

Altivar 21

Variable speed drives for
asynchronous motors

Installation Manual

09/2009



Contents

Important information	4
Before you begin	5
Steps for setting up the drive	7
Preliminary recommendations	8
Storing and shipping	8
Lifting and handling	8
Drive Ratings	9
Dimensions and weights	10
Mounting and temperature conditions	12
Removing the protective cover	12
Mounting methods	12
Derating curves	13
Minimum air flow rates	16
Position of the charging LED	18
Installing option card	19
Wiring	20
Wiring recommendations	20
Branch circuit protection	20
Output wiring	21
Grounding	21
Terminals	22
How to open the front cover up to 18.5 kW	22
How to open the front cover from 22 kW	22
Power terminals	23
Control terminals	26
Connection diagram	28
Logic input switch	29
Use on an impedance grounded system	30
Motor thermal protection	31
Electromagnetic compatibility	32

Important information

PLEASE NOTE

Please read these instructions carefully and examine the equipment in order to familiarize yourself with the device before installing, operating or carrying out any maintenance work on it.

The following special messages that you will come across in this document or on the device are designed to warn you about potential risks or draw your attention to information that will clarify or simplify a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that there is an electrical risk that will result in injury if the instructions are not followed.



This is a safety warning symbol. It warns you of the potential risk of injury. You must comply with all safety messages that follow this symbol in order to avoid the risk of injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death, serious injury or equipment damage.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death, serious injury or equipment damage.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** injury or equipment damage.

PLEASE NOTE:

Only qualified personnel are authorized to carry out maintenance work on electrical equipment. Schneider Electric accepts no responsibility for the consequences of using this device. This document does not constitute an instruction manual for inexperienced personnel.
© 2008 Schneider Electric. All rights reserved.

Before you begin

Read and follow these precautions before beginning any procedure with this drive.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this manual before installing or operating the Altivar 21 (ATV21) drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/– or across the DC bus capacitors.
- Before servicing the drive:
 - Disconnect all power.
 - Place a “DO NOT TURN ON” label on all power disconnects.
 - Lock all power disconnects in the open position.
 - Disconnect all power, including external control power that may be present, before servicing the drive. WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” on page 25 to verify that the DC voltage is less than 45 V. The drive LED is not an indicator of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive.

Failure to follow these instructions will result in death or serious injury.

DANGER

UNINTENDED EQUIPMENT OPERATION

Before turning on the drive or upon exiting the configuration menus, ensure that the inputs assigned to the Run command are in a state that will not cause the drive to run. Otherwise, the motor can start immediately.

Failure to follow these instructions will result in death, serious injury, or equipment damage.

WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link (1).
- Each implementation of an Altivar 21 drive must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

(1) For additional information refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.”

Before you begin

WARNING

LOSS OF CONTROL

- Set the communication error trip time to stop the drive in case the remote keypad display is deactivated by an unusual event such as tripping, an operation error, or a power outage.
- Ensure that the communication error trip time is properly set before deactivating the remote keypad display.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the drive, ensure that the line voltage is compatible with the line voltage range specified on the drive nameplate. The drive can be damaged if the line voltage is not compatible.

Failure to follow this instruction can result in injury or equipment damage.

INSTALLATION

■ 1 Receive and inspect the drive

- Check that the catalog number printed on the label is the same as that on the purchase order
- Remove the Altivar from its packaging and check that it has not been damaged in transit

■ 2 Check the line voltage

- Check that the line voltage is compatible with the voltage range of the drive (see pages [9](#) and [10](#))

■ 3 Mount the drive

- Mount the drive in accordance with the instructions in this document
- Install any internal and external options

■ 4 Wire the drive

- Connect the motor, ensuring that its connections correspond to the voltage
- Connect the line supply, after making sure that the power is off
- Connect the control
- Connect the speed reference

Steps 1 to 4 must be performed with the power off.



PROGRAMMING

- **5 Please refer to the Programming Manual**

Preliminary recommendations

Before installing the ATV21 drive, read this manual and follow all precautions.

WARNING

DAMAGED PACKAGING

If the packaging appears damaged, it can be dangerous to open it or handle it. Handle with care.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

WARNING

DAMAGED EQUIPMENT

Do not operate or install any drive that appears damaged.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Before removing the drive from its packaging, verify that the carton was not damaged in shipping. Carton damage usually indicates improper handling and the potential for device damage. If any damage is found, notify the carrier and your Schneider Electric representative.

Storing and shipping

If the drive is not immediately installed, store it in a clean, dry area where the ambient temperature is between -25 and $+70$ °C (-13 to $+158$ °F). If the drive must be shipped to another location, use the original shipping material and carton to protect the drive.

Lifting and handling

WARNING

HANDLING AND LIFTING HAZARD

Keep the area below any equipment being lifted clear of all personnel and property. Use the lifting method illustrated in following figure.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

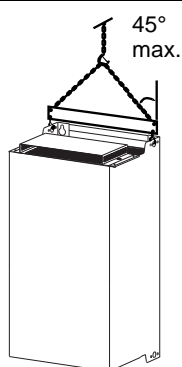
WARNING

RISK OF TOPPLING

- Keep the drive on the pallet until ready to install.
- Never place the drive in an upright position without proper support, such as a hoist, braces, or other mounting supports.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Lifting method



- Altivar 21 drives up to ATV21HD18N4 and ATV21W075N4 can be removed from their packaging and installed without a handling device.
- A hoist must be used for higher ratings.
- After removing the drive from its packaging, inspect it for damage. If any damage is found, notify the carrier and your sales representative.
- Verify that the drive nameplate and label conform to the packing slip and corresponding purchase order.

Drive Ratings

Three-phase supply voltage: 200 ... 240 V 50/60 Hz

Motor		Line supply (input)				Drive (output)			Altivar 21
Power ratings		Max. line current (4)		Apparent power	Max. prospective line Isc (2)	Nominal rated output current (1)	Transient output current (1) (3)	Total dissipated power at rated load (1)	Reference
		200 V	240 V	240 V					
kW	HP	A	A	kVA	kA	A	A	W	
0.75	1	3.3	2.7	1,1	5	4.6	5.1	63	ATV21H075M3X
1.5	2	6.1	5.1	2,1	5	7.5	8.3	101	ATV21HU15M3X
2.2	3	8.7	7.3	3,0	5	10.6	11.7	120	ATV21HU22M3X
3	—	—	10	4,2	5	13.7	15.1	146	ATV21HU30M3X
4	5	14.6	13	5,4	5	16.7	19.3	193	ATV21HU40M3X
5.5	7.5	20.8	17.3	7,2	22	24.2	26.6	249	ATV21HU55M3X
7.5	10	27.9	23.3	9,7	22	32.0	35.2	346	ATV21HU75M3X
11	15	42.1	34.4	14,3	22	46.2	50.8	459	ATV21HD11M3X
15	20	56.1	45.5	18,9	22	61.0	67.1	629	ATV21HD15M3X
18.5	25	67.3	55.8	23,2	22	74.8	82.3	698	ATV21HD18M3X
22	30	80.4	66.4	27,6	22	88.0	96.8	763	ATV21HD22M3X
30	40	113.3	89.5	37,2	22	117	128.7	1085	ATV21HD30M3X

(1) These power, amperage, and wattage ratings apply to:

- Drives ATV21H075M3X to HD15M3X operating at a switching frequency of 12 kHz and operating in a 40 °C (104 °F) ambient.
- Drives ATV21HD18M3X to HD30M3X operating at a switching frequency of 8 kHz, and operating in a 40 °C (104 °F) ambient.

See pages 12–14 for derating curves as a function of switching frequency, ambient temperature, and mounting conditions.

(2) Current on a line supply with the indicated short-circuit current rating.

(3) For 60 seconds.

(4) Typical value for the indicated motor power and for the maximum prospective line Isc.

Three-phase supply voltage: 380 ... 480 V 50/60 Hz

Motor		Line supply (input)				Drive (output)			Altivar 21
Power ratings		Max. line current (4)		Apparent power	Max. prospective line Isc (2)	Nominal rated output current (1)	Transient output current (1) (3)	Total dissipated power at rated load (1)	Reference
		380 V	480 V	380 V					
kW	HP	A	A	kVA	kA	A	A	W	
0.75	1	1.7	1.4	1,1	5	2.2	2.4	55	ATV21H075N4
1.5	2	3.2	2.5	2,1	5	3.7	4.0	78	ATV21HU15N4
2.2	3	4.6	3.6	3,0	5	5.1	5.6	103	ATV21HU22N4
3	—	6.2	4.9	4,1	5	7.2	7.9	137	ATV21HU30N4
4	5	8.1	6.4	5,3	5	8.2	10.0	176	ATV21HU40N4
5.5	7.5	10.9	8.6	7,2	22	12.0	13.2	215	ATV21HU55N4
7.5	10	14.7	11.7	9,7	22	16.0	17.6	291	ATV21HU75N4
11	15	21.1	16.8	13,9	22	22.5	24.8	430	ATV21HD11N4
15	20	28.5	22.8	18,7	22	30.5	33.6	625	ATV21HD15N4
18.5	25	34.8	27.8	22,9	22	37.0	40.7	603	ATV21HD18N4
22	30	41.6	33.1	27,3	22	43.5	47.9	626	ATV21HD22N4
30	40	56.7	44.7	37,3	22	58.5	64.4	847	ATV21HD30N4
37	50	68.9	54.4	45,3	22	79	86.9	976	ATV21HD37N4
45	60	83.8	65.9	55,2	22	94	103.4	1253	ATV21HD45N4
55	75	102.7	89	67,6	22	116	127.6	1455	ATV21HD55N4
75	100	141.8	111.3	93,3	22	160	176	1945	ATV21HD75N4

(1) These power, amperage, and wattage ratings apply to:

- Drives ATV21H075N4 to HD15N4 operating at a switching frequency of 12 kHz and operating in a 40 °C (104 °F) ambient.
- Drives ATV21HD18N4 to HD75N4 operating at a switching frequency of 8 kHz, and operating in a 40 °C (104 °F) ambient.

See pages 12–14 for derating curves as a function of switching frequency, ambient temperature, and mounting conditions.

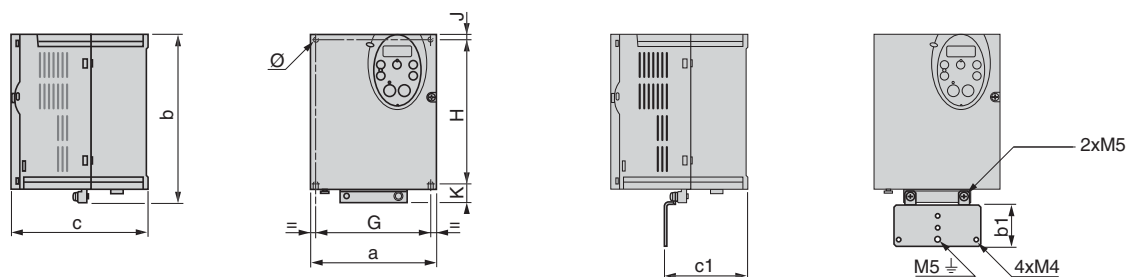
(2) Current on a line supply with the indicated short-circuit current rating.

(3) For 60 seconds.

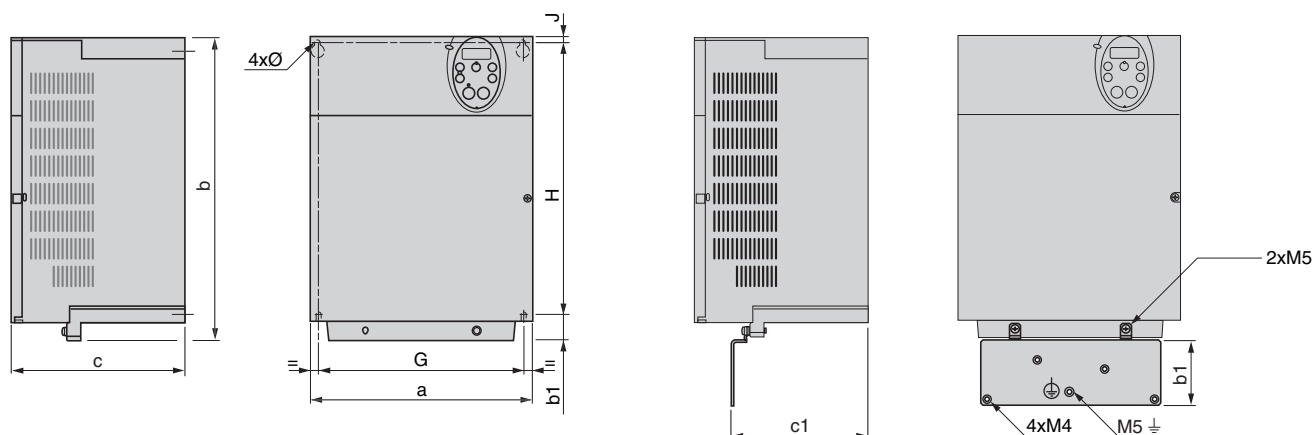
(4) Typical value for the indicated motor power and for the maximum prospective line Isc.

Dimensions and weights

The figures below shows outline drawings of the ATV21 drives and the tables gives the dimensions and weights of the various models.

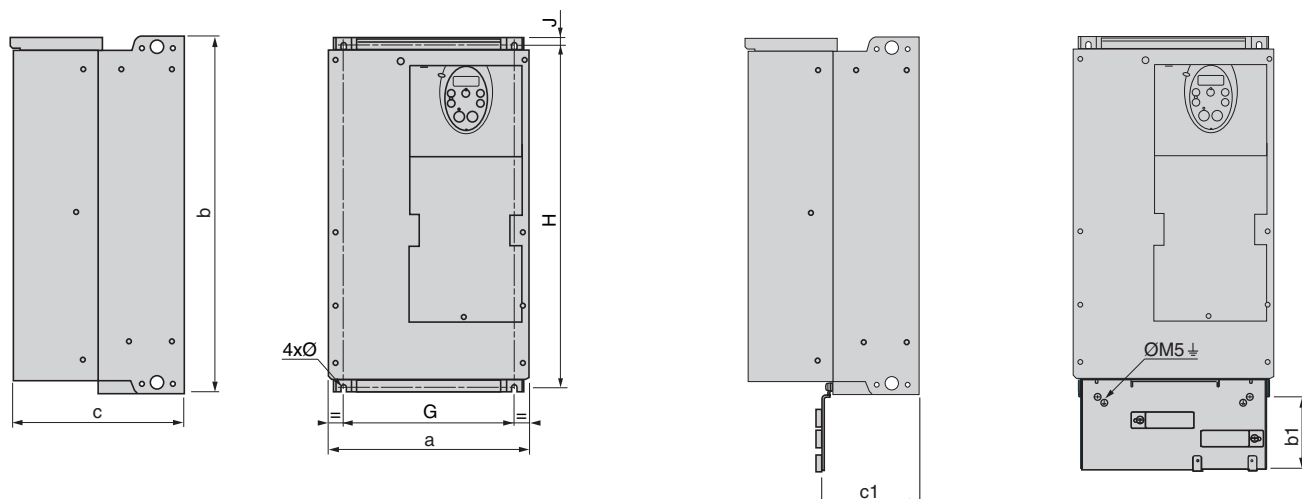


ATV21H	Dimensions mm (in.)									Weight kg (lb)
	a	b	b1	c	c1	G	H	J	Ø	
075M3X, U15M3X, U22M3X	107	143	49	150	67.3	93	121.5	5	5	1.80 (3.978)
075N4, U15N4, U22N4	(4.2)	(5.6)	(1.93)	(5.9)	(2.65)	(3.6)	(4.7)	(0.20)	(0.20)	2.00 (4.42)
U30M3x, U40M3X	142	184	48	150	88.8	126	157	6.5	5	3.05 (6.741)
U30N4, U40N4, U55N4	(5.6)	(7.2)	(1.8)	(5.9)	(3.50)	(4.9)	(6.1)	(0.26)	(0.20)	3.35 (7.404)

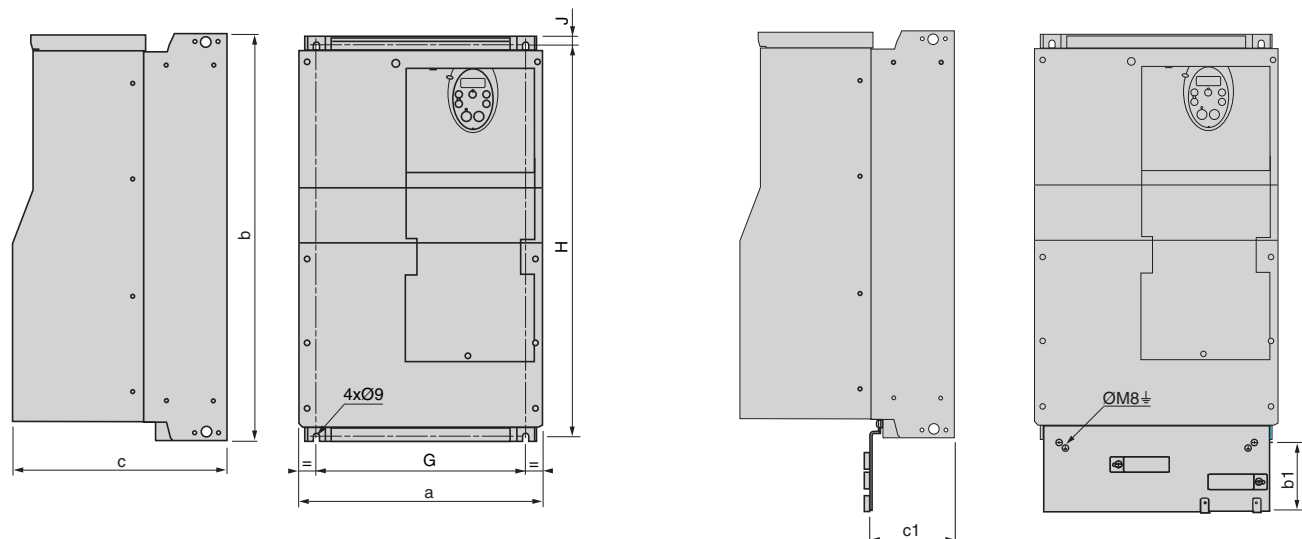


ATV21H	Dimensions mm (in.)									Weight kg (lb)
	a	b	b1	c	c1	G	H	J	Ø	
U55M3X, U75M3X	180	232	75	170	134.8	160	210	5	5	6.10 (13.481)
U40M3X, D11M3X, D15M3X	(7)	(9.1)	(2.9)	(6.7)	(5.31)	(6.3)	(8.2)	(0.20)	(0.20)	11.50 (25.4)
	245	329.5	75	190	147.6	225	295	7	6	
	(9.6)	(13)	(2.9)	(7.5)	(5.8)	(8.8)	(11.6)	(0.28)	(0.24)	

Dimensions and weights

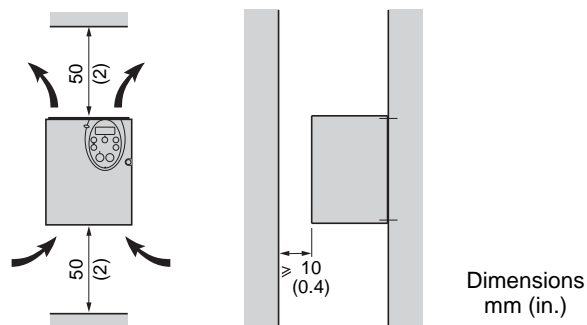


ATV21H	Dimensions mm (in.)									Weight kg (lb)
	a	b	b1	c	c1	G	H	J	Ø	
D22M3X	240	420	122	214	120	206	403	10	6	27.40 (60.554)
D22N4, D30N4	(9.4)	(16.5)	(4.8)	(8.4)	(4.72)	(8.1)	(15.8)	(0.39)	(0.24)	26.40 (58.344)
D37N4, D45N4	240	550	113	244	127	206	529	10	6	23.50 (51.81)
	(9.4)	(21.65)	(4.45)	(9.61)	(5.0)	(8.1)	(20.83)	(0.39)	(0.24)	



ATV21H	Dimensions mm (in.)									Weight kg (lb)
	a	b	b1	c	c1	G	H	J	Ø	
D30M3X	320	630	118	290	173	280	604.5	10	9	38.650 (85.42)
D55N4, D75N4	(12.5)	(24.8)	(4.65)	(11.4)	(6.81)	(11)	(23.8)	(0.39)	(0.35)	39.70 (87.74)

Mounting and temperature conditions



- Install the drive vertically, $\pm 10^\circ$.
- Do not place the drive close to heat sources.
- Leave sufficient free space around the drive to ensure that air can circulate from the bottom to the top of the unit.
- Leave a minimum of 10 mm (0.4 in.) of free space in front of the drive.

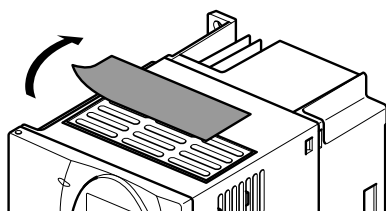
Removing the protective cover

See [“Mounting methods”, page 11](#) to determine the type of mounting appropriate for your application before removing the protective cover from the drive.

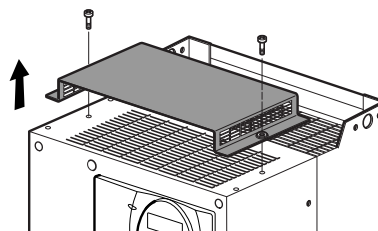
When IP20 protection is adequate, remove the protective cover on top of the drive as shown below.

For UL Type 1 protection, leave the protective cover on top of the drive and install a conduit entry kit.

ATV21H 075M3X to D18M3X, and
ATV21H 075N4 to D18N4



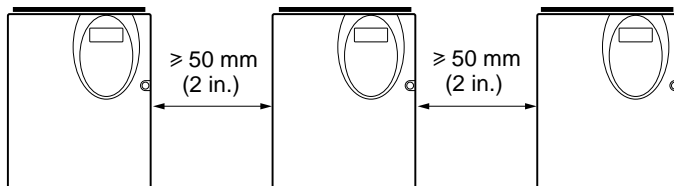
ATV21H D22M3X to D30M3X and
ATV21H D22N4 to D30N4



Mounting methods

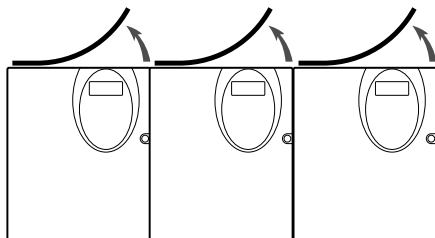
Type A mounting

Free space ≥ 50 mm (2 in.) on each side, with the protective cover in place.



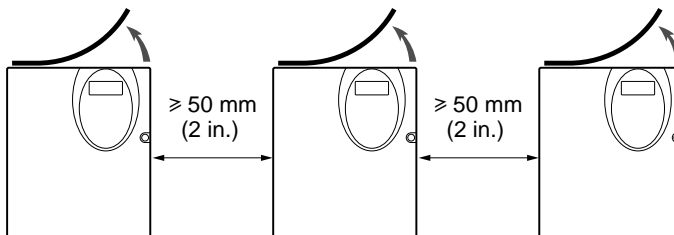
Type B mounting

Drives mounted side-by-side, with the protective cover removed (degree of protection becomes open type IP20).



Type C mounting

Free space ≥ 50 mm (2 in.) on each side, with the protective cover removed (degree of protection becomes open type IP20).



Mounting and temperature conditions

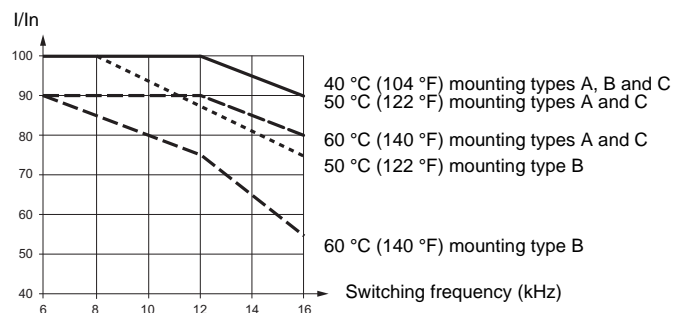
Derating curves

The curves illustrate the drive nominal current derating percentage ($I/I_n\%$) as a function of the temperature, switching frequency, and the type of mounting.

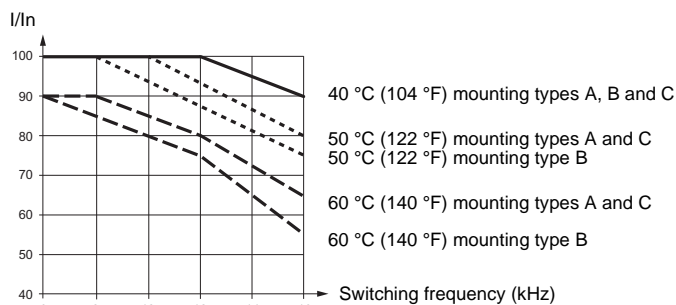
For example, 80% derating of a 20 hp, 460 V ATV21 drive nominally rated for 30.5 amperes continuously: $30.5 \times 0.8 = 24.4$ (15 hp).

For intermediate temperatures, interpolate between two curves.

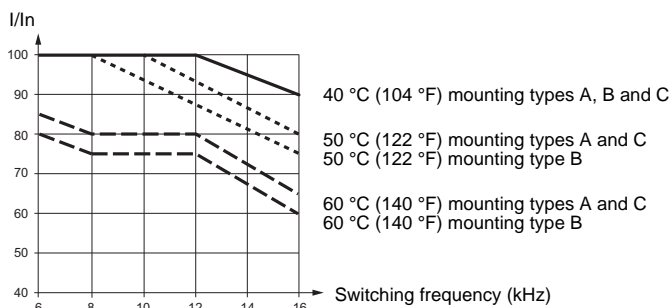
ATV21H075M3X



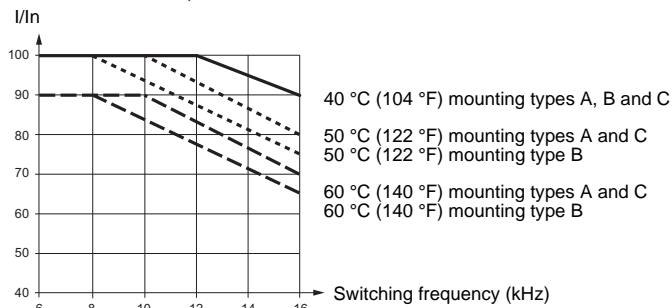
ATV21HU15M3X



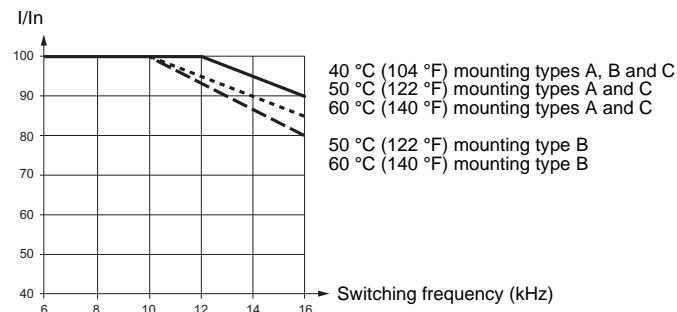
AT21HU22M3X



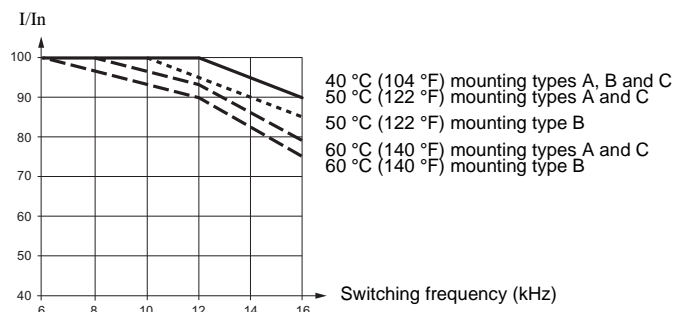
ATV21HU30M3X, ATV21HU40M3X



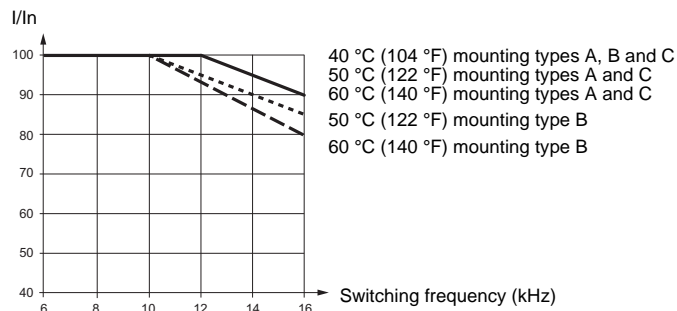
ATV21HU55M3X



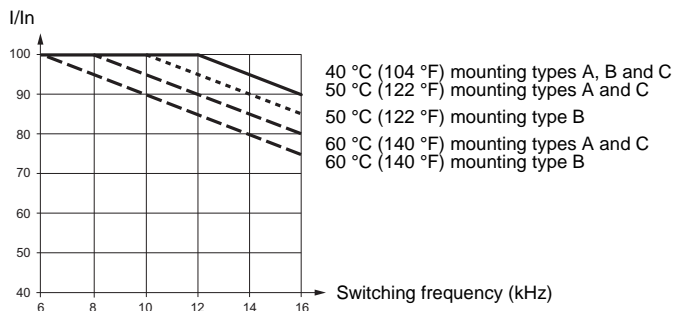
ATV21HU75M3X



ATV21HD11M3X

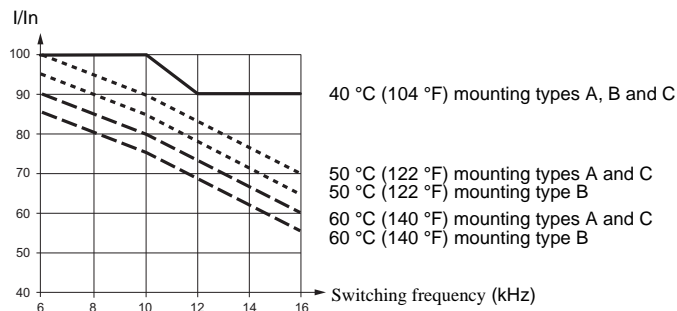


ATV21HD15M3X

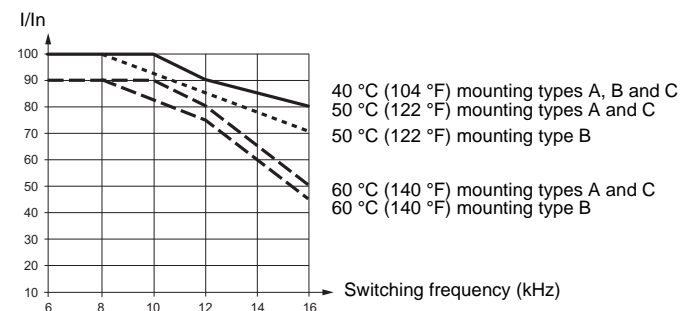


Mounting and temperature conditions

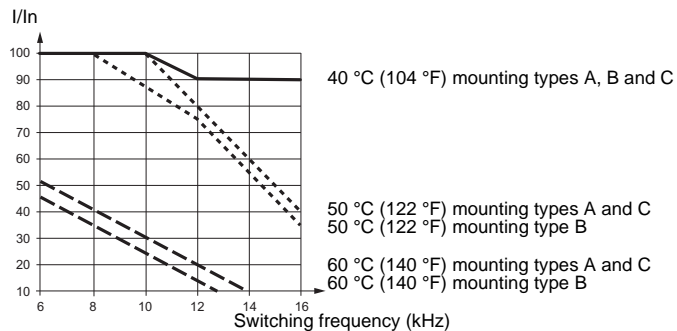
ATV21HD18M3X



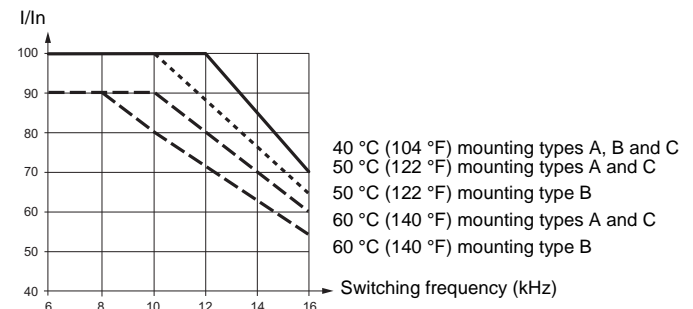
ATV21HD22M3X



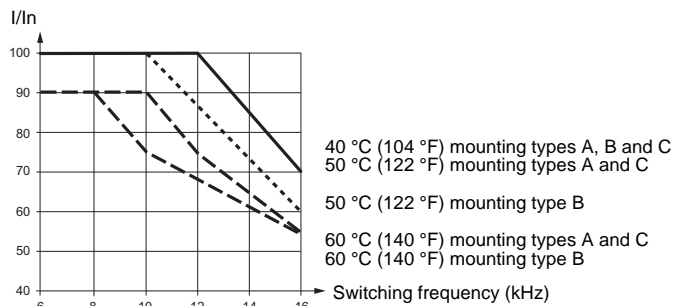
ATV21HD30M3X



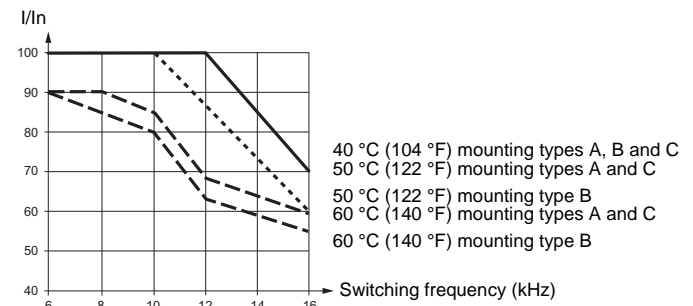
ATV21HU75N4



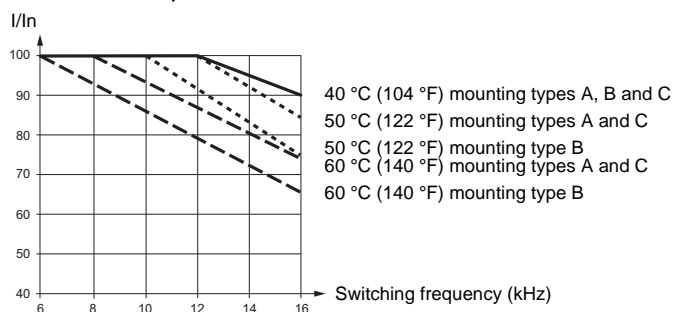
ATV21HU15N4



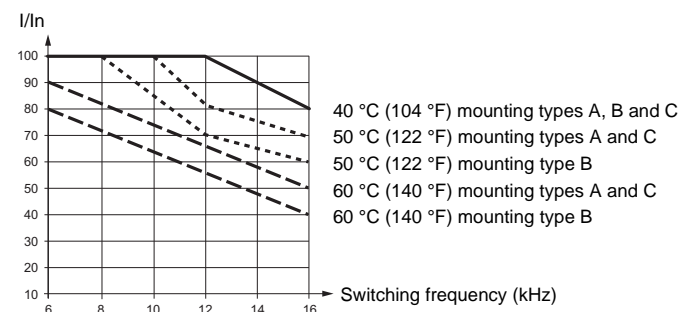
ATV21HU22N4



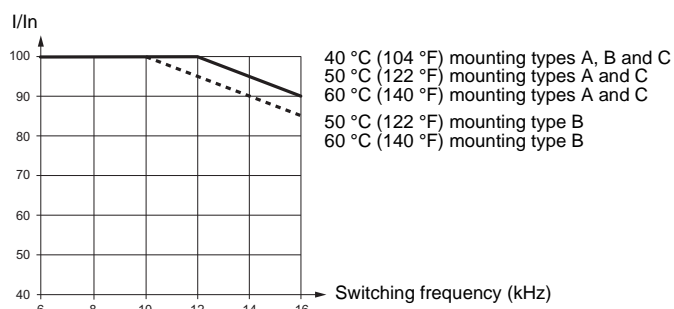
ATV21HU30N4, ATV21HU40N4



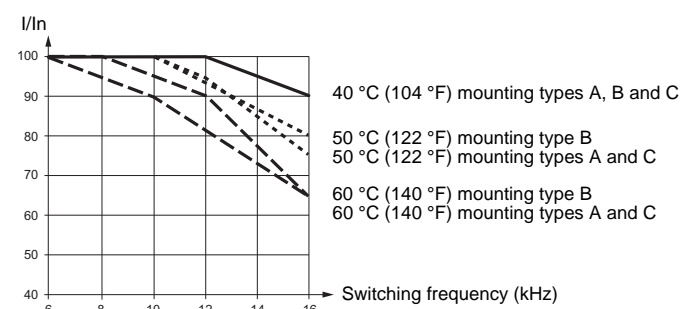
ATV21HU55N4



ATV21HU75N4

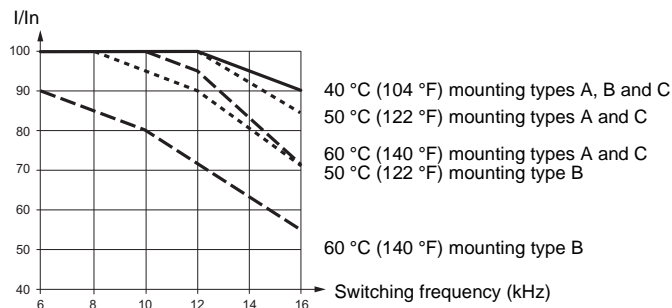


ATV21HD11N4

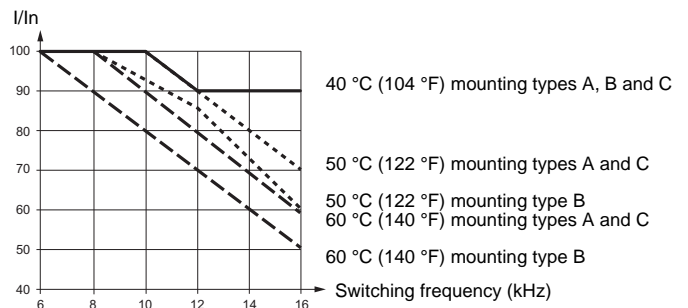


Mounting and temperature conditions

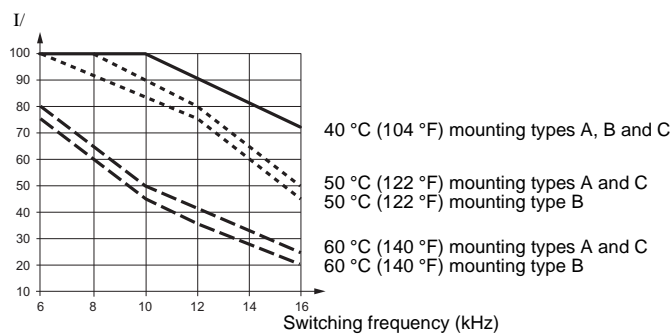
ATV21HD15N4



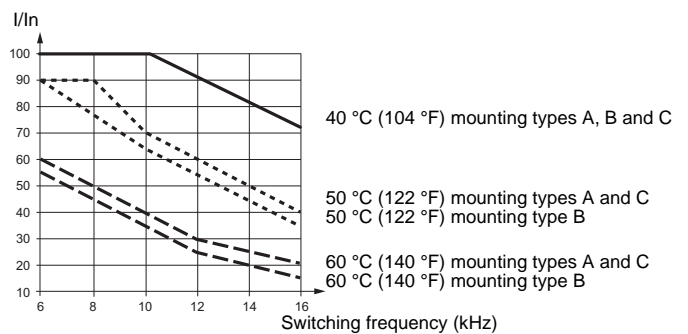
ATV21HD18N4



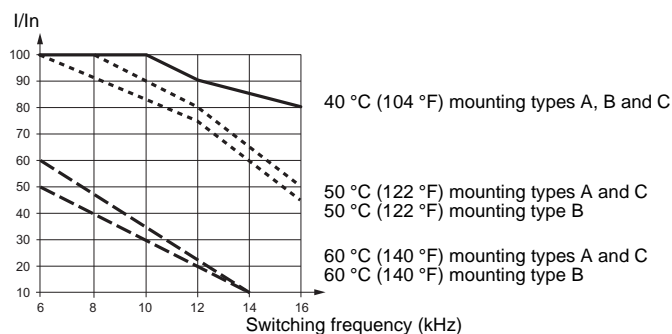
ATV21HD22N4



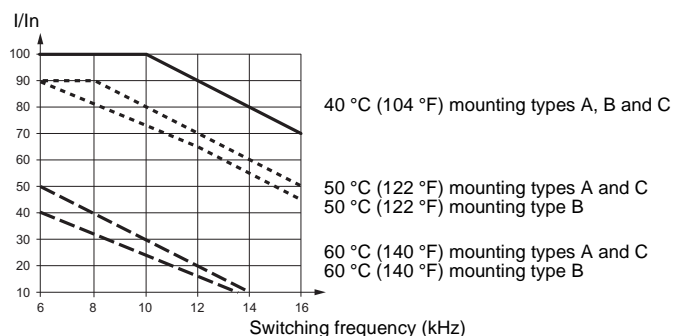
ATV21HD30N4



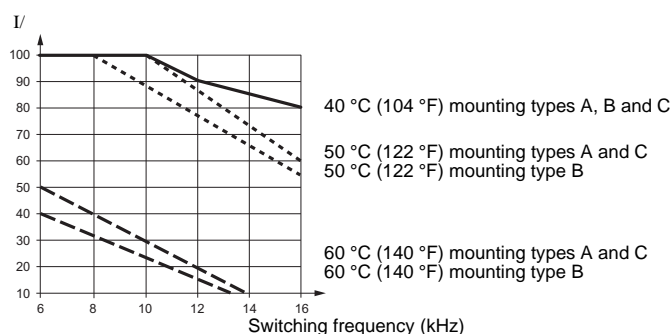
ATV21HD37N4



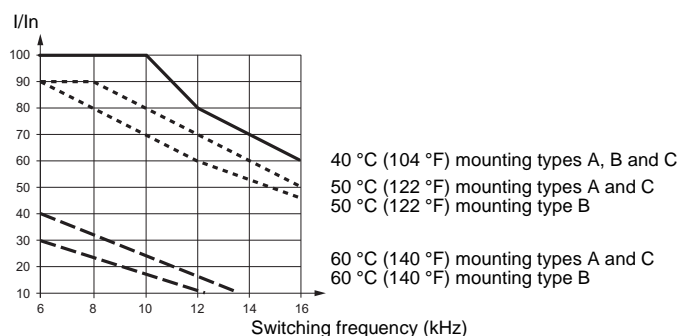
ATV21HD45N4



ATV21HD55N4



ATV21HD75N4



Mounting and temperature conditions

Minimum air flow rates

If you are installing the drive in a Type 1 enclosure, provide forced ventilation at a rate at least equal to the value listed below each drive.

Minimum ventilation rates

For drive	Flow rate	
	m ³ /hour	ft ³ /min
ATV21H075M3X	22	13
ATV21HU15M3X	35	21
ATV21HU22M3X	41	25
ATV21HU30M3X	50	30
ATV21HU40M3X	66	39
ATV21HU55M3X	85	50
ATV21HU75M3X	118	70
ATV21HD11M3X	157	93
ATV21HD15M3X	215	127
ATV21HD18M3X	239	141
ATV21HD22M3X	261	154
ATV21HD30M3X	371	219
ATV21H075N4	19	12
ATV21HU15N4	27	16
ATV21HU22N4	35	21
ATV21HU30N4	47	28
ATV21HU40N4	60	36
ATV21HU55N4	74	44
ATV21HU75N4	100	59
ATV21HD11N4	147	87
ATV21HD15N4	206	122
ATV21HD18N4	214	126
ATV21HD22N4	214	126
ATV21HD30N4	290	171
ATV21HD37N4	334	197
ATV21HD45N4	429	252
ATV21HD55N4	498	293
ATV21HD75N4	666	392

Mounting and temperature conditions

Ventilation

When mounting the drive inside a Type 12 or IP54 enclosure, follow these ventilation precautions:

- Observe the minimum clearance distances shown on page [11](#).
- If necessary, install a stirring fan to circulate the air inside the enclosure, to prevent hot spots in the drive, and to distribute the heat uniformly to surfaces used for convection cooling.

CAUTION

CONDENSATION

Where condensation is possible, keep the drive powered up when the motor is not running, or install thermostatically controlled strip heaters.

Failure to follow this instruction can result in injury or equipment damage.

Position of the charging LED

Before working on the drive, remove all power and wait 15 minutes to allow the DC bus to discharge. Then measure the DC bus voltage between the PA/+ and PC/- terminals.

! DANGER

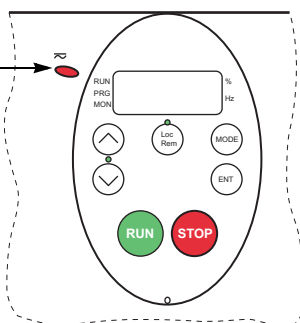
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Read and understand the precautions in "Before You Begin" starting on page 4 before performing this procedure.

Failure to follow this instruction will result in death or serious injury.

Capacitor charging LED

The capacitor charging LED on the drive is not an indicator of the absence of DC bus voltage. It only indicates when the capacitor is at full charge.



The DC bus voltage can exceed 1,000 Vdc. Use a properly rated voltage-sensing device when performing this procedure. To measure the DC bus voltage:

- 1 Disconnect all power.
- 2 Wait 15 minutes to allow the DC bus to discharge.
- 3 Measure the voltage of the DC bus between the PA/+ and PC/- terminals to ensure that the voltage is less than 45 Vdc.
- 4 If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.

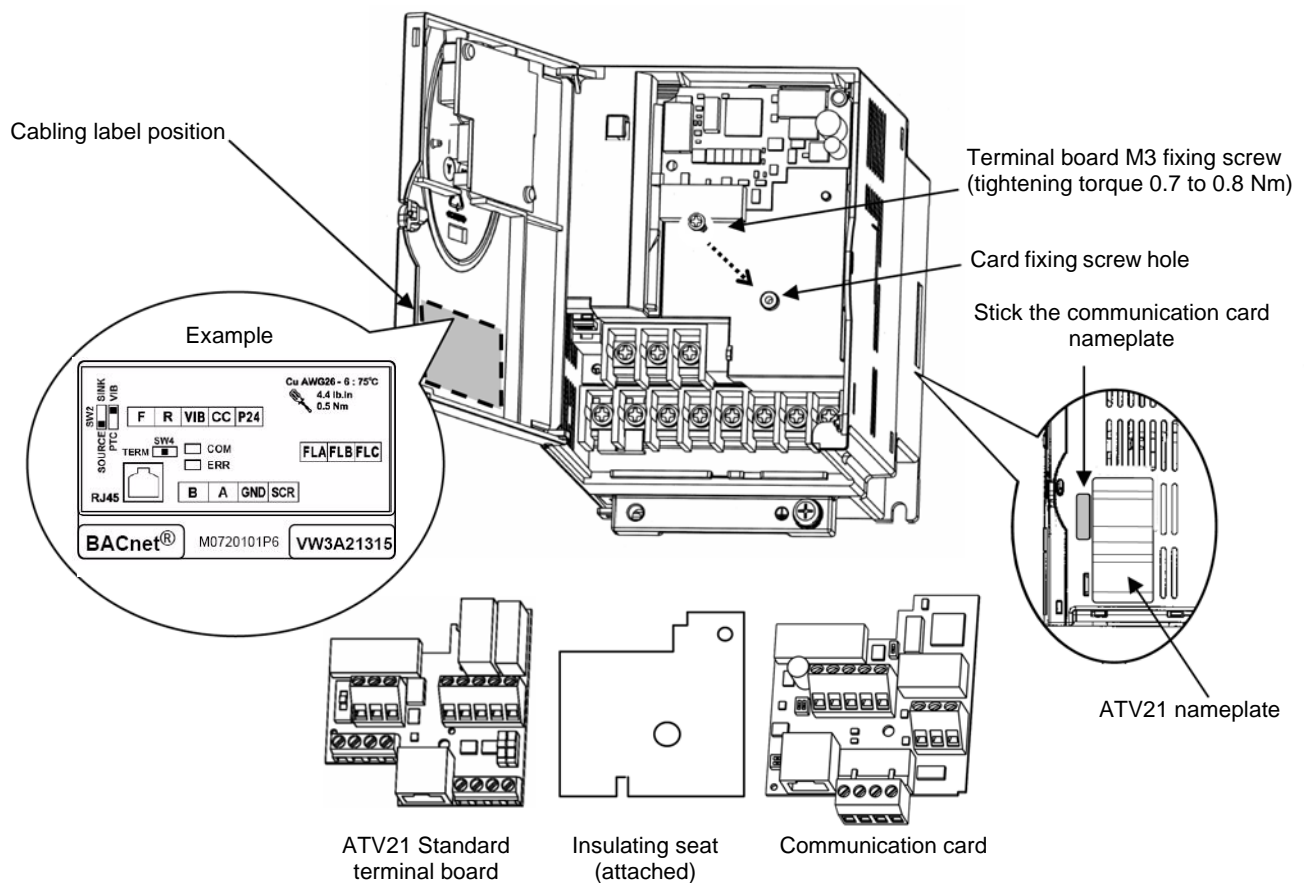
Installing option card

These should ideally be installed once the drive is mounted and before wiring it.

Install the communication card in ATV21 as follows.

- 1 Turn off the input power of ATV21 and wait for at least 15 minutes and then check that the CHARGE lamp on ATV21 is no longer lit.
- 2 Open the ATV21 front cover, remove the terminal board fixing screw and take off the ATV21 standard terminal board. See paragraph How to open the front cover, page 21. Be careful not to lose the terminal board fixing screw when removed since it may be used again.
- 3 Make the power and control the wiring connections to the drive before installing communication card.
- 4 Please attach the insulating sheet in ATV21. (Fix to the terminal board fixing screw hole and ATV21 catch pin.)
- 5 Install the communication card over the insulating sheet and secure it with the board fixing screw (M3 tapping screw tightening torque: 0.7 to 0.8Nm).
- 6 Stick the cabling label for communication card on the standard cabling label stuck on the reverse side of the ATV21 front cover. And stick the communication card nameplate near the standard nameplate. Be careful not to cover slits on the ATV21 enclosure.

Note: To install or remove the terminal board, make it slide in or out in parallel with board.



Wiring recommendations

Good wiring practice requires the separation of control circuit wiring from all power (line) wiring. In addition, power wiring to the motor must have the maximum possible separation from all other power wiring, whether from the same drive or other drives.

Do not run power and control wiring, or multiple power wiring, in the same conduit. This separation reduces the possibility of coupling electrical transients from power circuits into control circuits or from motor power wiring into other power circuits.

WARNING

IMPROPER WIRING PRACTICES

- Follow the wiring practices described in this document in addition to those already required by the National Electrical Code and local electrical codes.
- Do not apply input line voltage to the output terminals (U/T1, V/T2, W/T3).
- Check the power connections before energizing the drive.
- If replacing another drive, verify that all wiring connections to the ATV21 drive comply with all wiring instructions in this manual.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Follow the practices below when wiring ATV21 drives:

- Verify that the voltage and frequency of the input supply line and the voltage, frequency, and current of the motor match the rating on the drive nameplate.
- Use metallic conduit for all drive wiring. Do not run control and power wiring in the same conduit.
- Separate the metallic conduits carrying power wiring from those carrying control wiring by at least 76 mm (3 in.).
- Separate the non-metallic conduits or cable trays carrying power wiring from the metallic conduit carrying control wiring by at least 305 mm (12 in.).
- Whenever power and control wiring cross, the metallic conduits and non-metallic conduits or trays must cross at right angles.
- Equip all inductive circuits near the drive (such as relays, contactors, and solenoid valves) with noise suppressors.

Branch circuit protection

Refer to NEC Article 430 for sizing of branch circuit conductors. Ensure that all branch circuit components and equipment (such as transformers, feeder cables, disconnect devices, and protective devices) are rated for the input current of the ATV21 drive, or for the rated output current, whichever value is larger. The input current of the drives depends on the impedance of the power distribution system and the available short-circuit current at the drive input terminals.

Tables on page 8 provide input current information to optimally size branch circuit conductors. Do not exceed the short-circuit current rating shown in the tables. The short-circuit current rating is the available short-circuit current capability on the line side of the fuses or circuit breakers. A line reactor can be used to add impedance and reduce the available short-circuit current capability to the level allowed by the drive.

Note: Ensure that the branch circuit feeder protection rating is not less than the rated output current of the drive.

When more than two drives are installed in parallel on a common power line voltage, regardless of voltage rating, an individual line reactor per drive is recommended. This provides filtering between drives and reduces harmonic distortion when the system is partially loaded.

If starting the drive from line power, limit operations of the line contactor to less than once per minute to avoid premature failure of the filter capacitors and precharge resistor. Use the logic inputs to command the drive.

WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The National Electrical Code and the Canadian Electricity Code require branch circuit protection. Use the fuses recommended in the catalogue to achieve published short-circuit current ratings.
- Do not connect the drive to a power feeder whose short-circuit capacity exceeds the drive short-circuit current rating listed on the drive nameplate or in Tables on page 8.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring

Output wiring

The drive is sensitive to the amount of capacitance (either phase-to-phase or phase-to-ground) present on the output power conductors. Excessive capacitance can cause an overcurrent trip. Follow these guidelines when selecting output cable:

- Cable type: The cable selected must have a low capacitance phase-to-phase and phase-to-ground. Do not use mineral-impregnated cable because it has a very high capacitance. Immersion of cables in water increases capacitance.
- Cable length: The longer the cable, the greater the capacitance. Cable lengths greater than 30.5 m (100 ft.) can affect the drive and motor performance.
- When the output cable is in close proximity to other output cables, the drive may fault under some conditions because of high frequency switching and increased capacitance.
- **Do not use lightning arrestors and/or power factor correction capacitors on the output of the drive.**

For proper drive short circuit protection, certain values of inductance may be required in the output power wiring. Inductance can be supplied by the power wiring or auxiliary inductors.

⚠ CAUTION

INSUFFICIENT OUTPUT INDUCTANCE

Provide at least 500 mm (20 in.) of cable at the drive output (U/T1, V/T2, W/T3) to ensure a minimum inductance to protect the drive output from short circuits.

Failure to follow this instruction can result in injury or equipment damage.

Grounding

Ground the drive according to the National Electrical Code and all local codes to ensure safe, dependable operation.

- Connect a copper wire from the equipment ground lug or terminal to the power system ground conductor. Size the wire according to the drive rating and national and local codes.
- Verify that resistance to ground is 1 W or less. Improper grounding causes intermittent and unreliable operation.

⚠ DANGER

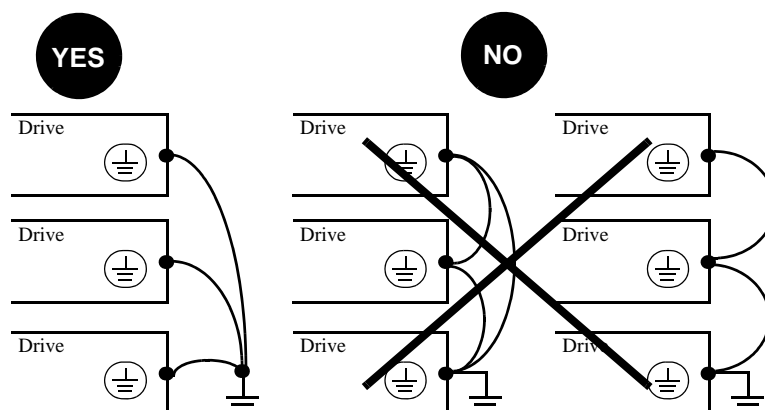
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ground the equipment using the provided ground connecting point. The drive panel must be properly grounded before power is applied.

Failure to follow this instruction will result in death or serious injury.

Ground multiple drives below. Do not loop the ground cables or connect them in series.

Grounding multiple drive

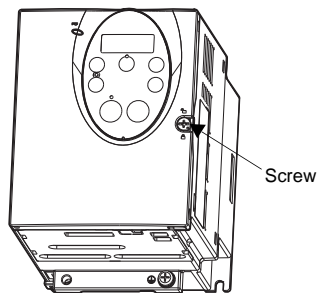


How to open the front cover up to 18.5 kW

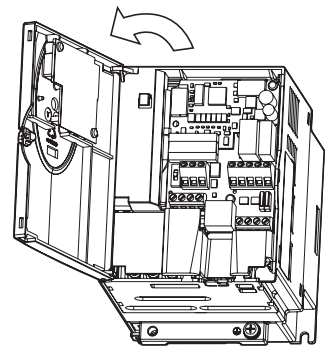
To access the terminals of ATV21 drives:

1. Turn the screw on the front panel 90° counter-clockwise to align the dot on the screw with the unlock position.

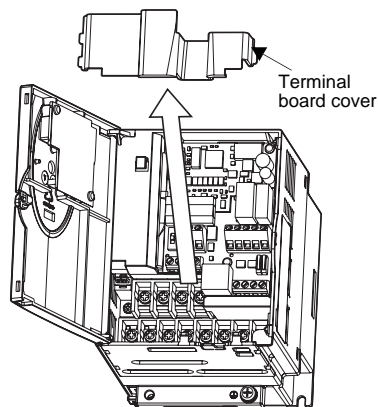
To avoid damaging the screw, do not apply excessive force or turn the screw more than 90°.



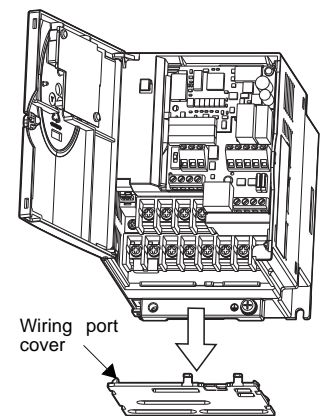
2. Pull the front panel toward you and swing it open to the left.



3. Remove the terminal board cover by pulling it up toward you.

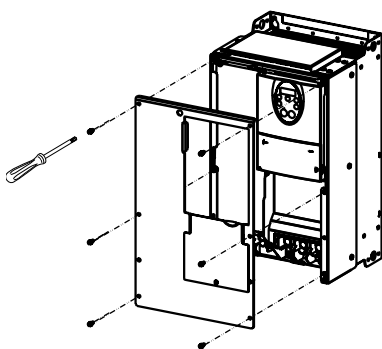


4. Remove the wiring port cover by pulling it down. Pass the cables through the wiring port, and connect them to the terminal board.



How to open the front cover from 22 kW

To access the terminals:



- 1 Remove the screws.
- 2 Lift off the cover.

Terminals

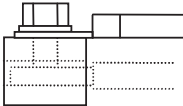
Power terminals

Arrangement of the power terminals

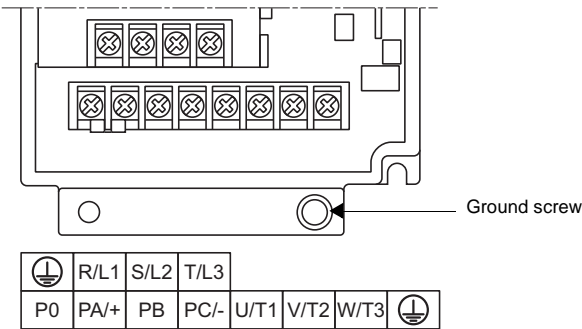
Connect the power terminals before connecting the control terminals.

A

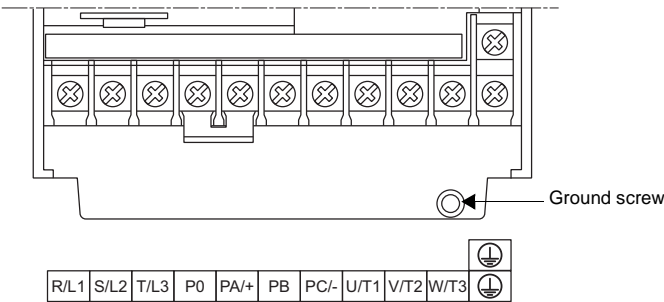
B



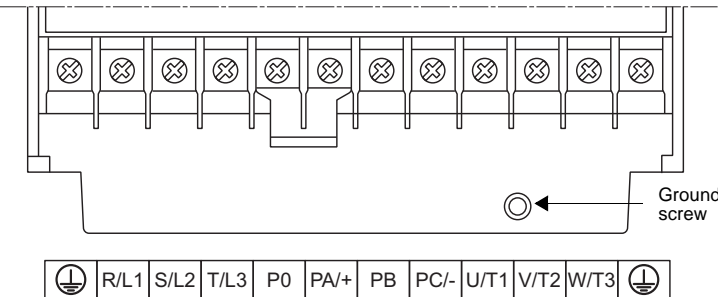
Each power terminal has the structure shown in the figure at left. Connect a cable to **A** if it has a ring terminal or to **B** if it does not have a terminal (bare wire).
Parts A and B can accommodate different cable sizes.



ATV21H	Maximum wire size		Tightening torque
	mm ²	AWG	Nm (lb.in)
075M3X, U15M3X, U22M3X, U30M3X, U40M3X 075N4, U15N4, U22N4, U30N4, U40N4	6	10	1.3 (11.5)

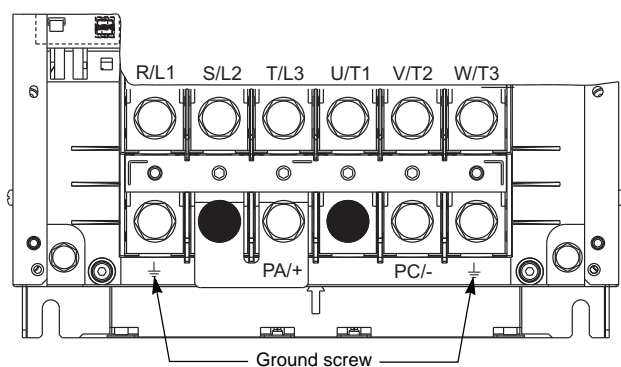


ATV21H	Maximum wire size		Tightening torque
	mm ²	AWG	Nm (lb.in)
U55N4	6	10	1.3 (11.5)
U55M3X, U75M3X U75N4 D11N4	16	6	2.5 (22.0)

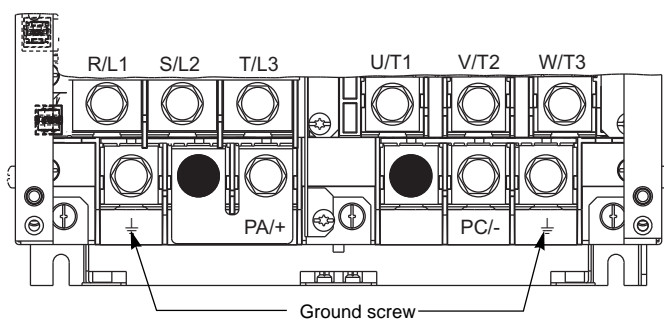


ATV21H	Maximum wire size		Tightening torque
	mm ²	AWG	Nm (lb.in)
D11M3X, D15M3X, D18M3X D15N4, D18N4	25	3	4.5 (40.0)

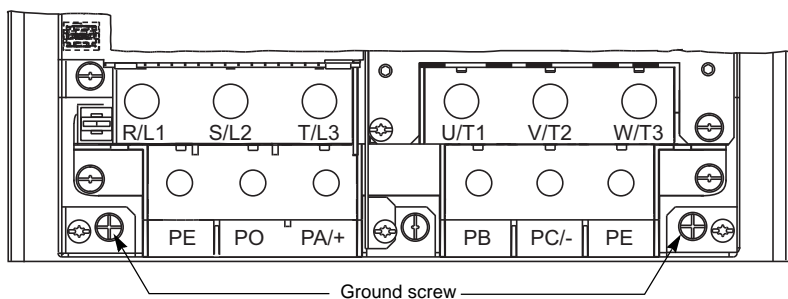
Terminals



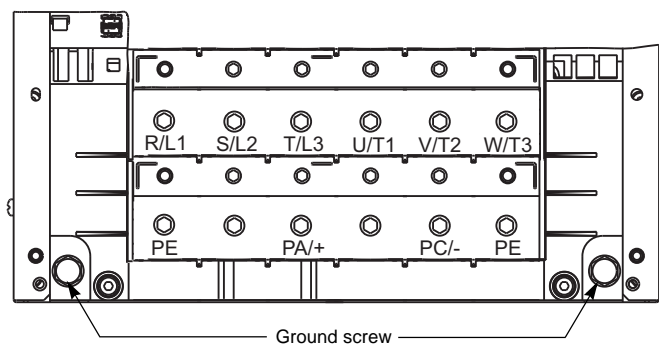
ATV21H	Maximum wire size		Tightening torque
	mm ²	AWG	Nm (lb.in)
D22M3X D22N4, D30N4	50	1/0	24 (212.0)



ATV21H	Maximum wire size		Tightening torque
	mm ²	kcmils	Nm (lb.in)
D30M3X	150	300	41 (363.0)



ATV21H	Maximum wire size		Tightening torque
	mm ²	AWG	Nm (lb.in)
D37N4, D45N4	50	1/0	24 (212.0)



ATV21H	Maximum wire size		Tightening torque
	mm ²	kcmils	Nm (lb.in)
D55N4, D75N4	150	300	41 (363.0)

Terminals

Power terminal functions

Terminals	Function
\perp	Ground terminal (1)
R/L1 S/L2 T/L3	Power supply
U/T1 V/T2 W/T3	Outputs to the motor
PO (2)	DC bus (+) polarity (do not use)
PA/+ (2) (3)	DC bus (+) polarity
PB	DC bus connection (do not use)
PC/– (3)	DC bus (–) polarity

(1) ATV21 drives have two ground terminals, one on the power terminal strip and one on the heatsink.

(2) Never remove the jumper between PO and PA/+.

(3) The PA/+ and PC/– terminals can only be used to measure the DC bus voltage.

Terminals

Control terminals

Connect the control terminals after connecting the power terminals.

!

DANGER

UNINTENDED EQUIPMENT OPERATION

- Prevent accidental grounding of logic inputs configured for sink logic. Accidental grounding can result in unintended activation of drive functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

Failure to follow these instructions will result in death or serious injury.

!

WARNING

RISK OF IMPROPER OPERATION

Do not change the setting of switch SW4 unless your system is wired for sink logic.
this instruction can result in death or serious injury.

Failure to follow this instruction can result in death or serious injury.

Refer to “Logic Input Switch” on page 28 for recommended circuit diagrams for source and sink logic.

Arrangement of the control terminals

SOURCE

PLC

SINK

SW4

PLC

P24

CC

F

R

RES

FM

FLA

FLB

FLC

RY

RC

FM

VIA

SW2

SW3

PP

VIA

VIB

CC

Connector (RJ45)

Switch:

SW4
(Selection of logic type)

SW2
(FM voltage/ current selection)

SW3
(VIA voltage/current selection)

Factory Setting:

SOURCE side (positive)

V (Voltage)

V (Voltage)

Control Terminal Wire Size and Torque:

Maximum wire size: 2.5 mm² (AWG 14)

Tightening torque: 0.6 Nm (5.3 lb.in)

Terminals

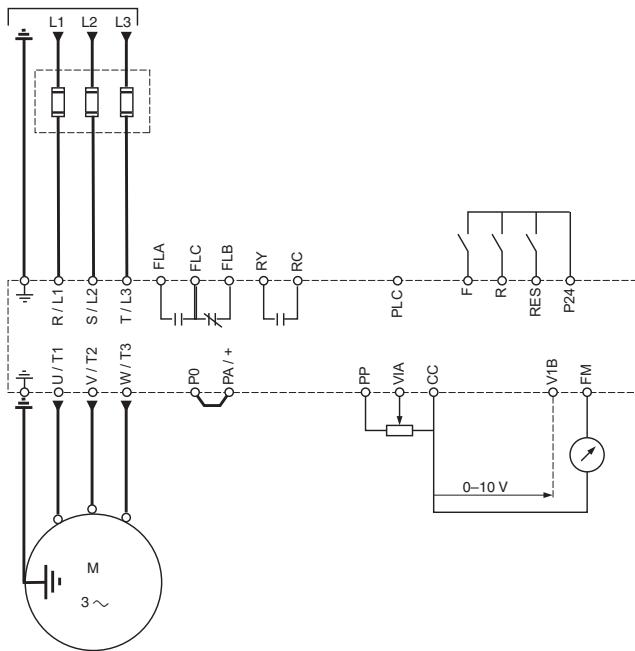
Control terminal characteristics

Terminals	Function	Characteristics	Default function setting
PLC	External power supply input	+24 Vdc input for external power supply for logic inputs Max. permissible voltage: 50 Vdc	—
P24	Internal supply	Short-circuit and overload protection: 24 Vdc supply (min. 21 Vdc, max. 27 Vdc), maximum current: 200 mA	
CC	Common	0 Vdc common (2 terminals)	
FLA, FLB, FLC	Configurable relay outputs	1 relay logic output, 1 N/C contact, and 1 N/O contact with common point Minimum switching capacity: 3 mA for 24 Vdc Maximum switching capacity: <ul style="list-style-type: none"> On resistive load ($\cos \varphi = 1$): 5 A for 250 Vac or 30 Vdc On inductive load ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 Vac or 30 Vdc Max. response time: 7 ms \pm 0.5 ms	Fault relay
RY, RC		1 relay logic output, 1 N/O contact Minimum switching capacity: 3 mA for 24 Vdc Maximum switching capacity: <ul style="list-style-type: none"> On resistive load ($\cos \varphi = 1$): 3 A for 250 Vac or 30 Vdc On inductive load ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 Vac or 30 Vdc Max. response time: 7 ms \pm 0.5 ms	Speed attained
F R RES	Configurable logic inputs	3 programmable logic inputs, 24 Vdc, compatible with level 1 PLC, IEC 65A-68 standard Impedance: 3.5 k Ω Maximum voltage: 30 Vdc Max. sampling time: 2 ms \pm 0.5 ms Multiple assignment makes it possible to configure several functions on one input	F: Run forward (2-wire control) R: Preset speed 1 command (15 Hz) RES: Fault reset
		Positive logic (Source): State 0 if y 5 Vdc or logic input not wired, state 1 if u 11 Vdc	
		Negative logic (Sink): State 0 if u 16 Vdc or logic input not wired, state 1 if y 10 Vdc	
FM	Configurable analog output	1 switch-configurable voltage or current analog output: <ul style="list-style-type: none"> Voltage analog output 0–10 Vdc, minimum load impedance 470 Ω Current analog output X–Y mA by programming X and Y from 0 to 20 mA, maximum load impedance: 500 Ω Max. sampling time: 2 ms \pm 0.5 ms Resolution: 10 bits Accuracy: ± 1 % for a temperature variation of 60 °C Linearity: ± 0.2 %	Output frequency
PP	Internal supply available	Short-circuit and overload protection: One 10.5 Vdc \pm 5% supply for the reference potentiometer (1 to 10 k Ω), maximum current: 10 mA	—
VIA	Configurable analog/logic input	Switch-configurable voltage or current analog input: <ul style="list-style-type: none"> Voltage analog input 0–10 Vdc, impedance 30 kΩ (max. safe voltage: 24 Vdc) Analog current input X–Y mA by programming X and Y from 0 to 20 mA, with impedance 242 Ω Max. sampling time: 2 ms \pm 0.5 ms Resolution: 11 bits Accuracy: ± 0.6 % for a temperature variation of 60 °C Linearity: ± 0.15 % of the maximum value This analog input is also configurable as a logic input. Consult the Altivar 21 Programming Manual for more information.	Primary speed reference, 0–10 V
VIB	Configurable analog input	Voltage analog input, configurable as an analog input or as a PTC probe input. Voltage analog input: <ul style="list-style-type: none"> 0–10 Vdc, impedance 30 kΩ (max. safe voltage 24 Vdc) Max. sampling time: 2 ms \pm 0.5 ms Resolution: 11 bits Accuracy: ± 0.6% for a temperature variation of 60 °C Linearity: ± 0.15% of the maximum value PTC probe input: <ul style="list-style-type: none"> 6 probes max. mounted in series Nominal value < 1.5 kΩ Trip resistance 3 kW, reset value 1.8 kΩ Short-circuit protection < 50 Ω 	Secondary speed reference, 1–10 V

Terminals

Connection diagram

Three-phase connection diagram for the drive at the factory settings.



Note: Connect the power terminals before connecting the control terminals. Install surge suppressors on all inductive circuits located near the drive or coupled to the same circuit.

Refer to the drive nameplate or to the catalogue for recommended fuses. Fast acting or time delay Class J fuses can be used.

Logic input switch

The logic input switch SW4 assigns the logic input type to either 24 V (source logic) or 0 V (sink logic).

Note: When the logic input is configured for sink logic, grounding the input signals can result in unintended activation of drive functions.

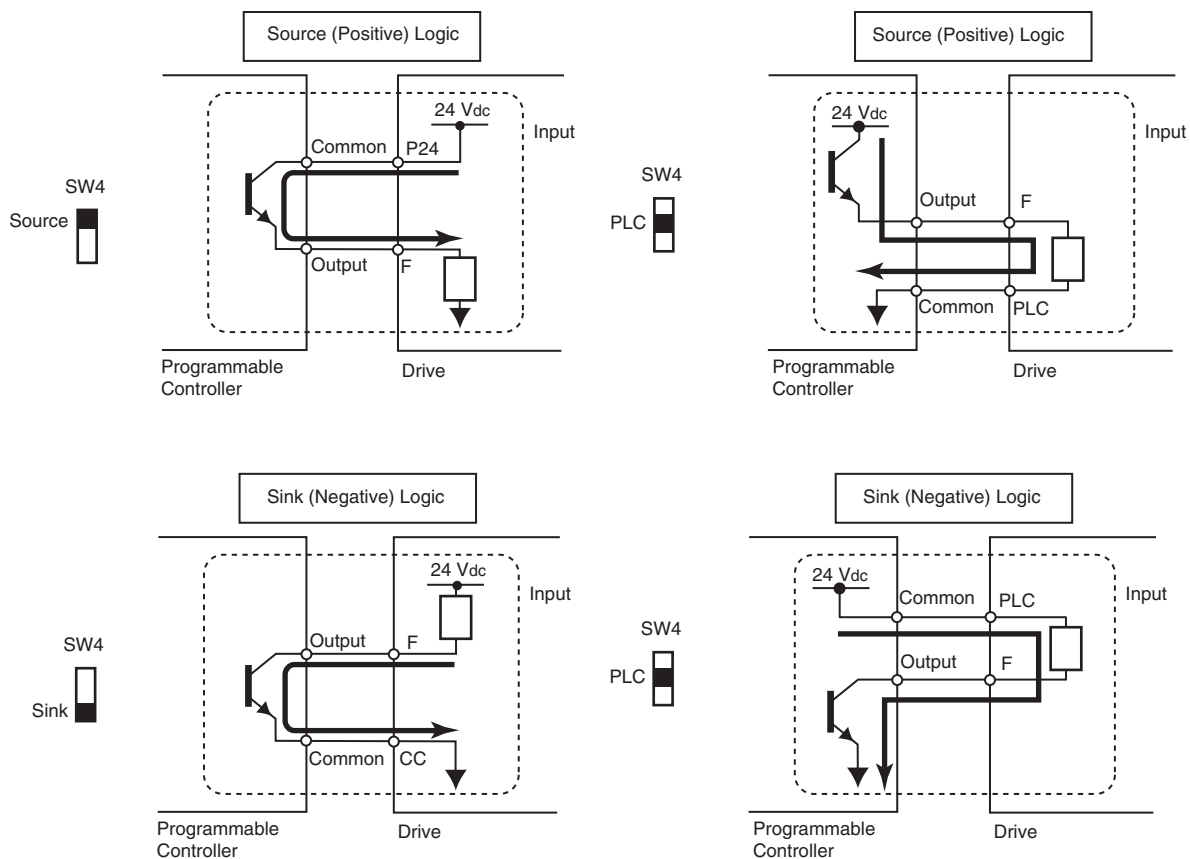
! DANGER

UNINTENDED EQUIPMENT OPERATION

- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Recommended circuit diagrams for source and sink logic

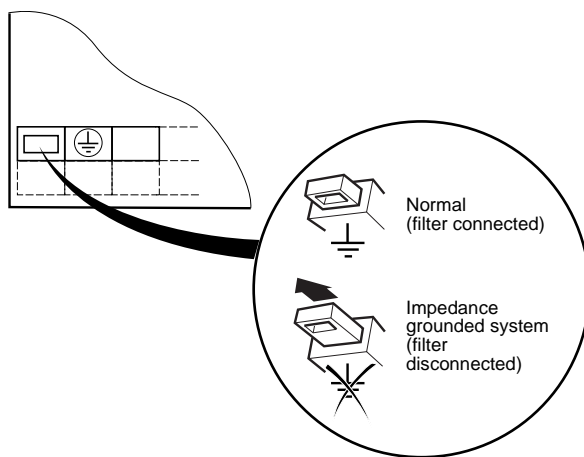


Use on an impedance grounded system

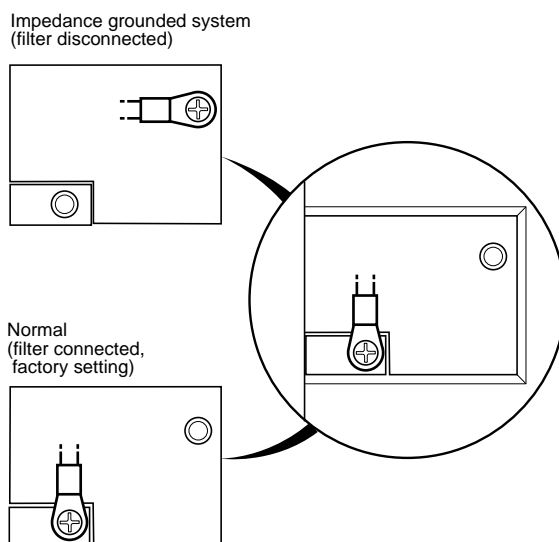
When using the ATV21 drive on a system with an isolated or impedance grounded neutral, use a permanent insulation monitor compatible with non-linear loads.

ATV21 480 V rated drives feature built-in radio frequency interference (RFI) filters with grounded capacitors. When using the drive on an impedance grounded system, we recommend that you isolate the RFI filters from ground to prevent reduction of their operating life.

- ATV21H 075N4 to U55N4, ATV21H D22N4 to D30N4: Pull out the jumper to the left of the ground terminal as illustrated below to isolate the RFI filters.



- ATV21H U75N4 to D18N4: Connect the cable to the top left of the power terminals as illustrated below to isolate the filters.



Motor thermal protection

Thermal protection is integrated into the drive by continuous calculation of I_2t , taking motor speed into account. The motor power rating must be between 10% and 100% of the drive rating.

CAUTION

LOSS OF MOTOR OVERLOAD PROTECTION

- Setting the parameter OLn to 2, 3, 6, or 7 (not factory setting) disables the internal motor overload protection function. In this case, external motor overload protection must be provided. For more information, refer to the Altivar® 21 Programming Manual.
- When using external overload relays connected to the drive output, the overload relay must be capable of operation across the expected range of drive output frequencies (including direct current).
- When using DC injection braking, the overload relay must be suitable for operation with direct current flowing in the motor. Do not use overload relays equipped with current transformers for sensing the motor current.

Failure to follow these instructions can result in injury or equipment damage.

If parameter F632 is set to zero (factory setting), the motor thermal state memory is reset to zero when the drive is powered down. For more information, refer to the Altivar® 21 Programming Manual.

This drive does not provide direct thermal protection for the motor. Consult the motor manufacturer for the thermal capability of the motor when operated over the desired speed range.

CAUTION

MOTOR OVERHEATING

- If parameter F632 is set to zero (factory setting), the motor thermal state memory is reset to zero when the drive is powered down. For more information, refer to the Altivar® 21 Programming Manual.
- Use a thermal sensor in the motor as required by the motor manufacturer for protection at all speeds and load conditions.

Failure to follow these instruction can result in injury or equipment damage.

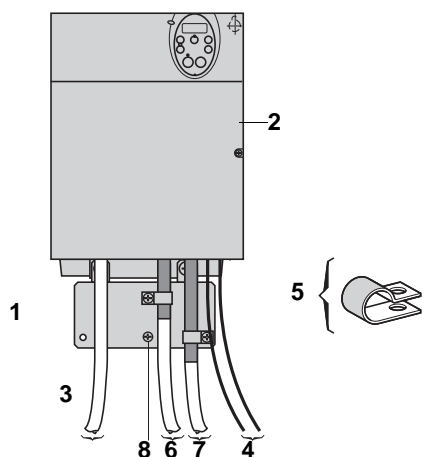
Electromagnetic compatibility

The ATV21 drive is considered to be a component. It is neither a machine nor a piece of equipment ready for use in accordance with the European Community directives (machinery directive or electromagnetic compatibility directive). It is the user's responsibility to ensure that the machine meets those standards.

Installation recommendations for meeting EN 55011 class A

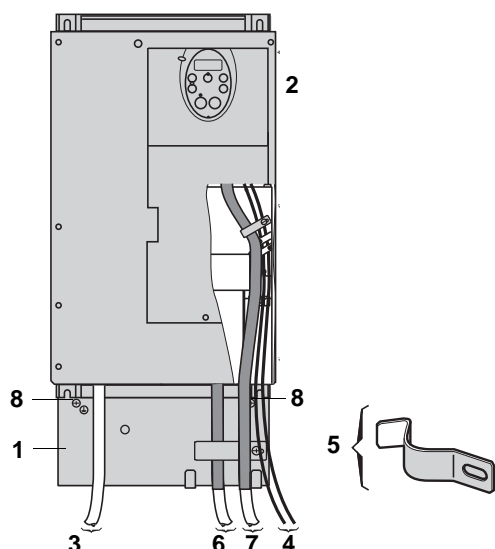
- Ensure that the grounds of the drive, the motor, and the cable shields are at equal potential.
- Use shielded cables with the shields connected to ground at both ends of the motor cable and control cables. Conduit can be used for part of the shielding length, provided that there is no break in continuity.
- Ensure maximum separation between the power supply cable (line supply) and the motor cable.

ATV21H 075M3X to D18M3X ATV21H 075N4 to D18N4



- 1 EMC plate supplied with the ATV21 drive.
- 2 ATV21 drive.
- 3 Non-shielded power supply wires or cables.
- 4 Non-shielded wires for the output of the safety relay contacts.
- 5 The shields for cables 6 and 7 must be securely attached to the EMC plate with stainless steel clamps (item 5). Strip cables 6 and 7 to expose the shields. Apply appropriately-sized clamps around the stripped portion of the cables and fasten them to the EMC plate.
- 6 Shielded cable for connection to the motor, with shield connected to ground at both ends. This shield must not be interrupted. If intermediate terminal blocks are used, they must be in EMC-shielded metal boxes.
- 7 Shielded cable for connection to control/command devices. For applications which require a large number of conductors, small cross-sections must be used (0.5 mm^2 , 20 AWG). This shield must not be interrupted. If intermediate terminal blocks are used, they must be in EMC-shielded metal boxes.
- 8 Ground screw. Use this screw for the motor cables on the low power rated drives, as the ground screw on the heatsink is inaccessible.

AV21H D22M3X to D30M3X ATV21H D22N4 to D75N4



If using an additional input filter, connect it directly to the line supply with an unshielded cable. Then make connection 3 on the drive using the filter output cable. Although there is a high frequency equipotential ground connection between the drive, motor, and cable shielding, you must still connect the PE protective conductors (green-yellow) to the appropriate terminals on each of the devices. You may also need to disconnect the shield at the motor end for very long cable runs to alleviate noise generation.



AAV85581

atv21_installation_manual_en_v2

09/2009