AVTRON
ACCel500 FREQUENCY CONVERTERS

Frames 4-12

Cleveland, Ohio

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AVTRON INDUSTRIAL AUTOMATION, INC.
Cleveland, Ohio

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SECTION I

SAFETY SUMMARY

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W A R N I N G

Hazardous voltages are used in the operation of this equipment and may cause severe personal injury or the loss of life if proper precautions are not taken. The following precautions should be taken to reduce the risk of injury or death.

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W A R N I N G

Separate motor overcurrent, overload, and overheating protection is required to be provided in accordance with the Canadian Electrical Code, Part I.

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A V E R T I S S E M E N T

Le moteur doit etre muni d'une protection distincte contre les surintensites, la surcharge et la surchauffe conformement au code canadian de l'electricitie, premiere partie.

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D A N G E R

Hazardous voltage will cause severe injury and death. Turn off and lock out all sources of power before servicing.

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D A N G E R

Presence de tensions dangereuses pouvant et perte de vie. Couper l'alimentation avant le depannage de cet equipment.

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W A R N I N G

DO NOT OPERATE RADIO TRANSMITTERS or CELL PHONES IN THE VICINITY OF THE ACCel500 DRIVE. The ACCel500 Drive is an electronic device. Although it is designed to operate reliably in typical industrial environments, the ACCel500 Drive can be affected by radio and/or cell phone transmitters. It is possible to cause drive faults, inappropriate/unintended drive I/O activity, and unpredictable operation that could result in damage to the ACCel500 Drive, damage to other equipment, or serious injury to personnel.

Radio transmitter interference is a site specific phenomena. Generally, electrical wires connected to terminals on the ACCel500 Drive are the conduits for radio interference. Interference can be minimized by good wiring design and installation practice. It is recommended that signs be posted in and around the drive system, warning of the possibility of interference if the drive is in operation. DO NOT USE radio transmitters or cell phones in the area.

Absence of a radio interference problem is no guarantee that a problem will never occur as conditions and environments can change.

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W A R N I N G

System Safety Considerations

In safety sensitive applications, it is strongly suggested that the system designer utilize a separate monitoring device to check the ACCel500 inputs and outputs, and other operating characteristics, to enhance the safety of personnel and property.

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1. Only qualified personnel familiar with this equipment should be permitted to install, operate, troubleshoot, or repair the apparatus after reading and understanding this manual.

2. Installation of the equipment must be performed in accordance with the National Electrical Code and any other state or local codes. Proper grounding, conductor sizing, and short circuit protection must be installed for safe operation.

3. During normal operation, keep all covers in place and cabinet doors shut.

4. When performing hands-on inspections and maintenance, be sure the incoming AC feed is turned off and locked out. The ACCel500 Drive and motor may have hazardous voltages present even if the AC feed is turned off. ****NOTE**** The armature contactor does not remove hazardous voltages when opened.

5. When necessary to take measurements with the power turned on, do not touch any electrical connection points. Remove all jewelry from wrists and fingers. Make sure test equipment is in safe operating condition.

6. While servicing with the power on, stand on approved insulating material and be sure not to be grounded.

7. Follow the instructions in this manual carefully and observe all danger notices.

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W A R N I N G

Accuracy of customer-installed calibration and configuration data is imperative in the operation of this equipment. Incorrect data may cause damage to the ACCel500 drive, motor, and process equipment.

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1-1 WARNINGS

- The ACCel500 frequency converter is meant for fixed installations only.
- Do not perform any measurements when the frequency converter is connected to the mains.
- Do not perform any voltage withstand tests on any part of the ACCel500 frequency converter. There is a certain procedure according to which the tests shall be performed. Ignoring this procedure may result in damaged product.
- The frequency converter has a large capacitive leakage current.
- If the frequency converter is used as a part of a machine, the machine manufacturer is responsible for providing the machine with a main switch (EN 60204-1).
- Only spare parts delivered by Avtron can be used.

1-2 SAFETY INSTRUCTIONS

- The components of the power unit of the frequency converter are **live** when ACCel500 is connected to mains potential. **Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.** The control unit is isolated from mains potential.
- The motor terminals U, V, W and the DC-link/brake resistor terminals are **live** when ACCel500 is connected to mains, **even if the motor is not running**.
- After disconnecting the frequency converter from the mains, wait until the fan stops and the indicators on the keypad go out (if no keypad is attached see the indicators on the cover). Wait 5 more minutes before doing any work on ACCel500 connections. Do not even open the cover before this time has expired.
- The control I/O terminals are isolated from the mains potential. However, the relay outputs and other I/O terminals may have a dangerous control voltage present even when the ACCel500 frequency converter is disconnected from mains.
- Before connecting the frequency converter to mains make sure that the ACCel500 front and cable covers are closed.

1-3 EARTHING AND EARTH FAULT PROTECTION

The ACCel500 frequency converter must always be earthed with an earthing conductor connected to the earthing terminal ⏚.

The earth fault protection inside the frequency converter protects only the converter itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the frequency converter, fault current protective switches may not function properly.

1-4 RUNNING THE MOTOR

Before starting the motor, check that the motor is mounted properly and ensure that the machine connected to the motor allows the motor to be started.

Set the maximum motor speed (frequency) according to the motor and the machine connected to it.

Before reversing the motor, make sure that this can be done safely.

Make sure that no power correction capacitors are connected to the motor cable.

Make sure that the motor terminals are not connected to mains potential.

SECTION II

RECEIPT OF DELIVERY

ACCel500 frequency converters have undergone scrupulous tests and quality checks at the factory before they are delivered to the customer. However, after unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete (compare the type designation of the product to the code below, Figure 2-1.

Should the drive have been damaged during the shipping, please contact primarily the cargo insurance company or the carrier.

If the delivery does not correspond to your order, contact the supplier immediately.

In the small plastic bag included in the delivery you will find a silver *Drive modified* sticker. The purpose of the sticker is to notify the service personnel about the modifications made in the frequency converter. Attach the sticker on the side of the frequency converter to avoid losing it. Should the frequency converter be later modified (option board added, IP or EMC protection level changed), mark the change in the sticker.

2-1 TYPE DESIGNATION CODE

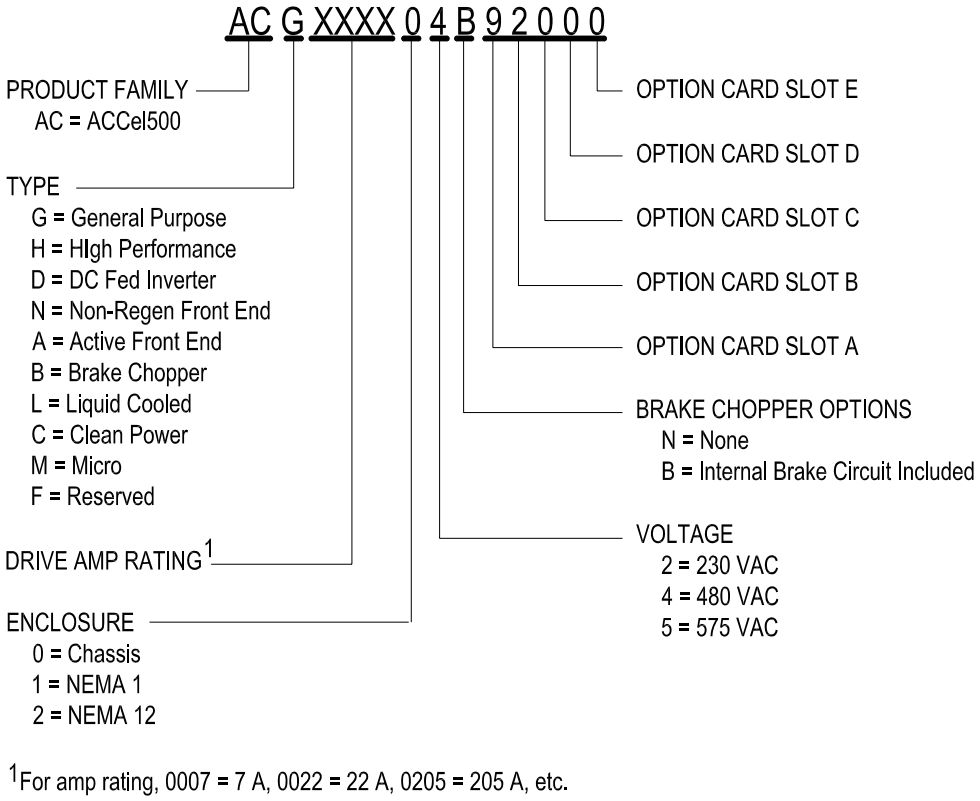


Figure 2-1. ACCel500 Type Designation Code

NOTE: Ask factory for other possible installation combinations.

2-2 STORAGE

If the frequency converter is to be kept in store before use, make sure that the ambient conditions are acceptable:

Storing temperature	–40 to +70°C
Relative humidity	<95%, no condensation

If the storage time exceeds 12 months, the electrolytic DC capacitors need to be charged with caution. Therefore, such a long storage time is not recommended.

2-3 MAINTENANCE

In normal conditions, ACCel500 frequency converters are maintenance-free. However, we recommend to clean the heatsink with compressed air whenever necessary. The cooling fan can easily be changed if necessary.

It may also be necessary to check the tightening torques of terminals at certain intervals.

2-4 WARRANTY

Only manufacturing defects are covered by the warranty. The manufacturer assumes no responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, commissioning, or use.

The manufacturer shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, wrong installation, unacceptable ambient temperature, dust, corrosive substances or operation outside the rated specifications.

Neither can the manufacturer be held responsible for consequential damages.

The manufacturer's time of warranty is 18 months from the delivery or 12 months from the commissioning whichever expires first (Avtron Warranty Terms).

The local distributor may grant a warranty time different from the above. This warranty time shall be specified in the distributor's sales and warranty terms. Avtron assumes no responsibility for any other warranties than that granted by Avtron itself.

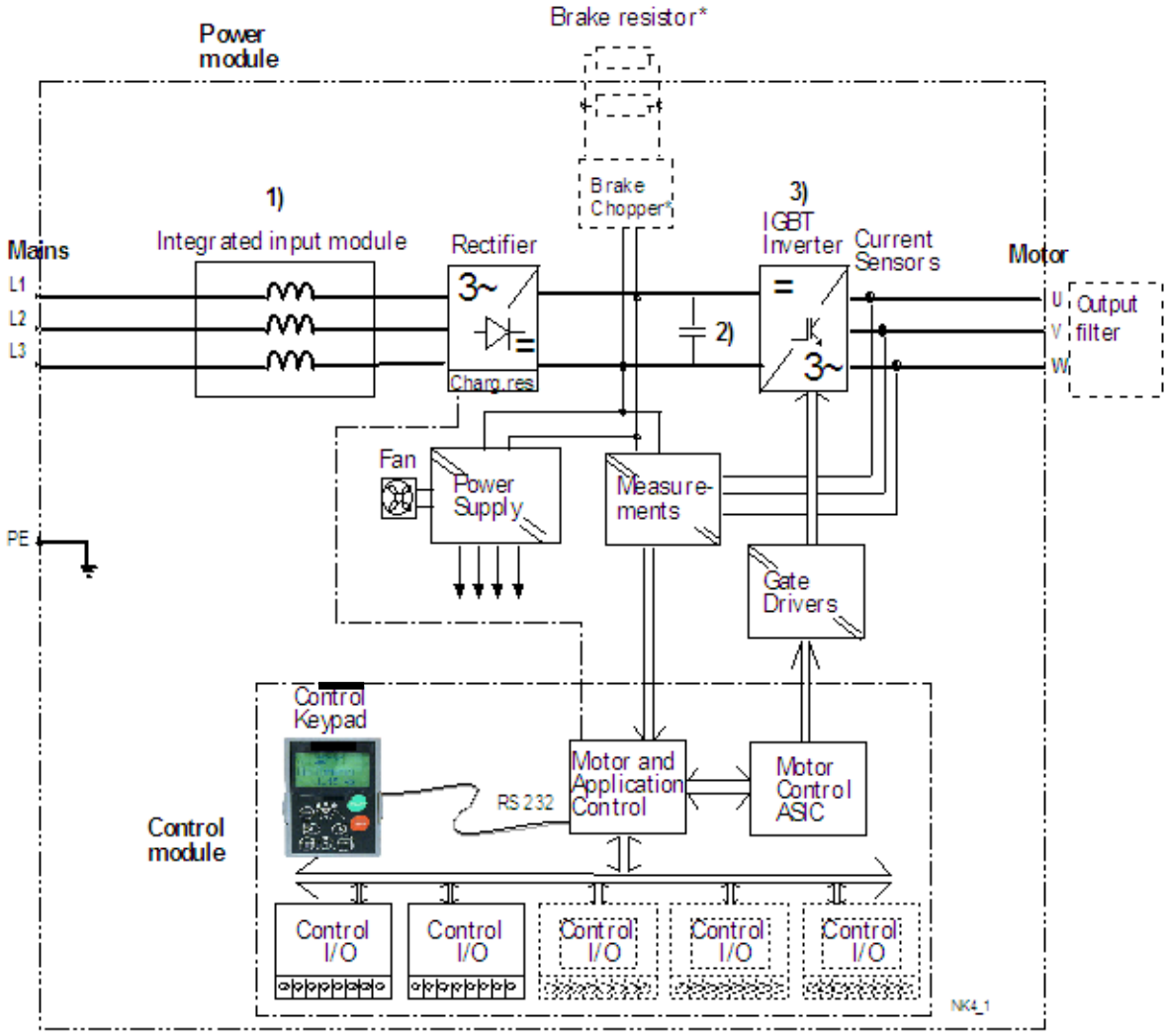
In all matters concerning the warranty, please contact first your distributor.

SECTION III

TECHNICAL DATA

3-1 INTRODUCTION

Figure 3-1 presents the block diagram of the ACCel500 frequency converter. The frequency converter mechanically consists of two units, the Power Unit and the Control Unit. Figures 5-7 to 5-20 depict the mechanical assemblages.



*The brake resistor can be installed internally in sizes FR4 to FR6. In all other frames, the brake resistor is available as option and installed externally.
Brake chopper belongs to the standard equipment in sizes FR4 to FR6, while in greater sizes (FR7 to FR9) it is optional.

Figure 3-1. ACCel500 Block Diagram

The three-phase AC choke (1) at the mains end together with the DC link capacitor (2) form an LC filter, which, again, together with the diode bridge produce the DC voltage supply to the IGBT inverter bridge (3) block. The AC choke also functions as a filter against high frequency disturbances from the mains as well as against those caused by the frequency converter to the mains. It, in addition, enhances the waveform of the input current to the frequency converter. The entire power drawn by the frequency converter from the mains is active power. The IGBT inverter bridge produces a symmetrical, 3-phase PWM-modulated AC voltage to the motor.

The Motor and Application Control Block is based on microprocessor software. The microprocessor controls the motor basing on the information it receives through measurements, parameter settings, control I/O and control keypad. The motor and application control block controls the motor control ASIC which, in turn, calculates the IGBT positions. Gate drivers amplify these signals for driving the IGBT inverter bridge.

The control keypad constitutes a link between the user and the frequency converter. The control keypad is used for parameter setting, reading status data and giving control commands. It is detachable and can be operated externally and connected via a cable to the frequency converter. Instead of the control keypad, also a PC can be used to control the frequency converter if connected through a similar cable.

You can have your frequency converter equipped with a control I/O board which is either isolated (OPT-A8) or not isolated (OPT-A1) from the ground.

A brake resistor is available as internal option for frames FR4 to FR6 of voltage classes 230 VAC and 460 VAC. In all other frames of voltage classes 230 VAC and 460 VAC, as well as in all frames of all other voltage classes, the brake resistor is available as option and is installed externally.

Optional I/O expander boards that increase the number of inputs and outputs to be used are also available. For more detailed information, contact the manufacturer or your local distributor.

3-2 **POWER RATINGS**

3-2.1 MAINS VOLTAGE 380 TO 500 VAC

High overload = Max current IS, 2 sec/20 sec, 150% overloadability, 1 min/10 min following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH).

Low overload = Max current IS, 2 sec/20 sec, 110% overloadability, 1 min/10 min following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL).

All sizes are available as IP21/NEMA1. Sizes FR4 to FR9 are additionally available as IP54/NEMA12.

TABLE 3-1. POWER RATINGS AND DIMENSIONS, SUPPLY VOLTAGE 380 TO 500 VAC

Mains Voltage 380 to 500 V, 50/60 Hz, 3~													
	Loadability							**Motor shaft power**					
	Low			High				380V Supply		500V Supply			
Frequency Converter Type	HP	Rated continuous current I_L (A)	10% overload current (A)	HP	Rated continuous current I_H (A)	50% overload current (A)	Max current I_S	10% OL 40°C P(kW)	50% OL 50°C P(kW)	10% OL 40°C P(kW)	50% OL 50°C P(kW)	**Frame**	**Dimensions and Weight in/lb (mm/kg)**
AC_0002	1.5	3.3	3.6	1	2.2	3.3	4.4	1.1	0.75	1.5	1.1	FR4	5.04x11.5x7.42/11 (128x292x190/5)
AC_0003	2	4.3	4.7	1.5	3.3	5.0	6.2	1.5	1.1	2.2	1.5	FR4	
AC_0004	3	5.6	6.2	2	4.3	6.5	8.6	2.2	1.5	3	2.2	FR4	
AC_0005	5	7.6	8.4	3	5.6	8.4	10.8	3	2.2	4	3	FR4	
AC_0007	n/a	9	9.9	5	7.6	11.4	14	4	3	5.5	4	FR4	
AC_0009	7.5	12	13.2	n/a	9	13.5	18	5.5	4	7.5	5.5	FR4	
AC_0012	10	16	17.6	7.5	12	18.0	24	7.5	5.5	11	7.5	FR5	5.67x15.4x8.43/17.9 (144x391x214/8.1)
AC_0016	15	23	25.3	10	16	24.0	32	11	7.5	15	11	FR5	
AC_0023	20	31	34	15	23	35	46	15	11	18.5	15	FR5	
AC_0031	25	38	42	20	31	47	62	18.5	15	22	18.5	FR6	7.68x20.4x9.33/40.8 (195x519x237/18,5)
AC_0038	30	46	51	25	38	57	76	22	18.5	30	22	FR6	
AC_0046	40	61	67	30	46	69	92	30	22	37	30	FR6	
AC_0061	50	72	79	40	61	92	122	37	30	45	37	FR7	9.33x23.3x10.1/77.2 (237x591x257/35)
AC_0072	60	87	96	50	72	108	144	45	37	55	45	FR7	
AC_0087	75	105	116	60	87	131	174	55	45	75	55	FR7	
AC_0105	100	140	154	75	105	158	210	75	55	90	75	FR8	11.5x29.8x13.5/128 (291x758x344/58)
AC_0140	125	170	187	100	140	210	280	90	75	110	90	FR8	
AC_0170	150	205	226	125	170	255	336	110	90	132	110	FR8	
AC_0205	200	261	287	150	205	308	349	132	110	160	132	FR9	18.9x45.3x14.3/322 (480x1150x362/146)
AC_0245	250	300	330	200	245	368	444	160	132	200	160	FR9	
AC_0330	300	385	424	250	330	450	540	200	160	250	200	FR10	23.5x79.4x23.7/661 (595x2018x602/300)
AC_0385	n/a	460	506	300	385	578	693	250	200	315	250	FR10	
AC_0460	400	520	572	350	460	690	828	250	250	355	315	FR10	
AC_0520	500	590	649	400	520	780	936	315	250	400	355	FR11	31.3x79.4x23.7/816 (794x2018x602/370)
AC_0590	n/a	650	715	500	590	885	1062	355	315	450	400	FR11	
AC_0650	600	730	803	n/a	650	975	1170	400	355	500	450	FR11	
AC_0730	n/a	820	902	600	730	1095	1314	450	400	500	500	FR12	47.6x79.4x23.7/1323 (1210x2017x602/600)
AC_0820	700	920	1012	n/a	820	1230	1476	500	450	630	500	FR12	
AC_0920		1030	1133	700	920	1380	1656	500	500	710	630	FR12	

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Note: The rated currents for FR10 to FR12 are all valid at an ambient temperature of 40 °C.

3-2.2 MAINS VOLTAGE 525 TO 690 VAC

High overload = Max current IS, 2 sec/20 sec, 150% overloadability, 1 min/10 min following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH).

Low overload = Max current IS, 2 sec/20 sec, 110% overloadability, 1 min/10 min following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL).

All sizes are available as IP21/NEMA1 or IP54/NEMA12.

TABLE 3-2. POWER RATINGS AND DIMENSIONS, SUPPLY VOLTAGE 525 TO 690 VAC

Mains Voltage 525 to 690 V, 50/60 Hz, 3~													
	Loadability							**Motor shaft power**					
	Low			High				690V supply		575V supply			
Frequency Converter Type	HP	Rated continuous current I_L (A)	10% overload current (A)	HP	Rated continuous current I_H (A	50% overload current (A)	Max current I_S	10% OL 40°C P(kW)	50% OL 50°C P(kW)	10% OL 40°C P(kW)	50% OL 50°C P(kW)	**Frame**	**Dimensions and Weight in/lb (mm/kg)**
AC_0003	3	4.5	5.0	2	3.2	4.8	6.4	3	2.2	3.0	2.0	FR6	7.68x20.4x9.33/40.8 (195x519x237/18,5)
AC_0004	n/a	5.5	6.1	3	4.5	6.8	9.0	4	3	3.0	3.0	FR6	
AC_0005	5	7.5	8.3	n/a	5.5	8.3	11.0	5.5	4	5.0	3.0	FR6	
AC_0007	7.5	10	11.0	5	7.5	11.3	15.0	7.5	5.5	7.5	5.0	FR6	
AC_0010	10	13	14.9	7.5	10	15.0	20.0	10	7.5	11	7.5	FR6	
AC_0013	15	18	19.8	10	13.5	20.3	27	15	10	15	11	FR6	
AC_0018	20	22	24.2	15	18	27.0	36	18.5	15	20	15	FR6	
AC_0022	25	27	29.7	20	22	33.0	44	22	18.5	25	20	FR6	
AC_0027	30	34	37	25	27	41	54	30	22	30	25	FR6	
AC_0034	40	41	45	30	34	51	68	37.5	30	40	30	FR7	9.33x23.3x10.1/77.2 (237x591x257/35)
AC_0041	50	52	57	40	41	62	82	45	37.5	50	40	FR7	
AC_0052	60	62	68	50	52	78	104	55	45	60	50	FR8	11.5x29.8x13.5/128 (291x758x344/58)
AC_0062	75	80	88	60	62	93	124	75	55	75	60	FR8	
AC_0080	100	100	110	75	80	120	160	90	75	100	75	FR8	
AC_0100	125	125	138	100	100	150	200	110	90	125	100	FR9	18.9x45.3x14.3/322 (480x1150x362/146)
AC_0125	150	144	158	125	125	188	213	132	110	150	125	FR9	
AC_0144	n/a	170	187	150	144	216	245	160	132	150	150	FR9	
AC_0170	200	208	229	n/a	170	255	289	200	160	200	150	FR9	
AC_0208	250	261	287	200	208	312	375	250	200	250	200	FR10	23.5x79.4x23.7/661 (595x2018x602/300)
AC_0261	300	325	358	250	261	392	470	315	250	300	250	FR10	
AC_0325	400	385	424	300	325	488	585	355	315	400	300	FR10	
AC_0385	450	460	506	400	385	578	693	450	355	450	400	FR11	31.3x79.4x23.7/816 (794x2018x602/370)
AC_0460	500	502	552	450	460	690	828	500	450	500	450	FR11	
AC_0502	n/a	590	649	500	502	753	904	560	500	600	500	FR11	
AC_0590	600	650	715	n/a	590	885	375	250	200	250	200	FR12	47.6x79.4x23.7/1323 (1210x2017x602/600)
AC_0650	700	750	825	600	650	975	470	315	250	300	250	FR12	
AC_0750	800	820	902	700	750	1125	585	355	315	400	300	FR12	

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Note: The rated currents for FR10 to FR12 are all valid at an ambient temperature of 40 °C.

3-2.3 MAINS VOLTAGE 208 to 240 VAC

High overload = Max current IS, 2 sec/20 sec, 150% overloadability, 1 min/10 min following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH).

Low overload = Max current IS, 2 sec/20 sec, 110% overloadability, 1 min/10 min following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL).

All sizes are available as IP21/NEMA1 or IP54/NEMA12.

TABLE 3-3. POWER RATINGS AND DIMENSIONS, SUPPLY VOLTAGE 208 TO 240 VAC

Mains Voltage 208 to 240 V, 50/60 Hz, 3~													
	Loadability							**Motor shaft power**					
	Low			High				230V supply		208-240V supply			
Frequency Converter Type	HP	Rated continuous current I_L (A)	10% overload current (A)	HP	Rated continuous current I_H (A)	50% overload current (A)	Max current I_S	10% OL 40°C P(kW)	50% OL 50°C P(kW)	10% OL 40°C P(hp)	50% OL 50°C P(hp)	**Frame**	**Dimensions and Weight in/lb (mm/kg)**
AC_0003	1	4.8	5.3	0.75	3.7	5.6	7.4	0.75	0.55	1	0.75	FR4	5.04x11.5x7.42/11 (128x292x190/5)
AC_0004	1.5	6.6	7.3	1	4.8	7.2	9.6	1.1	0.75	1.5	1	FR4	
AC_0006	2	7.8	8.6	1.5	6.6	9.9	13.2	1.5	1.1	2	1.5	FR4	
AC_0007	3	11	12.1	2	7.8	11.7	15.6	2.2	1.5	3	2	FR4	
AC_0011	n/a	12.5	13.8	3	11	16.5	22	3	2.2	-	3	FR4	
AC_0012	5	17.5	19.3	n/a	12.5	18.8	25	4	3	5	-	FR5	5.67x15.4x8.43/17.9 (144x391x214/8.1)
AC_0017	7.5	25	27.5	5	17.5	26.3	35	5.5	4	7.5	5	FR5	
AC_0025	10	31	34.1	7.5	25	37.5	50	7.5	5.5	10	7.5	FR5	
AC_0031	15	48	52.8	10	31	46.5	62	11	7.5	15	10	FR6	7.68x20.4x9.33/40.8 (195x519x237/18,5)
AC_0048	20	61	67.1	15	48	72.0	96	15	11	20	15	FR6	
AC_0061	25	75	83	20	61	92	122	22	15	25	20	FR7	9.33x23.3x10.1/77.2 (237x591x257/35)
AC_0075	30	88	97	25	75	113	150	22	22	30	25	FR7	
AC_0088	40	114	125	30	88	132	176	30	22	40	30	FR7	
AC_0114	50	140	154	40	114	171	210	37	30	50	40	FR8	11.5x29.8x13.5/128 (291x758x344/58)
AC_0140	60	170	187	50	140	210	280	45	37	60	50	FR8	
AC_0170	75	205	226	60	170	255	336	55	45	75	60	FR8	
AC_0205	100	261	287	75	205	308	349	75	55	100	75	FR9	18.9x45.3x14.3/322 (480x1150x362/146)
AC_0261	n/a	300	330	100	261	391	444	90	75	125	100	FR9	

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

3-3 BRAKE RESISTOR RATINGS

TABLE 3-4. BRAKE RESISTOR RATINGS, SUPPLY VOLTAGE 380 TO 500 VAC

Mains Voltage 380 to 500 V, 50/60 Hz, 3~					
Converter Type	Max. Brake Current [I]	Resistor Nom [ohm]	Converter Type	Max. Brake Current [I]	Resistor Nom. [ohm]
AC_0002	12	63	AC_0087	111	6.5
AC_0003	12	63	AC_0105	222	3.3
AC_0004	12	63	AC_0140	222	3.3
AC_0005	12	63	AC_0170	222	3.3
AC_0007	12	63	AC_0205	222	3.3
AC_0009	12	63	AC_0245	222	3.3
AC_0012	12	63	AC_0330	570	1.4
AC_0016	12	63	AC_0385	570	1.4
AC_0023	17	42	AC_0460	570	1.4
AC_0031	35	21	AC_0520	855	0.9
AC_0038	35	21	AC_0590	855	0.9
AC_0046	51	14	AC_0650	855	0.9
AC_0061	111	6.5	AC_0730	2 x 570	2 x 1.4
AC_0072	111	6.5	AC_0820	2 x 570	2 x 1.4

TABLE 3-5. BRAKE RESISTOR RATINGS, SUPPLY VOLTAGE 525 TO 690 VAC

Mains Voltage 525-690 V, 50/60 Hz, 3~					
Converter type	Max. brake current [I]	Resistor nom [ohm]	Converter type	Max. brake current [I]	Resistor nom. [ohm]
AC_0003	11	100	AC_0100	157.1	7
AC_0004	11	100	AC_0125	157.1	7
AC_0005	11	100	AC_0144	157.1	7
AC_0007	11	100	AC_0170	157.1	7
AC_0010	11	100	AC_0208	440.0	2.5
AC_0013	36.7	30	AC_0261	440.0	2.5
AC_0018	36.7	30	AC_0325	440.0	2.5
AC_0022	36.7	30	AC_0385	440.0	2.5
AC_0027	36.7	30	AC_0460	647.1	1.7
AC_0034	61.1	18	AC_0502	647.1	1.7
AC_0041	61.1	18	AC_0590	2 x 440	2 x 2.5
AC_0052	122.2	9	AC_0650	2 x 440	2 x 2.5
AC_0062	122.2	9	AC_0750	2 x 440	2 x 2.5
AC_0080	122.2	9			

TABLE 3-6. BRAKE RESISTOR RATINGS, SUPPLY VOLTAGE 208 TO 240 VAC

Mains Voltage 208-240 V, 50/60 Hz, 3~					
Converter Type	Max. Brake Current [I]	Resistor Nom. [ohm]	Converter Type	Max. Brake Current [I]	Resistor Nom. [ohm]
AC_0003	15	30	AC_0048	46	10
AC_0004	15	30	AC_0061	148	3.3
AC_0006	15	30	AC_0075	148	3.3
AC_0007	15	30	AC_0088	148	3.3
AC_0011	15	30	AC_0114	296	1.4
AC_0012	15	30	AC_0140	296	1.4
AC_0017	15	30	AC_0170	296	1.4
AC_0025	23	20	AC_0205	296	1.4
AC_0031	46	10	AC_0261	296	1.4

3-4 TECHNICAL DATA

TABLE 3-7. TECHNICAL DATA

Mains connection	Input voltage V_{in}	208 to 240V; 380 to 500V; 525 to 690V; –15% to +10%
	Input frequency	45 to 66 Hz
	Connection to mains	Once per minute or less
	Starting delay	2 s (FR4 to FR8); 5 s (FR9)
Motor connection	Output voltage	0—V_{in}
	Continuous output current	I_H: Ambient temperature max. +50°C, overload 1.5 x I_H (1 min./10 min.) I_L: Ambient temperature max. +40°C, overload 1.1 x I_L (1 min./10 min.)
	Starting current	I_S for 2 s every 20 s
	Output frequency	0 to 320 Hz (standard); 7200 Hz (special software)
	Frequency resolution	0.01 Hz (NXS); Application dependent (NXP)
Control characteristics	Control method	Frequency control V/f Open Loop Sensorless Vector Control Closed Loop Vector Control (NXP only)
	Switching frequency (see parameter 2.6.9)	**230/460:** Up to AC_0061: 1 to 16 kHz; Default: 10 kHz **230:** AC_0075 and greater: 1 to 10 kHz; Def: 3.6 kHz **460:** AC_0072 and greater: 1 to 6 kHz; Def: 3.6 kHz **575:** 1 to 6 kHz; Default: 1.5 kHz
	<u>Frequency reference</u> Analogue input Panel reference	 Resolution 0.1% (10-bit), accuracy ±1% Resolution 0.01 Hz
	Field weakening point	8 to 320 Hz
	Acceleration time	0.1 to 3000 sec
	Deceleration time	0.1 to 3000 sec
	Braking torque	DC brake: 30% * T_N (without brake option)
Ambient conditions	Ambient operating temperature	–10°C (no frost) to +50°C: I_H –10°C (no frost) to +40°C: I_L –10°C (no frost) to +35°C: for IP54/NEMA 12 AC_0520 and AC_0416
	Storage temperature	–40°C to +70°C

	Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
	Altitude	100% load capacity (no derating) up to 1,000 m 1-% derating for each 100m above 1000. Max. altitudes: 230V: 3000m; 460V: 3000m/2000m (corner-grounded network); 575V: 2000m
	Vibration EN50178/EN60068-2-6	5 to 150 Hz Displacement amplitude 1 mm (peak) at 5 to 15.8 Hz (FR4 to 9) Max acceleration amplitude 1 G at 15.8 to 150 Hz (FR4 to FR9) Displacement amplitude 0.25 mm (peak) at 5-31 Hz (FR10 to 12) Max acceleration amplitude 0.25 G at 31 to 150 Hz (FR10 to 12)
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP21/NEMA1 standard in entire kW/HP range IP54/NEMA12 option in entire kW/HP range **Note!** Keypad required for IP54/NEMA12
EMC (at default settings)	Immunity	Fulfils EN61800-3, first and second environment
	Emissions	Depend on EMC level. See chapters 2 and 3.
Safety		EN 50178 (1997), EN 60204-1 (1996), EN 60950 (2000, 3rd edition) (as relevant), CE, UL, CUL, FI, GOST R; (see unit nameplate for more detailed approvals)
Control connections (apply to boards OPT-A1, OPT-A2 and OPT-A3)	Analogue input voltage	0 to +10V, R_i = 200kΩ, (–10V to +10V joystick control) Resolution 0.1%, accuracy ±1%
	Analogue input current	0(4) to 20 mA, R_i = 250Ω differential
	Digital inputs (6)	Positive or negative logic; 18 to 30VDC
	Auxiliary voltage	+24V, ±10%, max volt. ripple < 100mVrms; max. 250mA Dimensioning: max. 1000mA/control box
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4) to 20mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min.switching load: 5V/10mA
Protections	Overvoltage trip limit Undervoltage trip limit	**230V**: 437 VDC; **460V**: 911 VDC; **575V**: 1200 VDC **230V**: 183 VDC; **460V**: 333 VDC; **575V**: 460 VDC
	Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Mains supervision	Trips if any of the input phases is missing
	Motor phase supervision	Trips if any of the output phases is missing
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24V and +10V reference voltages	Yes

SECTION IV

INSTALLATION

4-1 MOUNTING

The frequency converter can be mounted in either vertical or horizontal position on the wall or on the back plane of a cubicle. However, if the drive is mounted in a horizontal position, it is not protected against vertically falling drops of water.

Enough space shall be reserved around the frequency converter in order to ensure a sufficient cooling, see Table 4-10 and Table 4-11. Also see to that the mounting plane is relatively even.

The frequency converter shall be fixed with four screws (or bolts, depending on the unit size). The dimensions of installation are presented in section 4-11 and Table 4-10.

Lift units bigger than FR7 out of the package using a jib crane. Ask the factory or your local distributor for information on how to lift the unit safely.

Below you will find the dimensions of both wall-mounted as well as flange-mounted ACCel500 frequency converters. The dimensions of the opening needed in flange mounting are given in Table 4-3 and Table 4-5.

The sizes FR10 to FR12 are floor standing units. The enclosures are equipped with fixing holes. For dimensions see below.

See also section 4-2, Cooling.

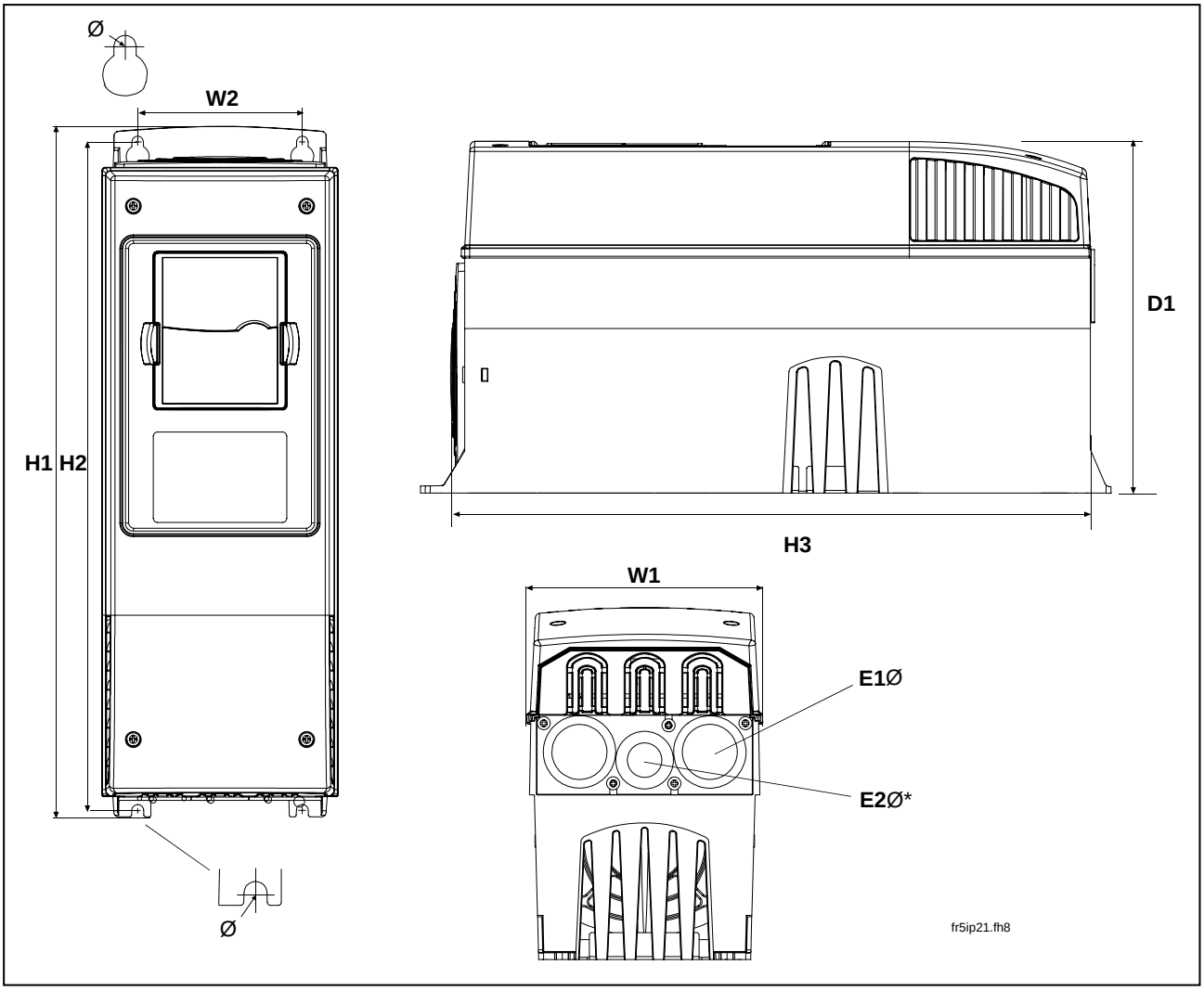


Figure 4-1. ACCel500 Dimensions

TABLE 4-1. DIMENSIONS FOR DIFFERENT FREQUENCY CONVERTER TYPES

Type	Dimensions [in (mm)]								
	W1	W2	H1	H2	H3	D1	∅	E1∅	E2∅*
0003—0011 (230V) 0002—0009 (460V)	5.04 (128)	3.94 (100)	12.9 (327)	12.3 (313)	11.5 (292)	7.48 (190)	0.27 (7)	3 x 1.11 (3 x 28,3)	
0012—0025 (230V) 0012—0023 (460V)	5.67 (144)	3.94 (100)	16.5 (419)	16.0 (406)	15.4 (391)	8.43 (214)	0.27 (7)	2 x 1.46 (2 x 37)	1 x 1.11 (1 x 28,3)
0031—0048 (230V) 0031—0046 (460V) 0003—0027 (575V)	7.68 (195)	5.83 (148)	22.0 (558)	21./3 (541)	20.4 (519)	4.33 (237)	0.35 (9)	3 x 1.46 (3 x 37)	
0061—0088 (230V) 0061—0087 (460V) 0034—0041 (575V)	9.33 (237)	7.48 (190)	24.8 (630)	24.2 (614)	23.3 (591)	10.1 (257)	0.35 (9)	3 x 1.85 (3 x 47)	
0114—0170 (230V) 0105—0170 (460V) 0052—0080 (575V)	11.4 (289)	10.0 (255)	29.9 (759)	28.8 (732)	28.4 (721)	13.5 (344)	0.35 (9)	2 x 2.32 (3 x 59)	

- = FR5 only

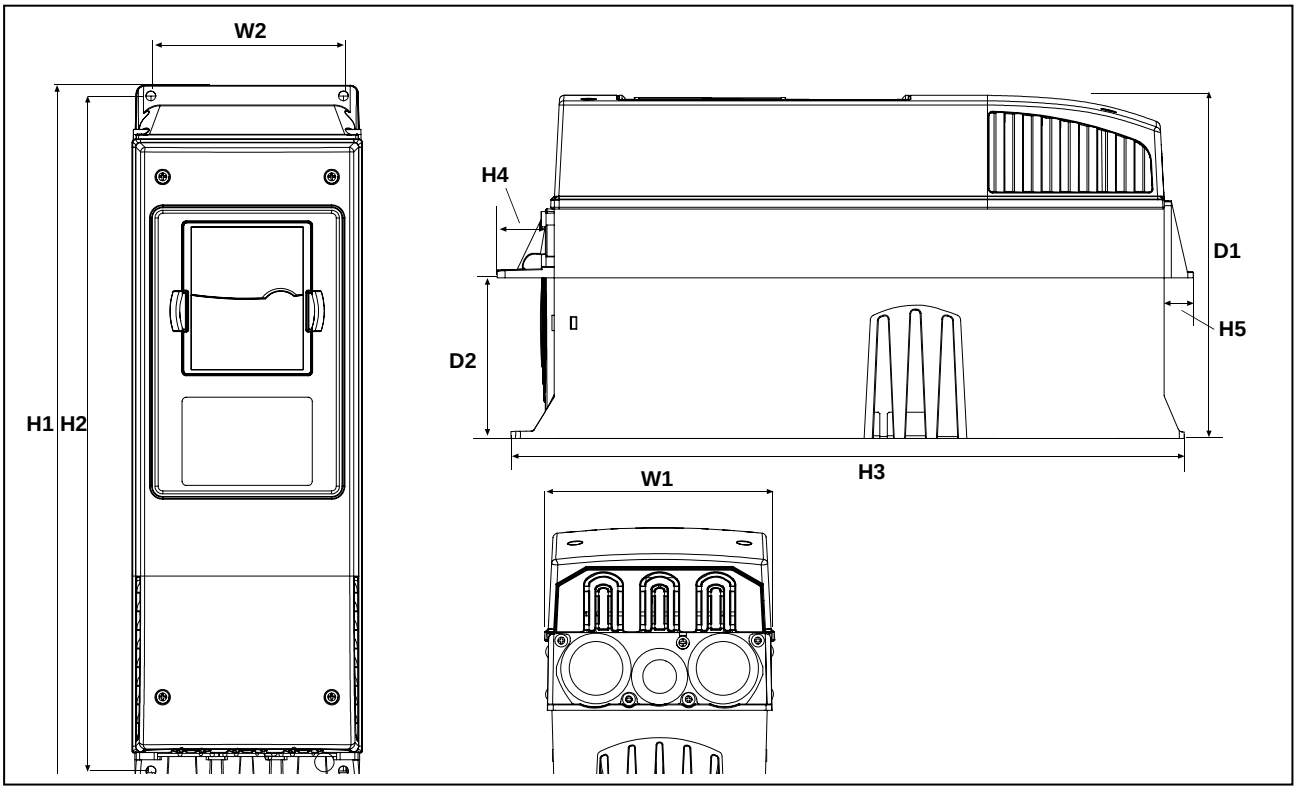


Figure 4-2. ACCel500 dimensions, FR4 to FR6; Flange Mounting

TABLE 4-2. DIMENSIONS FOR DIFFERENT FREQUENCY CONVERTER TYPES FR4 TO FR6, FLANGE MOUNTING

Type	Dimensions [in (mm)]									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	∅
0003—0011 (230V) 0002—0009 (460V)	5.04 (128)	4.45 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.18 (30)	0.87 (22)	7.48 (190)	3.03 (77)	0.27 (7)
0012—0025 (230V) 0012—0023 (460V)	5.67 (144)	4.72 (120)	17.1 (434)	17.1 (420)	16.5 (419)	1.42 (36)	0.71 (18)	8.43 (214)	3.94 (100)	0.27 (7)
0031—0048 (230V) 0031—0046 (460V) 0003—0027 (575V)	7.68 (195)	6.69 (170)	22.0 (560)	21.6 (549)	22.0 (558)	0.79 (30)	0.79 (20)	4.17 (237)	4.17 (106)	0.26 (6.5)

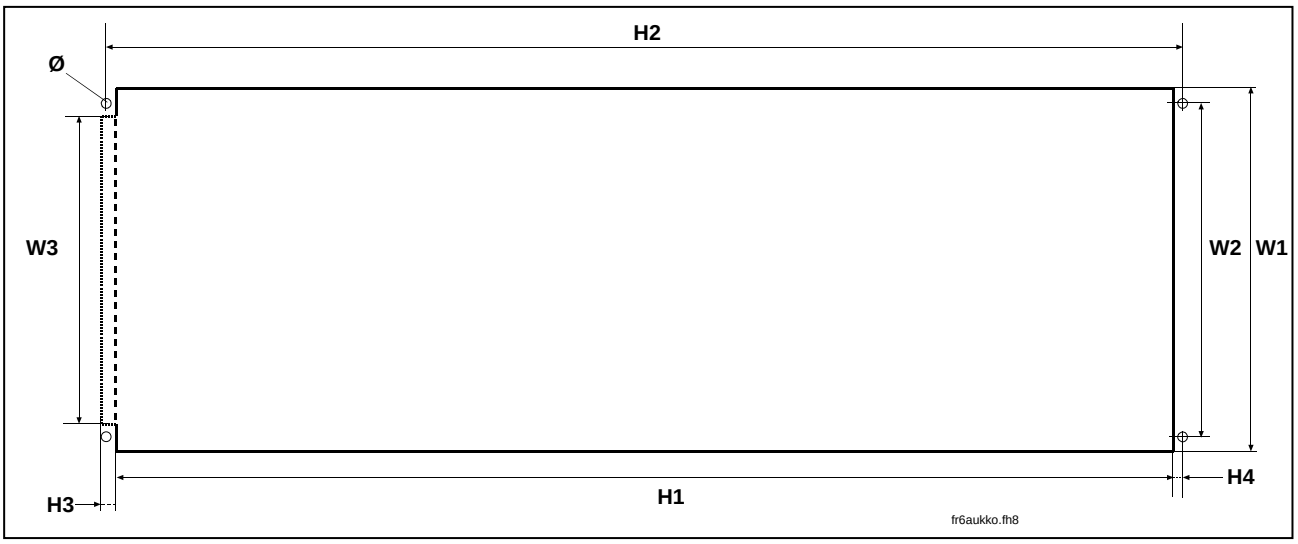


Figure 4-3. The Opening Needed for the Flange Mounting, FR4 to FR6

TABLE 4-3. DIMENSIONS FOR THE OPENING
FOR FLANGE MOUNTING, FR4 TO FR6

Type	Dimensions [in (mm)]							
	W1	W2	W3	H1	H2	H3	H4	∅
0003—0011 (230V) 0002—0009 (460V)	4.84 (123)	4.49 (113)	–	12.4 (315)	12.8 (325)	–	0.20 (5)	0.26 (6.5)
0012—0025 (230V) 0012—0023 (460V)	5.31 (135)	4.72 (120)	–	16.1 (410)	16.4 (420)	–	0.20 (5)	0.26 (6.5)
0031—0048 (230V) 0031—0046 (460V) 0003—0027 (575V)	7.88 (185)	6.69 (170)	(157)	21.2 (539)	21.6 (549)	0.27 (7)	0.20 (5)	0.26 (6.5)

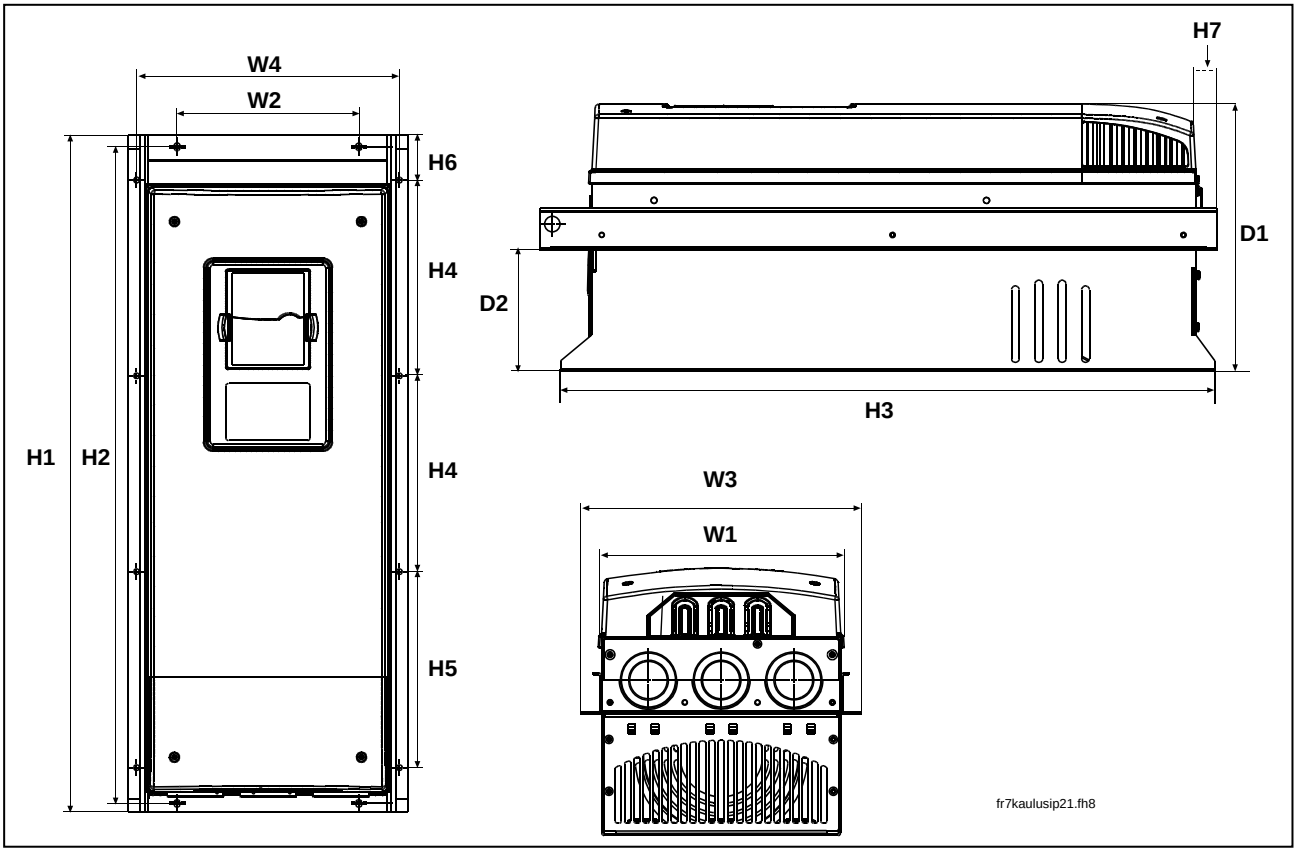


Figure 4-4. ACCel500 Dimensions, FR7 and FR8, Flange Mounting

TABLE 4-4. DIMENSIONS FOR DIFFERENT FREQUENCY CONVERTER TYPES FR7 AND FR8, FLANGE MOUNTING

Type	**Dimensions [in (mm)]**													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	∅
0061—0088 (230V) 0061—0087 (460V) 0034—0041 (575V)	9.33 (237)	6.89 (175)	10.6 (270)	3.96 (253)	25.4 (652)	24.3 (632)	24.8 (630)	7.42 (188.5)	7.42 (188.5)	0.91 (23)	0.79 (20)	10.12 (257)	4.61 (117)	0.22 (5.5)
0114—0170 (230V) 0105—0170 (460V) 0052—0080 (575V)	11.4 (289)	–	14.0 (355)	13.0 (330)	32.8 (832*)	–	29.9 (759)	10.2 (258)	10.4 (265)	1.69 (43)	1.24 (57)	13.54 (344)	4.33 (110)	0.35 (9)

*Brake resistor terminal box (202,5 mm) not included, see Figure 5-17.

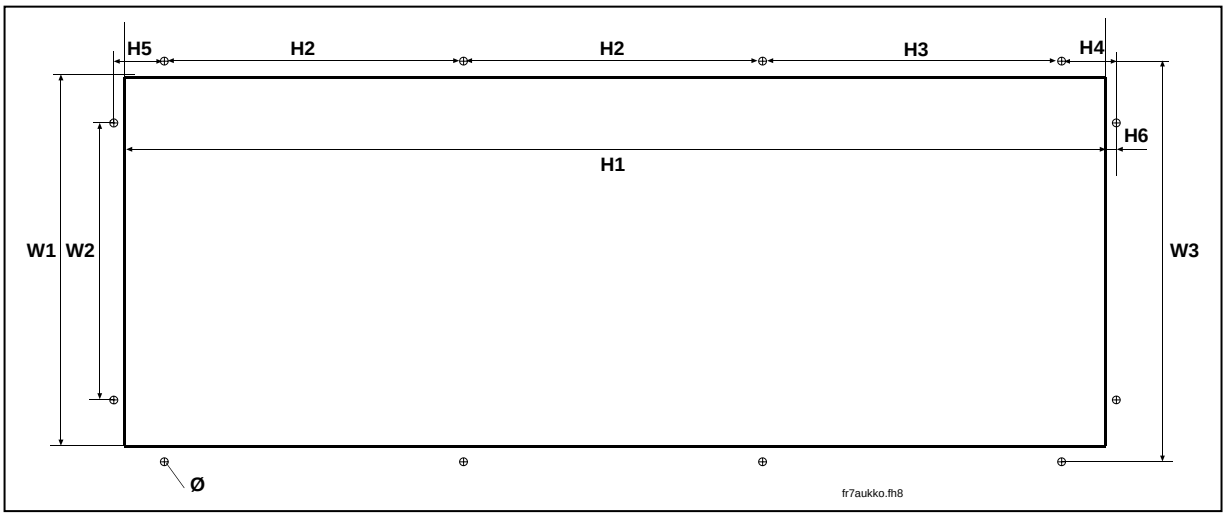


Figure 4-5. The Opening Needed for the Flange Mounting, FR7

TABLE 4-5. DIMENSIONS FOR THE OPENING FOR FLANGE MOUNTING, FR7

Type	**Dimensions [in (mm)]**									
	W1	W2	W3	H1	H2	H3	H4	H5	H6	∅
0061—0088 (230V) 0061—0087 (460V) 0034—0041 (575V)	9.17 (233)	6.89 (175)	9.9 (253)	24.4 (619)	7.42 (188.5)	7.42 (188.5)	1.36 (34.5)	1.26 (32)	0.27 (7)	0.22 (5.5)

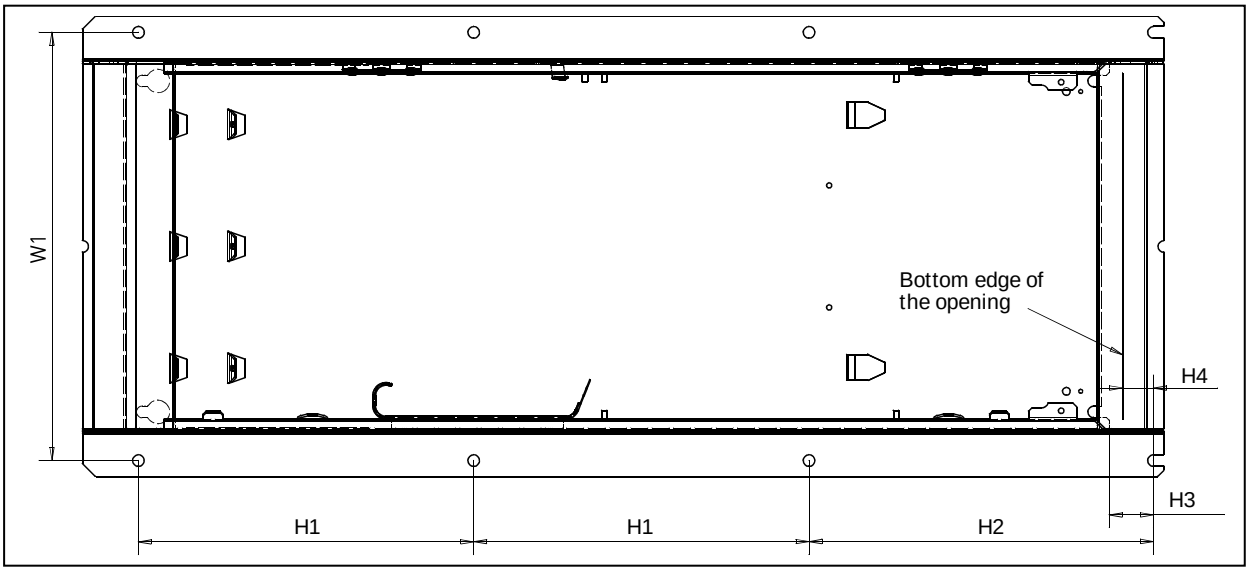


Figure 4-6. The Opening Needed for the Flange Mounting, FR8

TABLE 4-6. DIMENSIONS FOR THE OPENING FOR FLANGE MOUNTING, FR8

Type	**Dimensions [in (mm)]**					
	W1	H1	H2	H3	H4	∅
0114—0170 (230V) 0105—0170 (460V) 0052—0080 (575V)	13.0 (330)	10.2 (258)	10.4 (265)	1.34 (34)	0.94 (24)	0.35 (9)

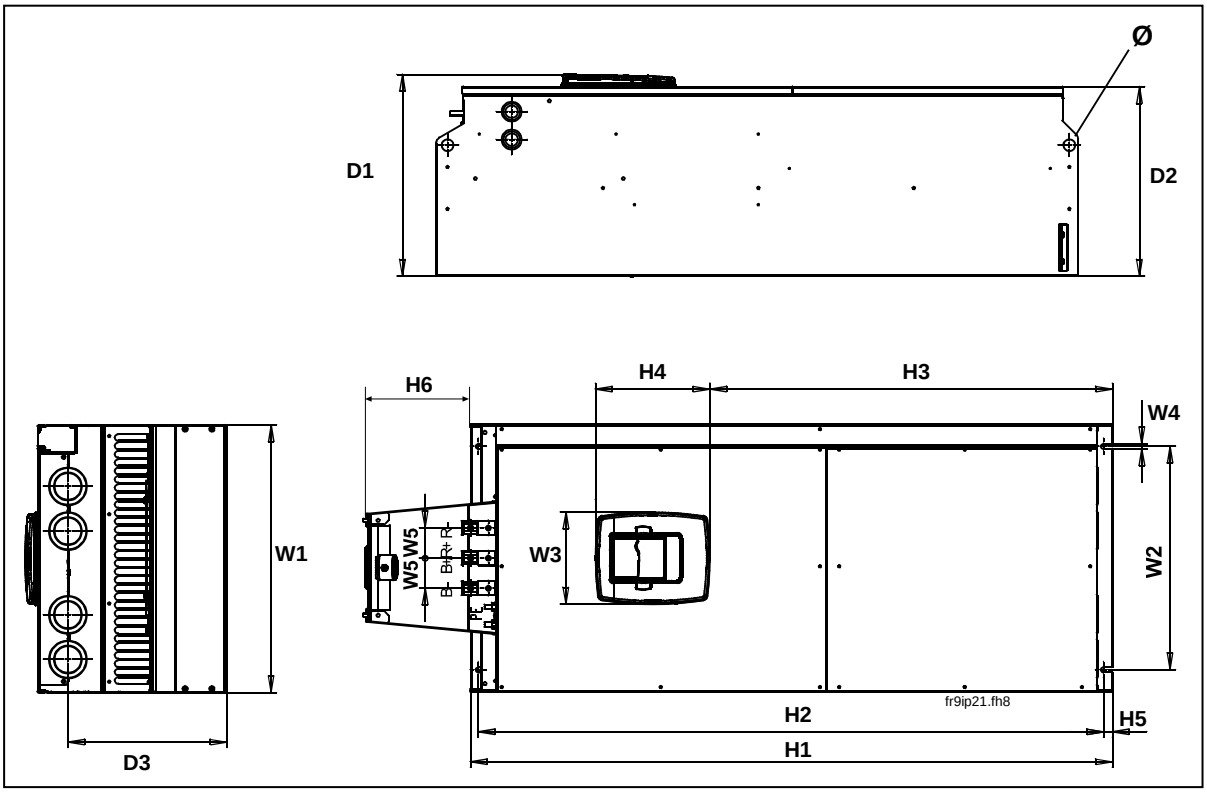


Figure 4-7. The Dimensions ACCel500, FR9

TABLE 4-7. THE DIMENSIONS ACCel500, FR9

Type	**Dimensions [in (mm)]**														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	D1	D2	D3	∅
0205-0261 (230V) 0205-0245 (460V) 0100-0170 (575V)	18.9 (480)	15.7 (400)	6.5 (165)	0.35 (9)	21.3 (54)	45.28 (1150*)	44.09 (1120)	67.8 (721)	47.4 (205)	4.57 (16)	7.4 (188)	14.3 (362)	13.4 (340)	11.2 (285)	0.83 (21)

*Brake resistor terminal box (H6) not included, see Figure 5-20.

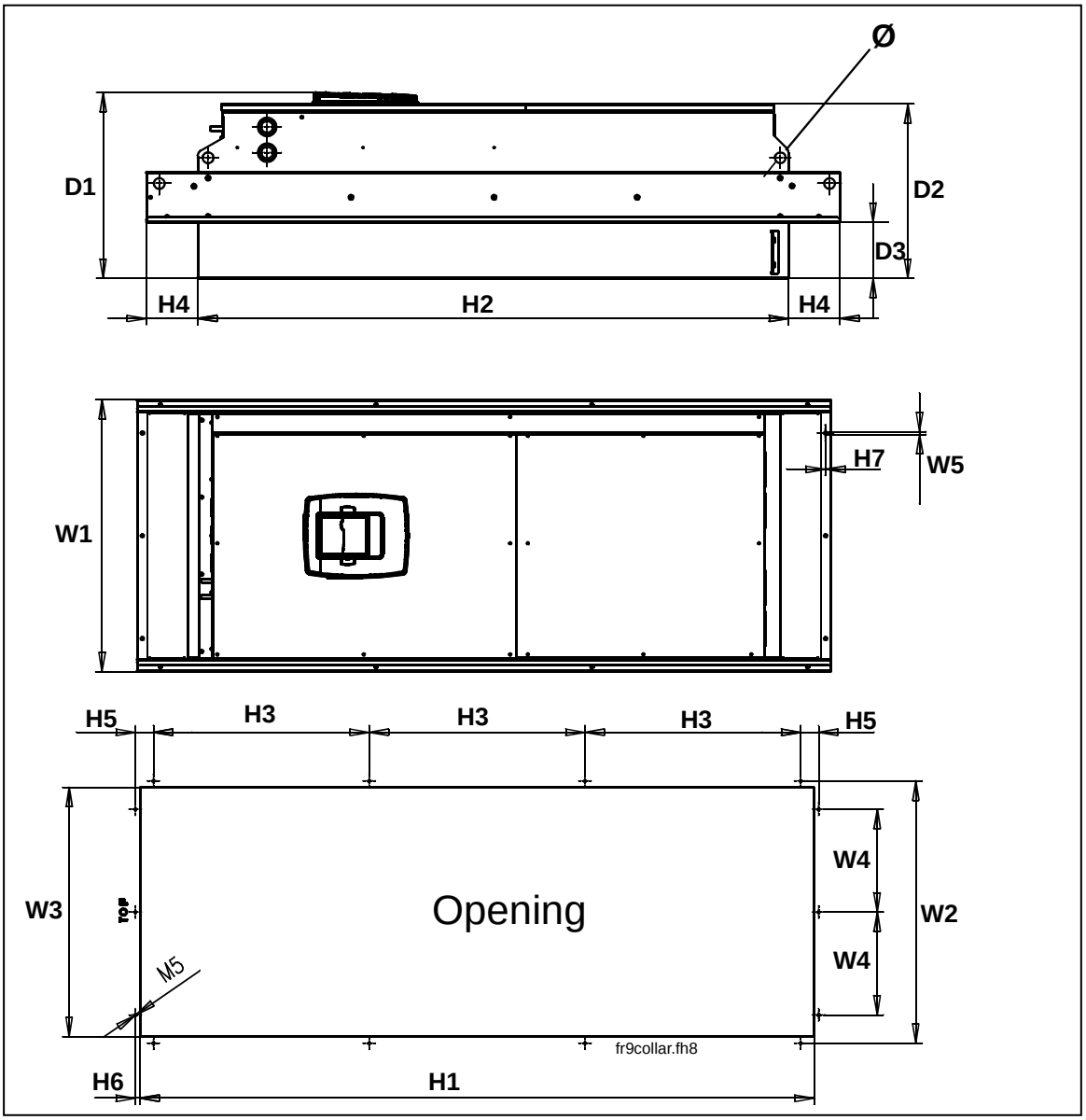


Figure 4-8. ACCel500 Dimensions; FR9 Flange Mounting

TABLE 4-8. ACCel500 DIMENSIONS FR9 FLANGE-MOUNTED

Type	**Dimensions [in (mm)]**															
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	∅
0205—0261 (230V) 0205—0245 (460V) 0100—0170 (575V)	20.9 (530)	20.1 (510)	19.1 (485)	17.9 (200)	0.22 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.94 (100)	1.38 (35)	0.35 (9)	0.08 (2)	14.3 (362)	13.4 (340)	4.29 (109)	0.83 (21)

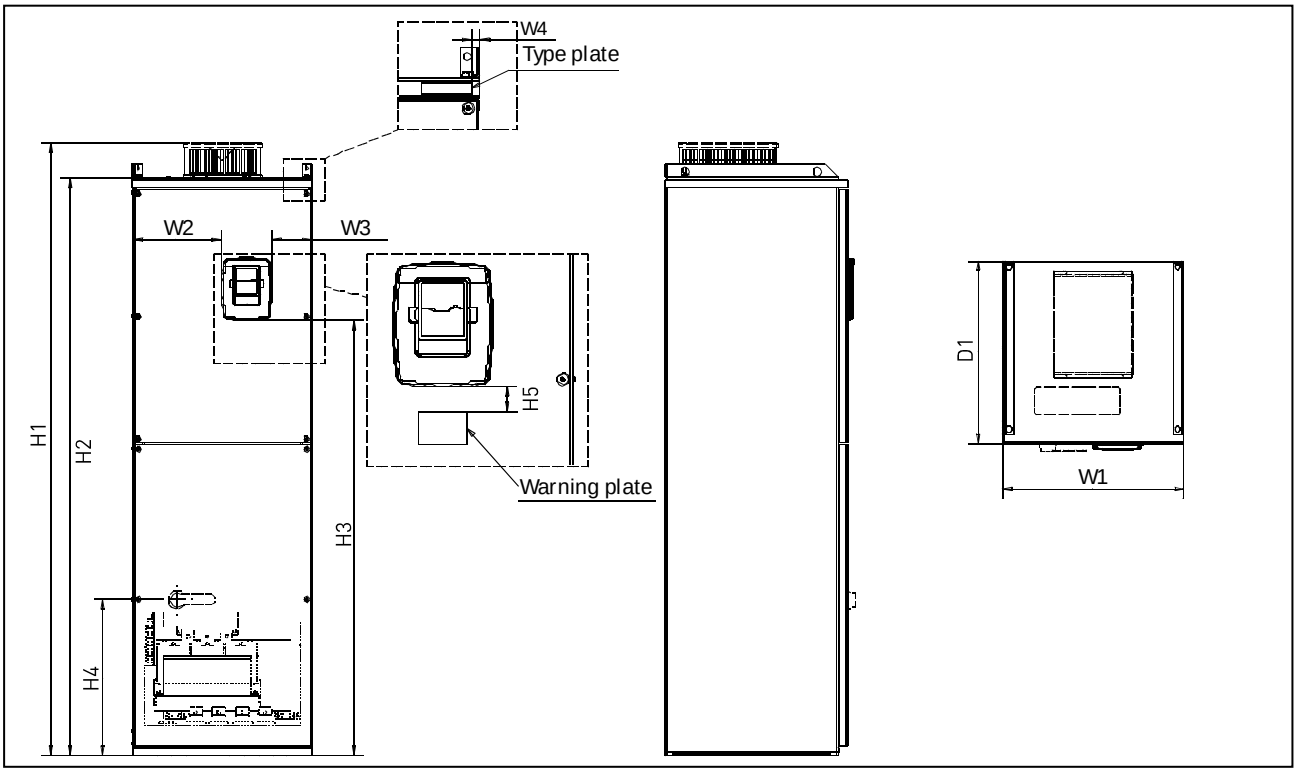


Figure 4-9. ACCel500 Dimensions, FR10 and FR11 (Floorstanding Units)

TABLE 4-9. ACCel500 DIMENSIONS,
FR10 AND FR11 (FLOORSTANDING UNITS)

Type	**Dimensions [in (mm)]**									
	W1	W2	W3	W4	H1	H2	H3	H4	H5	D1
0330 to 0460 (460V) 0208 to 0325 (575V)	23.4 (595)	11.5 (291)	5.16 (131)	0.59 (15)	79.4 (2018)	74.8 (1900)	56.5 (1435)	20.2 (512)	1.57 (40)	23.7 (602)
0520 to 0650 (460V) 0385 to 0502 (575V)	31.3 (794	15.4 (390)	9.06 (230)	0.59 (15)	79.4 (2018)	74.8 (1900)	56.5 (1435)	20.2 (512)	1.57 (40)	23.7 (602)

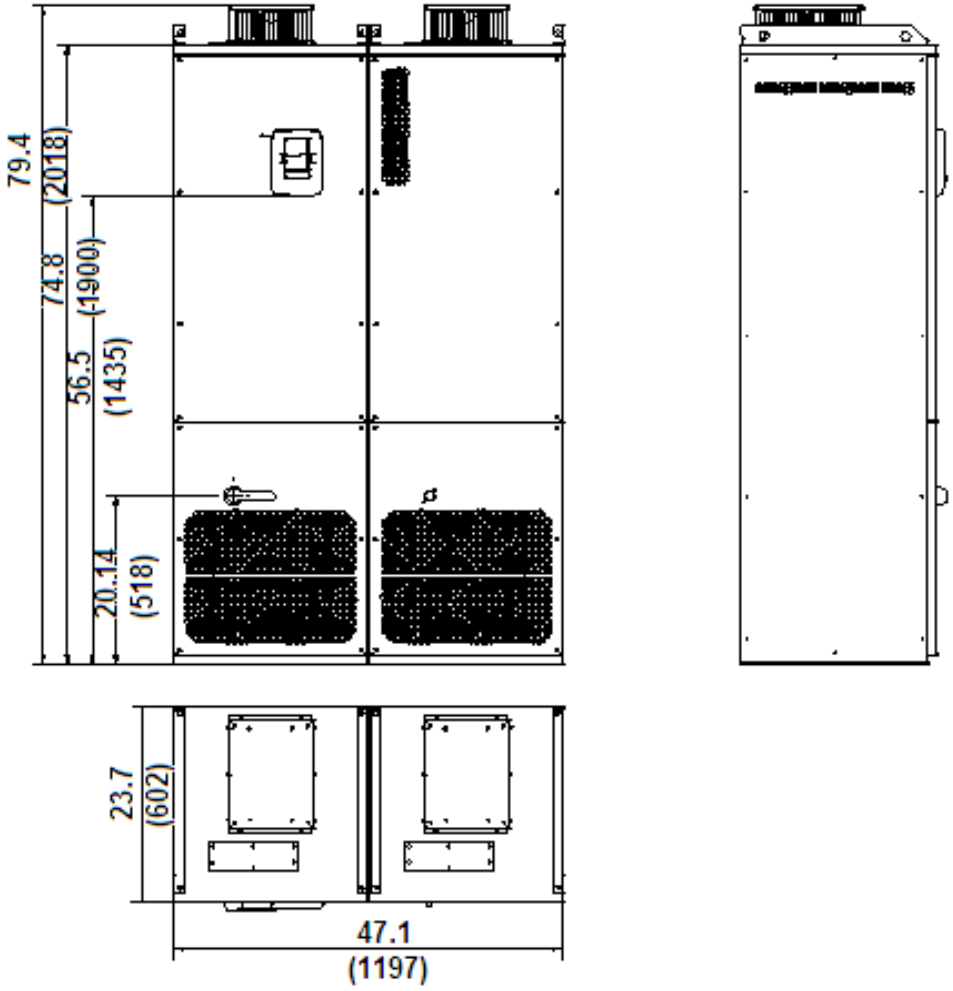


Figure 4-10. ACCel500 Dimensions, FR12 (Floorstanding Units)

4-2 COOLING

Enough free space shall be left around the frequency converter to ensure sufficient air circulation, cooling as well as maintenance. You will find the required dimensions for free space in the tables below.

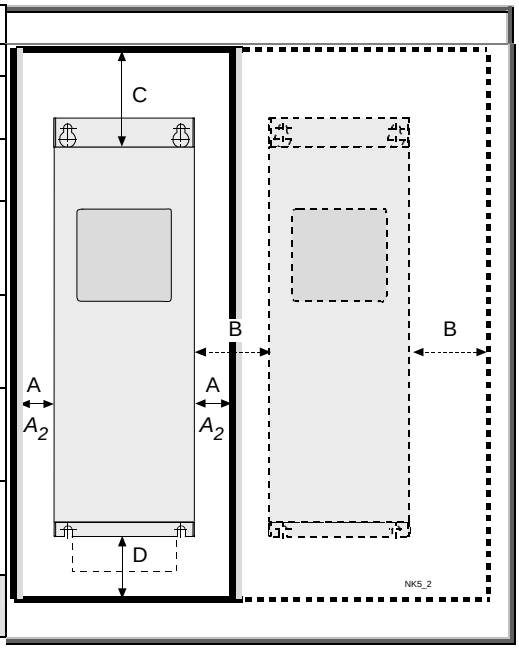
If several units are mounted above each other the required free space equals **C** + **D** (see figure below). Moreover, the outlet air used for cooling by the lower unit must be directed away from the air intake of the upper unit.

The amount of cooling air required is indicated below. Also make sure that the temperature of the cooling air does not exceed the maximum ambient temperature of the converter.

4-2.1 FR4 to FR9

TABLE 4-10. MOUNTING SPACE DIMENSIONS

Type	**Dimensions** [in (mm)]					
	A		***A*₂**	**B**	**C**	**D**
0003—0011 (230V) 0002—0009 (460V)	0.79 (20)			0.79 (20)	3.94 (100)	1.97 (50)
0012—0025 (230V) 0012—0023 (460V)	0.79 (20)			0.79 (20)	4.72 (120)	2.36 (60)
0031—0048 (230V) 0031—0046 (460V) 0003—0027 (575V)	1.18 (30)			0.79 (20)	6.30 (160)	3.15 (80)
0061—0088 (230V) 0061—0087 (460V) 0034—0041 (575V)	3.15 (80)			3.15 (80)	11.8 (300)	3.94 (100)
0114—0170 (230V) 0105—0170 (460V) 0052—0080 (575V)	3.15 (80)		5.91 (150)	3.15 (80)	11.8 (300)	7.87 (200)
0205—0261 (230V) 0205—0245 (460V) 0100—0170 (575V)	1.97 (50)			3.15 (80)	15.75 (400)	9.84 (250) (350**)
0330—0920 (460V) 0208—0750 (575V)	1.18 (30)					

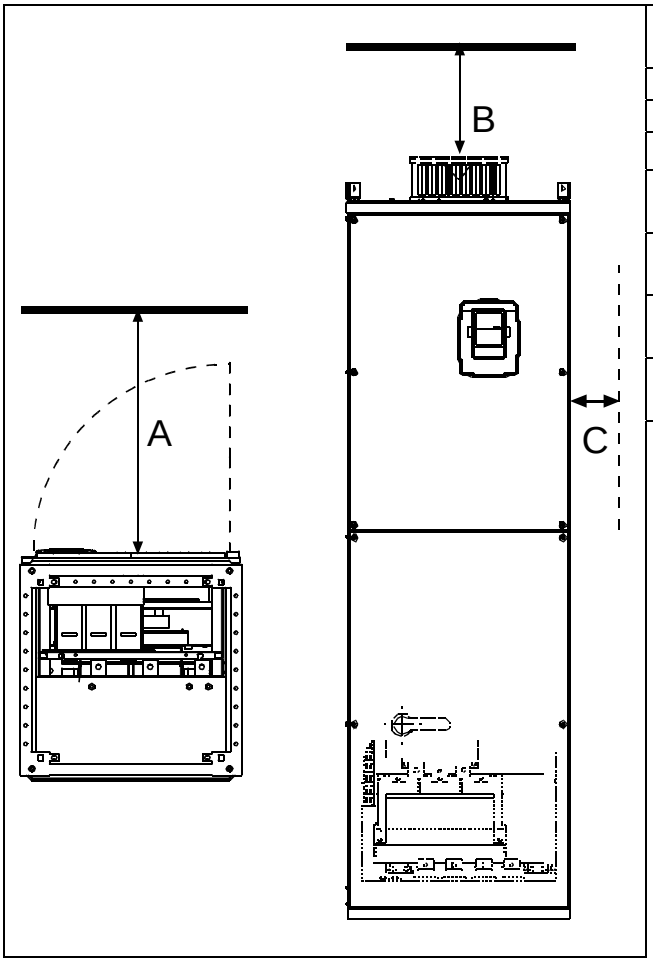


A = clearance around the freq. converter (see also ***A*₂** and **B**)
***A*₂** = clearance needed on either side of the frequency converter for fan change (without disconnecting the motor cables)
** = min. clearance for fan change
B = distance from one frequency converter to another or distance to cabinet wall
C = free space above the frequency converter
D = free space underneath the frequency converter

TABLE 4-11. REQUIRED COOLING AIR

Type	**Cooling air required** [cfm, (m^3/h))
0003—0011 (230V) 0002—0009 (460V)	41.2 (70)
0012—0025 (230V) 0012—0023 (460V) 0003—0010 (575V)	112 (190)
0031—0048 (230V) 0031—0046 (460V) 0013—0027 (575V)	250 (425)
0061—0088 (230V) 0061—0087 (460V) 0034—0041 (575V)	250 (425)
0114—0170 (230V) 0105—0170 (460V) 0052—0080 (575V)	383 (650)
0205—0261 (230V) 0205—0245(460V) 0100—0170 (575V)	765 (1300)

4-2.2 STANDALONE UNITS (FR10 TO FR12)



Mounting space dimensions [in (mm)]		
A	**B**	**C**
31.5 (800)	7.87 (200)	0.79 (20)

Type	**Cooling air required** [cfm (m^3/h))
0330—0460 (460V) 0208—0325 (575V)	1530 (2600)
0590—0650 (460V) 0385—0502 (575V)	2295 (3900)
0730—0920 (460V) 0590—0750 (575V)	3061 (5200)

Figure 4-11. Installation Space

4-3 POWER LOSSES

4-3.1 POWER LOSSES AS FUNCTION OF SWITCHING FREQUENCY

If the operator wants to raise the switching frequency of the drive (typically, in order to reduce the motor noise), this affects the power losses and cooling requirements, according to the graphs below.

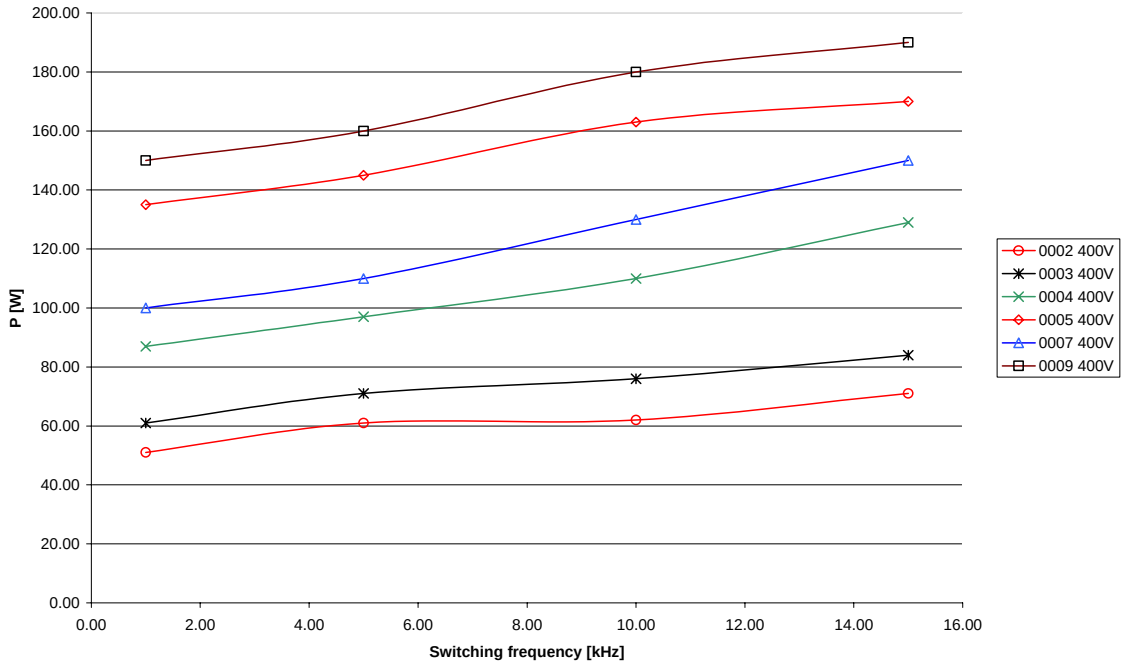


Figure 4-12. Power Loss as a Function of Switching Frequency; 0002 to 0009 (460 VAC)

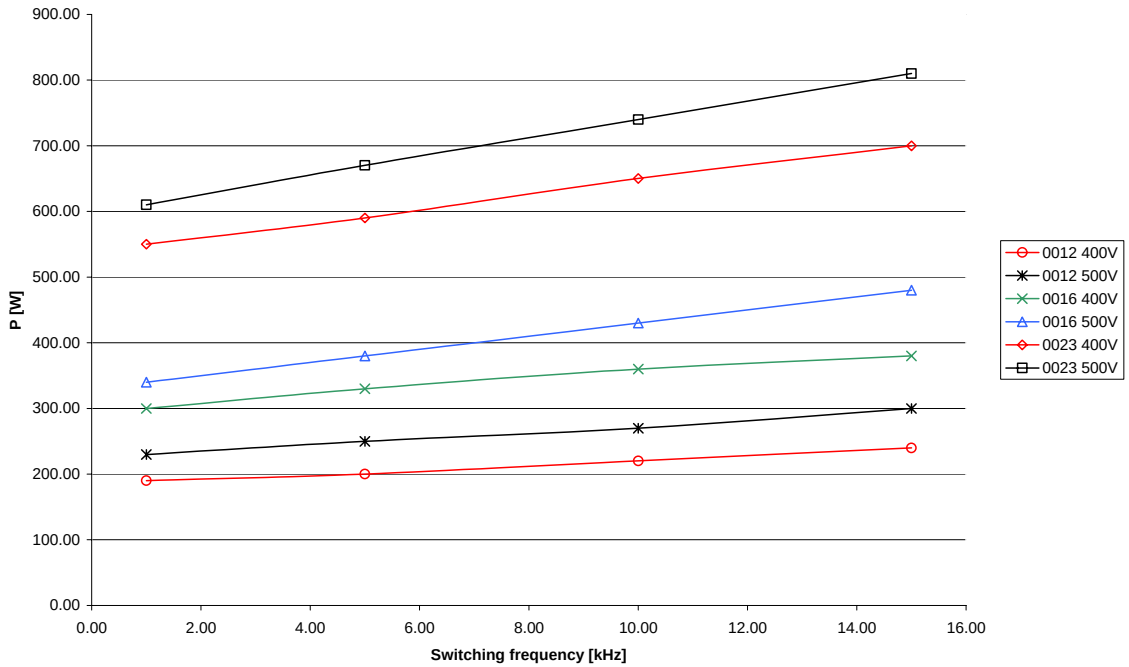


Figure 4-13. Power Loss as a Function of Switching Frequency; 0012 to 0023 (460 VAC)

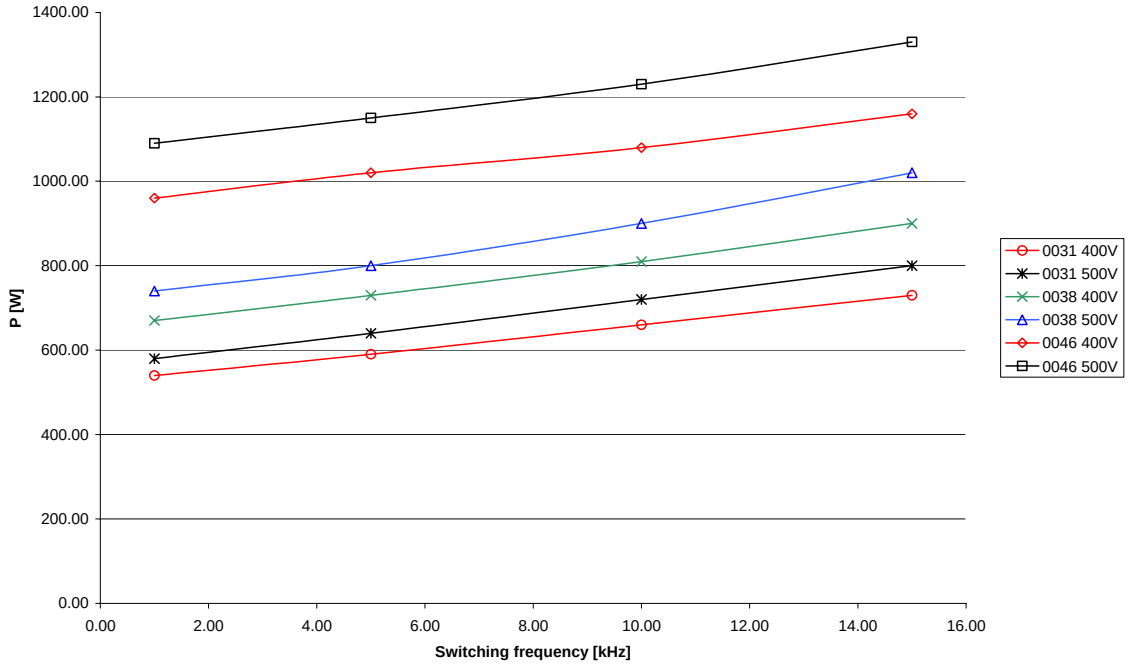


Figure 4-14. Power Loss as a Function of Switching Frequency; 0031 to 0046 (460 VAC)

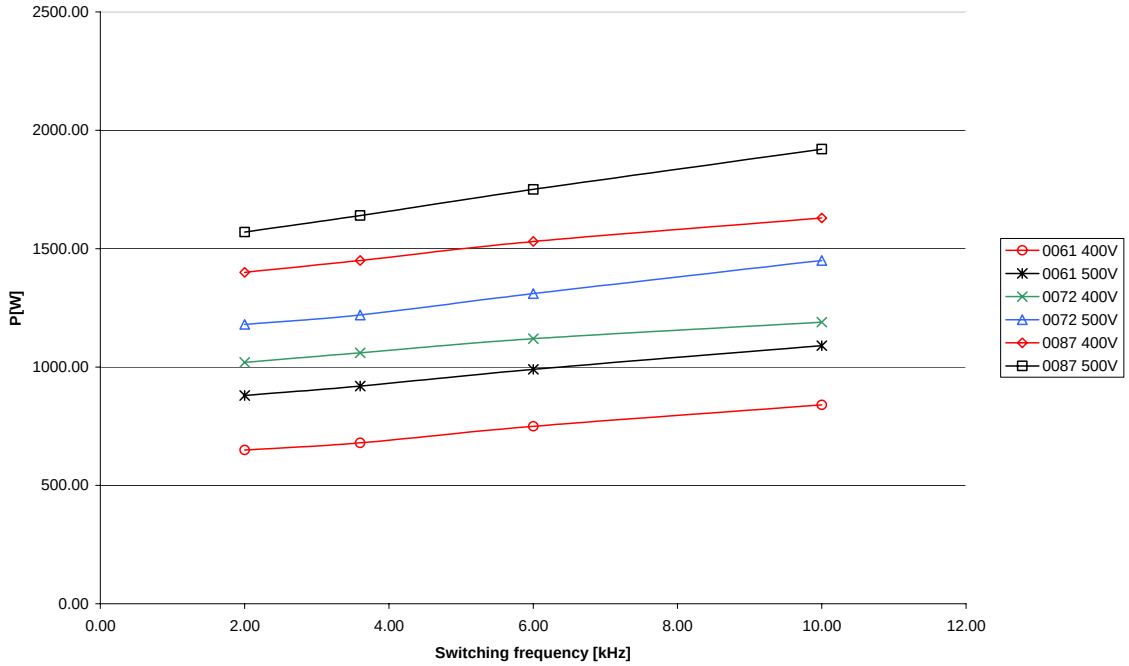


Figure 4-15. Power Loss as a Function of Switching Frequency; 0061 to 0087 (460 VAC)

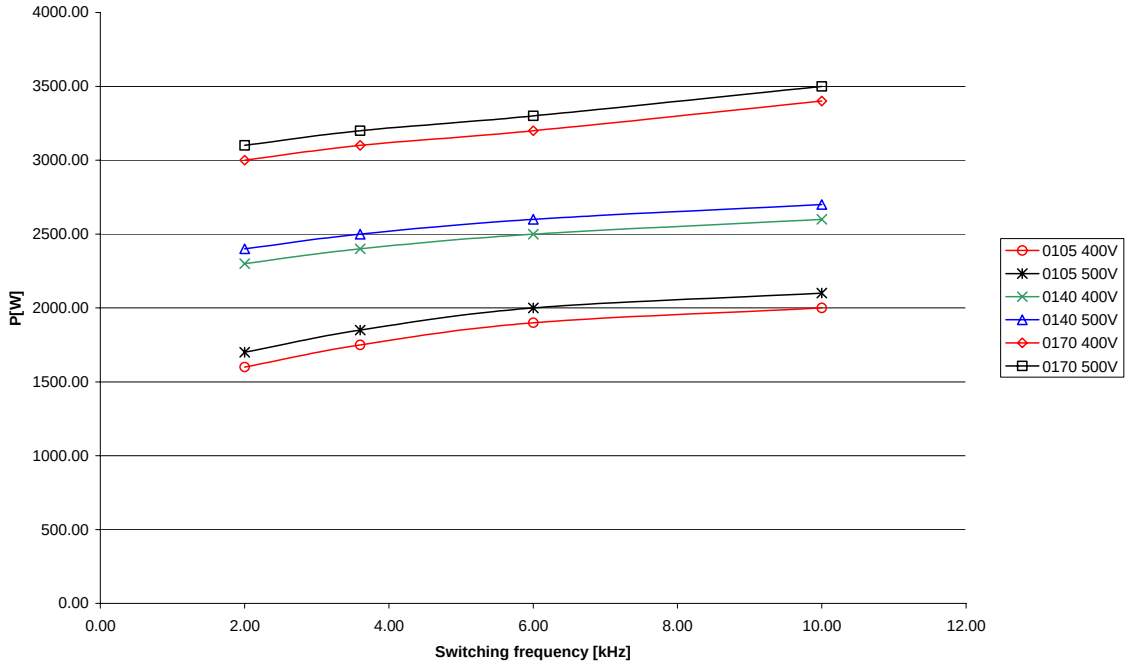


Figure 4-16. Power Loss as a Function of Switching Frequency; 0105 to 0170 (460 VAC)

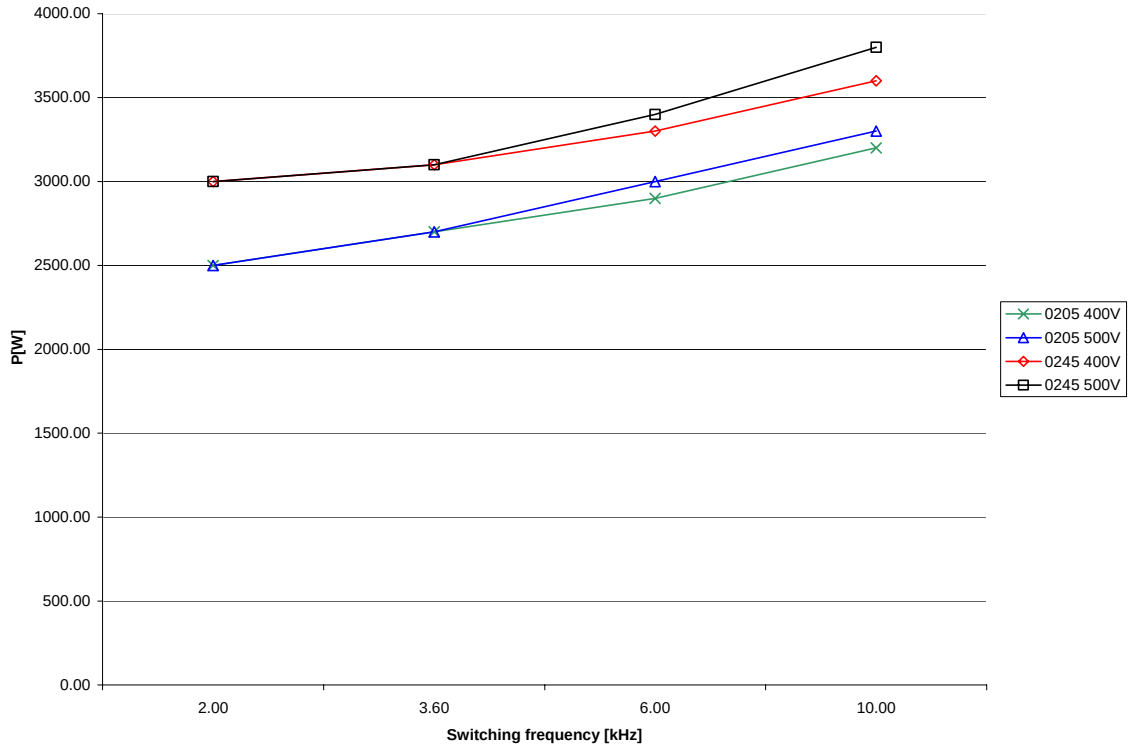


Figure 4-17. Power Loss as a Function of Switching Frequency; 0205 to 0245 (460 VAC)

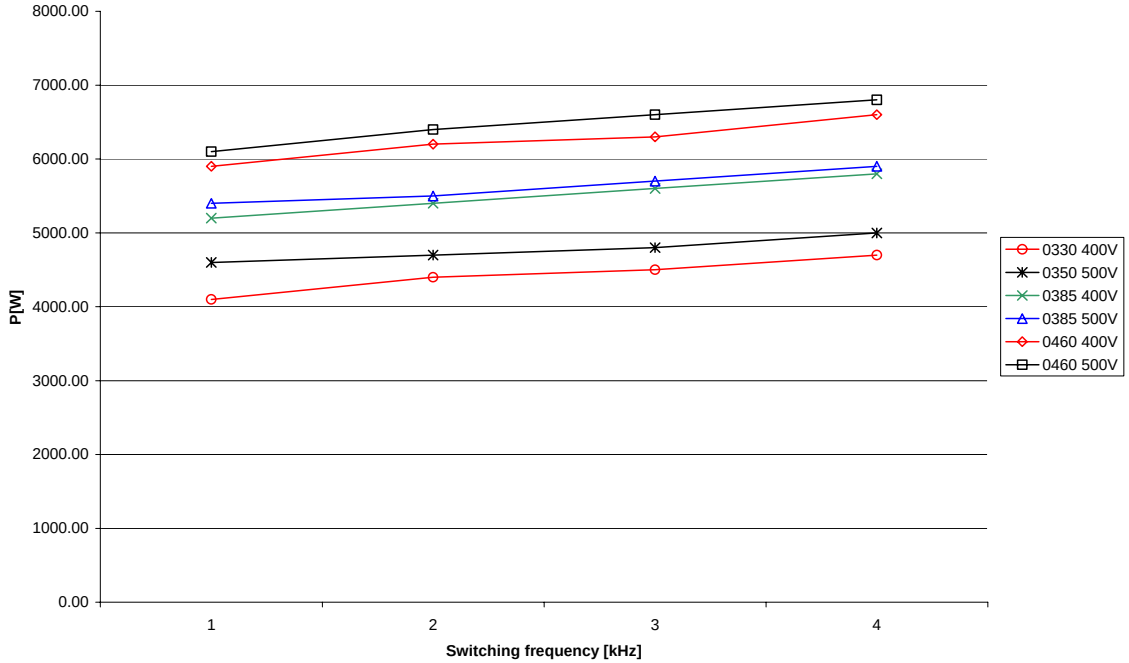


Figure 4-18. Power Loss as a Function of Switching Frequency; 0330 to 0460 (460V)

SECTION V

CABLING AND CONNECTIONS

5-1 POWER UNIT

5-1.1 POWER CONNECTIONS

5-1.1.1 Mains and Motor Cables

The mains cables are connected to terminals L1, L2 and L3 and the motor cables to terminals marked with **U**, **V** and **W**. A cable entry gland should be used when installing the motor cable at both ends in order to reach the EMC levels. See Table 5-1 for the cable recommendations for different EMC levels.

Use cables with heat resistance of at least +70°C. The cables and the fuses must be sized according to the frequency converter nominal OUTPUT current which you can find on the rating plate. Dimensioning according to the output current is recommended because the frequency converter input current never significantly exceeds the output current. Installation of cables according to UL regulations is presented in section 5-1.6.

Table 5-2 and Table 5-3 show the minimum dimensions of the Cu cables and the corresponding fuse sizes. See Table 5-2 and Table 5-3 for recommended fuse types.

If the motor temperature protection of the drive (see your application software manual) is used as an overload protection, the cable shall be chosen accordingly. If three or more cables are used in parallel for bigger units each cable requires a separate overload protection.

These instructions apply only to cases with one motor and one cable connection from the frequency converter to the motor. In any other case, ask the factory for more information.

TABLE 5-1. CABLE TYPES REQUIRED TO MEET STANDARDS

	1st Environment		2nd Environment		
Cable Type	**Levels C And H**		**Level L**	**Level T**	**Level N**
	unrestricted	restricted			
Mains cable	1		1	1	1
Motor cable	3*		2	2	2
Control cable	4		4	4	4

Level C = EN 61800-3+A11, 1st environment, unrestricted distribution EN 61000-6-4

Level H = EN 61800-3+A11, 1st environment, restricted distribution EN 61000-6-4

Level L = EN61800-3, 2nd environment

Level T: See section 2-2.3.

Level N: See section 2-2.3.

1 = Power cable intended for fixed installation and the specific mains voltage. Shielded cable not required.

2 = Symmetrical power cable equipped with concentric protection wire and intended for the specific mains voltage.

3 = Symmetrical power cable equipped with compact low-impedance shield and intended for the specific mains voltage. *360º earthing of the shield with cable glands in both ends needed for EMC levels C and H.

4 = Screened cable equipped with compact low-impedance shield.

Note: The EMC requirements are fulfilled at factory defaults of switching frequencies (all frames).

5-1.1.2 DC Supply and Brake Resistor Cables

Avtron frequency converters are equipped with terminals for the DC supply and an optional external brake resistor. These terminals are marked with B–, B+/R+ and R–. The DC bus connection is made to terminals B– and B+ and the brake resistor connection to R+ and R–. Note that the DC connection is optional for drives greater than FR8.

5-1.1.3 Control Cable

For information on control cables see section 5-2.1.1 and Table 5-1.

5-1.1.4 Cable and Fuse Sizes, 230V and 460V, FR4 to FR9

The table below shows typical cable sizes and types that can be used with the converter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

TABLE 5-2. CABLE AND FUSE SIZES: 230V AND 460V FREQUENCY CONVERTERS (FR4 TO FR9)

Frame	Type	IL [A]	Fuse [A]	Mains and motor cable Cu [AWG (mm2)]	Terminal cable size	
					Main terminal [AWG (mm2)]	Earth terminal [AWG (mm2)]
FR4	AC_0003—0006 (230V) AC_0002—0007 (460V)	3—6 2—7	10	3*15+15 (3*1.5+1.5)	18—12 (1—4)	18—14 (1—2.5)
	AC_0007—0011 (230V) AC_0009 (460V)	7—11 9	15	3*13+13 (3*2.5+2.5)	18—12 (1—4)	18—14 (1—2.5)
FR5	AC_0012 (230V) AC_0012 (460V)	12 12	20	3*11+11 (3*4+4)	18—8 (1—10)	18—8 (1—10)
	AC_0017 (230V) AC_0016 (460V)	17 16	25	3*9+9 (3*6+6)	18—8 (1—10)	18—8 (1—10)
	AC_0025 (230V) AC_0023 (460V)	25 23	35 30	3*9+9 (3*10+10)	18—8 (1—10)	18—8 (1—10)
FR6	AC_0031 (230V) AC_0031 (460V) AC_0038 (460V)	31 31 38	40 40 50	3*7+7 (3*10+10)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
	AC_0048 (230V) AC_0046 (460V)	48 46	70 60	3*5+5 (3*16+16)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
FR7	AC_0061 (230V) AC_0061 (460V)	61 61	80	3*5+5 (3*25+16)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	10—2/0 (6—70)
	AC_0075 (230V) AC_0072 (460V)	75 72	100	3*3+5 (3*25+16)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	10—2/0 (6—70)
	AC_0088 (230V) AC_0087 (460V)	88 87	125 110	3*1+5 (3*50+25)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	10—2/0 (6—70)
FR8	AC_0114 (230V) AC_0105 (460V)	114 105	150	3*0+5 (3*70+35)	4—3/0 (25—95 Cu/Al)	4—3/0 (25—95)
	AC_0140 (230V) AC_0140 (460V)	140 140	200	3*2/0+1 (3*95+50)	3/0—350 (95—185 Cu/Al)	3—3/0 (25—95)
	AC_0170 (230V) AC_0170 (460V)	170 170	225	3*3/0+0 (3*150+70)	3/0—350 (95—185 Cu/Al)	3—3/0 (25—95)
FR9	AC_0205 (230V) AC_0205 (460V)	205 205	300	3*4/0+2/0 (3*185+95 or 2*(3*120+70)	3/0—350 (95—185 Cu/Al)	4—3/0 (25—95)
	AC_0261 (230V) AC_0245 (460V)	261 245	350	3*4/0+2/0 (2*(3*120+70)	3/0—350 (95—185 Cu/Al)	4—3/0 (25—95)

5-1.1.5 Cable And Fuse Sizes, (575V) , FR6 To FR9

The table below shows typical cable sizes and types that can be used with the converter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

TABLE 5-3. CABLE AND FUSE SIZES FOR 575V FREQUENCY CONVERTERS (FR6 TO FR9)

Frame	Type	IL [A]	Fuse [A]	Mains and motor cable Cu [mm^2]	Terminal cable size	
					Main terminal [mm^2]	Earth terminal [mm^2]
FR6	AC_0003—0005	3—5	10	3*14+14 (3*2.5+2.5)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
	AC_0007—0010	7-10	16	3*14+14 (3*2.5+2.5)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
	AC_0013	13	20	3*12+12 (3*4+4)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
	AC_0018	16	25	3*10+10 (3*6+6)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
	AC_0022–0027	22-27	35	3*8+8 (3*10+10)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	14—2 (2.5—35)
FR7	AC_0034	34	50	3*8+8 (3*10+10)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	10—1/0 6—50
	AC_0041	41	63	3*6+6 (3*16+16)	14—1/0 10—1/0 (2.5—50 Cu) (6—50 Al)	10—1/0 6—50
FR8	AC_0052—0062	52–62	80	3*4+6 (3*25+16)	4—3/0 (25—95 Cu/Al)	4—3/0 25—95
	AC_0080	080	100	3*2+6 (3*25+16)		
FR9	AC_0100—0125 AC_0144	100-125 144	160 200	3*3/0+1/0 (3*95+50)	3/0—350 (95-185 Cu/Al2)	4—3/0 25—95
	AC_0170	170	250	3*300+2/0 (3*95+50)		

5-1.1.6 Cable and Fuse Sizes, (460V) , FR10 To FR12

The table below shows typical cable sizes and types that can be used with the converter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

TABLE 5-4. CABLE AND FUSE SIZES FOR 460V FREQUENCY CONVERTERS (FR10 TO FR12)

Frame	Type	IL [A]	Fuse In [A]	Mains and motor cable1) [AWG (mm^2)]	No. of supply cables	No. of motor cables
FR10	AC_0330	330	450	Cu: 2*(3*4/0+2/0) Al: 2*(3*350+1/0Cu) (Cu: 2*(3*350+1/0)) (Al: 2*(3*185Al+57Cu))	Even/Odd	Even/Odd
	AC_0385	385	500	Cu: 2*(3*300+2/0) Al: 2*(3*500Al+2/0Cu) (Cu: 2*(3*500+2/0)) (Al: 2*(3*240Al+72Cu))	Even/Odd	Even/Odd
	AC_0460	460	600	Cu: 2*(3*350+3/0) Al: 2*(3*600Al+3/0Cu) (Cu: 2*(3*600+3/0)) (Al: 2*(3*300Al+88Cu))	Even/Odd	Even/Odd
FR11	AC_0520	520	700	Cu: 2*(3*500+4/0) Al: 2*(3*237Al+1Cu) (Cu: 2*(3*4/0+1)) (Al: 4*(3*120Al+41Cu))	Even	Even/Odd
	AC_0590	590	800	Cu: 2*(3*3/0+1/0) Al: 2*(3*293Al+1Cu) (Cu: 4*(3*300+1)) (Al: 4*(3*150Al+41Cu))	Even	Even/Odd
	AC_0650	650	1000	Cu: 2*(3*4/0+2/0) Al: 2*(3*240Al+72Cu) (Cu: 4*(3*350+1/0)) (Al: 4*(3*185Al+57Cu))	Even	Even/Odd
FR12	AC_0730	730	1000	Cu: 2*(3*300+2/0) Al: 2*(3*350+1/0Cu) (Cu: 4*(3*350+1/0)) (Al: 4*(3*185Al+57Cu))	Even	Even
	AC_0820	820	1200	Cu: 2*(3*300+2/0) Al: 2*(3*500Al+1/0Cu) (Cu: 4*(3*500+2/0)) (Al: 4*(3*240Al+72Cu))	Even	Even
	AC_0920	920	1200	Cu: 2*(3*350+3/0) Al: 2*(3*600Al+3/0Cu) (Cu: 4*(3*600+3/0)) (Al: 4*(3*300Al+88Cu))	Even	Even

5-1.1.7 Cable and Fuse Sizes, (575V), FR10 to FR12

The table below shows typical cable sizes and types that can be used with the converter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

TABLE 5-5. CABLE AND FUSE SIZES FOR 575V FREQUENCY CONVERTERS (FR10 TO FR12)

Frame	Type	IL [A]	Fuse In [A]	Mains and motor cable1) [AWG (mm^2)]	No of supply cables	No of motor cables
FR10	AC_0208	208	300	Cu: 3*350+3/0 Al: 2*(3*3/0Al+2Cu) (Cu: 3*(3/0+2)) (Al: 2*(3*95Al+29Cu))	Even/Odd	Even/Odd
	AC_0261	261	350	Cu: 2*(3*3/0+1/0) Al: 2*(3*300Al+1Cu) (Cu: 2*(3*300+1)) (Al: 2*(3*150Al+41Cu))	Even/Odd	Even/Odd
	AC_0325	325	450	Cu: 2*(3*4/0+2/0) Al: 2*(3*350Al+1/0Cu) (Cu: 2*(3*350+1/0)) (Al: 2*(3*185Al+57Cu))	Even/Odd	Even/Odd
FR11	AC_0385	385	500	Cu: 2*(3*300+2/0) Al: 2*(3*500Al+2/0Cu) (Cu: 2*(3*350+1/0)) (Al: 2*(3*185Al+57Cu))	Even/Odd	Even/Odd
	AC_0460	460	600	Cu: 2*(3*350+3/0) Al: 2*(3*600Al+3/0 Cu) (Cu: 2*(3*600+3/0)) (Al: 2*(3*300Al+88 Cu))	Even	Even/Odd
	AC_0502	502	700	Cu: 2*(3*500+4/0) Al: 4*(3*4/0Al+1Cu) (Cu: 2*(3*4/0+1)) (Al: 4*(3*120Al+41Cu))	Even	Even/Odd
FR12	AC_0590	590	800	Cu: 4*(3*3/0+1/0) Al: 4*(3*300Al+1Cu) (Cu: 4*(3*300+1)) (Al: 4*(3*150Al+41Cu))	Even	Even
	AC_0650	650	1000	Cu: 4*(3*4/0+2/0) Al: 4*(3*300Al+1Cu) (Cu: 4*(3*300+1)) (Al: 4*(3*150Al+41Cu))	Even	Even
	AC_0750	750	1000	Cu: 4*(3*300+2/0) Al: 4*(3*350Al+1/0Cu) (Cu: 4*(3*350+1/0)) (Al: 4*(3*185Al+57Cu))	Even	Even

5-1.2 UNDERSTANDING THE POWER UNIT TOPOLOGY

Figure 5-1 shows the principles for mains and motor connections of the basic 6-pulse drive in frame sizes FR4 to FR12.

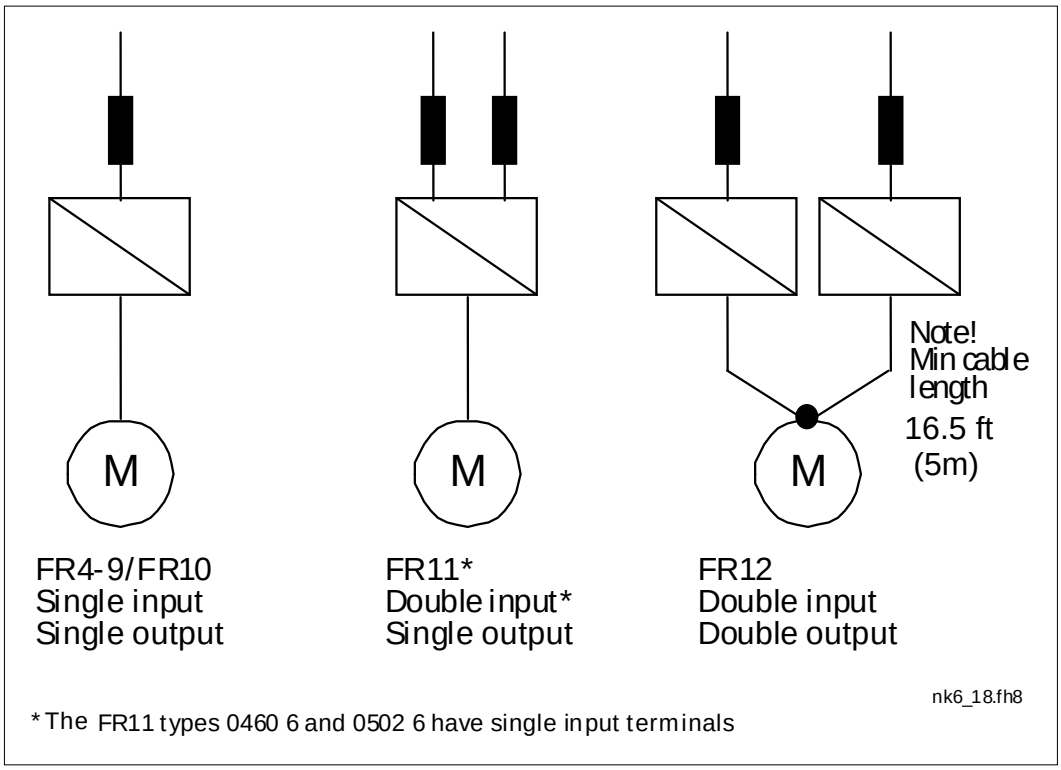


Figure 5-1. Topology of Mechanical Sizes FR4 – FR12

5-1.3 CHANGING THE EMC PROTECTION CLASS

The EMC protection level of ACCel500 frequency converters can be changed from class H to class T (and from class L to T (575V, FR6) with a simple procedure presented in the following figures.

NOTE: After having performed the change, check EMC Level modified on the sticker included the ACCel500 frequency converter (see below) and note the date. Unless already done, attach the sticker close to the nameplate of the frequency converter.

FR4 and FR5:

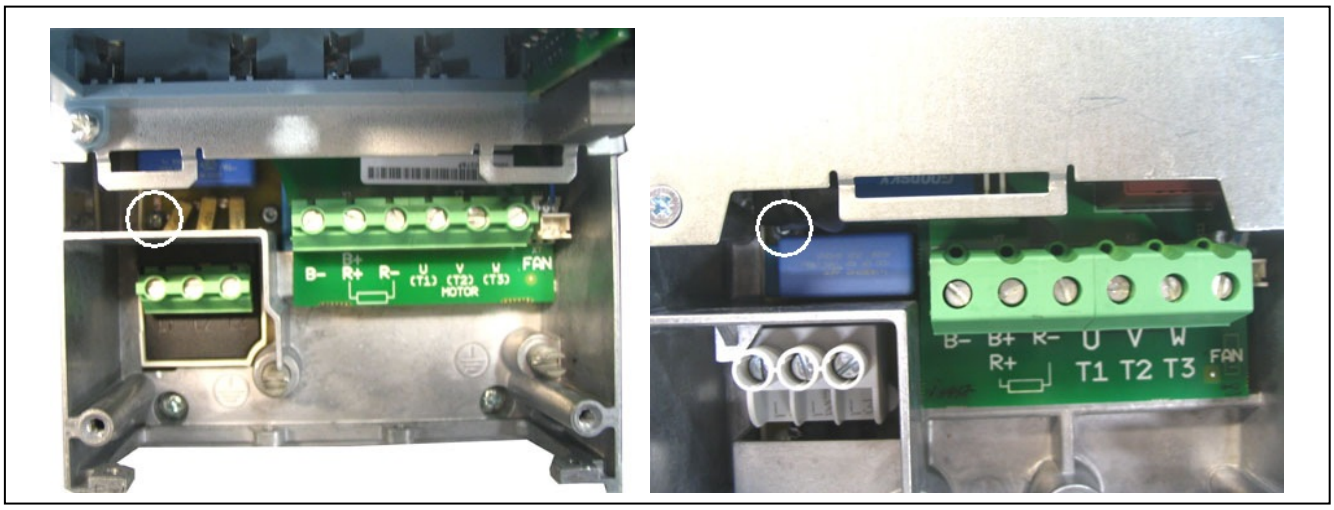


Figure 5-2. Changing of EMC Protection Class, FR4 (left) and FR5 (right).
First remove the cable cover.

FR6:

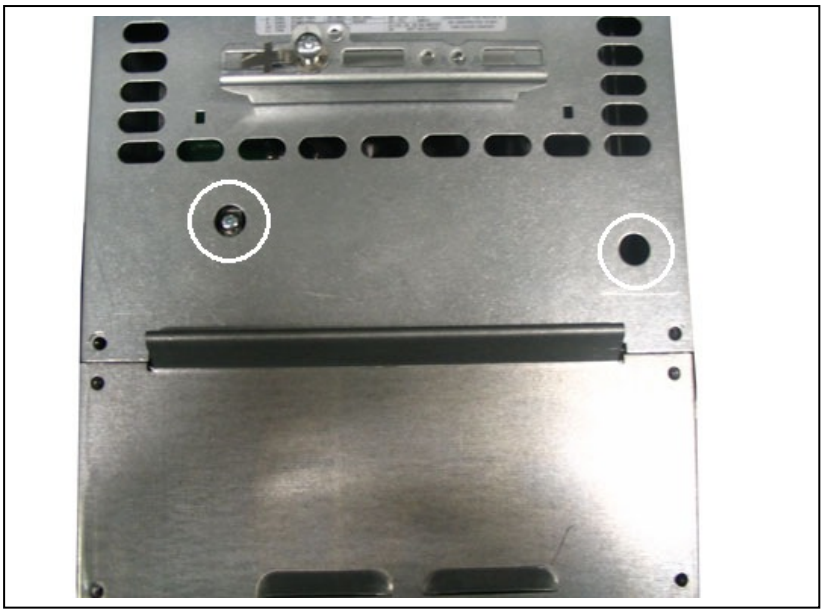
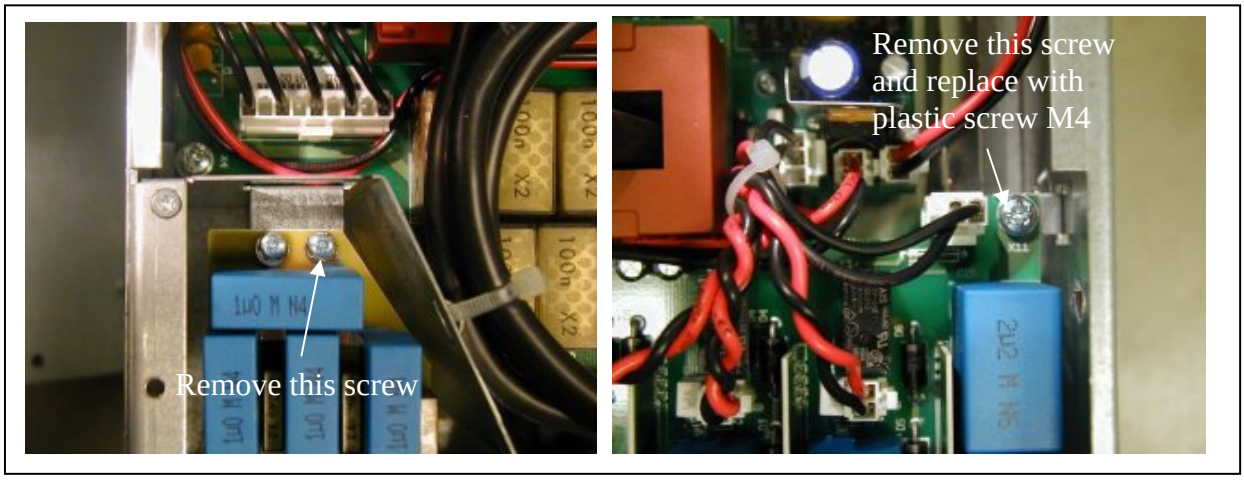


Figure 5-3. Changing of EMC Protection Class, FR6.
The cable cover does not need to be removed.

FR7:



NOTE: Only Avtron service personnel may change the EMC protection class of ACCel500, FR8 and FR9.

5-1.4 MOUNTING OF CABLE ACCESSORIES

Enclosed with your ACCel500 frequency converter, you have received a plastic bag containing components that are needed for the installation of the mains and motor cables in the frequency converter.

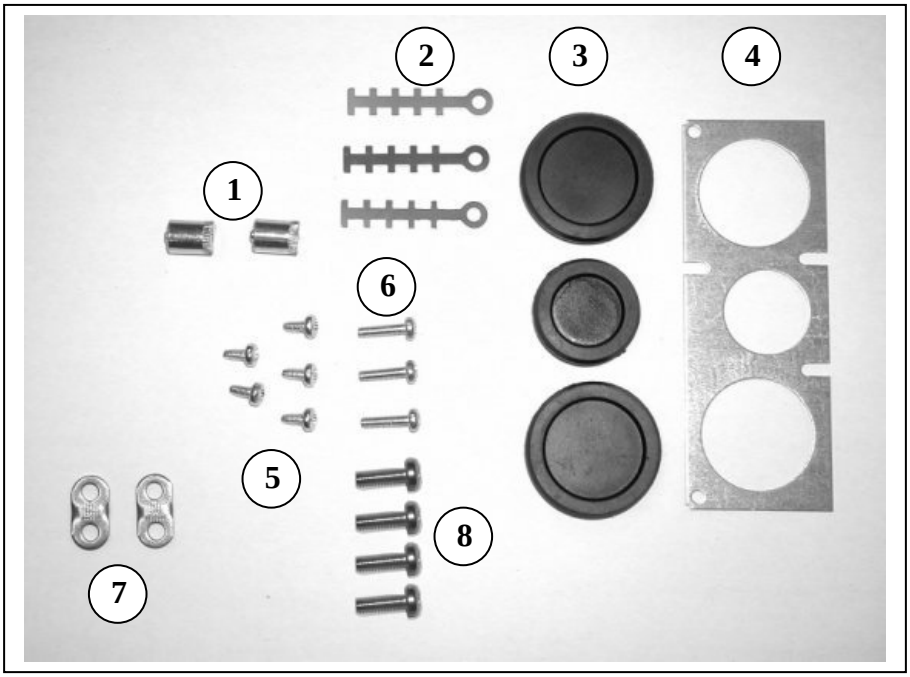


Figure 5-5. Cable Accessories

Components:

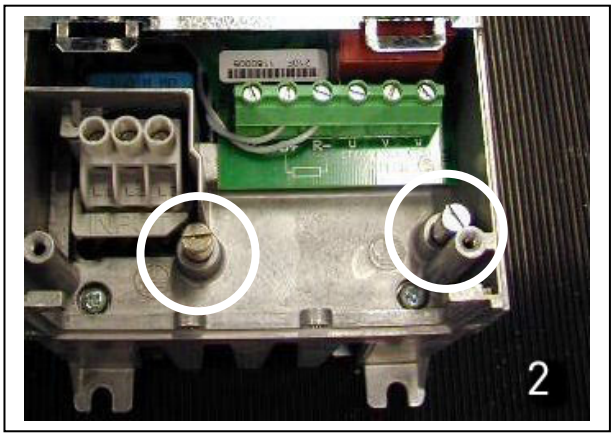
- Grounding terminals (FR4, FR5/MF4, MF5) (2)
- Cable clamps (3)
- Rubber grommets (sizes vary from class to class) (3)
- Cable entry gland (1)
- Screws, M4x10 (5)
- Screws, M4x16 (3)
- Grounding cable clamps (FR6, MF6) (2)
- Grounding screws M5x16 (FR6, MF6) (4)

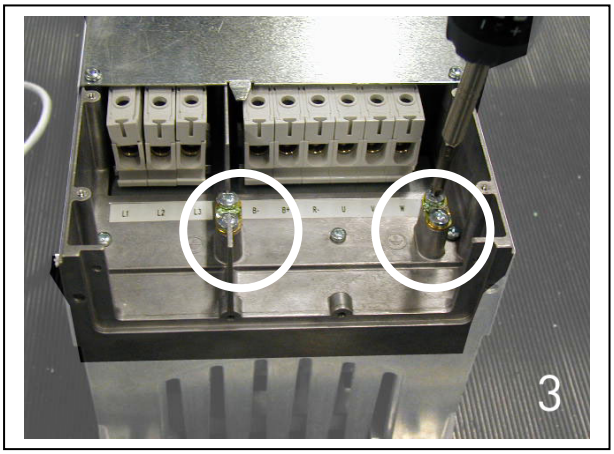
NOTE: The cable accessories installation kit for frequency converters of protection class IP54 includes all components except 4 and 5.

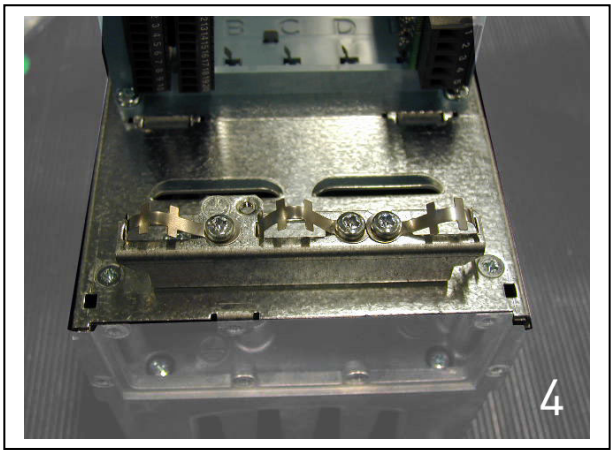
Mounting Procedure

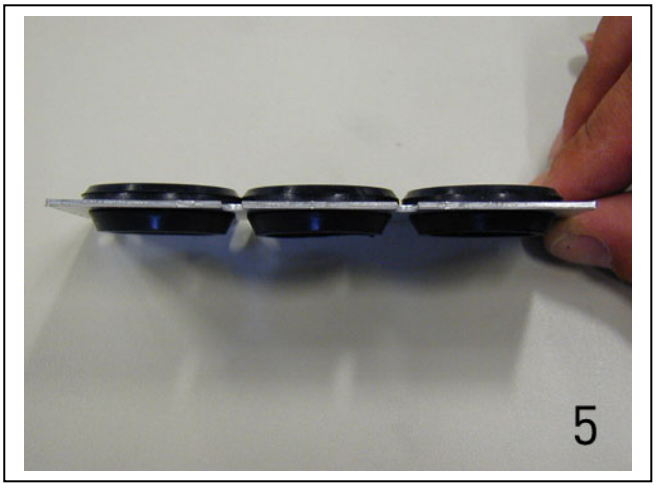
1. Make sure that the plastic bag you have received contains all necessary components.
2. Open the cover of the frequency converter (Figure 1).
3. Remove the cable cover. Observe the places for
   a) the grounding terminals (FR4/FR5; MF4/MF6) (Figure 2).
   b) the grounding cable clamps (FR6/MF6) (Figure 3).

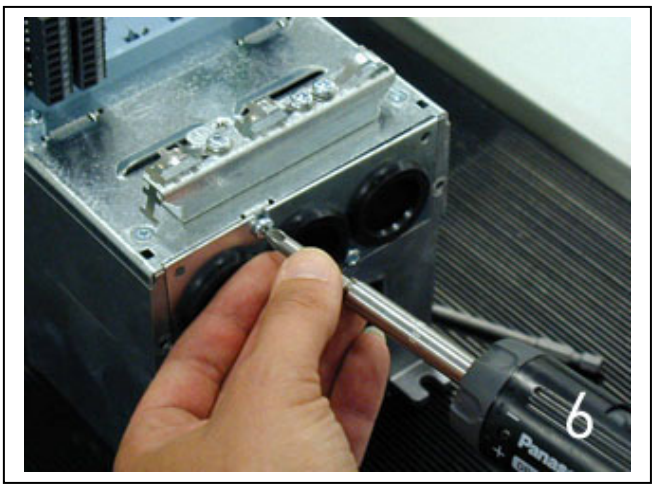
4. Re-install the cable cover. Mount the cable clamps with the three M4x16 screws as shown in Figure 4. Note that the location of the grounding bar in FR6/MF6 is different from what is shown in the picture.
5. Place the rubber grommets in the openings as shown in Figure 5.
6. Fix the cable entry gland to the frame of the frequency converter with the five M4x10 screws (Figure 6). Close the cover of the frequency converter.











5-1.5 INSTALLATION INSTRUCTIONS

<table>
<tr><td></td><td>1</td><td>Before starting the installation, check that none of the components of the frequency converter is live.</td></tr>
<tr><td></td><td>2</td><td>Place the motor cables sufficiently far from other cables:
Avoid placing the motor cables in long parallel lines with other cables.
If the motor cables run in parallel with other cables, note the minimum distances between the motor cables and other cables given in table below.
The given distances also apply between the motor cables and signal cables of other systems.
The maximum length of the motor cables is 300 m (units with power greater than 1.5 kW) and 100 m (units with power from 0.75 to 1.5 kW).
The motor cables should cross other cables at an angle of 90 degrees.

<table><tr><th>Distance
Between Cables (m)</th><th>Shielded Cable (m)</th></tr><tr><td>0.3</td><td>≤ 50</td></tr><tr><td>1.0</td><td>≤ 200</td></tr></table></td></tr>
<tr><td></td><td>3</td><td>If cable insulation checks are needed, see section 5-1.7.</td></tr>
<tr><td></td><td>4</td><td>Connect the cables:
Strip the motor and mains cables as advised in Table 5-6 and Figure 5-6.
Remove the screws of the cable protection plate. Do not open the cover of the power unit!
Make holes into and pass the cables through the rubber grommets on the bottom of the power unit (see section 5-1.4). NOTE: Use a cable gland instead of the grommet in types where this is required.
Connect the mains, motor and control cables into their respective terminals (see Figure 5-10).
For information on the installation of greater units, please contact the factory or your local distributor.
For Information on cable installation according to UL regulations see section 5-1.6.
Make sure that the control cable wires do not come in contact with the electronic components of the unit.
If an external brake resistor (option) is used, connect its cable to the appropriate terminal.
Check the connection of the earth cable to the motor and the frequency converter terminals marked with ⏚.
Connect the separate shield of the power cable to the earth terminals of the frequency converter, motor and the supply centre.
Attach the cable protection plate with the screws.
Ensure that the control cables or the cables of the unit are not trapped between the frame and the protection plate.</td></tr>
</table>

5-1.5.1 Stripping Lengths of Motor and Mains Cables

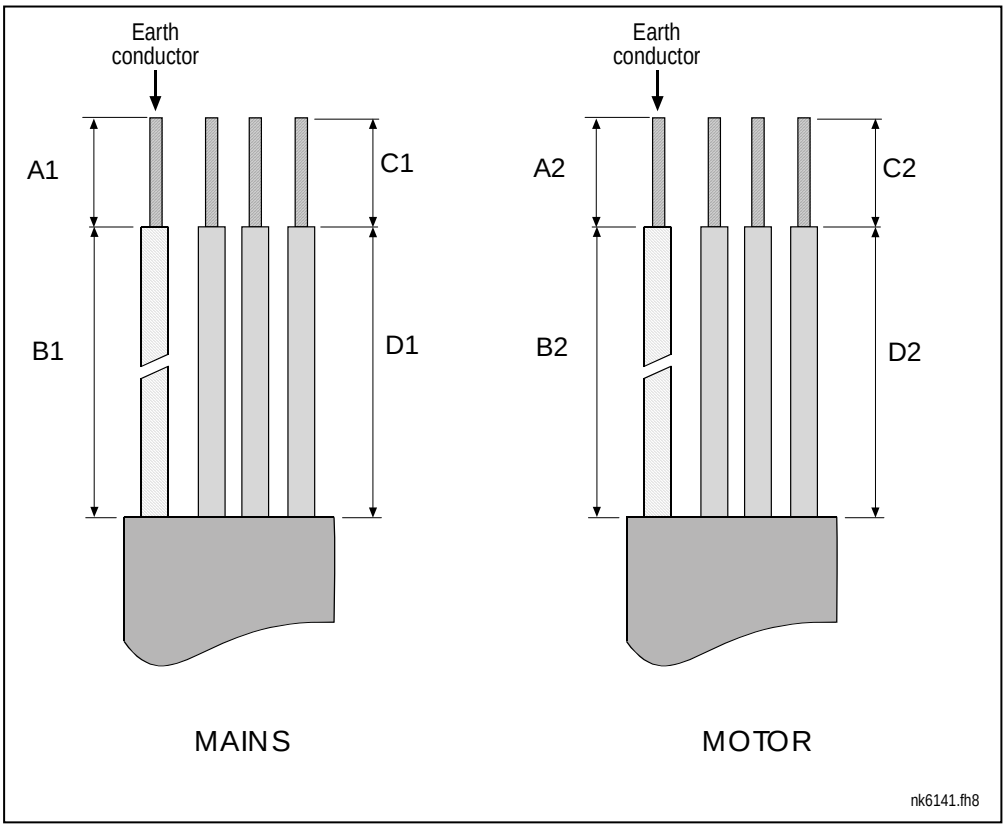


Figure 5-6. Stripping of Cables

TABLE 5-6. CABLES STRIPPING LENGTHS [in (mm)]

Frame	A1	B1	C1	D1	A2	B2	C2	D2
FR4	0.59 (15)	1.38 (35)	0.39 (10)	0.79 (20)	0.28 (7)	1.97 (50)	0.28 (7)	1.38 (35)
FR5	0.79 (20)	1.57 (40)	0.39 (10)	1.18 (30)	0.79 (20)	2.36 (60)	0.39 (10)	1.57 (40)
FR6	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)
FR7	0.91 (25)	4.72 (120)	0.91 (25)	4.72 (120)	0.91 (25)	4.72 (120)	0.98 (25)	4.72 (120)
FR8								
0114	0.98 (23)	9.45 (240)	0.98 (23)	9.45 (240)	0.98 (23)	9.45 (240)	0.98 (23)	9.45 (240)
0140—0170	1.10 (28)	9.45 (240)	1.10 (28)	9.45 (240)	1.10 (28)	9.45 (240)	1.10 (28)	9.45 (240)
FR9	1.10 (28)	11.6 (295)	1.10 (28)	11.6 (295)	1.10 (28)	11.6 (295)	1.10 (28)	11.6 (295)

5-1.5.2 ACCel500 Frames and Installation of Cables

NOTE: In case you want to connect an external brake resistor, see the separate Brake Resistor Manual.

Figure 5-7. ACCel500, FR4

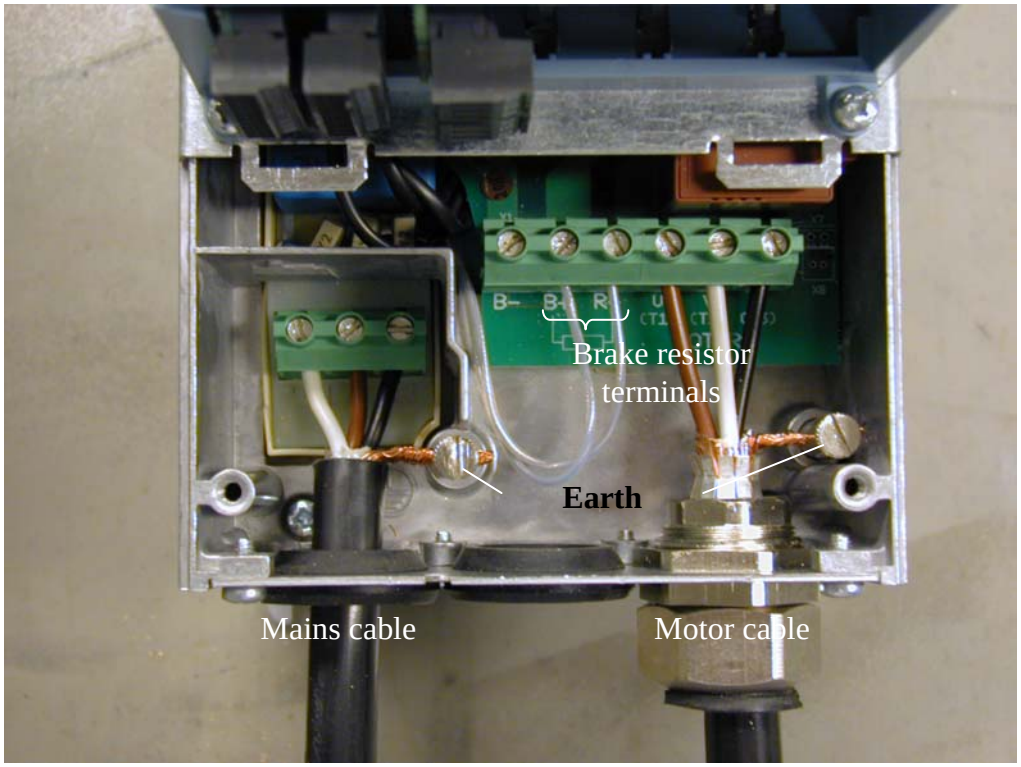


Figure 5-8. Cable Installation in ACCel500, FR4

Figure 5-9. ACCel500, FR5.

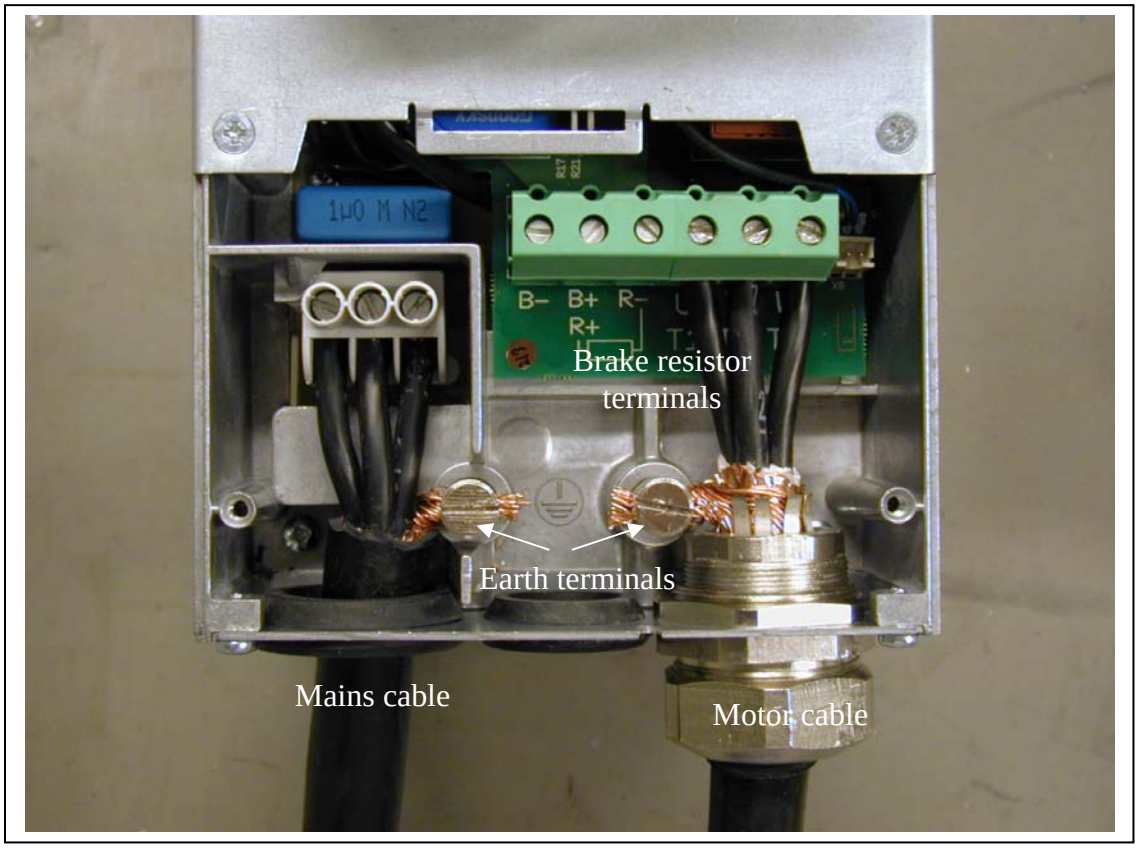


Figure 5-10. Cable Installation in ACCel500, FR5

Figure 5-11. ACCel500, FR6

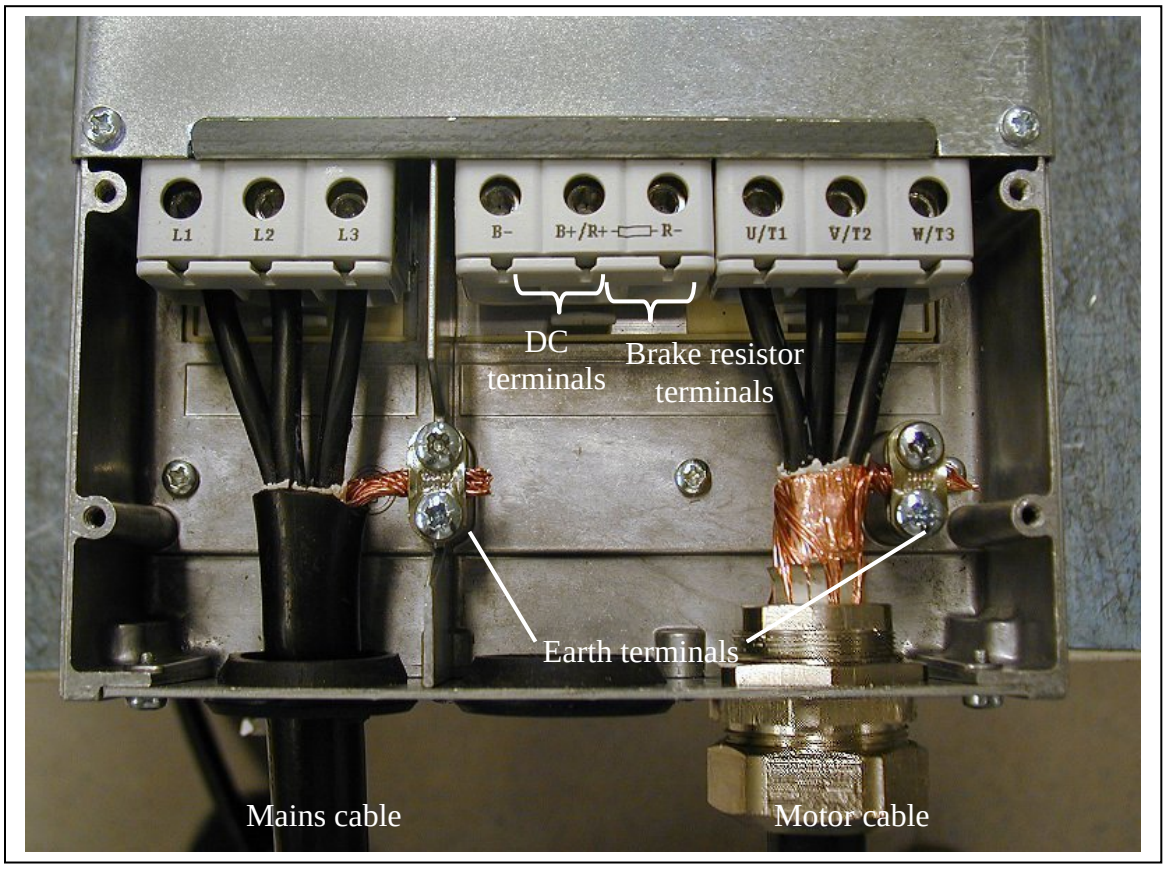


Figure 5-12. Cable Installation in ACCel500, FR6

Figure 5-13. ACCel500, FR7

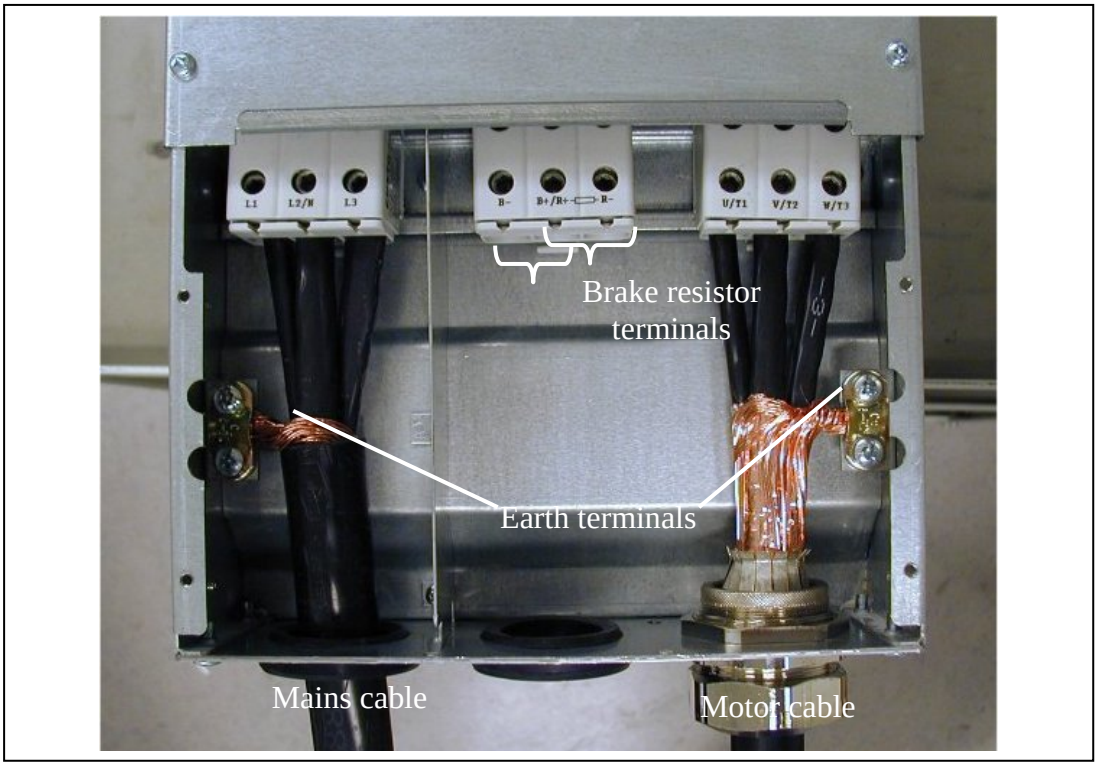


Figure 5-14. Cable Installation in ACCel500, FR7

Figure 5-15. ACCel500, FR8
(with Optional DC/Brake Resistor
Connection Box on Top)

Figure 5-16. Cable Installation in ACCel500, FR8

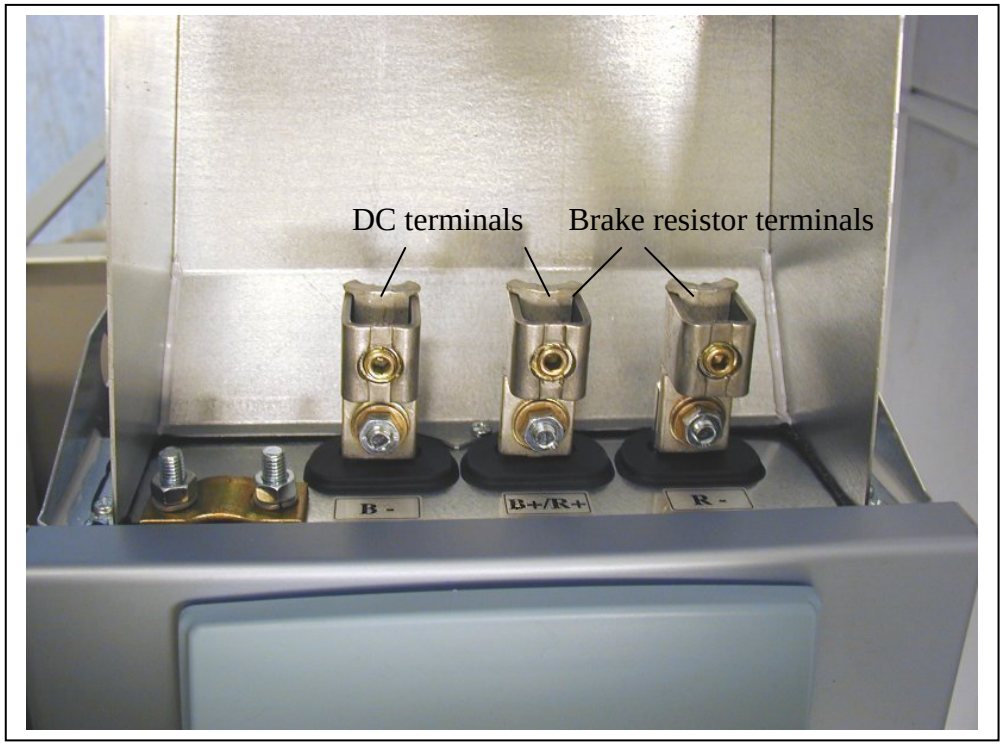


Figure 5-17. Brake Resistor Terminal Box on Top of FR8

Figure 5-18. ACCel500, FR9

Figure 5-19. Cable Installation in ACCel500, FR9

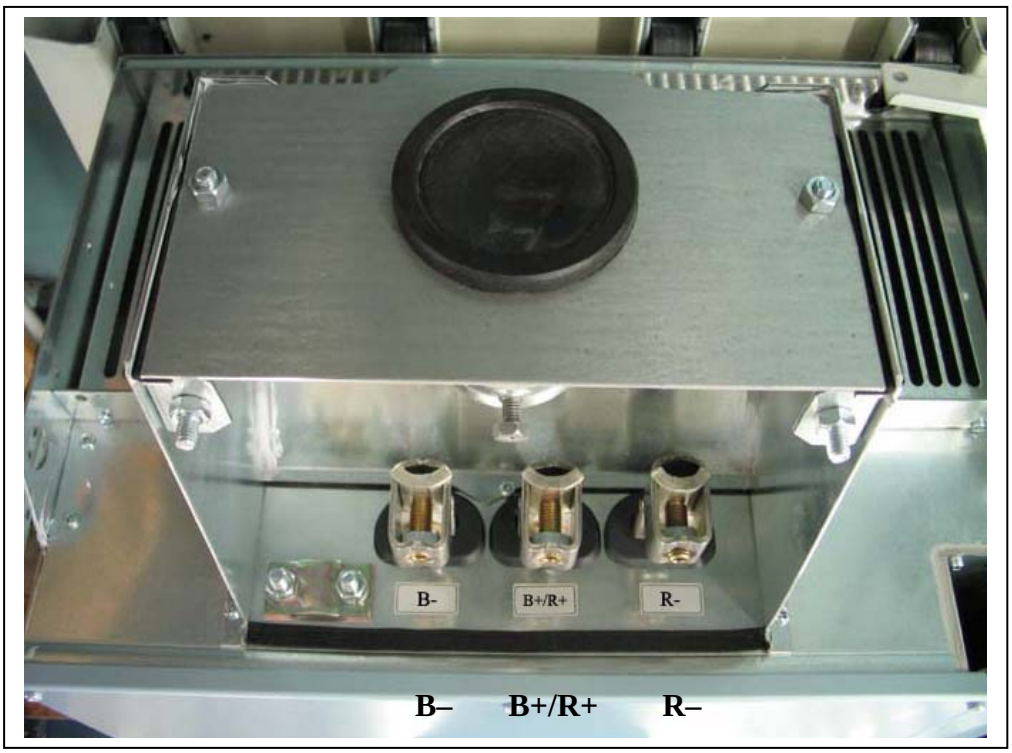


Figure 5-20. DC and Brake Resistor Terminals on FR9;
DC Terminals Marked with B– and B+,
Brake Resistor Terminals Marked with R+ and R–

5-1.6 CABLE SELECTION AND UNIT INSTALLATION IN ACCORDANCE WITH UL STANDARDS

To meet the UL (Underwriters Laboratories) regulations, use a UL-approved copper cable with a minimum heat-resistance of +60/75°C. Use Class 1 wire only.

The units are suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 600V maximum.

The tightening torques of the terminals are given in Table 5-7.

TABLE 5-7. TIGHTENING TORQUES OF TERMINALS

Type Amps (Input V)	Frame	Tightening Torque [in-lb (Nm)]
0003—0011 (230V) 0002—000 (460V)	FR4	.40 to .45 (0.5 to 0.6)
0012—0025 (230V) 0012—0023 (460V)	FR5	.88 to 1.1 (1.2 to 1.5)
0031—0048 (230V) 0031—0046 (460V) 0003—0026 (575V)	FR6	7.4 (10)
0061—0088 (230V) 0061—087 (460V) 0034—0062 (575V)	FR7	7.4 (10)
0114 (230V) 0105 (460V)	FR8	14.8 (20)
0140—0170 (230V) 0140—0170 (460V)	FR8	29.5 (40)
0205—0261 (230V) 0205—0245 (460V) 0100—0170 (575V)	FR9	29.5 (40)
0330—0920 (460V)	FR10 to 12	29.5 (40*)
0208—0750 (575V)	FR10 to 12	29.5 (40*)

* Tightening torque of terminal connection to the isolative base in Nm/in-lb.

** Apply counter torque to the nut on the other side of the terminal when tightening/loosening the terminal screw in order to avoid damage to the terminal.

5-1.7 CABLE AND MOTOR INSULATION CHECKS

Motor Cable Insulation Checks

Disconnect the motor cable from terminals U, V and W of the frequency converter and from the motor. Measure the insulation resistance of the motor cable between each phase conductor as well as between each phase conductor and the protective ground conductor. The insulation resistance must be >1MΩ.

Mains Cable Insulation Checks

Disconnect the mains cable from terminals L1, L2 and L3 of the frequency converter and from the mains. Measure the insulation resistance of the mains cable between each phase conductor as well as between each phase conductor and the protective ground conductor. The insulation resistance must be >1MΩ.

Motor Insulation Checks

Disconnect the motor cable from the motor and open the bridging connections in the motor connection box. Measure the insulation resistance of each motor winding. The measurement voltage must equal at least the motor nominal voltage but not exceed 1000 V. The insulation resistance must be >1MΩ.

5-2 CONTROL UNIT

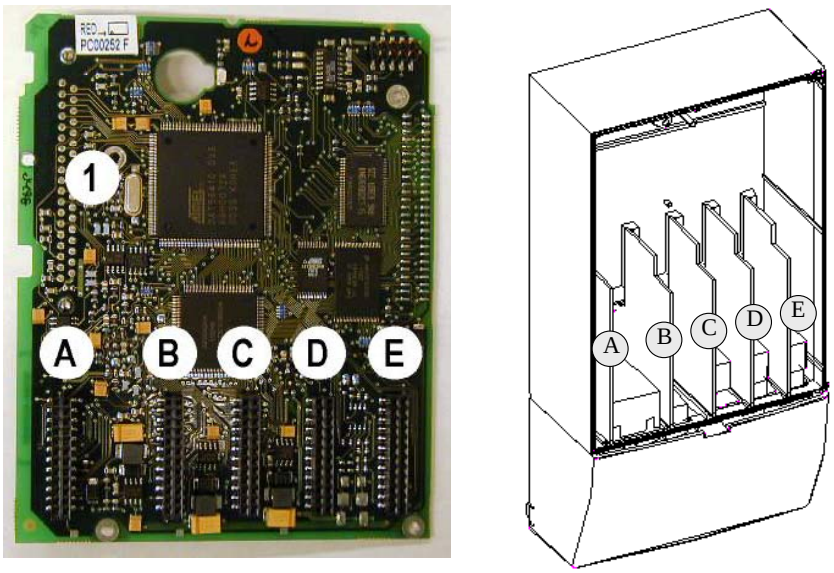


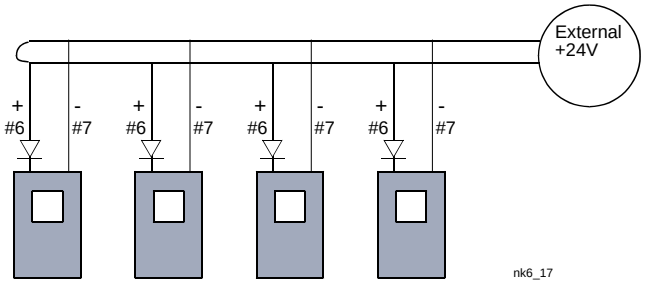
Figure 5-21. Control Board Connections

The control unit of the frequency converter consists of the control board and additional boards (see Figure 5-21) connected to the five slot connectors (A to E) of the control board. The control board is connected to the power unit through a D-connector (1) or fibre optic cables (FR9).

Usually, when the frequency converter is delivered from the factory, the control unit includes at least the standard compilation of two basic boards (I/O board and relay board) which are normally installed in slots A and B. On the next pages you will find the arrangement of the control I/O and the relay terminals of the two basic boards, the general wiring diagram and the control signal descriptions. The I/O boards mounted at the factory are indicated in the type code. For more information on the option boards, see ACCel500 Option Board Manual.

The control board can be powered externally (+24V, ±10%) by connecting the external power source to either of the bidirectional terminals, #6 or #12 (see section 5-2.1). This voltage is sufficient for parameter setting and for keeping the fieldbus active.

Note! If the 24V inputs of several frequency converters are connected in parallel, we recommend to use a diode in terminal #6 (or #12) in order to avoid current to flow in the opposite direction. This might damage the control board. See picture below.



5-2.1 CONTROL CONNECTIONS

The basic control connections for boards A1 and A2/A3 are shown in section 5-2.2. The signal descriptions are presented in the ACCel500 Expander I/O and Adapter I/O Boards Manual.

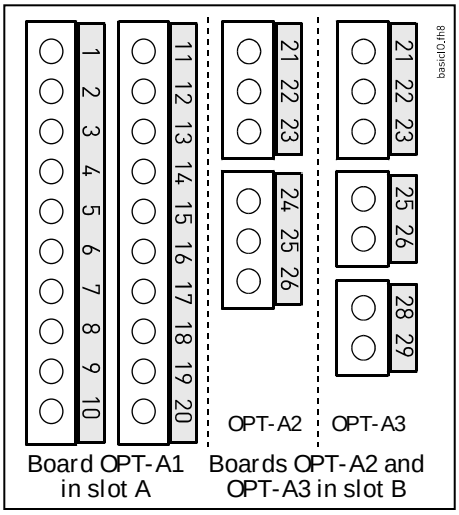


Figure 5-22. The I/O Terminals of the Two Basic Boards

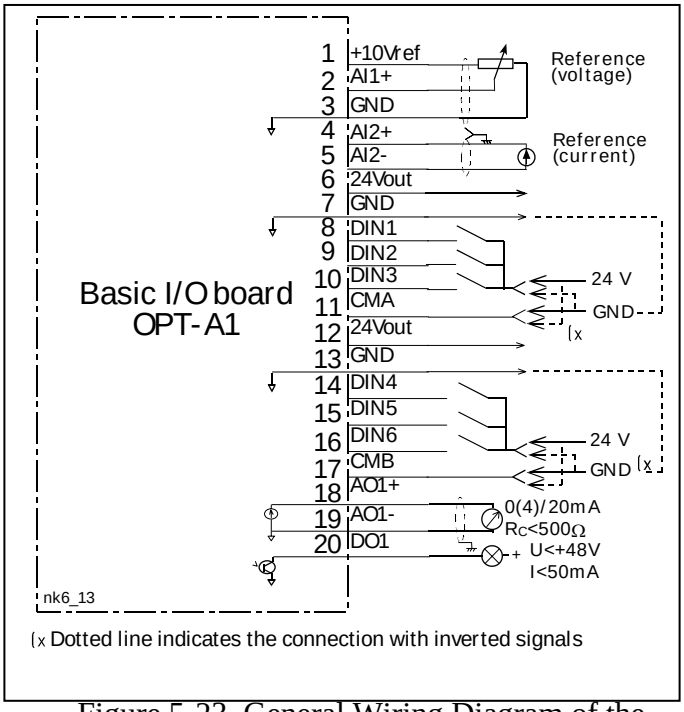


Figure 5-23. General Wiring Diagram of the Basic I/O Board (OPT-A1)

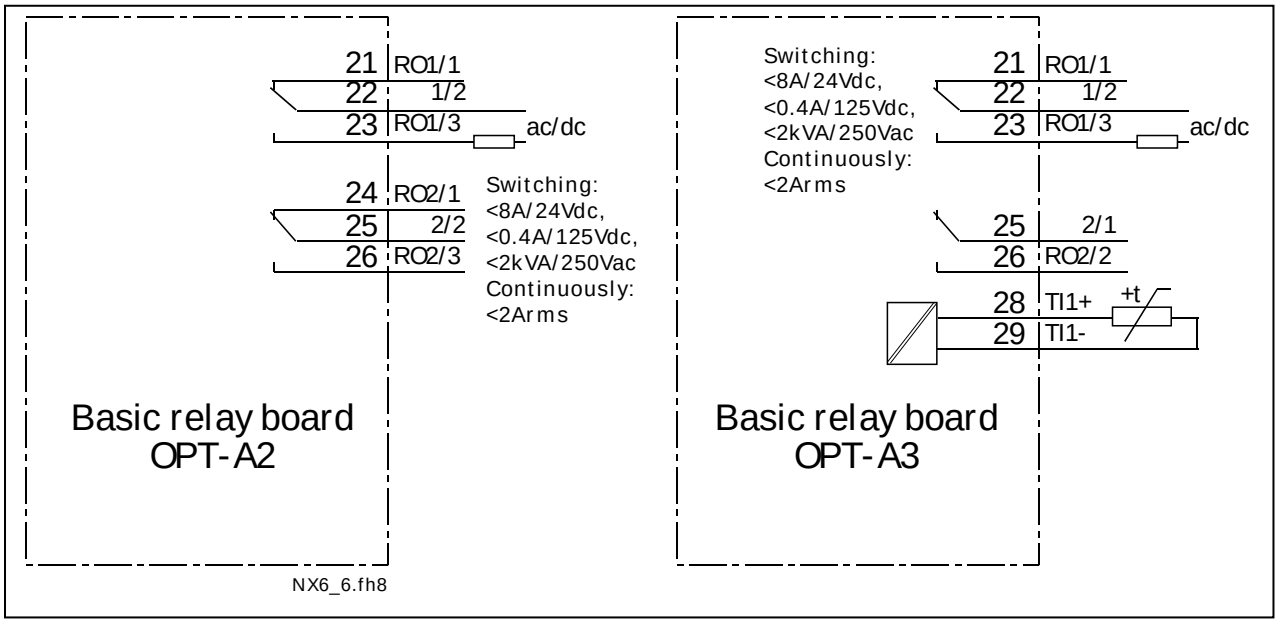


Figure 5-24. General Wiring Diagram of the Basic Relay Boards (OPT-A2/OPT-A3)

5-2.1.1 Control Cables

The control cables shall be at least 0.5 mm^2 screened multicore cables (see Table 5-1). The maximum terminal wire size is 2.5 mm^2 for the relay terminals and 1.5 mm^2 for other terminals.

Find the tightening torques of the option board terminals Table 5-8, below.

TABLE 5-8. TIGHTENING TORQUES OF TERMINALS

Terminal Screw	**Tightening Torque**	
	Nm	lb-in
Relay and thermistor terminals (screw M3)	0.5	4.5
Other terminals (screw M2.6)	0.2	1.8

5-2.1.2 Galvanic Isolation Barriers

The control connections are isolated from the mains potential and the GND terminals are permanently connected to ground. See Figure 5-22.

The digital inputs are galvanically isolated from the I/O ground. The relay outputs are additionally double-isolated from each other at 300 VAC (EN-50178).

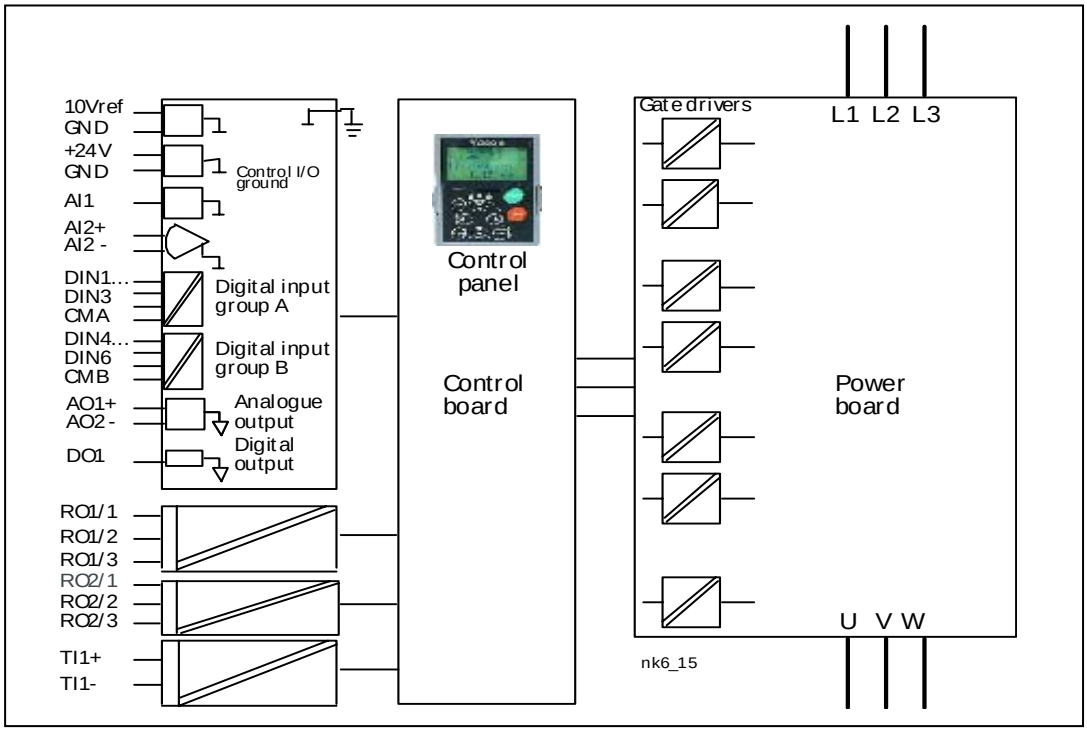


Figure 5-25. Galvanic Isolation Barriers

5-2.2 CONTROL TERMINAL SIGNALS

TABLE 5-9. CONTROL I/O TERMINAL SIGNALS ON BASIC I/O BOARD OPT-A1

OPT-A1			
Terminal		**Signal**	**Technical information**
1	+10 Vref	Reference voltage	Maximum current 10 mA
2	AI1+	Analogue input, voltage or current	Selection V or mA with jumper block X1 (see figure 5-25): Default: 0– +10V (Ri = 200 kΩ) (-10V to ..+10V Joy-stick control, selected with a jumper) 0– 20mA (Ri = 250 Ω)
3	GND/AI1–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
4	AI2+	Analogue input, voltage or current	Selection V or mA with jumper block X2 (see figure 5-25): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V to ..+10V Joy-stick control, selected with a jumper)
5	GND/AI2–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
6	24 Vout (bidirectional)	24V auxiliary voltage	±15%, maximum current 250mA (all boards total);150mA (from single board); Can also be used as external power backup for the control unit (and fieldbus)
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Digital input 1	R_i = min. 5kΩ 18 to 30V = "1"
9	DIN2	Digital input 2	
10	DIN3	Digital input 3	
11	CMA	Digital input common A for DIN1, DIN2 and DIN3.	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see figure 5-25):
12	24 Vout (bidirectional)	24V auxiliary voltage	Same as terminal #6
13	GND	I/O ground	Same as terminal #7
14	DIN4	Digital input 4	R_i = min. 5kΩ 18 to 30V = "1"
15	DIN5	Digital input 5	
16	DIN6	Digital input 6	
17	CMB	Digital input common B for DIN4, DIN5 and DIN6	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see figure 5-25):
18	AO1+	Analogue signal (+output)	Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 see figure 5-25):
19	AO1–	Analogue output common	
20	DO1	Open collector output	Maximum V_{in} = 48VDC Maximum current = 50 mA

TABLE 5-10. CONTROL I/O TERMINAL SIGNALS ON BASIC RELAY BOARD OPT-A2

OPT-A2				
Terminal		**Signal**	**Technical information**	
21	RO1/1	Relay output 1	Switching capacity	24 VDC / 8 A
				250 VAC / 8 A
22	RO1/2			125 VDC / 0.4 A
23	RO1/3		Min.switching load	5 V / 10 mA
24	RO2/1	Relay output 2	Switching capacity	24 VDC / 8 A
				250 VAC / 8 A
25	RO2/2			125 VDC / 0.4 A
26	RO2/3		Min.switching load	5 V / 10 mA

TABLE 5-11. CONTROL I/O TERMINAL SIGNALS ON BASIC RELAY BOARD OPT-A3

OPTA-3				
Terminal		**Signal**	**Technical information**	
21	RO1/1	Relay output 1	Switching capacity	24 VDC / 8 A
				250 VAC / 8 A
22	RO1/2			125 VDC / 0.4 A
23	RO1/3		Min.switching load	5 V / 10 mA
25	RO2/1	Relay output 2	Switching capacity	24 VDC /8 A
				250 VAC / 8 A
26	RO2/2			125 VDC / 0.4 A
			Min.switching load	5 V / 10 mA
28	TI1+	Thermistor input		
29	TI1–			

5-2.2.1 Digital Input Signal Inversions

The active signal level depends on which potential the common inputs CMA and CMB (terminals 11 and 17) are connected to. The alternatives are either +24V or ground (0 V). See Figure 5-23.

The 24-volt control voltage and the ground for the digital inputs and the common inputs (CMA, CMB) can be either internal or external.

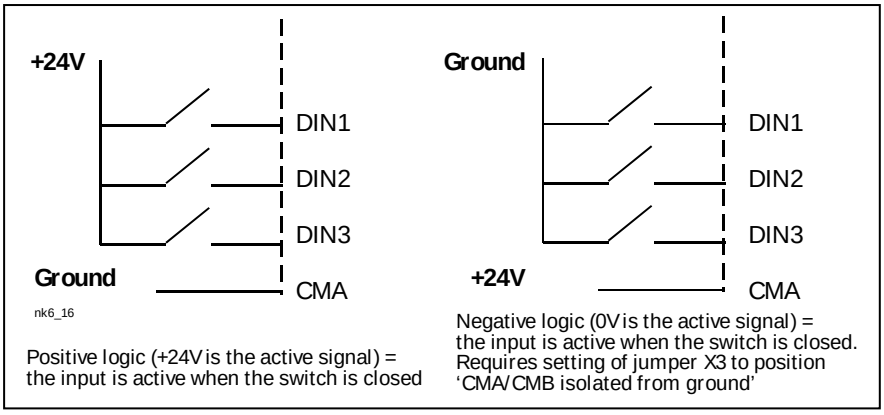


Figure 5-26. Positive/Negative Logic

5-2.2.2 Jumper Selections on the OPT-A1 Basic Board

The user is able to customize the functions of the frequency converter to better suit his needs by selecting certain positions for the jumpers on the OPT-A1 board. The positions of the jumpers determine the signal type of analogue and digital inputs.

On the A1 basic board, there are four jumper blocks, X1, X2, X3 and X6, each containing eight pins and two jumpers. The selectable positions of the jumpers are shown in Figure 5-25.

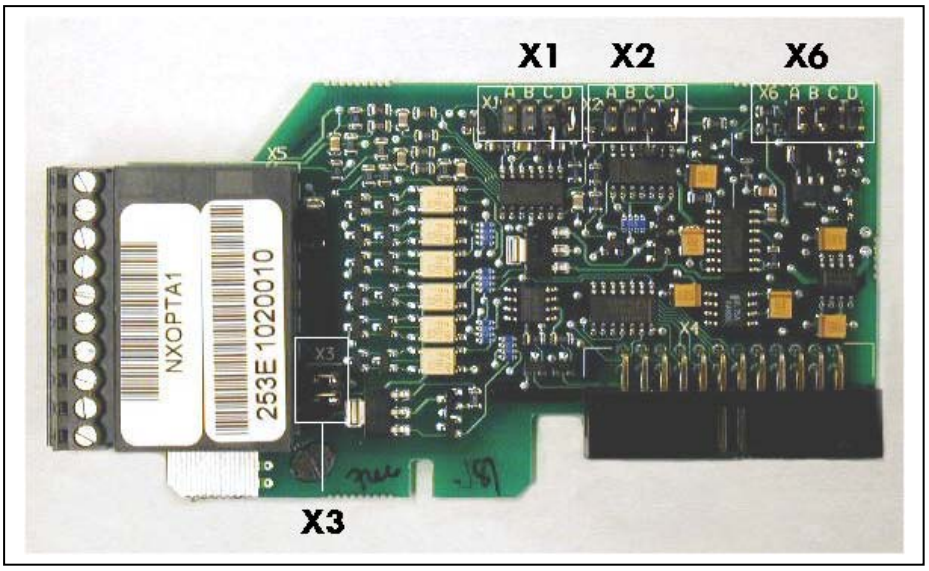


Figure 5-27. Jumper Blocks on OPT-A1

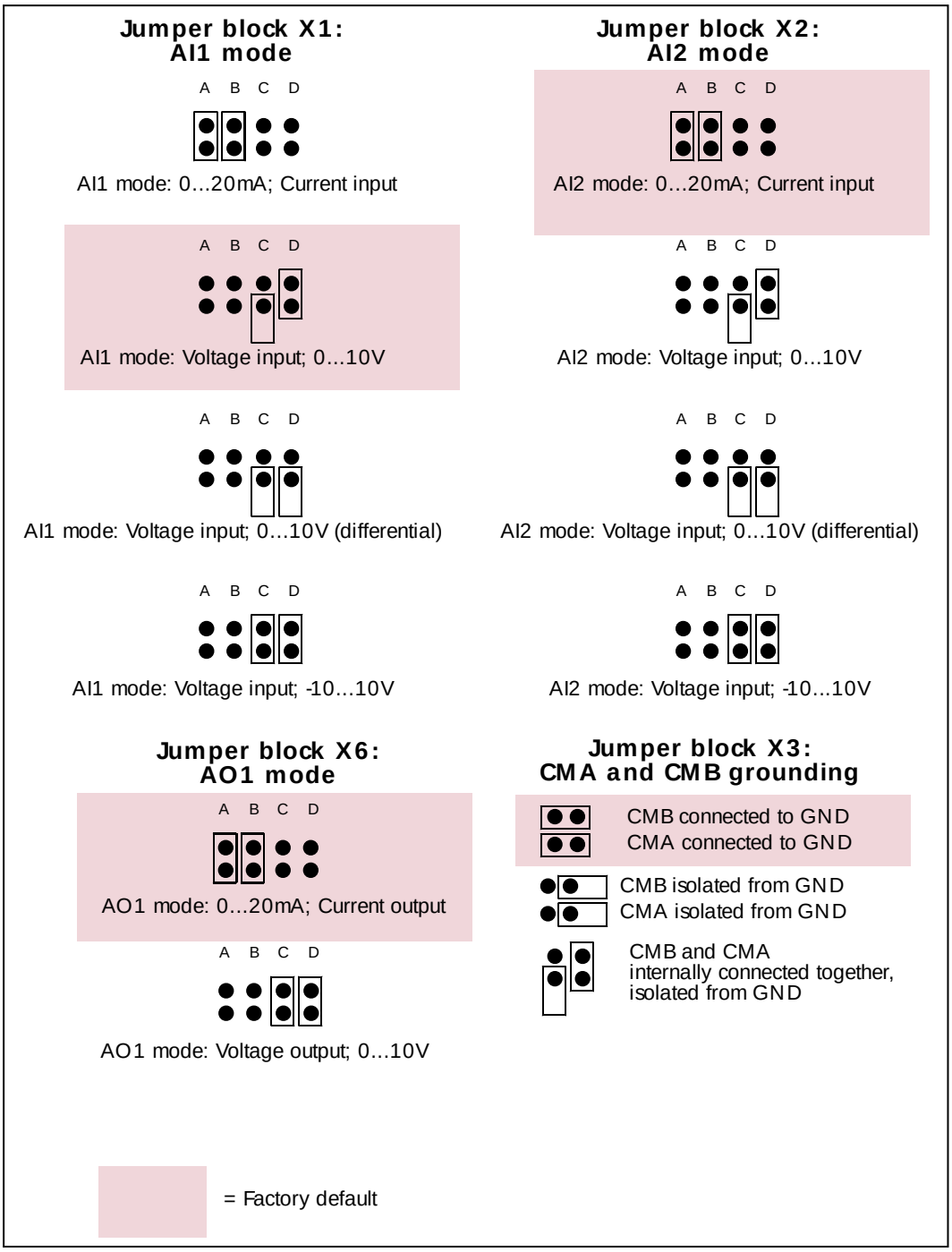


Figure 5-28. Jumper selection for OPT-A1

NOTE: If you change the AI/AO signal content, also remember to change the corresponding board parameter in menu M7.

SECTION VI

COMMISSIONING

6-1 SAFETY

Before commissioning, note the following directions and warnings:

- Internal components and circuit boards of the frequency converter (except for the galvanically isolated I/O terminals) are live when the ACCel500 frequency converter is connected to mains potential. Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.

- The motor terminals U, V, W and the DC-link/brake resistor terminals –/+ are live when the ACCel500 frequency converter is connected to mains, even if the motor is not running.

- The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when the ACCel500 frequency converter is disconnected from mains.

- Do not make any connections with the frequency converter connected to the mains.

- After having disconnected the frequency converter from the mains, wait until the fan stops and the indicators on the keypad go out (if no keypad is attached, see the indicator through the keypad base). Wait 5 more minutes before doing any work on ACCel500 connections. Do not even open the cover before this time has expired.

- Before connecting the frequency converter to mains, make sure that the ACCel500 front cover is closed.

- When running, the side of converter FR8 is hot. Do not touch with hands.

- When running, the back of frequency converter FR6 is hot. Therefore, it MUST NOT be mounted onto a surface which is not fireproof.

6-2 COMMISSIONING OF THE FREQUENCY CONVERTER

1. Read carefully the safety instructions in Chapter I and above and follow them.
2. After the installation, pay attention:
   - that both the frequency converter and the motor are grounded.
   - that the mains and motor cables comply with the requirements given in section 5-1.1.

   - that the control cables are located as far as possible from the power cables (see section 5-1.5, step 3), the shields of the shielded cables are connected to protective earth ⏚.

The wires may not touch the electrical components of the frequency converter.
- that the common inputs of digital input groups are connected to +24V or ground of the I/O terminal or the external supply.

3. Check the quality and quantity of cooling air (section 4-2 and Table 4-11).
4. Check the inside of the frequency converter for condensation.
5. Check that all Start/Stop switches connected to the I/O terminals are in Stop position.
6. Connect the frequency converter to mains.
7. Set the parameters of group 1 (See your Avtron application software manual) according to the requirements of your application. At least the following parameters should be set:
   - motor nominal voltage
   - motor nominal frequency
   - motor nominal speed
   - motor nominal current

   You will find the values needed for the parameters on the motor rating plate.
8. Perform run test without motor
   Perform either Test A or Test B:

   A Controls from the I/O terminals:
   a) Turn the Start/Stop switch to ON position.
   b) Change the frequency reference (potentiometer)
   c) Check in the Monitoring menu (M1) that the value of Output frequency changes according to the change of frequency reference.
   d) Turn the Start/Stop switch to OFF position.

   B Control from the control keypad:
   a) Change the control from the I/O terminals to the keypad.
   b) Push the Start button on the keypad 

   .
   c) Move over to the Keypad Control menu (M3) and Keypad Reference submenu and change the frequency reference using the Browser buttons
   
   .
   d) Check in the Monitoring menu (M1) that the value of Output frequency changes according to the change of frequency reference.
   e) Push the Stop button on the keypad 

   .

9. Run the startup tests without the motor being connected to the process, if possible. If this is not possible, secure the safety of each test prior to running it. Inform your co-workers of the tests.
   a) Switch off the supply voltage and wait up until the drive has stopped as advised in step 5, above.
   b) Connect the motor cable to the motor and to the motor cable terminals of the frequency converter.
   c) See to that all Start/Stop switches are in Stop positions.
   d) Switch the mains ON.
   e) Repeat test 8A or 8B.

10. Connect the motor to the process (if the startup test was run without the motor being connected).
    a) Before running the tests, make sure that this can be done safely.
    b) Inform your co-workers of the tests.
    c) Repeat test 8A or 8B.

APPENDIX A

RE-FORMING OF DC-BUS ELECTROLYTIC CAPACITORS FOLLOWING EXTENDED STORAGE

ACCel500 brand adjustable frequency drives from Avtron Industrial Automation, Inc. utilize large aluminum (Al) electrolytic capacitors in their DC section. Aluminum electrolytic capacitors are commonly used due the fact that they have very good capacitance values relative to their canister volume. They also have a high ripple current capacity.

In normal operation, the leakage current of the capacitors is low due to a dielectric aluminum oxide layer (forming) on the aluminum foil. If capacitors are stored for a long period of time without an applied voltage, the aluminum oxide layer loses its homogenous nature. As a result, when a voltage is applied, a high leakage current can result that can damage the capacitor. This is an attribute typical of all aluminum oxide type capacitors, and is not dependant on the manufacturer. With ACCel500 adjustable frequency drives, this means that the capacitors, charging resistors, rectifiers, etc. could be damaged if the unit is powered without proper forming of the capacitors.

Re-forming of capacitors following a long storage period:

A) Capacitors installed in adjustable frequency drives

Often, adjustable frequency drives are stored for extended periods of time without being powered; for example, distributor stock or customer spares. ***The re-forming of the capacitors in these units should be done at least once a year***. This can be done by applying and maintaining the required voltage to the unit for a minimum of 1 (one) hour.

If more than one year has elapsed since the unit was last energized, the re-forming of the capacitors must be done in a manner that limits the possibility of a high leakage current passing through the capacitors. The best solution to re-form the capacitors is to use a DC power supply with an adjustable current limit.

Follow these steps to re-form the capacitors:

1. Set the current limit for 300 to 500mA.

2. Connect the DC power supply directly to the **+** and **–** terminals of the DC bus (DC+ to B+ and DC- to B-) or directly to the terminals of the capacitors.

   For ACCel500 models which have no B+/B- terminals (for example, frame sizes FR8-FR9), the DC power supply can be connected between input phases L1 and L2.

3. Adjust the DC voltage up to the nominal DC voltage level of the unit (1.35*V_n AC) and maintain this level for at least 1 (one) hour.

If a DC power supply is not available and the unit has been stored de-energized for longer than 1 (one) year, consult the Avtron Field Service Department before connecting the power.

B) Loose spare capacitors

A loose, spare capacitor that is known to have been sitting de-energized for more than one year is best re-formed prior to installation in the adjustable frequency drive.

Follow these steps to re-form loose capacitors:

1. Set the DC supply current limit between 50 and 100mA.

2. Connect the DC power supply directly to the + and – terminals of the capacitors.

3. Set the DC voltage to the rated value for the capacitor. Maintain this level for at least 1 (one) hour.

Progress of the capacitor's re-forming can be monitored using the current meter on the DC power supply. Even though the leakage current may stabilize sooner, it is recommended to keep the capacitor energized for at least 1 (one) hour.

W A R N I N G

Due to high leakage resistance, a dangerous voltage can remain in the capacitors for a long period of time. For safety reasons, discharge the capacitors after re-forming them by using a resistor.

If re-forming of a capacitor is not done prior to their installation in an adjustable frequency drive, refer to section A of this appendix for the proper re-forming procedure.

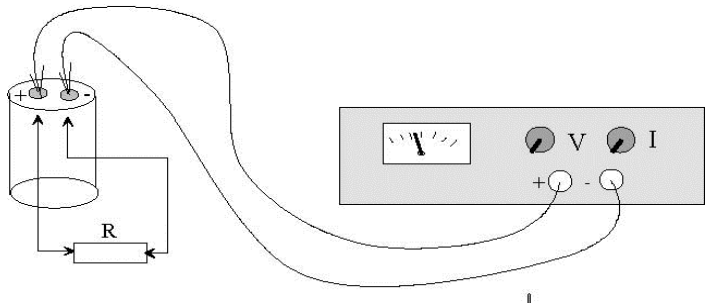


Figure 1 - Re-forming of a loose capacitor using an adjustable DC supply