

Altivar® 31

Adjustable Speed Drive Controllers

Variadores de velocidad ajustable

Variateurs de vitesse



Installation Manual
Guía de instalación
Guide d'installation

Retain for future use.
Conservar para uso futuro.
À conserver pour usage ultérieur.



**Altivar® 31 Adjustable Speed Drive Controllers
Installation Manual**

ENGLISH

**Variadores de velocidad Ajustable Altivar® 31
Guía de instalación**

ESPAÑOL

**Variateurs de vitesse Altivar® 31
Guide d'installation**

FRANÇAIS

ENGLISH

ESPAÑOL

FRANÇAIS

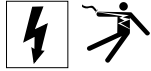
TABLE OF CONTENTS

Before You Begin 7
Introduction 8
Catalog Numbers 8
Receiving and Preliminary Inspection 8
Storing and Shipping 8
Precautions 9
Technical Specifications 10
Ratings 12
Dimensions and Weights 15
Mounting 16
 Clearances 16
 Removing the Protective Cover 16
 Mounting Methods 17
 Derating Curves 17
 Minimum Air Flow Rates 18
 Electromagnetic Compatibility 19
Mounting in a Type 12 or IP54 Metal Enclosure 20
 Calculating Enclosure Size 20
 Ventilation 21
Bus Voltage Measurement Procedure 22
General Wiring Practices 22
 Branch Circuit Connections 23
 Output Wiring 24
Grounding 25
Wiring 26
 Access to Terminals 26
 Power Terminals 26
 Arrangement of the Power Terminals 28
 Control Terminals 29
 Wiring Diagram for Factory Settings 31
 Logic Input Switch 32
 Recommended Circuit Diagrams:
 Positive (Source) Logic 33
 Recommended Circuit Diagrams: Negative (Sink) Logic 34
 Operation on an Impedance Grounded System 35
Recommended Fuses 36
Available Torque 37
Drive Controller Ventilation 38
Motor Thermal Protection 38
Electromagnetic Compatibility 39
 Installation Recommendations for Meeting EN 55011 Class A 39
Index 41

ENGLISH

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

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

WARNING

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

CAUTION

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

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

DRIVES PRODUCT SUPPORT

The Product Support Group is staffed from 8:00 am until 6:00 pm Eastern time to assist with product selection, start-up, and diagnosis of product or application problems. Emergency phone support is available 24 hours a day, 365 days a year.

| | |
|-----------|--|
| Toll free | 888-Square D (888-778-2733) |
| Telephone | 919-266-8600 |
| E-mail | drive.products.support@us.schneider-electric.com |
| Fax | 919-217-6508 |

BEFORE YOU BEGIN

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

⚠ DANGER

HAZARDOUS VOLTAGE

- Read and understand this manual before installing or operating the Altivar 31 drive controller. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- For more information on Altivar 31 drive controllers, see the *Altivar 31 Start-Up Guide*, VVDED303043US, and the *Altivar 31 Programming Manual*, VVDED303042US. Both manuals are shipped on a CD with the drive controller. They are also available from www.us.SquareD.com or from your Schneider Electric representative.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive controller, including printed wiring boards, operate at 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.
- Install and close all covers before applying power or starting and stopping the drive controller.
- Before servicing the drive controller:
 - Disconnect all power.
 - Place a “DO NOT TURN ON” label on the drive controller disconnect.
 - Lock the disconnect in the open position.
- Disconnect all power including external control power that may be present before servicing the drive controller. **WAIT 3 MINUTES** for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 22 to verify that the DC voltage is less than 45 Vdc. The drive controller LEDs are not accurate indicators of the absence of DC bus voltage.

Electric shock will result in death or serious injury.

INTRODUCTION

The Altivar 31 (ATV31) family of adjustable frequency AC drive controllers is used for controlling three-phase asynchronous motors. The controllers range from:

- 0.25 to 3 hp (0.18 to 2.2 kW), 208/230/240 V, single-phase input
- 0.25 to 20 hp (0.18 to 15 kW), 208/230/240 V, three-phase input
- 0.5 to 20 hp (0.37 to 15 kW), 400/460/480 V, three-phase input
- 1 to 20 hp (0.75 to 15 kW), 525/575/600 V, three-phase input

This manual contains installation instructions for ATV31 drive controllers. The following documentation is also provided with the controller:

- *Altivar 31 Start-Up Guide*, VVDED303043US
- *Altivar 31 Programming Manual*, VVDED303042US (on CD only)

CATALOG NUMBERS

Refer to Table 1 for a guide to interpreting ATV31 drive controller catalog numbers. ATV31HU15M2A is used as an example catalog number.

Table 1: ATV31 Catalog Numbers

| Drive Controller Family: | Type: | Rating: | Voltage Range: | Variation: |
|--------------------------|--|---|--|-----------------------------|
| ATV31 | H | U15 | M2 | A |
| | H: Heatsink product C: Enclosed product K: Kit product | O: 0 to 0.99 kW U: 1 to 9.99 kW D: 10 to 99.99 kW | M2: 200 V / 240 V, 1 phase M3X: 200 V / 240 V, 3 phase without filter N4: 380 V / 500 V, 3 phase S6X: 525 V / 600 V, 3 phase without filter | A: with local control panel |

RECEIVING AND PRELIMINARY INSPECTION

Before installing the ATV31 drive controller, read this manual and follow all precautions.

- Before removing the drive controller 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.
- After removing the drive controller from its packaging, visually inspect the exterior for shipping damage. If any is found, notify the carrier and your sales representative. Do not install a damaged device.
- Verify that the drive controller nameplate and label conform to the packing slip and corresponding purchase order.

⚠ CAUTION

DAMAGED EQUIPMENT

Do not operate or install any drive controller that appears damaged.

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

STORING AND SHIPPING

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

PRECAUTIONS

Before powering up and configuring the drive controller, read and observe the following precautions.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Before powering up and configuring the drive controller, ensure that the logic inputs are switched off (state 0) to prevent unintended starting.
- An input assigned to the run command may cause the motor to start immediately on exiting the configuration menus.

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

CAUTION

INCOMPATIBLE LINE VOLTAGE

- Before powering up and configuring the drive controller, ensure that the line voltage is compatible with the supply voltage range shown on the drive controller nameplate.
- The drive controller may be damaged if the line voltage is not compatible.

Failure to follow this instruction can result in equipment damage.

TECHNICAL SPECIFICATIONS

Table 2: Environment

| | |
|-----------------------------|---|
| Degree of Protection | <ul style="list-style-type: none"> • IP20 without protective vent cover, NEMA 1, UL open type. • IP21 on wiring terminals • IP31 and IP41 all other areas • UL Type 1 without removal of the protective vent cover from the top of the controller and with the addition of the Conduit Entry Kit (see page 16). |
| Resistance to vibrations | Conforming to IEC/EN 60068-2-6: 1.5 mm peak to peak from 3 to 13 Hz, 1 gn from 13 to 150 Hz |
| Resistance to shocks | 15 gn for 11 ms conforming to IEC/EN 60068-2-27 |
| Pollution degree | Pollution degree 2 according to UL 840. Protect the drive controller against dust, corrosive gas, and falling liquid. |
| Maximum relative humidity | 96% maximum, non-condensing and without dripping (provide heating system if there is condensation) Conforms to IEC 60068-2-3 |
| Maximum ambient temperature | Storage: -13 to +158 °F (-25 to +70 °C) Operation: +14 to +122 °F (-10 to +50 °C) without vent cover removed and without derating +14 to +140 °F (-10 to +60 °C) with vent cover removed and with derating. Refer to derating curves on page 17. |
| Altitude | Up to 3,300 ft (1,000 m) without derating; derate by 1% for each additional 330 ft (100 m) |

Table 3: Electrical Characteristics

| | |
|-----------------------------|---|
| Input voltage | ATV31••••M2 (1 phase): 200 V -15% to 240 V +10% ATV31••••M3X (3 phase): 200 V -15% to 240 V +10% ATV31••••N4 (3 phase): 380 V -15% to 460 V +15% ATV31••••S6X (3 phase): 525 V -15% to 575 V +15% |
| Input frequency | 50/60 Hz ±5% |
| Input phases | ATV31••••M2: 1 ATV31••••M3X: 3 ATV31••••N4: 3 ATV31••••S6X: 3 |
| Output voltage | Maximum voltage equal to input voltage |
| Output frequency | 0 to 500 Hz |
| Output phases | 3 |
| Max. transient current | Up to 150% of nominal drive controller current for 60 seconds (see Tables 4–7 on pages 12–13) |
| Braking torque | With braking resistor: 100% of nominal motor torque continuously and up to 150% for 60 s. Without braking resistor: Drive controllers ≥ ATV31•U22••: 30% of nominal motor torque Drive controllers ≤ ATV31•U15••: 50% of nominal motor torque Drive controllers ≤ ATV31•075••: 100% of nominal motor torque Drive controllers ≤ ATV31•018M2: 150% of nominal motor torque |
| Frequency resolution | Display: 0.1 Hz Analog inputs: 0.1 Hz to 100 Hz maximum [(high speed - low speed)/1024] |
| Switching frequency | Adjustable from 2.0 kHz to 16 kHz. Randomly modulated by default, but this can be disabled. |
| Drive controller protection | Galvanic isolation between power and control (power supplies, inputs, outputs) Protection against short circuits: <ul style="list-style-type: none"> • within internal power supplies • between output phases • between output phases and ground Protection against input phase loss Thermal protection against overheating and overcurrents Undervoltage and overvoltage faults Overbraking fault |
| Motor protection | Thermal protection integrated in the drive controller by I^2t calculation Protection against motor phase loss |

Table 3: Electrical Characteristics (continued)

| | |
|--|---|
| Dielectric strength | <p>Between ground and power terminals:</p> <ul style="list-style-type: none"> • ATV31****M2 and M3X: 2040 Vdc • ATV31****N4: 2410 Vdc • ATV31****S6X: 2550 Vdc <p>Between control and power terminals:</p> <ul style="list-style-type: none"> • ATV31****M2 and M3X: 2880 Vac • ATV31****N4: 3400 Vac • ATV31****S6X: 3600 Vac |
| Resistance to ground | >500 MΩ (electrical isolation) 500 Vdc for 1 minute |
| Communication | <p>Modbus and CANopen are integrated into the drive controller and available via an RJ45 connector.</p> <p>Modbus RS-485 multidrop serial link characteristics:</p> <ul style="list-style-type: none"> • Modbus in RTU mode • Services supported: decimal function codes 03, 06, 16, 23, and 43 • Broadcasting • Number of addresses: drive address can be configured via the integrated terminal from 1 to 247 • Maximum number of ATV31 drive controllers: 31 (two 470 Ω master pull-down resistors) • Transmission speed: 4800, 9600, or 19200 bps <p>The following devices can be connected to the RS-485 link:</p> <ul style="list-style-type: none"> • Remote keypad display • PowerSuite software workstation • PLC • Microprocessor card • PC <p>CANopen To connect the ATV31 drive controller to a CANopen network, use the VW3CANTAP2 adapter. The following services are supported:</p> <ul style="list-style-type: none"> • Implicit exchange of Process Data Object (PDO): <ul style="list-style-type: none"> - 2 PDOs depending DSP 402 velocity mode. - 2 configurable PDOs (data and transmission type). - PDOs can be exchanged between slave devices. • Explicit exchange of Service Data Object (SDO): <ul style="list-style-type: none"> - 1 receive SDO and 1 transmit SDO • Boot-up messages, emergency messages, node guarding, and producer and consumer heartbeat. • Number of addresses: drive controller address can be configured via the integrated terminal from 1 to 127. • Maximum number of drive controllers: 127 • Transmission speed: 10, 20, 50, 125, 250, 500 kbps or 1 Mbps |
| Codes and standards | <p>UL Listed per UL 508C as incorporating electronic overload protection: UL File E164874 CCN NMMS.</p> <p>CSA Certified to CSA C22.2 No. 14: CSA File LR96921 Class 3211 06.</p> <p>CE Marked in accordance with the European low voltage (73/23/EEC and 93/68/EEC) and EMC (89/336/EEC) directives.</p> <p>Conforms to applicable NEMA ICS, IEC, NOM, C-TICK, and ISO 9001 standards.</p> |
| Electromagnetic compatibility | <p>Altivar 31 drive controllers meet IEC and EN requirements, the strictest international standards for electrical industrial control devices. They conform to EN 50178 governing electromagnetic compatibility and conducted and radiated emissions.</p> <ul style="list-style-type: none"> • IEC/EN 61000-4-2 level 3 • IEC/EN 61000-4-3 level 3 • IEC/EN 61000-4-4 level 4 • IEC/EN 61000-4-5 level 3 (power access) • IEC/EN 61800-3, environments 1 and 2 |
| Conducted and radiated emissions for drive controllers (Consult the ATV31 Catalog for optional EMC filters) | <p>All ratings:</p> <ul style="list-style-type: none"> • IEC/EN 61800-3, environments 2 (industrial network) and 1 (public utility network) in limited distribution. <p>ATV31H018M2 to CU40N4:</p> <ul style="list-style-type: none"> • EN 55011, Class A, Group 1; EN 61800-3 Category C2 with additional EMC filter; • EN 55022, Class B, Group 1; EN 61800 <p>ATV31HU22M2 to HD15N4:</p> <ul style="list-style-type: none"> • EN 55011, Class A, Group 2; EN 61800-3 Category C3 with additional EMC filter • EN 55022, Class A, Group 1; EN 61800-3 Category C2 • EN 55022, Class B, Group 1; EN 61800-3 Category C1 <p>ATV31H018M3X to HD15M3X: With additional EMC filter:</p> <ul style="list-style-type: none"> • EN 55011, Class A, Group 1; EN 61800-3 Category C2 • EN 55022, Class B, Group 1; EN 61800-3 Category C1 |

RATINGS

Table 4: 208 V -15% / 240 V +10% at 50/60 Hz, Single-Phase Input, Three-Phase Output

| Altivar 31 Catalog no. ¹ | Motor Power indicated on nameplate ² | | Line supply (input) | | | | Drive controller (output) | | |
|--|--|----------|--------------------------------|------|------------------------------|----------------------------------|--|---|--------------------------------------|
| | | | Max. line current ³ | | Short-circuit current rating | Max. inrush current ⁴ | Nominal rated output current I _n ² | Transient output current ^{2,5} | Total dissipated power at rated load |
| | at 208 V | at 240 V | kA | A | | | | | |
| | kW | hp | A | A | kA | A | A | W | |
| ATV31H018M2 | 0.18 | 0.25 | 3.0 | 2.5 | 1 | 10 | 1.5 | 2.3 | 24 |
| ATV31H037M2 | 0.37 | 0.5 | 5.3 | 4.4 | 1 | 10 | 3.3 | 5.0 | 41 |
| ATV31H055M2 | 0.55 | 0.75 | 6.8 | 5.8 | 1 | 10 | 3.7 | 5.6 | 46 |
| ATV31H075M2 | 0.75 | 1 | 8.9 | 7.5 | 1 | 10 | 4.8, 4.6, 4.2 ⁶ | 7.2 | 60 |
| ATV31HU11M2 | 1.1 | 1.5 | 12.1 | 10.2 | 1 | 19 | 6.9 | 10.4 | 74 |
| ATV31HU15M2 | 1.5 | 2 | 15.8 | 13.3 | 1 | 19 | 8.0 | 12.0 | 90 |
| ATV31HU22M2 | 2.2 | 3 | 21.9 | 18.4 | 1 | 19 | 11.0 | 16.5 | 123 |

Table 5: 208 V -15% / 240 V +10% at 50/60 Hz, Three-Phase Input, Three-Phase Output

| Altivar 31 Catalog no. ¹ | Motor Power indicated on nameplate ² | | Line supply (input) | | | | Drive controller (output) | | |
|--|--|----------|--------------------------------|------|------------------------------|----------------------------------|--|---|--------------------------------------|
| | | | Max. line current ³ | | Short-circuit current rating | Max. inrush current ⁴ | Nominal rated output current I _n ² | Transient output current ^{2,5} | Total dissipated power at rated load |
| | at 208 V | at 240 V | kA | A | | | | | |
| | kW | hp | A | A | kA | A | A | W | |
| ATV31H018M3X | 0.18 | 0.25 | 2.1 | 1.9 | 5 | 10 | 1.5 | 2.3 | 23 |
| ATV31H037M3X | 0.37 | 0.5 | 3.8 | 3.3 | 5 | 10 | 3.3 | 5.0 | 38 |
| ATV31H055M3X | 0.55 | 0.75 | 4.9 | 4.2 | 5 | 10 | 3.7 | 5.6 | 43 |
| ATV31H075M3X | 0.75 | 1 | 6.4 | 5.6 | 5 | 10 | 4.8 | 7.2 | 55 |
| ATV31HU11M3X | 1.1 | 1.5 | 8.5 | 7.4 | 5 | 10 | 6.9 | 10.4 | 71 |
| ATV31HU15M3X | 1.5 | 2 | 11.1 | 9.6 | 5 | 10 | 8.0 | 12.0 | 86 |
| ATV31HU22M3X | 2.2 | 3 | 14.9 | 13.0 | 5 | 10 | 11.0 | 16.5 | 114 |
| ATV31HU30M3X | 3 | 3 | 19.1 | 16.6 | 5 | 19 | 13.7 | 20.6 | 146 |
| ATV31HU40M3X | 4 | 5 | 24.2 | 21.1 | 5 | 19 | 17.5 | 26.3 | 180 |
| ATV31HU55M3X | 5.5 | 7.5 | 36.8 | 32.0 | 22 | 23 | 27.5 | 41.3 | 292 |
| ATV31HU75M3X | 7.5 | 10 | 46.8 | 40.9 | 22 | 23 | 33.0 | 49.5 | 388 |
| ATV31HD11M3X | 11 | 15 | 63.5 | 55.6 | 22 | 93 | 54.0 | 81.0 | 477 |
| ATV31HD15M3X | 15 | 20 | 82.1 | 71.9 | 22 | 93 | 66.0 | 99.0 | 628 |

¹ Catalog number for a drive controller without a reference potentiometer and RUN/STOP buttons. For a drive controller with a reference potentiometer and RUN/STOP buttons, add an "A" at the end of the catalog number. For example, ATV31HO18M2A.

² These power ratings and currents are for a maximum ambient temperature of 50 °C (122 °F) and a switching frequency of 4 kHz in continuous operation. The switching frequency is adjustable from 2 to 16 kHz. Above 4 kHz, the drive controller will reduce the switching frequency in the event of excessive temperature rise. The temperature rise is controlled by a PTC probe in the power module. Derate the nominal current if continuous operation above 4 kHz is required. Derating curves are shown on page 17 as a function of switching frequency, ambient temperature, and mounting conditions.

³ Current on a line supply with the indicated short-circuit current rating.

⁴ Peak current on power-up, for the maximum voltage (240 V +10%).

⁵ For 60 seconds.

⁶ 4.8 A at 200 V, 4.6 A at 208 V, 4.2 A at 240 V.

Table 6: 400 V -15% / 460 V +15% at 50/60 Hz, Three-Phase Input, Three-Phase Output

| Altivar 31 | Motor | | Line supply (input) | | | | Drive controller (output) | | |
|--------------------------|---|------|--------------------------------|----------|------------------------------|----------------------------------|--|---------------------------------------|--------------------------------------|
| Catalog no. ² | Power indicated on nameplate ³ | | Max. line current ⁴ | | Short-circuit current rating | Max. inrush current ⁵ | Nominal rated output current I _n ³ | Max. transient current ^{3,6} | Total dissipated power at rated load |
| | | | at 400 V | at 460 V | | | | | |
| | kW | hp | A | A | kA | A | A | A | W |
| ATV31H037N4 | 0.37 | 0.5 | 2.2 | 1.7 | 5 | 10 | 1.5 | 2.3 | 32 |
| ATV31H055N4 | 0.55 | 0.75 | 2.8 | 2.2 | 5 | 10 | 1.9 | 2.9 | 37 |
| ATV31H075N4 | 0.75 | 1 | 3.6 | 2.7 | 5 | 10 | 2.3 | 3.5 | 41 |
| ATV31HU11N4 | 1.1 | 1.5 | 4.9 | 3.7 | 5 | 10 | 3.0 | 4.5 | 48 |
| ATV31HU15N4 | 1.5 | 2 | 6.4 | 4.8 | 5 | 10 | 4.1 | 6.2 | 61 |
| ATV31HU22N4 | 2.2 | 3 | 8.9 | 6.7 | 5 | 10 | 5.5 | 8.3 | 79 |
| ATV31HU30N4 | 3 | 3 | 10.9 | 8.3 | 5 | 10 | 7.1 | 10.7 | 125 |
| ATV31HU40N4 | 4 | 5 | 13.9 | 10.6 | 5 | 10 | 9.5 | 14.3 | 150 |
| ATV31HU55N4 | 5.5 | 7.5 | 21.9 | 16.5 | 22 | 30 | 14.3 | 21.5 | 232 |
| ATV31HU75N4 | 7.5 | 10 | 27.7 | 21.0 | 22 | 30 | 17.0 | 25.5 | 269 |
| ATV31HD11N4 | 11 | 15 | 37.2 | 28.4 | 22 | 97 | 27.7 | 41.6 | 397 |
| ATV31HD15N4 | 15 | 20 | 48.2 | 36.8 | 22 | 97 | 33.0 | 49.5 | 492 |

Table 7: 525 V -15% / 575 V +15% at 50/60 Hz, Three-Phase Input, Three-Phase Output¹

| Altivar 31 | Motor | | Line supply (input) | | | | Drive controller (output) | | |
|--------------------------|---|-----|--------------------------------|----------|------------------------------|----------------------------------|--|---------------------------------------|--------------------------------------|
| Catalog no. ² | Power indicated on nameplate ³ | | Max. line current ⁴ | | Short-circuit current rating | Max. inrush current ⁵ | Nominal rated output current I _n ³ | Max. transient current ^{3,6} | Total dissipated power at rated load |
| | | | at 525 V | at 600 V | | | | | |
| | kW | hp | A | A | kA | A | A | A | W |
| ATV31H075S6X | 0.75 | 1 | 2.8 | 2.4 | 5 | 12 | 1.7 | 2.6 | 36 |
| ATV31HU15S6X | 1.5 | 2 | 4.8 | 4.2 | 5 | 12 | 2.7 | 4.1 | 48 |
| ATV31HU22S6X | 2.2 | 3 | 6.4 | 5.6 | 5 | 12 | 3.9 | 5.9 | 62 |
| ATV31HU40S6X | 4 | 5 | 10.7 | 9.3 | 5 | 12 | 6.1 | 9.2 | 94 |
| ATV31HU55S6X | 5.5 | 7.5 | 16.2 | 14.1 | 22 | 36 | 9.0 | 13.5 | 133 |
| ATV31HU75S6X | 7.5 | 10 | 21.3 | 18.5 | 22 | 36 | 11.0 | 16.5 | 165 |
| ATV31HD11S6X | 11 | 15 | 27.8 | 24.4 | 22 | 117 | 17.0 | 25.5 | 257 |
| ATV31HD15S6X | 15 | 20 | 36.4 | 31.8 | 22 | 117 | 22.0 | 33.0 | 335 |

¹ A 3% line reactor is required for all 575 V drive controller installations.

² Catalog number for a drive controller without a reference potentiometer and RUN/STOP buttons. For a drive with a control potentiometer and RUN/STOP buttons, add an "A" at the end of the catalog number. For example, ATV31H037N4A.

³ These power ratings and currents are for a maximum ambient temperature of 50 °C (122 °F) and a switching frequency of 4 kHz in continuous operation. The switching frequency is adjustable from 2 to 16 kHz. Above 4 kHz, the drive controller will reduce the switching frequency in the event of excessive temperature rise. The temperature rise is controlled by a PTC probe in the power module. Derate the nominal current if continuous operation above 4 kHz is required. Derating curves are shown on page 17 as a function of switching frequency, ambient temperature, and mounting conditions.

⁴ Current on a line supply with the indicated short-circuit current rating.

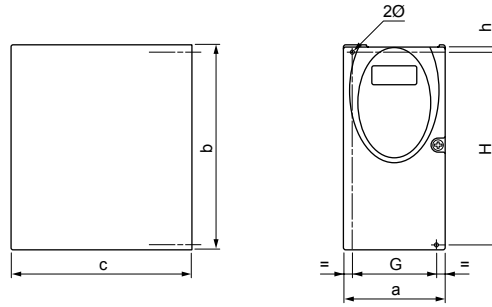
⁵ Peak current on power-up, for the maximum voltage (460 Vac / 575 Vac +15%).

⁶ For 60 seconds.

Table 8: Minimum Dynamic Braking Resistance Values

| Drive Controller Catalog No. | PA to PB Min. Resistance Value |
|-----------------------------------|-----------------------------------|
| | Ω |
| ATV31H/C/K018M2, ATV31H/C/K037M2 | 40 |
| ATV31H/C/K055M2, ATV31H/C/K075M2 | |
| ATV31H/C/KU11M2, ATV31H/C/KU15M2 | 27 |
| ATV31H018M3X, ATV31H037M3X | 40 |
| ATV31H055M3X, ATV31H075M3X | |
| ATV31HU11M3X, ATV31HU15M3X | 27 |
| ATV31H/C/K037N4, ATV31H/C/K055N4 | 80 |
| ATV31H/C/K075N4 | |
| AATV31H/C/KU11N4, ATV31H/C/KU15N4 | 54 |
| ATV31H/C/KU22N4 | |
| ATV31H/C/KU22M2 | 25 |
| ATV31HU22M3X | |
| ATV31HU30M3X | 16 |
| ATV31H/C/KU30N4 | 55 |
| ATV31H/C/KU40N4 | 36 |
| ATV31HU22M3X | 25 |
| ATV31HU30M3X | 16 |
| ATV31H/C/KU30N4 | 55 |
| ATV31H/C/KU40N4 | 36 |
| ATV31H/KU55N4 | 29 |
| ATV31H/KU75N4 | 19 |
| ATV31HU55S6X | 34 |
| ATV31HU75S6X | 23 |
| ATV31HU40M3X | 16 |
| ATV31H/KD11N4, ATV31H/KD15N4 | 20 |
| ATV31HD11S6X, ATV31HD15S6X | 24 |
| ATV31HU55M3X, ATV31HU75M3X | 8 |
| ATV31HD11M3X, ATV31HD15M3X | 5 |

DIMENSIONS AND WEIGHTS

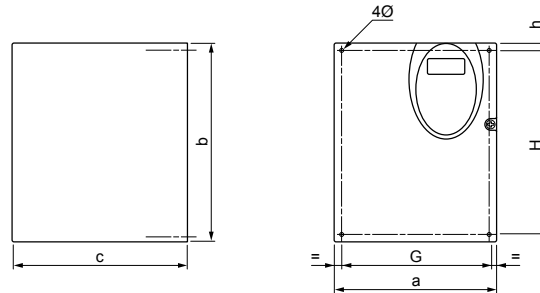


ATV31 Size 1 to 6 Dimensions.eps

ENGLISH

Table 9: Frame Sizes 1–6

| ATV31..... ¹ | Frame Size | a mm (in.) | b mm (in.) | c ² mm (in.) | G ³ mm (in.) | h mm (in.) | H ³ mm (in.) | Ø mm (in.) | Weight kg (lb.) |
|---|------------|------------------|------------------|-------------------------------|-------------------------------|------------------|-------------------------------|------------------|-----------------------|
| H018M3X, H037M3X | 1 | 72 (2.83) | 145 (5.71) | 120 (4.72) | 60 (2.36) | 5 (0.20) | 121.5 (4.78) | 5 (0.20) | 0.9 (1.99) |
| H055M3X, H075M3X | 2 | 72 (2.83) | 145 (5.71) | 130 (5.12) | 60 (2.36) | 5 (0.20) | 121.5 (4.78) | 5 (0.20) | 0.9 (1.99) |
| H018M2, H037M2 | 3 | 72 (2.83) | 145 (5.71) | 130 (5.12) | 60 (2.36) | 5 (0.20) | 121.5 (4.78) | 5 (0.20) | 1.05 (2.32) |
| H055M2, H075M2 | 4 | 72 (2.83) | 145 (5.71) | 140 (5.51) | 60 (2.36) | 5 (0.20) | 121.5 (4.78) | 5 (0.20) | 1.05 (2.32) |
| HU11M3X, HU15M3X | 5 | 105 (4.13) | 143 (5.63) | 130 (5.12) | 93 (3.66) | 5 (0.20) | 121.5 (4.78) | 5 (0.20) | 1.25 (2.76) |
| HU11M2, HU15M2, HU22M3X, H037N4, H055N4, H075N4, HU11N4, HU15N4, H075S6X, HU15S6X | 6 | 105 (4.13) | 143 (5.63) | 150 (5.91) | 93 (3.66) | 5 (0.20) | 121.5 (4.78) | 2 x 5 (0.20) | 1.35 (2.92) |



ATV31 Size 7 to 8 Dimensions.eps

Table 10: Frame Sizes 7–9

| ATV31..... ¹ | Frame Size | a mm (in.) | b mm (in.) | c ² mm (in.) | G ³ mm (in.) | h mm (in.) | H ³ mm (in.) | Ø mm (in.) | Weight kg (lb.) |
|--|------------|------------------|------------------|-------------------------------|-------------------------------|------------------|-------------------------------|------------------|-----------------------|
| HU22M2, HU30M3X, HU40M3X, HU22N4, HU30N4, HU40N4, HU22S6X, HU40S6X | 7 | 140 (5.51) | 184 (7.24) | 150 (5.91) | 126 (4.96) | 6.5 (0.26) | 157 (6.18) | 5 (0.20) | 2.35 (5.19) |
| HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X | 8 | 180 (7.09) | 232 (9.13) | 170 (6.69) | 160 (6.30) | 5 (0.20) | 210 (8.27) | 5 (0.20) | 4.70 (10.39) |
| HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X | 9 | 245 (9.65) | 330 (13.0) | 190 (7.48) | 225 (8.86) | 7 (1.93) | 295 (11.61) | 6 (0.24) | 9.0 (19.89) |

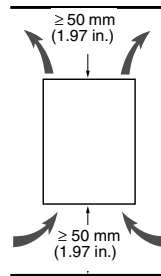
¹ The symbol “*” in a catalog number indicates the part of the number that varies with drive controller size or rating.

² For controllers with a potentiometer and Run/Stop buttons, add 8 mm (0.31 in.) for the potentiometer.

³ The values for this dimension are ±1 mm (0.04 in.).

MOUNTING

Clearances



Install the drive controller vertically, $\pm 10^\circ$.

Do not place the drive controller close to heating sources.

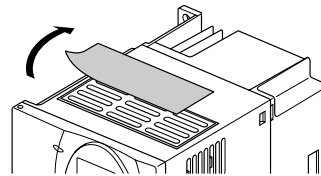
Leave sufficient free space around the drive controller to ensure that air can circulate from the bottom to the top of the unit.

Leave a minimum of 10 mm (0.4 in.) of free space in front of the drive controller.

ATV31 Clearances.eps

Removing the Protective Cover

When IP20 protection is adequate, remove the protective cover on top of the drive controller as shown in the figure below. Consult "Mounting Methods" on page 17 to determine the type of mounting appropriate for your application before removing the protective cover from the drive controller. For UL Type 1 protection, the protective cover must remain installed on the top of the controller and a conduit entry kit must be installed.



Example: ATV31HU11M3X

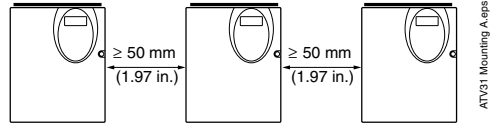
ATV31 Protective Covers.eps

Mounting Methods

Refer to the derating curves below to determine which mounting method best fits the application.

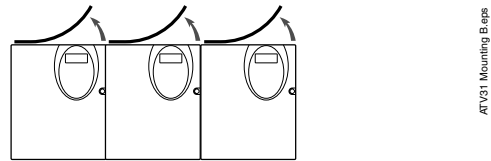
Type A Mounting

Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover in place.



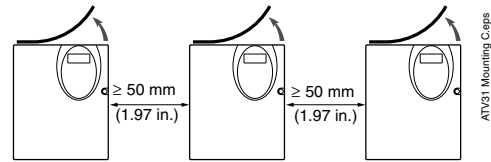
Type B Mounting

Drive controllers mounted side-by-side, with the protective cover removed (degree of protection becomes IP20).



Type C Mounting

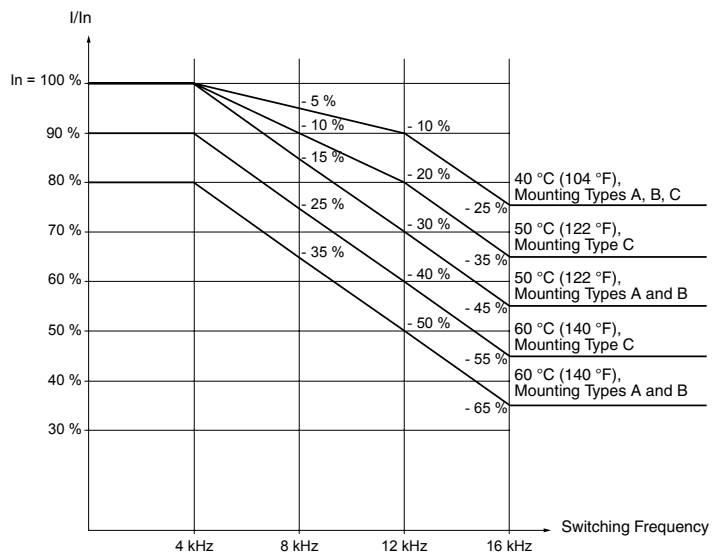
Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover removed (degree of protection becomes IP20).



Derating Curves

The following figure contains derating curves for the drive current (I_n) as a function of temperature, switching frequency, and type of mounting. For intermediate temperatures, such as 55 °C (131 °F), interpolate between two curves.

ATV31 drive controllers can be used at altitudes up to 3,300 ft. (1,000 m) without derating. Derate by 1% for each additional 330 ft. (100 m.).



Minimum Air Flow Rates

If you are installing the drive controller in an enclosure, provide an air flow at least equal to the value listed in Table 11 for your drive controller.

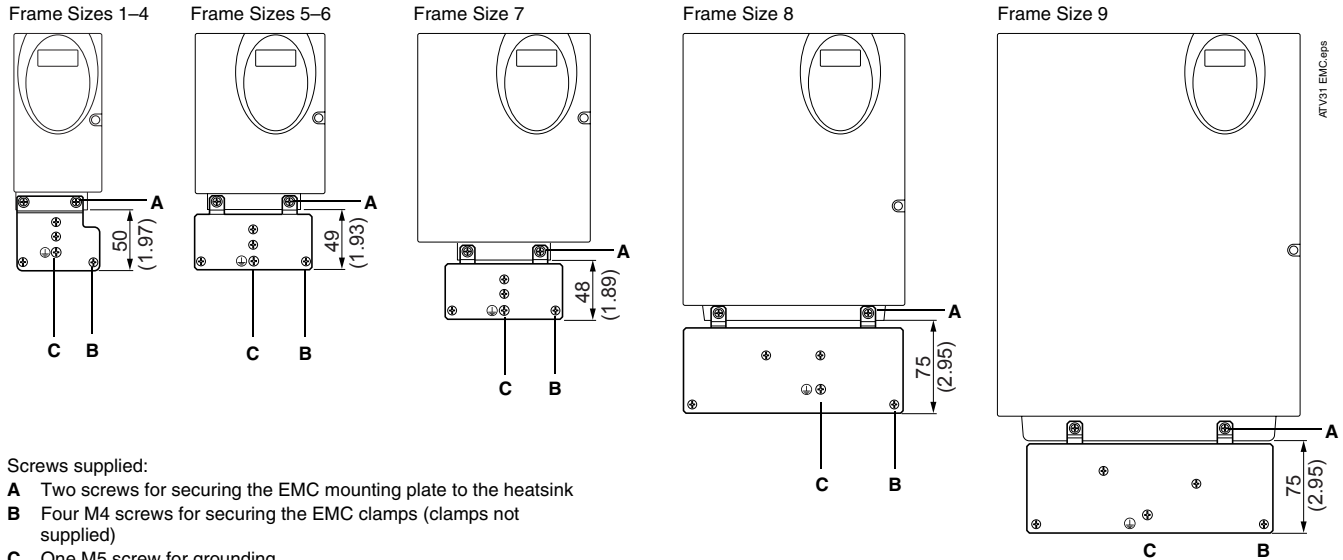
Table 11: Minimum Air Flow Rates

| ATV31***** ¹ | Flow Rate | |
|---|----------------------|-----------------------------|
| | m ³ /hour | Cubic Feet per Minute (CFM) |
| H018M2, H037M2, H055M2, H018M3X, H037M3X, H055M3X, H037N4, H055N4, H075N4, HU11N4 H075S6X, HU15S6X | 18 | 10.6 |
| H075M2, HU11M2, HU15M2 H075M3X, HU11M3X, HU15M3X HU15N4, HU22N4 HU22S6X, HU40S6X | 33 | 19.4 |
| HU22M2, HU22M3X, HU30M3X, HU40M3X HU30N4, HU40N4 HU55S6X, HU75S6X | 93 | 54.8 |
| HU55M3X HU55N4, HU75N4 HD11S6X | 102 | 60.1 |
| HU75M3X, HD11M3X, HD11N4, HD15N4 HD15S6X | 168 | 99.0 |
| HD15M3X | 216 | 127.2 |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

Electromagnetic Compatibility

An EMC mounting plate is supplied with the drive controller for grounding the shields of the power cables when it is necessary for the installation to meet EN 55011 Class A requirements. Secure the mounting plate to the holes in the ATV31 drive controller's heatsink using the two screws (A) supplied as shown in the figure below. Refer to page 39 for instructions on grounding the cable shields on the EMC plate.



Screws supplied:

- A Two screws for securing the EMC mounting plate to the heatsink
- B Four M4 screws for securing the EMC clamps (clamps not supplied)
- C One M5 screw for grounding

| ATV31***** ¹ | Frame Size |
|---|------------|
| H018M3X, H037M3X | 1 |
| H055M3X, H075M3X | 2 |
| H018M2, H037M2 | 3 |
| H055M2, H075M2 | 4 |
| HU11M3X, HU15M3X | 5 |
| HU11M2, HU15M2, HU22M3X, H037N4, H055N4, H075N4, HU11N4, HU15N4, H075S6X, HU15S6X | 6 |

| ATV31***** ¹ | Frame Size |
|--|------------|
| HU22M2, HU30M3X, HU40M3X, HU22N4, HU30N4, HU40N4, HU22S6X, HU40S6X | 7 |
| HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X | 8 |
| HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X | 9 |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

MOUNTING IN A TYPE 12 OR IP54 METAL ENCLOSURE

Calculating Enclosure Size

The equation for calculating R_{th} ($^{\circ}\text{C}/\text{W}$), the maximum allowable thermal resistance of the enclosure, is as follows:

$$R_{th} = \frac{T_i - T_o}{P}$$

T_i = Max. internal ambient temp. ($^{\circ}\text{C}$) around the controller
 T_o = Max. external ambient temp. ($^{\circ}\text{C}$) around enclosure
 P = Total power dissipated in enclosure (W)

For the power dissipated by the drive controllers at rated load, see Tables 4–7 on pages 12–13.

The useful heat exchange surface area, S (in^2), of a wall-mounted enclosure generally consists of the sides, top, and front. The minimum surface area required for a drive controller enclosure is calculated as follows:

NOTE: Contact the enclosure manufacturer for K factors.

$$S = \frac{K}{R_{th}}$$

K = Thermal resistance per square inch of the enclosure
 R_{th} = Thermal resistance of the enclosure (calculated previously)

Consider the following points when sizing the enclosure:

- Use only metal enclosures, since they have good thermal conduction.
- Do not install enclosures where external heat sources (such as direct sunlight) can add to the enclosure heat load. This procedure does not consider radiant or convected heat load from external sources.
- If additional devices are present inside the enclosure, consider the heat load of those devices in the calculation.
- The actual useful area for convection cooling of the enclosure will vary depending upon the method of mounting. The mounting method must allow for free air movement over all surfaces considered for convection cooling.

The following sample illustrates calculation of the enclosure size for an ATV31HU40N4 (5 hp) drive controller mounted in a Type 12 or IP54 enclosure.

- Maximum external temperature: $T_o = 25^{\circ}\text{C}$
- Power dissipated inside the enclosure: $P = 150\text{ W}$
- Maximum internal temperature: $T_i = 40^{\circ}\text{C}$
- Thermal resistance per square inch of the enclosure: $K = 186$

Calculate the maximum allowable thermal resistance, R_{th} :

$$R_{th} = \frac{40^{\circ}\text{C} - 25^{\circ}\text{C}}{150\text{ W}} = 0.115^{\circ}\text{C}/\text{W}$$

Calculate the minimum useful heat exchange surface area, S :

$$S = \frac{186}{0.115} = 1624.4\text{ in}^2$$

Useful heat exchange surface area (S) of the proposed wall-mounted enclosure:

- Height: 28 in (711 mm)
- Width: 24 in (610 mm)
- Depth: 12 in (305 mm)

$$\begin{array}{ccc} \text{front area} & \text{top area} & \text{side area} \\ \downarrow & \downarrow & \downarrow \\ S = (24 \times 28) + (24 \times 12) + 2(28 \times 12) = 1632 \text{ in}^2 \end{array}$$

If the selected enclosure does not provide the required surface area or does not meet application needs, consider the following:

- Use a larger enclosure.
- Add a passive heat exchanger to the enclosure.
- Add an air conditioning unit to the enclosure.

Ventilation

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

- Observe the minimum clearance distances shown on page 16.
- Follow the installation precautions on page 9.
- If necessary, install a stirring fan to circulate the air inside the enclosure, to prevent hot spots in the drive controller, and to distribute the heat uniformly to surfaces used for convection cooling.

▲ CAUTION

CONDENSATION

Where condensation is possible, keep the drive controller 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.

BUS VOLTAGE MEASUREMENT PROCEDURE

⚠ DANGER

HAZARDOUS VOLTAGE

Read and understand the precautions on page 7 before performing this procedure.

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

The bus voltage can exceed 1000 Vdc. Use appropriately rated measuring equipment when performing this procedure. To measure the bus capacitor voltage:

1. Disconnect all power from the drive controller.
2. Wait 3 minutes to allow the DC bus to discharge.
3. Measure the DC bus voltage between the PA (+) and PC (–) terminals to verify that the DC voltage is less than 45 Vdc. Refer to page 28 for the location of the power terminals. **It may take up to 15 minutes for the DC bus voltage to discharge.**
4. If the bus capacitors do not fully discharge, contact your local Schneider Electric representative—do not service or operate the drive controller.

GENERAL WIRING PRACTICES

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 controller or other drive controllers; **do not run 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.

⚠ CAUTION

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.
- The drive controller will be damaged if input line voltage is applied to the output terminals (U, V, W).
- Check the power connections before energizing the drive controller.
- If replacing another drive controller, verify that all wiring connections to the ATV31 drive controller comply with all wiring instructions in this manual.

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

Follow the practices below when wiring ATV31 drive controllers:

- 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 controller nameplate.
- Use metallic conduit for all drive controller 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 used to carry 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 controller (such as relays, contactors, and solenoid valves) with noise suppressors, or connect them to a separate circuit.

Branch Circuit Connections

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 ATV31 drive controller, or for the rated output current, whichever value is larger. The input current of the controller depends on the impedance of the power distribution system and the available short-circuit current at the drive input terminals.

Tables 4–7 on pages 12–13 provide input current information to optimally size branch circuit conductors. Do not exceed the short-circuit rating shown in the tables. The short-circuit 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 controller.

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

CAUTION

NUISANCE TRIPPING

A 3% line reactor is required in all 575 V drive installations.

Failure to follow this instruction can result in equipment damage.

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

If starting the drive controller 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 controller.

⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The National Electrical Code requires branch circuit protection. Use the fuses recommended in Tables 15–17 on pages 36–37 to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the drive controller short-circuit current rating listed on the drive controller nameplate or Tables 4–7 on pages 12–13.

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

Output Wiring

The drive controller 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 controller and motor performance.
- A load filter is recommended on all 575 V applications, especially when the motor leads exceed 12 m (40 ft.).
- When the output cable is in close proximity to other output cables, the drive controller 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 controller.**

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

⚠ CAUTION

INSUFFICIENT OUTPUT INDUCTANCE

For proper drive controller 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.

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

GROUNDING

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

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

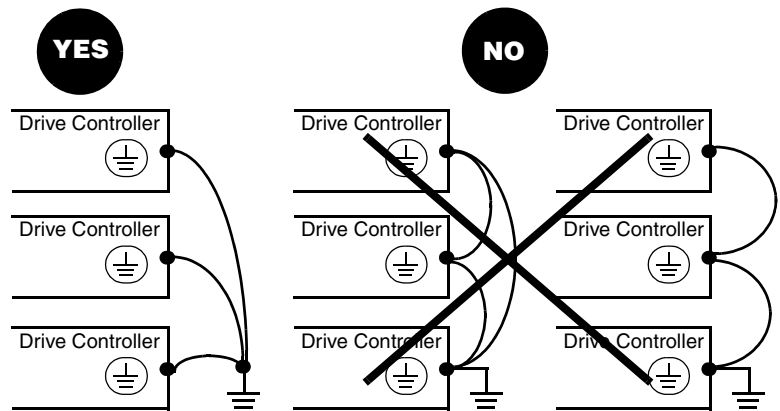
⚠ DANGER

HAZARDOUS VOLTAGE

Ground equipment using the provided ground connecting point as shown in the figure below. The drive controller panel must be properly grounded before power is applied.

Electric shock will result in death or serious injury.

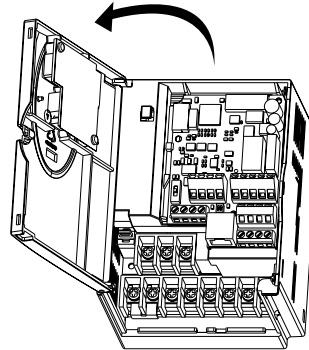
Ground multiple drive controllers as shown in the figure below. Do not loop the ground cables or connect them in series.



WIRING

Access to Terminals

To access the terminals, open the cover as shown in the figure below.



Example ATV31HU11M2

ATV31 Terminals.eps

Power Terminals

Connect the power terminals before connecting the control terminals.

Table 12: Power Terminal Characteristics

| ATV31***** ¹ | Maximum Conductor Size | | Tightening Torque | |
|---|------------------------|-----|-------------------|-------|
| | mm ² | AWG | N•m | lb-in |
| H018M2, H037M2, H055M2, H075M2, H018M3X, H037M3X, H055M3X, H075M3X, HU11M3X, HU15M3X | 2.5 | 14 | 0.8 | 7.08 |
| HU11M2, HU15M2, HU22M2, HU22M3X, HU30M3X, HU40M3X, H037N4, H055N4, H075N4, HU11N4, HU15N4, HU22N4, HU30N4, HU40N4 H075S6X, HU15S6X, HU22S6X, HU40S6X | 5 | 10 | 1.2 | 10.62 |
| HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X | 16 | 6 | 2.2 | 19.47 |
| HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X | 25 | 3 | 4 | 35.40 |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

Table 13: Power Terminal Functions

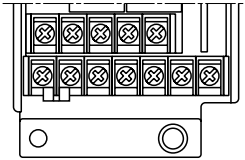
| Terminal | Function | On ATV31 Drive Controllers: |
|----------------------|---|---|
| ⏚ | Ground terminal | All ratings |
| R/L1 S/L2 | Power supply | ATV31****M2 ¹ |
| R/L1 S/L2 T/L3 | | ATV31****M3X ¹ |
| | | ATV31****N4 ¹ ATV31****S6X ¹ |
| PO | DC bus + polarity | All ratings |
| PA/+ | Output to braking resistor (+ polarity) | All ratings |
| PB | Output to braking resistor | All ratings |
| PC/- | DC bus - polarity | All ratings |
| U/T1 V/T2 W/T3 | Outputs to the motor | All ratings |

NOTE: Never remove the jumper between PO and PA/+.

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

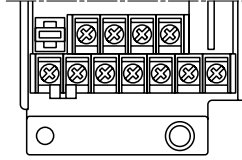
Arrangement of the Power Terminals

ATV31H018M3X, H037M3X, H055M3X, H075M3X



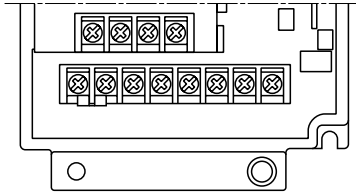
| | | | | | | | | | |
|----|------|------|------|------|------|------|--|--|--|
| ⏚ | ⏚ | R/L1 | S/L2 | T/L3 | | | | | |
| P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 | | | |

ATV31H018M2, H037M2, H055M2, H075M2



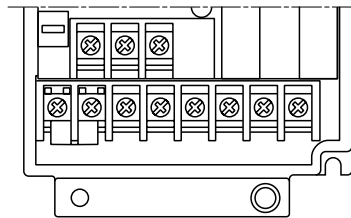
| | | | | | | | | | |
|----|------|------|------|------|------|------|--|--|--|
| ⏚ | ⏚ | R/L1 | S/L2 | | | | | | |
| P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 | | | |

ATV31HU11M3X, HU15M3X, HU22M3X, HU30M3X, HU40M3X, H037N4,
H055N4, H075N4, HU11N4, HU15N4, HU22N4, HU30N4, HU40N4,
H075S6X, HU15S6X, HU22S6X, HU40S6X



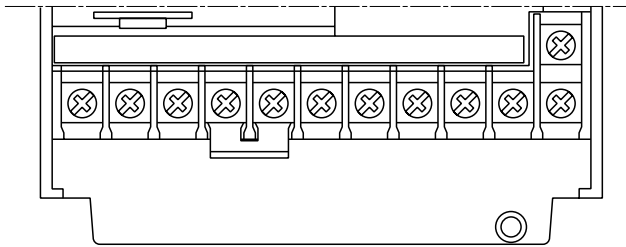
| | | | | | | | | | |
|----|------|------|------|------|------|------|---|--|--|
| ⏚ | R/L1 | S/L2 | T/L3 | | | | | | |
| P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 | ⏚ | | |

ATV31HU11M2, HU15M2, HU22M2



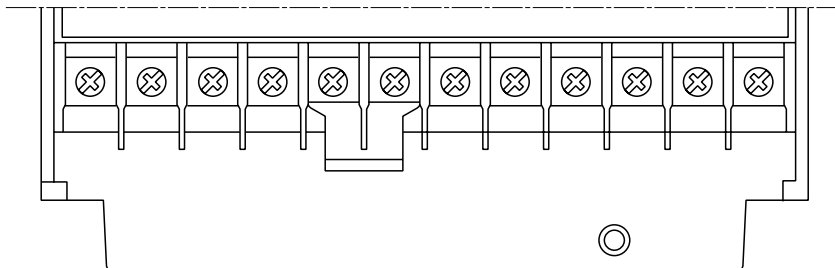
| | | | | | | | | | |
|----|------|------|------|------|------|------|---|--|--|
| ⏚ | R/L1 | S/L2 | | | | | | | |
| P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 | ⏚ | | |

ATV31HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X



| | | | | | | | | | |
|------|------|------|----|------|----|------|------|------|------|
| | | | | | | | | | |
| R/L1 | S/L2 | T/L3 | P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 |
| | | | | | | | | | ⏚ |

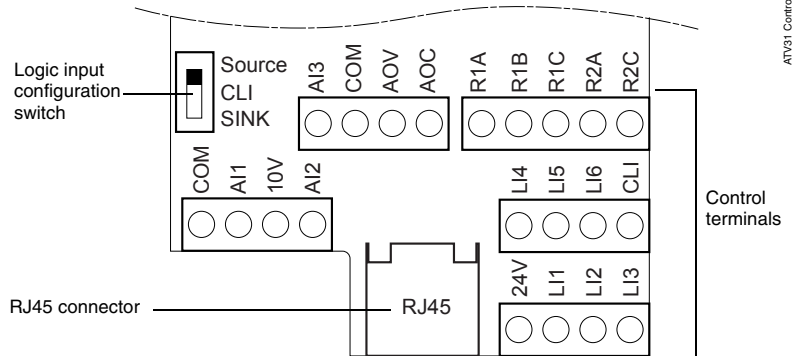
ATV31HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X



| | | | | | | | | | | | |
|---|------|------|------|----|------|----|------|------|------|------|---|
| ⏚ | R/L1 | S/L2 | T/L3 | P0 | PA/+ | PB | PC/- | U/T1 | V/T2 | W/T3 | ⏚ |
|---|------|------|------|----|------|----|------|------|------|------|---|

Control Terminals

Connect the control terminals after connecting the power terminals.



Maximum conductor size is 2.5 mm² (14 AWG)
Maximum tightening torque is 0.6 N•m (5.31 lb-in).

Table 14: Control Terminal Characteristics

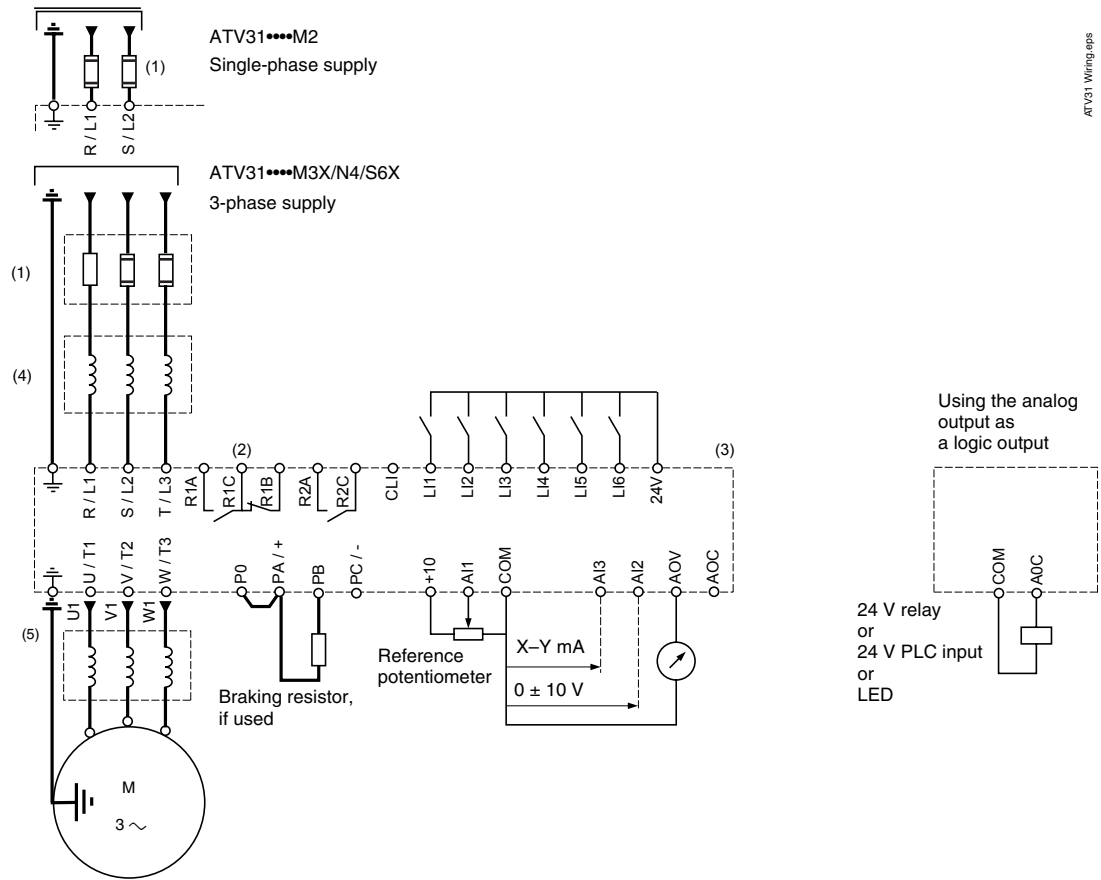
| Terminal | Function | Electrical characteristics |
|-------------------|---|--|
| R1A R1B R1C | R1A is a N.O. contact. R1B is a N.C. contact. R1C is the common. R1 is a programmable relay, factory set as a fault relay. As a fault relay, R1A is closed and R1B is open when the controller is powered with no fault. | <ul style="list-style-type: none"> Min. switching capacity: 10 mA for 5 Vdc Max. switching capacity on a resistive load (power factor = 1 and L/R time constant = 0 ms): 5 A for 250 Vac and 30 Vdc Max. switching capacity on an inductive load (power factor = 0.4 and L/R time constant = 7 ms): 1.5 A for 250 Vac and 30 Vdc Sampling time: 8 ms Service life: 100,000 operations at max. switching power; 1,000,000 operations at min. switching power |
| R2A R2C | N.O. contact of programmable relay R2 | |
| COM | Analog I/O common | 0 V |
| AI1 | Analog voltage input | Analog input 0 to +10 V (max. safe voltage is 30 V) <ul style="list-style-type: none"> Impedance: 30 kΩ Resolution: 0.01 V, 10-bit converter Precision: ± 4.3% of max. value Linearity: ± 0.2% of max. value Sampling time: 8 ms Shielded cable length: 100 m max. |
| 10 V | Power supply for setpoint potentiometer 1 to 10 kΩ | +10 V (+ 8%, - 0%), 10 mA max, protected against short circuits and overloads |
| AI2 | Analog voltage input | Bipolar analog input 0 to ±10 V (max. safe voltage is ±30 V) The + or - polarity of the voltage on AI2 affects the direction of the setpoint and therefore the direction of operation. <ul style="list-style-type: none"> Impedance: 30 kΩ Resolution: 0.01 V, 10-bit + sign converter Precision: ± 4.3% of max. value Linearity: ± 0.2% of max. value Sampling time: 8 ms Shielded cable length: 100 m max. |
| AI3 | Analog current input | Analog input X to Y mA; X and Y programmable from 0–20 mA <ul style="list-style-type: none"> Impedance: 250 Ω Resolution: 0.02 mA, 10-bit converter Precision: ± 4.3% of max. value Linearity: ± 0.2% of max. value Sampling time: 8 ms |
| COM | Analog I/O common | 0 V |

Table 14: Control Terminal Characteristics (continued)

| Terminal | Function | Electrical characteristics |
|--|---|--|
| AOV or AOC | Analog voltage output AOV or Analog current output AOC or Logic voltage output on AOC Either AOV or AOC can be assigned, but not both. | Analog output 0 to 10 V, min. load impedance 470 Ω or Analog output X to Y mA; X and Y programmable from 0–20 mA, max. load impedance 800 Ω <ul style="list-style-type: none"> Resolution: 8 bits¹ Precision: ± 1%¹ Linearity: ± 0.2%¹ Sampling time: 8 ms or AOC can be configured as a 24 V logic output with a min. load impedance of 1.2 kΩ |
| 24 V | Logic input power supply | + 24 V protected against short circuits and overloads, min. 19 V, max. 30 V Max. available current is 100 mA. |
| L11 L12 L13 L14 L15 L16 | Logic inputs | Programmable logic inputs <ul style="list-style-type: none"> + 24 V power supply (max. 30 V) Impedance: 3.5 kΩ State 0 if the voltage difference between LI- and CLI is < 5 V, State 1 if the voltage difference between LI- and CLI is > 11 V Sampling time: 4 ms |
| CLI | Logic input common | See page 31. |

¹ Characteristics of the digital/analog converter.

Wiring Diagram for Factory Settings



NOTE: The line supply terminals are shown at the top and the motor terminals are shown at the bottom. Connect the power terminals before connecting the control terminals. Install surge suppressors on all inductive circuits located near the drive controller or coupled to the same circuit.

- (1) Refer to the drive controller nameplate or to the tables on pages 36–37 for recommended fuses. Fast acting or time delay Class J fuses can be used.
- (2) Fault relay contacts for remote indication of drive controller status.
- (3) Internal +24 V. If an external source is used (30 V max.), connect the 0 V terminal of the source to the 0 V (COM) terminal, and do not use the +24 V terminal on the drive controller for any purpose.
- (4) Line reactor, if used. All 575 V installations must include a line reactor. See page 23.
- (5) Installation of a load filter is recommended for all 575 V applications. See page 24.

Logic Input Switch

The logic input switch assigns the logic input common link to 0 V (Source logic), 24 V (Sink logic), or floating.

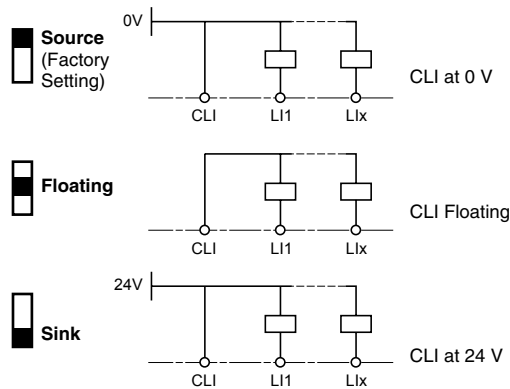
NOTE: When the logic input is configured for Sink logic, grounding the input signals can result in unintended activation of drive controller functions.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

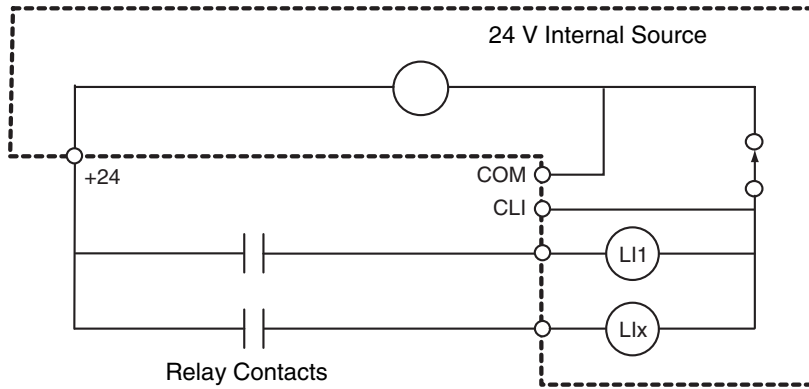
- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

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



**Recommended Circuit Diagrams:
Positive (Source) Logic**

Internal 24 V Supply

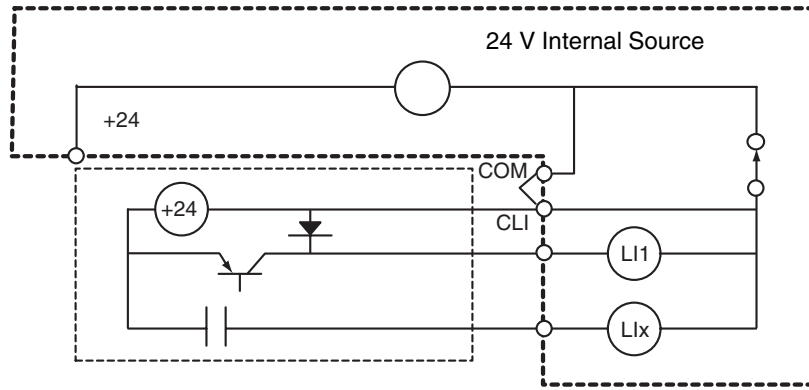


Logic Input Switch in Source Position (Factory Setting for controllers other than ATV31•••A).

Note: The heavy dashed line represents the drive controller.

Pos.LogicInternalSupply.eps

External Supply or PLC



Logic Input Switch in Source Position or Floating Position with a Jumper Installed from COM to CLI.

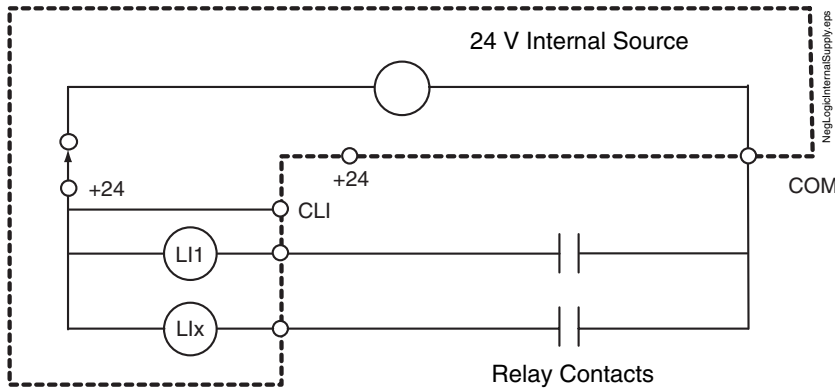
Note: The heavy dashed line represents the drive controller.

Pos.LogicExternalSupply.eps

PLC with either transistor outputs or relay contacts and its own internal supply

**Recommended Circuit Diagrams:
Negative (Sink) Logic**

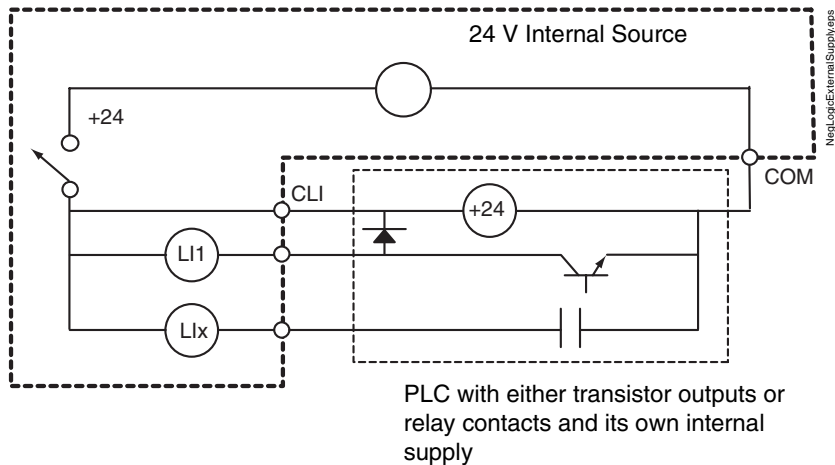
Internal 24 V Supply



Logic Input Switch in Sink Position

Note: The heavy dashed line represents the drive controller.

External Supply or PLC



Logic Input Switch in Floating Position

Note: The heavy dashed line represents the drive controller.

PLC with either transistor outputs or relay contacts and its own internal supply

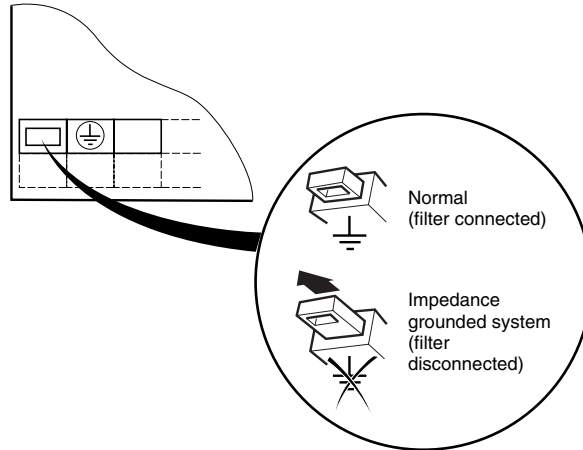
Negative (Sink) Logic is not recommended in cases where COM can become grounded. If COM is grounded, and any of the logic input wires have an insulation fault to ground, that input will be activated, possibly causing an unintended start of the motor. Refer to the precaution on page 32.

Operation on an Impedance Grounded System

When using the ATV31 drive controller on a system with an isolated or impedance grounded neutral, use a permanent insulation monitor compatible with non-linear loads.

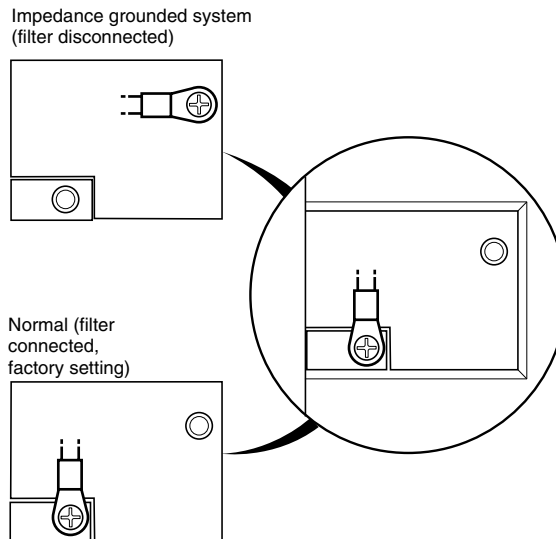
ATV31•••••M2 and N4 drive controllers feature built-in radio frequency interference (RFI) filters with grounded capacitors. When using the drive controller on an impedance grounded system, we recommend that you isolate the RFI filters from ground to prevent reduction of their operating life.

- ATV31H018M2 to U22M2 and ATV31H037N4 to U40N4: Pull out the jumper to the left of the ground terminal as illustrated below to isolate the RFI filters.



ATV31 Jumper.eps

- ATV31HU55N4 to D15N4: Connect the cable to the top left of the power terminals as illustrated below to isolate the filters (ATV31HU55N4 shown).



ATV31 Jumper.eps

RECOMMENDED FUSES

Table 15: Recommended Fuses for 208/230 V Drive Controllers

| Motor | | Drive Controller ATV31H***** ¹ | 600 V Fuses | |
|-------|------|--|-------------|----------------------|
| kW | hp | | Class CC | Class J ² |
| 0.18 | 0.25 | 018M2 | 6 A | 6 A |
| 0.37 | 0.5 | 037M2 | 10 A | 10 A |
| 0.55 | 0.75 | 055M2 | 10 A | 10 A |
| 0.75 | 1 | 075M2 | 15 A | 15 A |
| 1.1 | 1.5 | U11M2 | 20 A | 20 A |
| 1.5 | 2 | U15M2 | 20 A | 20 A |
| 2.2 | 3 | U22M2 | 30 A | 30 A |
| 0.18 | 0.25 | 018M3X | 3 A | 3 A |
| 0.37 | 0.5 | 037M3X | 6 A | 6 A |
| 0.55 | 0.75 | 055M3X | 10 A | 10 A |
| 0.75 | 1 | 075M3X | 10 A | 10 A |
| 1.1 | 1.5 | U11M3X | 15 A | 15 A |
| 1.5 | 2 | U15M3X | 15 A | 15 A |
| 2.2 | 3 | U22M3X | 20 A | 20 A |
| 3 | 3 | U30M3X | 25 A | 25 A |
| 4 | 5 | U40M3X | — | 35 A |
| 5.5 | 7.5 | U55M3X | — | 50 A |
| 7.5 | 10 | U75M3X | — | 60 A |
| 11 | 15 | D11M3X | — | 80 A |
| 15 | 20 | D15M3X | — | 110 A |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

² Fast acting or time delay.

Table 16: Recommended Fuses for 460 V Drive Controllers

| Motor | | Drive Controller ATV31H***** ¹ | 600 V Fuses | |
|-------|------|--|-------------|----------------------|
| kW | hp | | Class CC | Class J ² |
| 0.37 | 0.5 | 037N4 | 3 A | 3 A |
| 0.55 | 0.75 | 055N4 | 6 A | 6 A |
| 0.75 | 1 | 075N4 | 6 A | 6 A |
| 1.1 | 1.5 | U11N4 | 10 A | 10 A |
| 1.5 | 2 | U15N4 | 10 A | 10 A |
| 2.2 | 3 | U22N4 | 15 A | 15 A |
| 3 | 3 | U30N4 | 15 A | 15 A |
| 4 | 5 | U40N4 | 20 A | 20 A |
| 5.5 | 7.5 | U55N4 | 30 A | 30 A |
| 7.5 | 10 | U75N4 | — | 35 A |
| 11 | 15 | D11N4 | — | 50 A |
| 15 | 2.0 | D15N4 | — | 70 A |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

² Fast acting or time delay.

Table 17: Recommended Fuses for 575 V Drive Controllers

| Motor | | Drive Controller ATV31H..... ¹ | 600 V Fuses | |
|-------|-----|--|-------------|----------------------|
| kW | hp | | Class CC | Class J ² |
| 0.75 | 1 | 075S6X | 6 A | 6 A |
| 1.5 | 2 | U15S6X | 6 A | 6 A |
| 2.2 | 3 | U22S6X | 10 A | 10 A |
| 4 | 5 | U40S6X | 15 A | 15 A |
| 5.5 | 7.5 | U55S6X | 20 A | 20 A |
| 7.5 | 10 | U75S6X | 25 A | 25 A |
| 11 | 15 | D11S6X | — | 35 A |
| 15 | 20 | D15S6X | — | 45 A |

¹ The symbol "*" in a catalog number indicates the part of the number that varies with controller size or rating.

² Either fast acting or time delay.

AVAILABLE TORQUE

For continuous duty operation:

- With self-ventilated motors, motor cooling depends on speed.
- When running at speeds less than 50% of the nameplate motor speed, it may be necessary to derate the motor.

For operation in overspeed:

- Since the voltage does not increase with the frequency, reduced induction in the motor and loss of torque occur. Consult the motor manufacturer to ensure that the motor can operate in overspeed.
- For a special motor, the nominal frequency and the maximum frequency are adjustable between 40 and 500 Hz.

▲ CAUTION

MACHINERY OVERSPEED

Some motors and/or loads may not be suited for operation above the nameplate motor speed and frequency. Consult the motor manufacturer before operating the motor above its rated speed.

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

DRIVE CONTROLLER VENTILATION

The fan starts automatically when the drive controller is commanded to run (receives a run command and a speed reference). It stops a few seconds after the drive controller is stopped (when output frequency is less than 0.5 Hz and DC injection braking is completed).

NOTE: The fan may start without a run command if the drive controller temperature exceeds allowable limits.

MOTOR THERMAL PROTECTION

Thermal protection is integrated into the drive controller by continuous calculation of I^2t , taking motor speed into account. The motor power rating must be between 20% (50% for 575 V drive controllers) and 115% of the drive controller rating.

NOTE: The motor thermal state memory is reset to zero when the drive controller is switched off.

⚠ CAUTION

LOSS OF MOTOR OVERLOAD PROTECTION

- Setting the I_{th} parameter to its maximum value disables the internal motor overload protection function. In this case, external motor overload protection must be provided.
- When using external overload relays connected to the drive controller output, the overload relay must be capable of operation across the expected range of drive controller 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.

⚠ CAUTION

MOTOR OVERHEATING

- This drive controller does not provide direct thermal protection for the motor.
- The motor thermal state memory is reset to zero when the drive controller is switched off.
- Use of a thermal sensor in the motor may be required for protection at all speeds and load conditions.
- Consult the motor manufacturer for thermal capability of the motor when operated over the desired speed range.

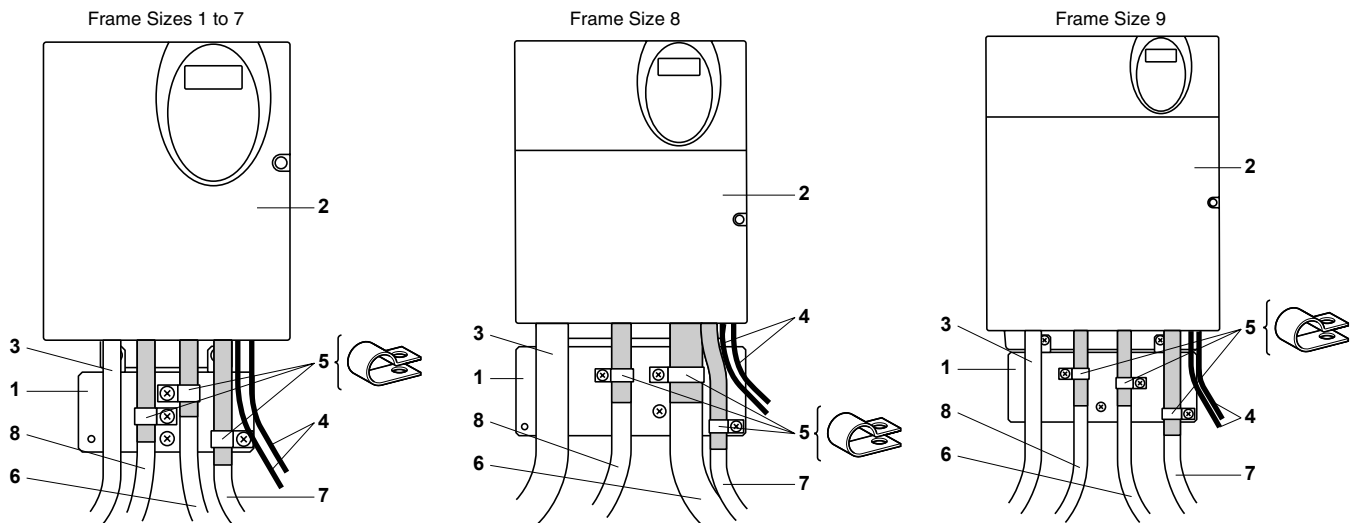
Failure to follow this instruction can result in injury or equipment damage.

ELECTROMAGNETIC COMPATIBILITY

The ATV31 controller 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 controller, 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, control cables, and the braking resistor (if used). 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.



| | | Frame Size | | | | | | | | |
|--------------|---------------------|---------------------|-------------------|-------------------|---------------------|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| ATV31 | H018M3X, H037M3X | H055M3X, H075M3X | H018M2, H037M2 | H055M2, H075M2 | HU11M3X, HU15M3X | HU11M2, HU15M2 HU22M3X H037N4, H055N4, H075N4, HU11N4, HU15N4 H075S6X, HU15S6X | HU22M2 HU30M3X, HU40M3X HU22N4, HU30N4, HU40N4 HU22S6X, HU40S6X | HU55M3X, HU75M3X HU55N4, HU75N4 HU55S6X, HU75S6X | HD11M3X, HD15M3X HD11N4, HD15N4 HD11S6X, HD15S6X | |

1. EMC plate supplied with the drive controller, installed as illustrated on page 19.
2. ATV31 drive controller.
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, 7, and 8 must be securely attached to the EMC plate with stainless steel clamps (item 5). Strip cables 6, 7, and 8 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 (20 AWG, 0.5 mm²). This shield must not be interrupted. If intermediate terminal blocks are used, they must be in EMC-shielded metal boxes.
8. Shielded cable for connecting the braking resistor, if used. The shield must be connected to ground at both ends. This shield must be unbroken, and if there are intermediate terminals, they must be in EMC-shielded metal boxes.

If using an additional input filter, connect it directly to the line supply with an unshielded cable. Then make connection 3 on the drive controller using the filter output cable.

Although there is a high frequency equipotential ground connection between the drive controller, 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.

A

AI1 29
AI2 29
AI3 29
air flow. See ventilation
altitude 10, 17
AOC 30
AOV 30

B

braking
 DC injection and overload relays 38
 dynamic braking resistance 14
 resistor 10
 output to 27
 torque 10
branch circuit connections 23
bus capacitor voltage. See voltage
bus voltage measurement 22

C

cable
 output length 24
 output type 24
CANopen 11
capacitance 24
capacitors, power factor correction 24
catalog numbers
 interpreting drive catalog no. 8
CE 11
circuit breakers 23
clearances
 mounting 16
CLI 30
codes and standards 11
COM 29
common
 analog I/O, COM 29
 logic input, CLI 30
communication
 CANopen 11
 Modbus 11
condensation 21
conductors. See wiring
conduit
 for wiring drive 22
 routing 22
conduit entry kit 16
contactors 23
control terminals. See terminals
CSA 11
C-TICK 11
current
 drive nominal output 12–13
 drive transient output 12–13
 input 23
 maximum inrush 12–13
 output 23
 peak, on power up 12–13
 short circuit 23
 transient 10

D

damage 8

DC bus
 +polarity 27
 -polarity 27
derating 17
dielectric strength 11
dimensions 15
disconnect devices 23
documentation
 programming manual 8
 start-up guide 8
dynamic braking resistance 14

E

electrical characteristics 10–11
electromagnetic compatibility 11, 19
 EMC filters 11
 EMC mounting plate 19
 installation for 39
 meeting EN 55011 Class A 39
EMC. See electromagnetic compatibility
emissions 11
EN 11
 EN 55011 11, 39
enclosure
 IP54 20
 mounting the drive in 18, 20–21
 sizing 20–21
 Type 12 20
 ventilation 21
environment 10

F

fan
 in enclosure 21
 on drive controller 38
feeder cables 23
filters
 EMC 11
 input 40
 load 24
 RFI 35
floating logic 32
frequency
 input 10
 output 10
 resolution 10
 switching 10, 13, 17
fuses 23
 recommended 36–37

G

ground
 resistance to 11
 terminal 27
grounding 25

H

heat exchanger 21
hp
 motor nameplate 12–13
 range of drive 8
humidity 10

I

ICS 11
IEC 11
impedance
 impedance grounded systems 35
 line 23
 of analog input 29
 of analog output 30
 of logic input 30
inductance 24
input
 analog current, AI3 29
 analog voltage, AI1 29
 analog voltage, AI2 29
 current. See current
 frequency. See frequency
 phases. See phases
 voltage. See voltage
inputs, logic. See logic inputs
installation 16–21
 two or more drives in parallel 23
insulation monitor 35
IP20 16
ISO 11

K

kW
 motor nameplate 12–13

L

L1 27
L2 27
L3 27
LI1 30
LI2 30
LI3 30
LI4 30
LI5 30
LI6 30
lightning arrestors 24
line
 contactor 23
 impedance. See impedance
 reactor 23
 voltage. See voltage
load filter 24
logic
 floating 32
 sink 32, 34
 source 32–33
logic input switch 32
logic inputs
 common, CLI 30
 LI1 30
 LI2 30
 LI3 30
 LI4 30
 LI5 30
 LI6 30
 power supply 30
 state at power up 9

- M**
- Modbus 11
 - mounting
 - and heating sources 16
 - clearances 16
 - derating curves 17
 - in an enclosure 18, 20–21
 - methods 17
 - NEMA Type 12 (IP54) 21
 - on EMC mounting plate 19
- N**
- NEMA 11
 - noise suppressors 23
 - NOM 11
- O**
- output
 - analog voltage, AOV 30
 - current. See current
 - frequency. See frequency
 - logic voltage, AOC 30
 - phases. See phases
 - terminals 27
 - voltage. See voltage.
 - overbraking 10
 - overcurrent 10, 23–24
 - overheating 10, 38
 - overload relays 38
 - with DC injection braking 38
 - overspeed 37
 - overvoltage 10
- P**
- PA 27
 - PB 27
 - PC 27
 - phases
 - input 10
 - output 10
 - PO 27
 - pollution degree 10
 - potentiometer 12–13
 - power supply for 29
 - power
 - dissipated at rated load 12–13
 - wiring 22
 - power supply
 - for logic inputs 30
 - for potentiometer 29
 - power terminals. See terminals
 - protection
 - against phase loss 10
 - against short circuits 10
 - degree of 10
 - disabling internal motor overload 38
 - drive controller 10
 - external motor overload 38
 - IP20 10, 16
 - IP21 10
 - IP31 10
 - IP41 10
 - motor 10, 38
 - overbraking 10
 - overcurrent 23
 - overvoltage 10
 - thermal 10, 38
 - UL Type 1 10, 16
 - undervoltage 10
 - protective vent cover 17
 - removing 16
- R**
- R1A 29
 - R1B 29
 - R1C 29
 - R2A 29
 - R2C 29
 - ratings, of drive 12–13
 - receiving 8
 - relay
 - fault 29
 - programmable 29
 - relays 23
 - resolution frequency. See frequency
 - RFI filters 35
 - RJ45 connector 29
- S**
- shipping
 - damage 8
 - packing the drive 8
 - shock 10
 - short circuit 10
 - current 23
 - current rating 12–13
 - sink logic 32, 34
 - solenoid valves 23
 - source logic 32–33
 - specifications
 - electrical 10–11
 - environment 10
 - standards. See codes and standards
 - starting
 - from line power 23
 - start-up guide 8
 - storing
 - proper storage area 8
 - temperature 8, 10
 - supply voltage. See voltage
 - switch
 - logic input 32
 - switching frequency. See frequency
- T**
- T1 27
 - T2 27
 - T3 27
 - temperature 17, 20
 - ambient 10
 - operating 10
 - storing 8, 10
 - terminals
 - access to 26
 - control 29–30
 - A11 29
 - A12 29
 - A13 29
 - AOC 30
 - AOV 30
 - CLI 30
 - COM 29
 - LI1 30
 - LI2 30
 - LI3 30
 - LI4 30
 - LI5 30
 - LI6 30
 - logic input power supply 30
 - power supply for potentiometer 29
 - R1A 29
 - R1B 29
 - R1C 29
 - R2A 29
 - R2C 29
 - power 26–28
 - ground 27
 - L1 27
 - L2 27
 - L3 27
 - PB 27
 - PC 27
 - PO 27
 - T1 27
 - T2 27
 - T3 27
 - thermal
 - protection 38
 - resistance 20
 - sensor 38
 - torque
 - available for continuous duty 37
 - available for overspeed 37
 - braking 10
 - transformers 23
 - transient current. See current
 - Type 1. See protection
 - Type 12. See enclosure
- U**
- UL 11
 - undervoltage 10
- V**
- ventilation 18, 21, 38
 - in enclosure 21
 - vibration 10
 - voltage
 - bus capacitor 22
 - input 10, 12–13
 - line voltage
 - compatibility with supply voltage 9
 - output 10
 - range of drive 8

W

- weights 15
- wiring 22–35
 - branch circuit connections 23
 - diagram 31
 - general practices 22
 - minimum inductance 24
 - output 24
 - power 22
 - routing cable 22
 - separation of control and power 22
 - separation of non-metallic and metallic 23
 - terminal access 26
- wiring diagram
 - drive 31
 - sink logic 34
 - source logic 33

ENGLISH