12	15.5	23	31
Intermittent (3x380–440 V) [A]	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34
Continuous (3x441–480 V) [A]	1.1	2.1	3.4	4.8	6.3	8.2	11	14	21	27
Intermittent (3x441–480 V) [A]	1.2	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7
Maximum input current										
Continuous (3x380Y/220–440Y/254 V) [A]	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9
Intermittent (3x380Y/220–440Y/254 V) [A]	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9
Continuous (3x441Y/255–480Y/277 V) [A]	1.0	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7
Intermittent (3x441Y/255–480Y/277 V) [A]	1.1	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2
Weight enclosure protection rating IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.3 (7.3)	3.3 (7.3)	3.4 (7.5)	4.3 (9.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)
Output current 50 °C (122 °F) ambient temperature										
Continuous (3x380–440 V) [A]	1.04	1.93	3.7	4.85	6.3	8.4	10.9	14	20.9	28
Intermittent (3x380–440 V) [A]	1.1	2.1	4.07	5.4	6.9	9.2	12	15.4	23	30.8
Continuous (3x441–480 V) [A]	1.0	1.8	3.4	4.4	5.5	7.5	10	12.6	19.1	24
Intermittent (3x441–480 V) [A]	1.1	2.0	3.7	4.8	6.1	8.3	11	13.9	21	26.4

Table 10: Mains Supply 3x380Y/220–480Y/277 V AC, 18.5–90.0 kW (25.0–125.0 hp), Enclosure Sizes H5–H8

Drive	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	18.5	22	30	37	45	55	75	90
Typical shaft output [hp]	25	30	40	50	60	75	100	125
Protection rating IP20/Open Type	H5	H5	H6	H6	H6	H7	H7	H8
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	16 (6)	16 (6)	35 (2)	35 (2)	35 (2)	50 (1)	95 (0)	120 (250MCM)
Output current 40 °C (104 °F) ambient temperature								
Continuous (3x380–440 V) [A]	37	42.5	61	73	90	106	147	177
Intermittent (3x380–440 V) [A]	40.7	46.8	67.1	80.3	99	116	161	194
Continuous (3x441–480 V) [A]	34	40	52	65	80	105	130	160
Intermittent (3x441–480 V) [A]	37.4	44	57.2	71.5	88	115	143	176
Maximum input current								
Continuous (3x380Y/220–440Y/254 V) [A]	35.2	41.5	57	70	84	103	140	166
Intermittent (3x380Y/220–440Y/254 V) [A]	38.7	45.7	62.7	77	92.4	113	154	182
Continuous (3x441Y/255–480Y/277 V) [A]	29.3	34.6	49.2	60.6	72.5	88.6	120.9	142.7
Intermittent (3x441Y/255–480Y/277 V) [A]	32.2	38.1	54.1	66.7	79.8	97.5	132.9	157
Weight enclosure protection rating IP20 [kg (lb)]	9.5 (20.9)	9.5 (20.9)	24.5 (54)	24.5 (54)	24.5 (54)	36 (79.4)	36 (79.4)	51 (112.4)
Output current 50 °C (122 °F) ambient temperature								
Continuous (3x380–440 V) [A]	34.1	38	48.8	58.4	72	74.2	102.9	123.9
Intermittent (3x380–440 V) [A]	37.5	41.8	53.7	64.2	79.2	81.6	113.2	136.3
Continuous (3x441–480 V) [A]	31.3	35	41.6	52	64	73.5	91	112
Intermittent (3x441–480 V) [A]	34.4	38.5	45.8	57.2	70.4	80.9	100.1	123.2

Table 11: Mains Supply 3x380–480 V AC, 0.75–18.5 kW (1.0–25 hp), Enclosure Sizes I2–I4

Drive	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K
Typical shaft output [kW]	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5
Typical shaft output [hp]	1.0	2.0	3.0	4.0	5.0	7.5	10	15	20	25
Protection rating IP54	I2	I2	I2	I2	I2	I3	I3	I4	I4	I4
Maximum cable size in terminals (mains, motor) [mm²(AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)	16 (6)
Output current 40 °C (104 °F) ambient temperature										
Continuous (3x380–440 V) [A]	2.2	3.7	5.3	7.2	9.0	12	15.5	23	31	37
Intermittent (3x380–440 V) [A]	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34	40.7
Continuous (3x441–480 V) [A]	2.1	3.4	4.8	6.3	8.2	11	14	21	27	34
Intermittent (3x441–480 V) [A]	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4
Maximum input current										
Continuous (3x380–440 V) [A]	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9	35.2
Intermittent (3x380–440 V) [A]	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9	38.7
Continuous (3x441–480 V) [A]	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3
Intermittent (3x441–480 V) [A]	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2	32.2
Weight enclosure protection rating IP54 [kg (lb)]	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	7.2 (15.9)	7.2 (15.9)	13.8 (30.4)	13.8 (30.4)	13.8 (30.4)
Output current 50 °C (122 °F) ambient temperature										
Continuous (3x380–440 V) [A]	1.93	3.7	4.85	6.3	7.5	10.9	14	20.9	28	33
Intermittent (3x380–440 V) [A]	2.1	4.07	5.4	6.9	9.2	12	15.4	23	30.8	36.3
Continuous (3x441–480 V) [A]	1.8	3.4	4.4	5.5	6.8	10	12.6	19.1	24	30
Intermittent (3x441–480 V) [A]	2.0	3.7	4.8	6.1	8.3	11	13.9	21	26.4	33

Table 12: Mains Supply 3x380–480 V AC, 22–90 kW (30–125 hp), Enclosure Sizes I6–I8

Drive	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	22	30	37	45	55	75	90
Typical shaft output [hp]	30	40	50	60	70	100	125
Protection rating IP54	I6	I6	I6	I7	I7	I8	I8
Maximum cable size in terminals (mains, motor) [mm²(AWG)]	35 (2)	35 (2)	35 (2)	50 (1)	50 (1)	95 (3/0)	120 (4/0)
Output current 40 °C (104 °F) ambient temperature							
Continuous (3x380–440 V) [A]	44	61	73	90	106	147	177
Intermittent (3x380–440 V) [A]	48.4	67.1	80.3	99	116.6	161.7	194.7
Continuous (3x441–480 V) [A]	40	52	65	80	105	130	160
Intermittent (3x441–480 V) [A]	44	57.2	71.5	88	115.5	143	176
Maximum input current							
Continuous (3x380–440 V) [A]	41.8	57	70.3	84.2	102.9	140.3	165.6
Intermittent (3x380–440 V) [A]	46	62.7	77.4	92.6	113.1	154.3	182.2
Continuous (3x441–480 V) [A]	36	49.2	60.6	72.5	88.6	120.9	142.7
Intermittent (3x441–480 V) [A]	39.6	54.1	66.7	79.8	97.5	132.9	157
Weight enclosure protection rating IP54 [kg (lb)]	27 (59.5)	27 (59.5)	27 (59.5)	45 (99.2)	45 (99.2)	65 (143.3)	65 (143.3)
Output current 50 °C (122 °F) ambient temperature							
Continuous (3x380–440 V) [A]	35.2	48.8	58.4	63	74.2	102.9	123.9
Intermittent (3x380–440 V) [A]	38.7	53.9	64.2	69.3	81.6	113.2	136.3
Continuous (3x441–480 V) [A]	32	41.6	52	56	73.5	91	112
Intermittent (3x441–480 V) [A]	35.2	45.8	57.2	61.6	80.9	100.1	123.2

Table 13: Mains Supply 3x525–600 V AC, 18.5–90 kW (25–125 hp), Enclosure Sizes H6–H8

Drive	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	18.5	22	30	37	45	55	75	90
Typical shaft output [hp]	25	30	40	50	60	70	100	125
IP20/Open type	H6	H6	H6	H7	H7	H7	H8	H8
Maximum cable size in terminals (mains, motor) [mm²(AWG)]	35 (2)	35 (2)	35 (2)	50 (1)	50 (1)	50 (1)	95 (0)	120 (4/0)
Output current 40 °C (104 °F) ambient temperature								
Continuous (3x525–550 V) [A]	28	36	43	54	65	87	105	137
Intermittent (3x525–550 V) [A]	30.8	39.6	47.3	59.4	71.5	95.7	115.5	150.7
Continuous (3x551–600 V) [A]	27	34	41	52	62	83	100	131
Intermittent (3x551–600 V) [A]	29.7	37.4	45.1	57.2	68.2	91.3	110	144.1
Maximum input current								
Continuous (3x525–550 V) [A]	27	33.1	45.1	54.7	66.5	81.3	109	130.9
Intermittent (3x525–550 V) [A]	29.7	36.4	49.6	60.1	73.1	89.4	119.9	143.9
Continuous (3x551–600 V) [A]	25.7	31.5	42.9	52	63.3	77.4	103.8	124.5
Intermittent (3x551–600 V) [A]	28.3	34.6	47.2	57.2	69.6	85.1	114.2	137
Weight enclosure protection rating IP20/Open type [kg (lb)]	24.5 (54)	24.5 (54)	24.5 (54)	36 (79.3)	36 (79.3)	36 (79.3)	51 (112.4)	51 (112.4)
Output current 50 °C (122 °F) ambient temperature								
Continuous (3x525–550 V) [A]	19.6	25.2	30.1	37.8	45.5	60.9	73.5	95.9
Intermittent (3x525–550 V) [A]	21.6	27.7	33.1	41.6	50	67	80.9	105.5
Continuous (3x551–600 V) [A]	18.9	23.8	28.7	36.4	43.3	58.1	70	91.7
Intermittent (3x551–600 V) [A]	20.8	26.2	31.6	40	47.7	63.9	77	100.9

Table 14: Mains Supply 3x525–600 V AC, 2.2–15 kW (3.0–20 hp), Enclosure Sizes H9–H10

Drive	P2K2	P3K0	P3K7	P5K5	P7K5	P11K	P15K
Typical shaft output [kW]	2.2	3.0	3.7	5.5	7.5	11	15
Typical shaft output [hp]	3.0	4.0	5.0	7.5	10	15	20
IP20/Open type	H9	H9	H9	H9	H9	H10	H10
Maximum cable size in terminals (mains, motor) [mm²(AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	10 (8)	10 (8)
Output current 40 °C (104 °F) ambient temperature							
Continuous (3x525–550 V) [A]	4.1	5.2	6.4	9.5	11.5	19	23
Intermittent (3x525–550 V) [A]	4.5	5.7	7.0	10.5	12.7	20.9	25.3
Continuous (3x551–600 V) [A]	3.9	4.9	6.1	9.0	11	18	22
Intermittent (3x551–600 V) [A]	4.3	5.4	6.7	9.9	12.1	19.8	24.2
Maximum input current							
Continuous (3x525–550 V) [A]	3.7	5.1	5.9	8.7	11.9	16.5	22.5
Intermittent (3x525–550 V) [A]	4.1	5.6	6.5	9.6	13.1	18.2	24.8
Continuous (3x551–600 V) [A]	3.5	4.8	5.6	8.3	11.4	15.7	21.4
Intermittent (3x551–600 V) [A]	3.9	5.3	6.2	9.2	12.5	17.3	23.6
Weight enclosure protection rating IP20/Open type [kg (lb)]	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	11.5 (25.3)	11.5 (25.3)
Output current 50 °C (122 °F) ambient temperature							
Continuous (3x525–550 V) [A]	2.9	3.6	4.5	6.7	8.1	13.3	16.1
Intermittent (3x525–550 V) [A]	3.2	4.0	4.9	7.4	8.9	14.6	17.7
Continuous (3x551–600 V) [A]	2.7	3.4	4.3	6.3	7.7	12.6	15.4
Intermittent (3x551–600 V) [A]	3.0	3.7	4.7	6.9	8.5	13.9	16.9

7 Ambient Conditions

Table 15: Operating Environment Specifications

Protection rating	IP20/Open Type, IP54
Enclosure kit available	IP21, Type 1
Temperature during operation	• H1–H5 & I2–I4: -20 °C...+50 °C (-4 °F...+122 °F) • H6–H10 & I6–I8: -10 °C...+50 °C (+14 °F...+122 °F)
Temperature during storage/transport	-30 °C...+65/+70 °C (-22 °F...+149/+158 °F)
Minimum ambient temperature during full-scale operation	0 °C (32 °F)
Relative humidity	5–95% (IEC 60721-3-3; Class 3K3 (non-condensing) during operation)
Altitude	• Maximum altitude above sea level without derating: 1000 m (3281 ft) • Maximum altitude above sea level with derating: 3000 m (9843 ft)
Contamination level	• Aggressive environment (IEC 60721-3-3) • Coated enclosure sizes H1–H5 (standard) and H6–H10 (optional): Class 3C3 • Non-coated enclosure sizes H6–H10 and I2–I8: Class 3C2

8 EMC Compatibility and Motor Cable Length

The EMC product standard for drives defines 4 categories (C1, C2, C3, and C4) with specified requirements for emission and immunity. The following table states the definition of the 4 categories and the equivalent classification from EN 55011.

Table 16: Correlation between IEC 61800-3 and EN 55011

EN/IEC 61800-3 Category	Definition	Equivalent emission class in EN 55011
C1	Drives installed in the 1st environment (home and office) with a supply voltage less than 1000 V.	Class B
C2	Drives installed in the 1st environment (home and office) with a supply voltage less than 1000 V, which are neither plug-in nor movable and are intended to be installed and commissioned by a professional.	Class A Group 1
C3	Drives installed in the 2nd environment (industrial) with a supply voltage lower than 1000 V.	Class A Group 2
C4	Drives installed in the 2nd environment with a supply voltage equal to or above 1000 V or rated current equal to or above 400 A or intended for use in complex systems.	No limit line. Make an EMC plan.

When the generic (conducted) emission standards are used, the drives are required to comply with the limits in the following table.

Table 17: Correlation between Generic Emission Standards and EN 55011

Environment	Generic emission standard	Equivalent emission class in EN 55011
First environment (home and office)	EN/IEC 61000-6-3 Emission standard for residential, commercial and light industrial environments.	Class B
Second environment (industrial environment)	EN/IEC 61000-6-4 Emission standard for industrial environments.	Class A Group 1

For further details, see the design guide.

9 Fuses

The recommended fuses in the following table are suitable for use on a circuit capable of delivering 100000 Arms (symmetrical), 240 V or 480 V depending on the drive voltage rating. With the proper fusing, the drive Short Circuit Current Rating (SCCR) is 100000 Arms.

Table 18: Recommended Fuses and Circuit Breakers for UL508C Types

FC 101		Circuit breaker ⁽¹⁾		Fuse				
		UL508C	Non-UL	UL508C				
Enclosure size	Power rating [kW (hp)]	–	–	Bussmann	Bussmann	Bussmann	Bussmann	Maximum fuse
				Type RK5	Type RK1	Type J	Type T	Type G
Minimum SCCR	1/3/5/10 kA	1/3/5/10 kA ⁽²⁾	5 kA ⁽³⁾					1/3/5/10 kA ⁽²⁾
Maximum SCCR	100 kA ⁽⁴⁾	5/100 kA ⁽⁵⁾	100 kA ⁽⁴⁾					5/100 kA ⁽⁶⁾
3x200–240 V IP20/Open type								
H1	0.25–1.5 (0.33–2.0)	–	–	FRS-R-10	KTN-R-10	JKS-10	JJN-10	10
H2	2.2 (3.0)	–	–	FRS-R-15	KTN-R-15	JKS-15	JJN-15	16
H3	3.7 (5.0)	–	–	FRS-R-25	KTN-R-25	JKS-25	JJN-25	25
H4	5.5–7.5 (7.5–10)	–	–	FRS-R-50	KTN-R-50	JKS-50	JJN-50	50
H5	11 (15)	–	–	FRS-R-80	KTN-R-80	JKS-80	JJN-80	63
H6	15–18.5 (20–25)	Cutler-Hammer EGE3100FFG	Moeller NZMB1- A125	FRS-R-100	KTN-R-100	JKS-100	JJN-100	125
H7	22–30 (30–40)	Cutler-Hammer JGE3150FFG	Moeller NZMB1- A160	FRS-R-150	KTN-R-150	JKS-150	JJN-150	160
H8	37–45 (50–60)	Cutler-Hammer JGE3200FFG	Moeller NZMB1- A200	FRS-R-200	KTN-R-200	JKS-200	JJN-200	200
3x380–480 V IP20/Open type								
H1	0.37–1.5 (0.5–2.0)	–	–	FRS-R-10	KTS-R-10	JKS-10	JJS-10	10
H2	2.2–4.0 (3.0–5.0)	–	–	FRS-R-15	KTS-R-15	JKS-15	JJS-15	16
H3	5.5–7.5 (7.5–10)	–	–	FRS-R-25	KTS-R-25	JKS-25	JJS-25	25
H4	11–15 (15–20)	–	–	FRS-R-50	KTS-R-50	JKS-50	JJS-50	50

Table 18: Recommended Fuses and Circuit Breakers for UL508C Types

FC 101		Circuit breaker ⁽¹⁾		Fuse				
		UL508C	Non-UL	UL508C				
Enclosure size	Power rating [kW (hp)]	–	–	Bussmann	Bussmann	Bussmann	Bussmann	Maximum fuse
				Type RK5	Type RK1	Type J	Type T	Type G
H5	18.5–22 (25–30)	–	–	FRS-R-80	KTS-R-80	JKS-80	JJS-80	63
H6	30 (40) 37 (50) 45 (60)	Cutler-Hammer EGE3125FFG	Moeller NZMB1- A125	FRS-R-125	KTS-R-125	JKS-125	JJS-125	80 100 125
H7	55 (70) 75 (100)	Cutler-Hammer JGE3200FFG	Moeller NZMB1- A200	FRS-R-200	KTS-R-200	JKS-200	JJS-200	150 200
H8	90 (125)	Cutler-Hammer JGE3250FFG	Moeller NZMB2- A250	FRS-R-250	KTS-R-250	JKS-250	JJS-250	250
3x525–600 V IP20/Open type								
H9	2.2–7.5 (3.0–10)	–	–	FRS-R-20	KTS-R-20	JKS-20	JJS-20	20
H10	11–15 (15–20)	–	–	FRS-R-30	KTS-R-30	JKS-30	JJS-30	35
H6	18.5–30 (25–40)	Cutler-Hammer EGE3080FFG	Cut-ler-Hammer EGE3080FFG	FRS-R-80	KTS-R-80	JKS-80	JJS-80	80
H7	37–55 (50–70)	Cutler-Hammer JGE3125FFG	Cut-ler-Hammer JGE3125FFG	FRS-R-125	KTS-R-125	JKS-125	JJS-125	125
H8	75–90 (100–125)	Cutler-Hammer JGE3200FAG	Cut-ler-Hammer JGE3200FAG	FRS-R-200	KTS-R-200	JKS-200	JJS-200	200
3x380–480 V IP54								
I2	0.75–4.0 (1.0–5.0)	–	PKZM0-16	–	–	–	–	16
I3	5.5–7.5 (7.5–10)	–	PKZM0-25	–	–	–	–	25
I4	11–18.5 (15–25)	–	PKZM4-63	–	–	–	–	63
I6	22–37 (30–50)	–	–	–	–	–	–	125
I7	45–55 (60–70)	–	–	–	–	–	–	160
I8	75–90 (100–125)	–	–	–	–	–	–	200

- 1) H1–H5 drives do not support circuit breakers.
2) The rating is 1 kA for a maximum continuous input current of up to 16 A, 3 kA for a maximum continuous input current from over 16 A to 63 A, 5 kA for a maximum continuous input current from over 63 A to 125 A, and 10 kA for a maximum continuous input current from over 125 A to 315 A.
3) The rating is 5 kA for H1–H5 drives.
4) The rating is 100 kA for H6–H10 drives.
5) The rating is 5 kA for I2–H4 drives, and 100 kA for H6–H10 and I6–I8 drives.
6) The rating is 5 kA for H1–H5 and I2–H4 drives, and 100 kA for H6–H10 and I6–I8 drives.

Table 19: Minimum Cabinet Dimensions for UL508C Types

Enclosure size	Minimum cabinet dimensions [H x W x D] [mm (in)]	Minimum cabinet volume [L]
H1–H3	500 x 400 x 260 (19.7 x 15.7 x 10.2)	52
H4–H6, H10, I2–I4	800 x 400 x 300 (31.5 x 15.7 x 11.8)	96
H7–H8	1200 x 800 x 400 (47.2 x 31.5 x 15.7)	384
H9	500 x 400 x 250 (19.7 x 15.7 x 9.8)	50
I6–I8	–	–

10 Accessories and Spare Parts

Accessories	Code number
VLT® Control Panel LCP 31	132B0200
VLT® Control Panel LCP 32	132B9221
VLT® Mains-Free Interface	132B9222
LCP RJ45 Plug Converter	132B0203
Mounting kit for LCP incl. fasteners, 3 m cable and gasket	132B0201
Screws and plugs for enclosure sizes H1-H5	132B5907

11 Other Resources

Other resources are available to understand advanced drive functions and programming.

- The VLT® HVAC Basic Drive FC 101 Programming Guide provides information on how to program and includes complete parameter descriptions.
- The VLT® HVAC Basic Drive FC 101 Design Guide provides all technical information about the drive. It also lists options and accessories.

The technical documentation is available in electronic form online at www.danfoss.com.

12 Illustrations

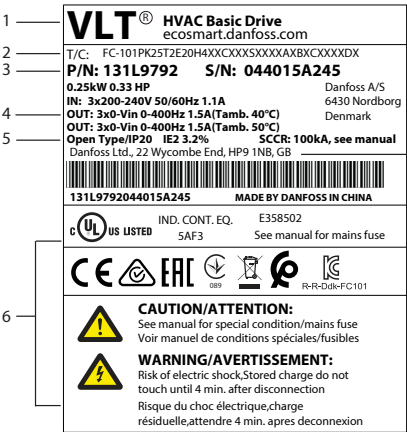


Figure 2: Product Label (Example)

1	Product name
2	Type code
3	Code number and serial number
4	Voltage, frequency, and current
5	Enclosure (Ingress protection rating and UL compliant rating), efficiency data, and short-circuit current ratings
6	Warnings and compliance information
7	

NOTICE

- CE certification: Not available for 3x525–600 V drives.
- UL 508C compliance: Not applicable to IP54 drives.

7	Company name and address
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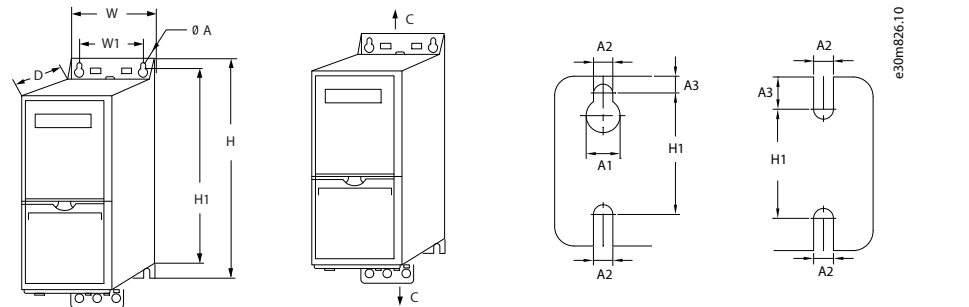


Figure 3: Mechanical Dimensions

Table 20: Mechanical Dimensions, Enclosure Sizes H1–H5

mm (in)	H1	H2	H3	H4	H5
H	195 (7.7)	227 (8.9)	255 (10.0)	296 (11.7)	334 (13.1)
H ⁽¹⁾	273 (10.7)	303 (11.9)	329 (13.0)	359 (14.1)	402 (15.8)
H1	183 (7.2)	212 (8.3)	240 (9.4)	275 (10.8)	314 (12.4)
W	75 (3.0)	90 (3.5)	100 (3.9)	135 (5.3)	150 (5.9)
W1	56 (2.2)	65 (2.6)	74 (2.9)	105 (4.1)	120 (4.7)
D	168 (6.6)	190 (7.5)	206 (8.1)	241 (9.5)	255 (10)
C	100 (4.0)	100 (4.0)	100 (4.0)	100 (4.0)	100 (4.0)
A1	9 (0.35)	11 (0.43)	11 (0.43)	12.6 (0.50)	12.6 (0.50)
A2	4.5 (0.18)	5.5 (0.22)	5.5 (0.22)	7 (0.28)	7 (0.28)
A3	5.3 (0.21)	7.4 (0.29)	8.1 (0.32)	8.4 (0.33)	8.5 (0.33)
Maximum weight kg (lb)	2.1 (4.6)	3.4 (7.5)	4.5 (9.9)	7.9 (17.4)	9.5 (20.9)

1) Including decoupling plate.

Table 21: Mechanical Dimensions, Enclosure Sizes H6–H8

mm (in)	H6	H7	H8	H9	H10
H	518 (20.4)	550 (21.7)	660 (26)	269 (10.6)	399 (15.7)
H ⁽¹⁾	595 (23.4)/635 (25), 45 kW	630 (24.8)/690 (27.2), 75 kW	800 (31.5)	374 (14.7)	419 (16.5)
H1	495 (19.5)	521 (20.5)	631 (24.8)	257 (10.1)	380 (15)
W	239 (9.4)	313 (12.3)	375 (14.8)	130 (5.1)	165 (6.5)
W1	200 (7.9)	270 (10.6)	330 (13)	110 (4.3)	140 (5.5)
D	242 (9.5)	335 (13.2)	335 (13.2)	205 (8.0)	248 (9.8)
C	200 (7.9)	200 (7.9)	225 (8.9)	100 (4)	200 (7.9)
A1	–	–	–	11 (0.43)	12 (0.47)
A2	8.5 (0.33)	8.5 (0.33)	8.5 (0.33)	5.5 (0.22)	6.8 (0.27)
A3	15 (0.6)	17 (0.67)	17 (0.67)	9 (0.35)	7.5 (0.30)
Maximum weight kg (lb)	24.5 (54)	36 (79)	51 (112)	6.6 (14.6)	12 (26.5)

1) Including decoupling plate.

Table 22: Mechanical Dimensions, Enclosure Sizes I2–I8

mm (in)	I2	I3	I4	I6	I7	I8
H	332 (13.1)	368 (14.5)	476 (18.7)	650 (25.6)	680 (26.8)	770 (30)
H1	318.5 (12.53)	354 (13.9)	460 (18.1)	624 (24.6)	648 (25.5)	739 (29.1)

Table 22: Mechanical Dimensions, Enclosure Sizes I2–I8- (continued)

mm (in)	I2	I3	I4	I6	I7	I8
W	115 (4.5)	135 (5.3)	180 (7.0)	242 (9.5)	308 (12.1)	370 (14.6)
W1	74 (2.9)	89 (3.5)	133 (5.2)	210 (8.3)	272 (10.7)	334 (13.2)
D	225 (8.9)	237 (9.3)	290 (11.4)	260 (10.2)	310 (12.2)	335 (13.2)
C	100 (4)	100 (4)	100 (4)	200 (7.9)	200 (7.9)	225 (8.9)
A1	11 (0.43)	12 (0.47)	12 (0.47)	19 (0.75)	19 (0.75)	19 (0.75)
A2	5.5 (0.22)	6.5 (0.26)	6.5 (0.26)	9 (0.35)	9 (0.35)	9 (0.35)
A3	9 (0.35)	9.5 (0.37)	9.5 (0.37)	9 (0.35)	9.8 (0.39)	9.8 (0.39)
Maximum weight kg (lb)	5.3 (11.7)	7.2 (15.9)	13.8 (30.42)	27 (59.5)	45 (99.2)	65 (143.3)

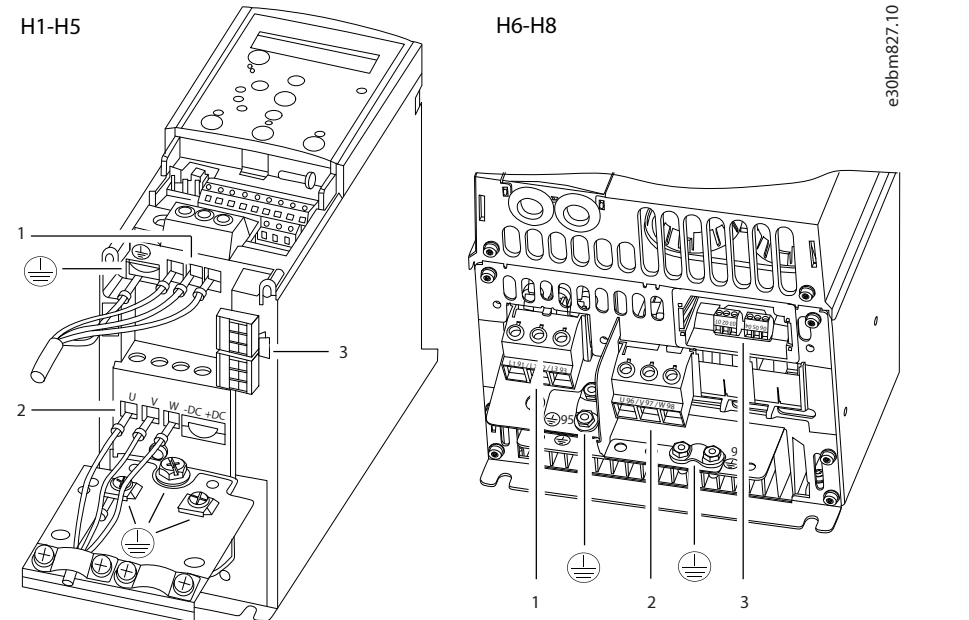


Figure 4: Installing Ground, Mains, and Motor Cables

- 1

Mains
- 2

Motor
- 3

Relays

Refer to the design guide for installation drawings of grounding, mains, and motor cables for other enclosure sizes.

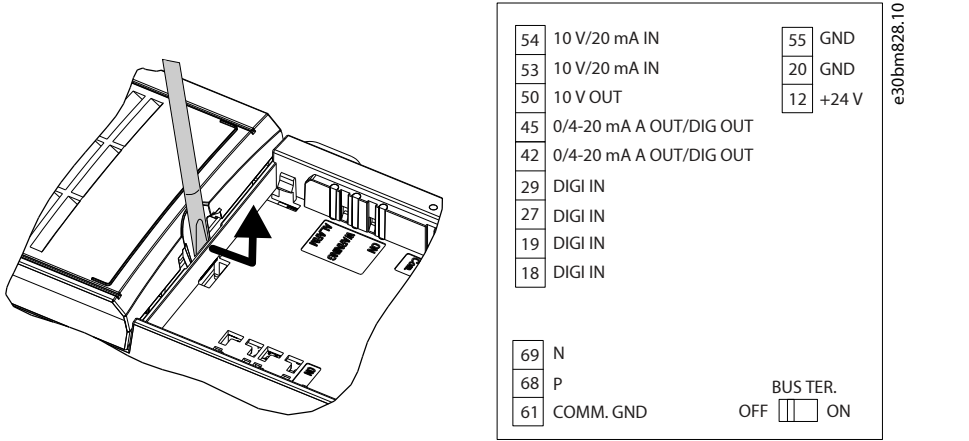


Figure 5: Control Terminals