

Altivar[®] 31

Adjustable Speed AC Drives

Catalog
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File 8800



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Altivar 31 Adjustable Speed AC Drives

PRODUCT OVERVIEW

The Altivar 31 (ATV31) adjustable speed AC drive controller incorporates the latest sensorless flux vector technology into a compact, easy-to-use design for three-phase asynchronous squirrel-cage motors. This versatile drive controller offers increased performance while maintaining cost-effectiveness. The ATV31 drive provides advanced speed control capabilities for motors from 0.25–20 hp (0.18 to 15 kW). 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

Industrial users and OEMs who specialize in material handling, pump, fan, packing, packaging and general purpose motor control applications will find the features and functions of the ATV31 drive controller well suited for their use.

Key Benefits

- Saves valuable panel space with compact design and side-by-side mounting capability up to 50 °C (122 °F).
- Designed as a robust and reliable fourth-generation drive
- Meets international standards
- Integrates Modbus® and CANopen protocols as standard into the drive controller, providing an economical solution for networking mini-drives into an industrial network.
- Offers a choice of two integrated interfaces:
 - ATV31••••• with display and menu navigation keys
 - ATV31•••••A with display, menu navigation keys, and local control (Run/Stop keys and speed reference potentiometer).
- Supplied with a heat sink for normal environments and ventilated enclosures

Functions

The ATV31 drive controller has six logic inputs, three analog inputs, one logic/analog output, and two relay outputs. The main functions integrated into the drive controller are as follows:

- Motor and drive protection
- Linear, S, U, and customized acceleration and deceleration ramps
- +/- Speed
- 16 preset speeds
- PI references and regulator
- Two-wire or three-wire control
- Brake sequence
- Automatic catch-on-the-fly with speed detection and automatic restart
- Fault configuration
- Stop type configuration
- Configuration saved in the drive controller
- Assignment of several functions to one logic input

Altivar 31 Adjustable Speed AC Drives

Field Installed Kits

Options and Accessories

The following options and accessories are available for the ATV31 drive controller:

- Braking resistors
- EMC (RFI) input filters
- DIN rail mounting plates
- UL Type 1 conduit entrance kit
- Adapter plate for replacing an Altivar 28 (ATV28) drive controller
- Various user interface and communication options

FIELD INSTALLED KITS

Conduit Entrance Kits



This option is a conduit box that allows three or more conduit entries. It attaches to the bottom of the drive controller. With the addition of this kit and without removal of the protective vent cover on the top of the drive, the degree of protection is UL Type 1.

ATV28 Replacement Kits



These kits contain brackets to adapt the spacing of the ATV31 mounting holes to that of the ATV28 drive controller. This allows the ATV31 drive to use the panel holes and mounting hardware already in place for the ATV28 controller.

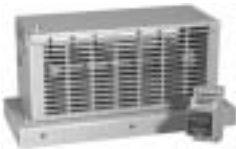
EMC (RFI) Input Filter

The EMC input filter allows the drive to comply with European (CE) conducted emissions standard EN55022 Class B. An EN55011 Class A filter is built into the ATV31 drive controller (ATV31••••N4, ATV31••••M2 only).

DIN Rail Kit

This kit allows frame size 1–6 ATV31 drive controllers to be DIN rail mounted.

Dynamic Braking Resistor Kits



Dynamic braking resistors packaged in UL Type 1 enclosures are available for applications requiring fast cycle times. The kits mount separately.

Remote Keypad Display Mounting Kit

This kit can be used to mount a keypad display remotely, such as on the door of a wall-mounted or floor-standing enclosure. The remote keypad display offers the same features as the drive local keypad display, with the addition of run, stop/reset, and forward/reverse buttons, as well as an access locking switch. Up to four complete configurations can be stored in the remote keypad display and transferred to other drives of the same rating. The kit has an IP65 rating and includes a remote mount keypad display, hardware, and a 3 m (10 ft) cable to save and download configurations (up to four configuration files can be saved).

Altivar 31 Adjustable Speed AC Drives Catalog Numbers



PowerSuite Software



Cable and connectors

PowerSuite™ Commissioning Software for PCs and HP® Jornada® Pocket PCs

This Microsoft® Windows®-based software offers the following functionality:

- Display, configure, and adjust the parameters
- Upload and download configurations
- Operate the drive controller
- View the fault history
- Create or modify a configuration in a stand-alone mode and transfer it to an ATV31 drive controller

New options have been added for the ATV31 drive, such as an oscilloscope function, parameter name customization, configuration locking using a password, and creation of a user menu.

Communication Options

The ATV31 drive connects directly to Modbus and CANopen networks by means of an RJ45 connector, which supports both protocols. The communication function provides access to the drive controller's configuration, adjustment, control, and monitoring functions. Various communication options are available such as cables, junction boxes, and terminators.

Ethernet/Modbus Bridge

The ATV31 drive can be connected to an Ethernet network via an Ethernet/Modbus bridge for control and monitoring. Ethernet communication is primarily intended for the following applications:

- Coordination with PLCs
- Local or centralized supervision
- Communication with production management software
- Communication with remote I/O
- Communication with industrial control products

Communication Gateways

The ATV31 drive can connect to other communication networks by means of the following gateways for control and monitoring:

- Fipio/Modbus
- DeviceNet/Modbus
- Profibus DP/Modbus

CATALOG NUMBERS

Use the table below as a guide to interpreting ATV31 drive controller catalog numbers.

ATV31HU15M2A is used as an example.

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



Ethernet/Modbus bridge



FIPIO/Modbus gateway



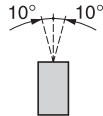
Profibus DP/Modbus gateway

Altivar 31 Adjustable Speed AC Drives

Technical Specifications

TECHNICAL SPECIFICATIONS

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.
Resistance to vibration	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 shock	15 g 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 31.
Altitude	Up to 3,300 ft (1,000 m) without derating; derate by 1% for each additional 330 ft (100 m)
Operating position Maximum permanent angle in relation to the normal vertical mounting position	

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
Speed range	1–50
Transient overtorque	170–200% nominal motor torque (typical value)
Max. transient current	Up to 150% of nominal drive controller current for 60 seconds
Braking torque	With braking resistor: 100% of nominal motor torque continuously and up to 150% for 60 s. Without braking resistor: <ul style="list-style-type: none"> 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 ² t calculation Protection against motor phase loss
Dielectric strength	Between ground and power terminals: ATV31••••M2 and M3X: 2040 Vdc ATV31••••N4: 2410 Vdc ATV31••••S6X: 2550 Vdc Between control and power terminals: 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

Altivar 31 Adjustable Speed AC Drives

Technical Specifications

Electrical Characteristics (Continued)

Communication Modbus	Modbus and CANopen are integrated into the drive controller and available via an RJ45 connector. RS-485 multidrop serial link characteristics: <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 local keypad display 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 • The following devices can be connected to the RS-485 link: <ul style="list-style-type: none"> — Remote keypad display — PowerSuite software workstation — PLC — Microprocessor card — PC
CANopen	To connect the ATV31 drive controller to a CANopen network, use the VW3CANTAP2 adapter. The following services are supported: <ul style="list-style-type: none"> • Implicit exchange of Process Data Object (PDO): <ul style="list-style-type: none"> — Two predefined PDOs conforming to DSP 402 Velocity Mode — Two 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"> — One receive SDO and one 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	UL Listed per UL 508C as incorporating electronic overload protection: UL File E164874 CCN NMMS. CSA Certified to CSA C22.2 No. 14: CSA File LR96921 Class 3211 06. CE Marked in accordance with the European low voltage (73/23/EEC and 93/68/EEC) and EMC (89/336/EEC) directives. Conforms to applicable NEMA ICS, IEC, NOM, C-TICK, and ISO 9001 standards.
Electromagnetic immunity Electromagnetic compatibility	ATV31 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. <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 page 17 for additional EMC filters)	All ratings: <ul style="list-style-type: none"> • IEC/EN 61800-3, environments 2 (industrial network) and 1 (public utility network) in limited distribution. ATV31H018M2 to CU40N4: <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 ATV31HU22M2 to HD15N4: <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 ATV31H018M3X to HD15M3X: With additional EMC filter: <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
Prospective short-circuit current ICC	ATV31***M2 <ul style="list-style-type: none"> • ≤ 1000 (ICC at connection point) for single phase power supply ATV31H018M3X...HU40M3X, ATV31*037N4...*U40N4, ATV31H075S6X...HU40S6X <ul style="list-style-type: none"> • ≤ 5000 (ICC at connection point) for three-phase power supply ATV31HU55M3X...HD15M3X, ATV31HU55N4...HD15N4, ATV31KU55N4...KD15N4, ATV31HU55S6X...HD15S6X <ul style="list-style-type: none"> • ≤ 2000 (ICC at connection point) for three-phase power supply
Maximum connection capacity and tightening torque of the power supply terminals, motor, braking module, and DC bus	H018M2, H037M2, H055M2, H075M2, H018M3X, H037M3X, H055M3X, H075M3X, HU11M3X, HU15M3X <ul style="list-style-type: none"> • 14 AWG (2.5 mm²) • 7.08 lb-in (0.8 N•m) HU11M2, HU15M2, HU22M2, HU22M3X, HU30M3X, HU40M3X, H037N4, H055N4, H075N4, HU11N4, HU15N4, HU22N4, HU30N4, HU40N4 H075S6X, HU15S6X, HU22S6X, HU40S6X <ul style="list-style-type: none"> • 10 AWG (5 mm²) • 10.62 lb-in (1.2 N•m) HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X <ul style="list-style-type: none"> • 6 AWG (16 mm²) • 19.47 lb-in (2.2 N•m) HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X <ul style="list-style-type: none"> • 3 AWG (25 mm²) • 35.40 lb-in (4 N•m)

Altivar 31 Adjustable Speed AC Drives

Technical Specifications

Electrical Characteristics (Continued)

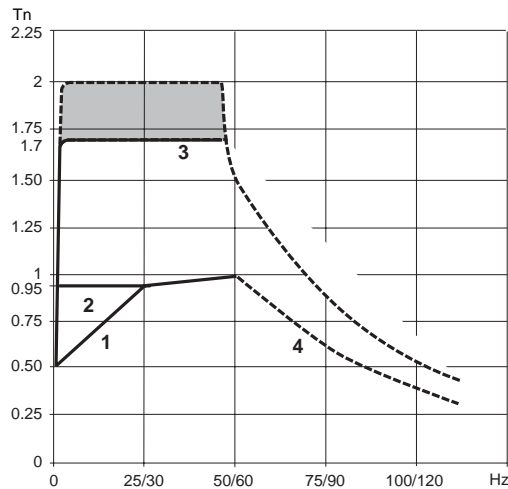
Electrical isolation	Electrical isolation between power and control (inputs, outputs, power supplies)
Internal supplies available	Short-circuit and overload protection: One +10 V (-0 / +8%) supply for setpoint potentiometer (2.2 to 10 k Ω), maximum current 10 mA One +24 V supply (min. 19 V, max. 30 V) for logic inputs, maximum current 100 mA
Configurable analog inputs	Three configurable analog inputs AI1, AI2, AI3. AI1—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: $\pm 4.3\%$ of max. value • Linearity: $\pm 0.2\%$ of max. value • Sampling time: 8 ms • Shielded cable length: 100 m (328 ft) max. AI2—Analog input 0 to +10 V (max. safe voltage is 30 V) 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: $\pm 4.3\%$ of max. value • Linearity: $\pm 0.2\%$ of max. value • Sampling time: 8 ms • Shielded cable length: 100 m (328 ft) max. AI3—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: $\pm 4.3\%$ of max. value • Linearity: $\pm 0.2\%$ of max. value • Sampling time: 8 ms
Analog output configurable for voltage, current, and logic output Analog voltage output AOV or Analog current output AOC or Logic voltage output on AOC <i>Either AOV or AOC can be assigned, but not both.</i>	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 bits • Precision: $\pm 1\%$ • Linearity: $\pm 0.2\%$ • Sampling time: 8 ms or AOC can be configured as a 24 V logic output with a min. load impedance of 1.2 k Ω
Configurable relay outputs 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. R2A, R2C N.O. contact of programmable relay R2	<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
Logic inputs LI LI1 LI2 LI3 LI4 LI5 LI6	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 LIx and CLI is < 5 V, State 1 if the voltage difference between LIx and CLI is > 11 V • Sampling time: 4 ms
Maximum I/O connection capacity and tightening torque	14 AWG (2.5 mm ²) 0.6 N•m (5.31 lb-in)
Acceleration and deceleration ramps	Ramp profiles: <ul style="list-style-type: none"> • linear, can be adjusted separately from 0.1 to 999.9 s • S, U, or customized Automatic adaptation of deceleration ramp time if braking capacities are exceeded, possible inhibition of this adaptation (use of braking resistor).
DC injection braking	<ul style="list-style-type: none"> • By a signal on a programmable logic input • Automatically as soon as the estimated output frequency drops to < 0.5 Hz, period adjustable from 0 to 30 s or continuous, current adjustable from 0 to 1.2 In
Signalling on the drive local keypad display	<ul style="list-style-type: none"> • One red LED indicating the presence of drive voltage • Four 7-segment displays • Two CANopen status LEDs (RUN and ERR).
Scan time for reference change	5 ms

Altivar 31 Adjustable Speed AC Drives

Technical Specifications

Torque characteristics (typical curves)

The torque characteristics curves below define the available continuous torque and transient overtorque for both force-cooled and self-cooled motors. The only difference is in the ability of the motor to provide a high continuous torque at less than half the nominal speed.



1. Self-cooled motor: continuous useful torque
2. Force-cooled motor: continuous useful torque
3. Transient overtorque 1.7 to 2 Tn
4. Torque in overspeed at constant power (1)

Special uses

- **Use with a motor with a different rating to that of the drive**

The drive can supply any motor having a power rating lower than that for which it is designed.

For motor ratings slightly higher than that of the drive, ensure that the load does not exceed the continuous output current of the drive.

- **Test on a low power motor or without a motor**

In a testing or maintenance environment, the drive can be run without switching to a motor with the same rating as the drive (particularly useful in the case of high power drives). Deactivation of motor phase loss detection is required.

- **Connecting motors in parallel**

The rating of the drive must be greater than or equal to the sum of the currents of the motors to be connected to the drive.

External thermal protection must be provided for each motor.

If connecting three or more motors in parallel, it is advisable to install an output filter between the drive and the motors.

1) The nominal frequency of the motor and the maximum output frequency are adjustable between 40 and 500 Hz.

Note: Check the mechanical overspeed characteristics of the selected motor with the manufacturer.

Altivar 31 Adjustable Speed AC Drives Selection

SELECTION

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

ATV31 Drive Catalog number 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
	kW	hp	at 208 V	at 240 V					
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



ATV31H037M2

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

ATV31 Drive Catalog number 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
	kW	hp	at 208 V	at 240 V					
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



ATV31HU40MX3

- ¹ Catalog number for a drive controller without a reference potentiometer or 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.
- 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 31 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.

Altivar 31 Adjustable Speed AC Drives Selection

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



ATV31HU75N4

ATV31 Drive Catalog number ²	Motor		Line Supply (Input)				Drive Controller (Output)		
	Power indicated on nameplate ³		Max. line current ⁴		Short-circuit current rating	Max. inrush current ⁵	Nominal rated output current I _n ^{3,6}	Max. transient current ^{3,6}	Total dissipated power at rated load
	kW	hp	at 400 V A	at 460 V A					
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

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

ATV31 Drive Catalog number ²	Motor		Line Supply (Input)				Drive Controller (Output)		
	Power indicated on nameplate ³		Max. line current ⁴		Short-circuit current rating	Max. inrush current ⁵	Nominal rated output current I _n ^{3,6}	Max. transient current ^{3,6}	Total dissipated power at rated load
	kW	hp	at 525 V A	at 600 V A					
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 or 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.

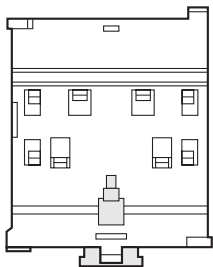
³ These power ratings and currents are for a maximum ambient temperature of 50 °C (122 °F) and a switching frequency of 4 kHz in continuous operation. The switching frequency is adjustable from 2 to 16 kHz. Above 4 kHz, the drive controller will reduce the switching frequency in the event of excessive 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 31 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.

Altivar 31 Adjustable Speed AC Drives Accessories



ACCESSORIES

DIN Rail Mounting Plate

Description	For Drives	Catalog Number	Weight kg (lb)
Plate for mounting on DIN rail, width 35 mm	ATV31H018M2, ATV31H037M2, ATV31H055M2, ATV31H075M2, ATV31H018M3X, ATV31H037M3X, ATV H055M3X, ATV31H075M3X	VW3A11851	0.200 (0.44)
	ATV31HU11M2, ATV31HU15M2, ATV31HU11M3X, ATV31HU15M3X, ATV31HU22M3X, ATV31H037N4, ATV31H055N4, ATV31H075N4, ATV31HU11N4, ATV31HU15N4, ATV31H075S6X, ATV31HU15S6X	VW3A31852	0.220 (0.49)

UL Type 1 Conduit Entrance Kit ⁽¹⁾

Description	For Drives	Catalog Number	Weight kg (lb)
Mechanical device attached to the bottom of the ATV31 drive	ATV31H018M2, ATV31H037M2, ATV31H055M2, ATV31H075M2	VW3A31812	0.400 (.88)
	ATV31H018M3X, ATV31H037M3X, ATV H055M3X, ATV31H075M3X	VW3A31811	0.400 (.88)
	ATV31HU11M3X, ATV31HU15M3X	VW3A31813	0.400 (.88)
	ATV31HU11M2, ATV31HU15M2, ATV31HU22M3X, ATV31H037N4, ATV31H055N4, ATV31H075N4, ATV31HU11N4, ATV31HU15N4, ATV31H075S6X, ATV31HU15S6X	VW3A31814	0.500 (1.10)
	ATV31HU22M2, ATV31HU30M3X, ATV31HU40M3X, ATV31HU22N4, ATV31HU30N4, ATV31HU40N4, ATV31HU22S6X, ATV31HU40S6X	VW3A31815	0.500 (1.10)
	ATV31HU55M3X, ATV31HU75M3X, ATV31HU55N4, ATV31HU75N4, ATV31HU55S6X, ATV31HU75S6X	VW3A31816	0.900 (1.98)
	ATV31HD11M3X, ATV31HD15M3X, ATV31HD11N4, ATV31HD15N4, ATV31HD11S6X, ATV31HD15S6X	VW3A31817	1.200 (2.65)

1) This device allows cables to be connected directly to the drive using conduits or cable glands.

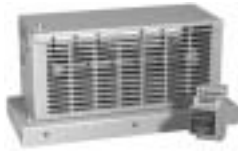
ATV28 Replacement Kit

Description	For Drives	Catalog Number	Weight kg (lb)
Mechanical adapters for using an ATV31 drive in place of an ATV28 drive of the same rating (using the ATV28 mounting holes)	ATV31H018M2, ATV31H037M2, ATV31H055M2, ATV31H075M2, ATV31H018M3X, ATV31H037M3X, ATV H055M3X, ATV31H075M3X	VW3A31821	—
	ATV31HU11M2, ATV31HU15M2, ATV31HU11M3X, ATV31HU15M3X, ATV31HU22M3X, ATV31H075S6X, ATV31HU15S6X	VW3A31822	—
	ATV31HU55N4, ATV31HU75N4, ATV31HU55M3X, ATV31HU75M3X, ATV31HU55S6X, ATV31HU75S6X	VW3A31823	—

Remote Keypad Display

Description	Catalog Number	Weight kg (lb)
For ATV31 drives of all ratings, assembly including: • keypad display, cable fitted with two connectors • seal and screws for IP 65 mounting on an enclosure door	VW3A31101	—

Altivar 31 Adjustable Speed AC Drives Dynamic Braking Resistor Kits



DYNAMIC BRAKING RESISTOR KITS

The dynamic braking resistor kit allows the ATV31 drive controllers to function in quadrants 2 and 4 of the four-quadrant speed/torque curve. In these quadrants of motor operation, the motor is essentially a generator through which energy is transferred from the motor load back to the drive controller. This results in elevated DC bus voltage to the drive controller, which may cause it to shut down to protect itself. Dynamic braking resistor kits are commonly used to dissipate the excess energy generated by the motor operating in this mode. The flow of current to the braking resistor is controlled by the dynamic braking transistor. Applications include machines with high inertia, overhauling loads, and machines with fast cycles.

The following table shows the minimum ohmic value of the resistor that can be used with the ATV31 drive controllers. Using lower than recommended values will cause excessive current flow, exceeding the rating of the dynamic braking transistor.

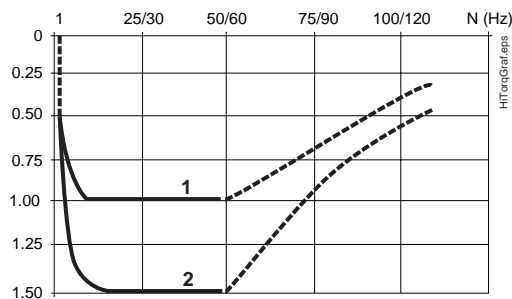
Minimum Dynamic Braking Resistance Values

240 V Single-Phase Drive Controller Catalog No.	PA / PB Minimum Resistance Ω	240 V Three-Phase Drive Controller Catalog No.	PA / PB Minimum Resistance Ω	460 V Three-Phase Drive Controller Catalog No.	PA / PB Minimum Resistance Ω	575 V Three-Phase Drive Controller Catalog No.	PA / PB Minimum Resistance Ω
ATV31H018M2	40	ATV31H018M3X	40	ATV31H037N4	80	ATV31H075S6X	96
ATV31H037M2		ATV31H037M3X		ATV31H055N4		ATV31HU15S6X	64
ATV31H055M2	40	ATV31H055M3X	40	ATV31H075N4	80	ATV31HU22S6X	
ATV31H075M2		ATV31H075M3X		ATV31HU11N4		ATV31HU75S6X	65
ATV31HU11M2	27	ATV31HU11M3X	27	ATV31HU15N4	54	ATV31HU40S6X	44
ATV31HU15M2		ATV31HU15M3X		ATV31HU22N4	54	ATV31HU55S6X	34
ATV31HU22M2	25	ATV31HU22M3X	25	ATV31HU30N4	55	ATV31HU75S6X	23
		ATV31HU30M3X	16	ATV31HU40N4	36	ATV31HU11S6X	24
		ATV31HU40M3X		ATV31HU55N4	29	ATV31HU15S6X	
		ATV31HU55M3X	8	ATV31HU75N4	19		
		ATV31HU75M3X		ATV31HD11N4	20		
		ATV31HU11M3X	5	ATV31HD15N4			
		ATV31HU15M3X					

The following charts show the motor braking torque capacity of an ATV31 drive controller with a braking resistor.

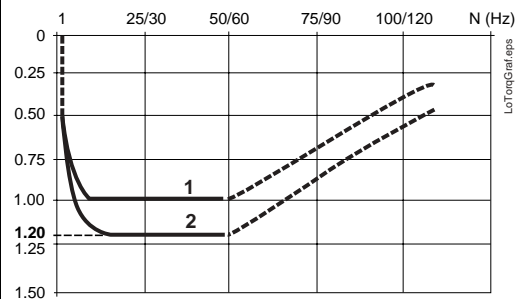
Braking Torque with Resistor

Constant-Torque Applications



1. Continuous braking torque (driving load) load factor = 100%.
2. Maximum transient braking torque (for 60 s).

Variable-Torque Applications



1. Continuous braking torque (driving load) load factor = 100%.
2. Maximum transient braking torque (for 60 s).

Altivar 31 Adjustable Speed AC Drives

Dynamic Braking Resistor Kits

Calculating Resistor Size

The standard dynamic braking (DB) resistor assemblies are suitable for a wide variety of drive system stopping applications. However, when the driven machinery may present an overhauling load or large inertia to the drive system, the suitability of the DB resistor assembly should be checked.

The suitability of a DB resistor assembly is determined by analyzing the mechanical system of the driven machinery. From the analysis, the following key parameters are computed:

- The peak braking power required during stopping or speed changes (P_i). The value of P_i determines the maximum allowable ohmic value of the DB resistor.
- The amount of power that must be absorbed (P_d) for a given time (t_d) by the DB resistors during stopping or speed changes of the drive. The value of P_d and t_d determine the required time-current characteristic of the DB resistor.
- The calculation of dynamic braking power requires V_{db} .
 - **575 V drives:** $V_{db} = 1020 \text{ V}$
 - **460 V drives:** $V_{db} = 850 \text{ V}$
 - **230 V drives:** $V_{db} = 375 \text{ V}$
- The average power that must be dissipated by the DB resistor during an entire cycle of the machine (P_a). The value of P_a determines the required continuous current rating of the DB resistor.

The following example illustrates the process.

Given:

The application consists of a 5 hp, 460 Vac, 1740 rpm motor (N_{base} = base speed) with a rotor inertia of 0.28 lb-ft². The motor is being controlled by an ATV31HU40N4 operating in the constant torque mode. The motor is driving a machine with an inertia 10 times that of the motor with no interposing gear box. The machine resistive (friction) torque is one-tenth of the rated motor torque at full speed. The requirement is to stop in 5 seconds from rated speed at a rate of 2 cycles/minute.

Mechanical System Parameters:

Rated motor torque: $T_n = (HP \times 5250)/N_{base} = (5 \times 5250)/1740 = 15.1 \text{ lb-ft}$

Machine cycle time: $t_c = (60 \text{ seconds})/(\text{two operations per minute}) = 30 \text{ seconds}$

Machine speed change during deceleration: $N_d = 1740 \text{ rpm} - 0 \text{ rpm} = 1740 \text{ rpm}$

Machine deceleration time: $t_d = 5 \text{ seconds}$

Mechanical system resistive (friction) torque: $T_r = (15.1 \text{ lb-ft})/10 = 1.51 \text{ lb-ft}$

Mechanical system overhauling torque: $T_o = 0.00 \text{ lb-ft}$

Mechanical system combined inertia: $J_c = 0.28 \text{ lb-ft}^2 + (10) \times 0.28 \text{ lb-ft}^2 = 3.08 \text{ lb-ft}^2$

Mechanical system inertial torque for a 5 second deceleration rate (as set by controller deceleration ramp):

$$T_j = J_c \times (N_d)/(308 \times (t_d)) = 3.08 \times 1740/(308 \times 5) = 3.48 \text{ lb-ft}$$

Required braking torque from motor: $T_b = T_j + T_o - T_r = 3.48 + 0.00 - 1.51 = 1.97 \text{ lb-ft}$

NOTE: The required braking torque must not exceed the motor's ability to produce torque. For inertial loads, including those depicted in the above examples, the required braking torque must not exceed the torque-producing ability of the dynamic braking unit with the recommended braking resistor (approximately 1.5 times the motor rated torque for constant torque applications).

For machines that can continuously overhaul the motor, the value of overhauling torque (T_o) minus the resistive torque (T_r) must not exceed the motor continuous torque rating at any speed.

Altivar 31 Adjustable Speed AC Drives Dynamic Braking Resistor Kits

DB resistor requirements:

Peak braking power required to develop braking torque (T_b) when decelerating from a given speed
 $P_i = T_b \times N_{base} / (7.04) = (1.97 \times 1740) / (7.04) = 487 \text{ W}$

The braking power that must be absorbed for a time (t_d) during stopping or speed changing operation: $P_d = 0.5 \times P_i = 0.5 \times 487 = 243 \text{ W}$ for a period of t_d seconds

The average braking power that must be dissipated during a machine cycle:
 $P_a = P_d \times t_d / t_c = 243 \times 5 / 30 = 40.5 \text{ W}$

Capability of VW3A66711 DB resistor assembly for ATV31HU40N4 controller:

Peak braking power that can be developed with the VW3A66711 DB resistor assembly with the controller configured for 460 Vac input line operation: $P_i = (V_{db})^2 / R_{db} = (850 \text{ V})^2 / 120 \Omega = 6020 \text{ W}$

The braking power that can be absorbed for t_d (based on the DB resistor hot state current-time characteristic curve shown below):

$$P_d = R_{db} \times [(Multiple\ of\ I_r\ at\ t_d) \times I_r]^2 = 120 \Omega \times (3.5 \times 1.0)^2 = 1470 \text{ W}$$

Since R_{db} limits the peak current that can be drawn from the drive controller DC bus, the value of $[(Multiple\ of\ I_r) \times I_r]$ must be limited to no greater than $(\sqrt{P_i / R_{db}})$.

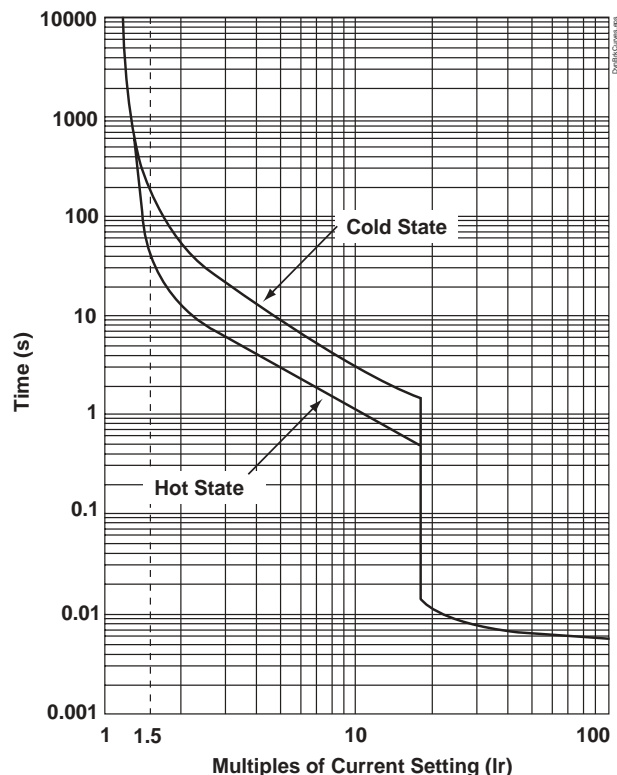
The average braking power that can be dissipated continuously:

$$P_a = R_{db} \times (I_r)^2 = 120 \Omega \times (1)^2 = 120 \text{ W}$$

For this example, the VW3A66711 DB resistor assembly will work as intended for the application.

Current/Time Characteristics for DB Resistor Assemblies

The figure below shows the allowable GV2 trip times as a function of current setting multiples with the dynamic braking resistor assembly located in a 40 °C (104 °F) ambient temperature environment. See "Calculating Resistor Size" on page 14 for an example of how to calculate resistor size.



Altivar 31 Adjustable Speed AC Drives

Dynamic Braking Resistor Kits

The kits in the following table use the thermal protection of a GV2 manual starter and have a Type 1 rating per UL 50. The insulation system is suitable for use in a Pollution Degree 3 environment (refer to NEMA ICS-1 Annex A). The package is UL/CSA marked.

Dynamic Braking Resistor Kits Technical Specifications

Dynamic Braking Kit for:	Ohmic Value (Rdb) Ω	Continuous Current Rating of Assembly (Ir) A	Average Power (W)	Catalog Number
ATV31H018M2-037M2 ATV31H018M3X-037M3X ATV31H037N4-U40N4	120	1.00	120	VW3A66711
ATV31H055M2-U22M2 ATV31H055M3X-U22M3X ATV31HU55N4-U75N4	56	1.45	118	VW3A66712
ATV31HU30M3X-U40M3X ATV31HD11N4-D15N4	28	2.70	204	VW3A66713
ATV31HU55M3X-U75M3X	14	3.80	202	VW3A66714
ATV31HD11M3X-D15M3X	10	10.00	1000	VW3A66715

Altivar 31 Adjustable Speed AC Drives

Additional EMC Input Filters

ADDITIONAL EMC INPUT FILTERS

Function

The ATV31 drive has built-in radio interference input filters to meet EMC “product” standards for adjustable speed drives, IEC/EN 61800-3, and to comply with the European EMC (electromagnetic compatibility) directive.

The additional filters enable the drives to meet more stringent requirements: they are designed to reduce conducted emissions on the line supply below the limits of standards EN 55011 class A (1) or EN 55022 class B.

These additional filters are installed underneath ATV31H drives. They act as supports for the drives and are fixed to them via tapped holes.

Considerations for isolated or impedance grounded neutral systems

The standard IEC 61800-3, annex D2.1, indicates that on isolated or impedance grounded neutral systems, the filters can affect the operation of insulation monitors.

The efficiency of additional filters on this type of system also depends on the nature of the impedance between neutral and earth and is therefore unpredictable.

If installing a machine on an isolated or impedance grounded neutral system, one solution is to insert an isolation transformer and connect locally to the machine on a neutral connection or neutral-to-earth system.

Characteristics

Conformity to standards			EN 133200
Degree of protection			IP 21 and IP 41 on upper part
Maximum relative humidity			93% without condensation or dripping water conforming to IEC 68-2-3
Ambient air temperature around the device	Operation	°C (°F)	- 10 to +60 (14 to +140)
	Storage	°C (°F)	- 25 to +70 (-13 to +158)
Maximum operating altitude	Without derating	m (ft)	1000 (3281) [above this, derate the current by 1% per additional 100 m (328 ft)]
Vibration resistance	Conforming to IEC 60068-2-6		1.5 mm peak to peak from 3 to 13 Hz 1 gn peak from 13 to 150 Hz
Shock resistance	Conforming to IEC 60068-2-27		15 gn for 11 ms
Max. nominal voltage	50/60 Hz single phase	V	240 +10%
	50/60 Hz three-phase	V	240 +10% 500 +10% 600 +10%

Altivar 31 Adjustable Speed AC Drives

Additional EMC Input Filters

EMC Filters

For Drives Catalog number	Maximum length of shielded cable		Filter			Catalog number	Weight kg (lb)
	EN 55011 Class A (1)	EN 55022 Class B (2)	In (2)	II (3)	Loss (4)		
	m (ft)	m (ft)	A	mA	W		
Single phase supply voltage: 200/240 V 50/60 Hz							
ATV31H/C/K018M2	50 (164)	20 (66)	9	100	—	VW3A31401	—
ATV31H/C/K037M2							
ATV31H/C/K055M2							
ATV31H/C/K075M2							
ATV31H/C/KU11M2	50 (164)	20 (66)	16	150	—	VW3A31403	—
ATV31H/C/KU15M2							
ATV31H/C/KU22M2	50 (164)	20 (66)	22	80		VW3A31405	—
Three-phase supply voltage: 200/240 V 50/60 Hz							
ATV31H018M3X	5 (16)	—	7	7	—	VW3A31402	—
ATV31H037M3X							
ATV31H055M3X							
ATV31H075M3X							
ATV31HU11M3X	5 (16)	—	15	15	—	VW3A31404	—
ATV31HU15M3X							
ATV31HU22M3X							
ATV31HU30M3X	5 (16)	—	25	35	—	VW3A31406	—
ATV31HU40M3X							
ATV31HU55M3X	5 (16)	—	47	45	—	VW3A31407	—
ATV31HU75M3X							
ATV31HD11M3X	5 (16)	—	83	15	—	VW3A31408	—
ATV31HD15M3X							
Three-phase supply voltage: 380/500 V 50/60 Hz							
ATV31H/C/K037N4	50 (164)	20 (66)	15	15	—	VW3A31404	—
ATV31H/C/K055N4							
ATV31H/C/K075N4							
ATV31H/C/KU11N4							
ATV31H/C/KU15N4							
ATV31H/C/KU22N4	50 (164)	20 (66)	25	35	—	VW3A31406	—
ATV31H/C/KU30N4							
ATV31H/C/KU40N4							
ATV31H/KU55N4	50 (164)	20 (66)	47	45	—	VW3A31407	—
ATV31H/KU75N4							
ATV31H/KD11N4	50 (164)	20 (66)	49	45	—	VW3A31409	—
ATV31H/KD15N4							

1) For a switching frequency of 2 to 16 kHz. These limits are given as examples only, as they vary depending on the interference capacity of the motors and the cables used. If motors are connected in parallel, it is the total length that should be considered.

2) In: Nominal filter current.

3) Maximum earth leakage current at 50 Hz.

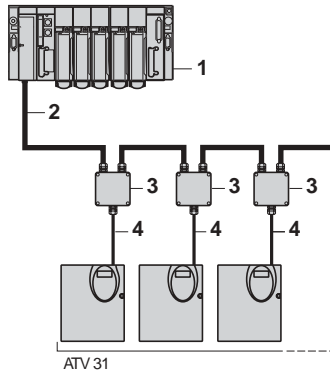
4) By heat dissipation.

COMMUNICATION OPTIONS

Modbus and CANopen communication

The ATV31 drive can be connected directly to Modbus and CANopen buses by means of an RJ45 connector, which supports both protocols. The communication function provides access to the drive's configuration, adjustment, control, and monitoring functions.

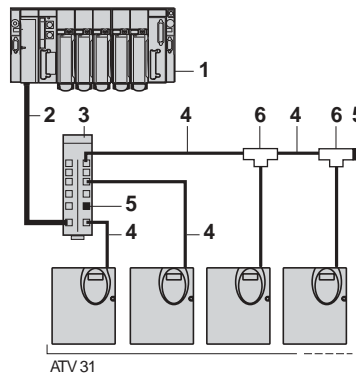
CANopen



- 1 PLC (1)
- 2 CANopen trunk cable
- 3 CANopen tap junction **VW3CANTAP2**
- 4 CANopen drop cable **VW3CANCARR****

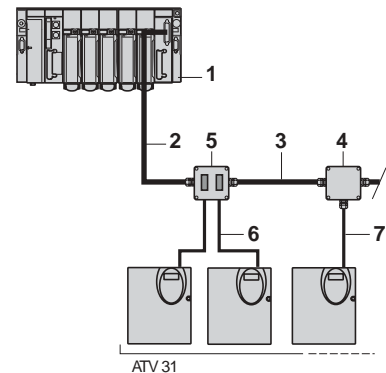
Modbus

Connections via splitter blocks and RJ45 connectors



- 1 PLC (1)
- 2 Modbus cable depending on the type of controller or PLC
- 3 Modbus splitter block **LU9 GC3**
- 4 Modbus drop cables **VW3A8306 R****
- 5 Line terminators **VW3A8306RC**
- 6 Modbus T-junction boxes **VW3A8306TF**** (with cable)

Connections via junction boxes



- 1 PLC (1)
- 2 Modbus cable depending on the type of controller or PLC
- 3 Modbus cables **TSXCSA-00**
- 4 T-junction box **TSXSCA 50**
- 5 Subscriber socket **TSXSCA 62**
- 6 Modbus drop cables **VW3A8306**
- 7 Modbus drop cables **VW3A8306D30**

Connections via screw terminals

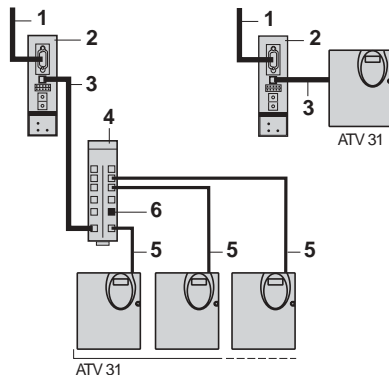
Use a Modbus drop cable **VW3A8306 D30** and line terminators **VW3A8306 DRC**.

Other communication devices

The ATV31 drive can also be connected to the following networks via a module (bridge or gateway):

- Ethernet
- Fipio
- Profibus DP
- DeviceNet

The communication function provides access to the drive's configuration, adjustment, control, and monitoring functions.



- 1 To network
- 2 Communication modules
- 3 Cables **VW3A8306R****, **VW3P07306R10** or **VW3A8306D30**, depending on the type of module.
- 4 Modbus splitter block **LU9 GC3**
- 5 Modbus drop cables **VW3A8306 R****
- 6 Line terminator **VW3A8306RC**

1) Consult the Telemecanique PLC catalogs.

Altivar 31 Adjustable Speed AC Drives Communication Options

Modbus and CANopen communication

Connection Accessories

Description		Catalog Number	Weight kg (lb)	
CANopen bus junction box		VW3CANTAP2	–	
Modbus junction box 3 screw terminals, RC line terminator To be connected using cable VW3A8306D30		TSXSCA50	0.520 (1.15)	
Modbus subscriber socket Two female 15-way SUB-D connectors and two screw terminals, RC line terminator To be connected using cable VW3A8306		TSXSCA62	0.570 1.26)	
Modbus splitter block Ten RJ45 connectors and one screw terminal		LU9GC3	0.500 (1.10)	
Modbus line terminators (1)	For RJ45 connector	R = 120 Ω C = 1 nF	VW3A8306RC	0.200 (0.44)
		R = 150 Ω	VW3A8306R	0.200 (0.44)
	For screw terminals	R = 120 Ω C = 1 nF	VW3A8306DRC	0.200 (0.44)
		R = 150 Ω	VW3A8306DR	0.200 (0.44)
Modbus T-junction boxes		With integrated cable (0.3 m / 1.0 ft)	VW3A8306TF03	–
		With integrated cable (1.0 m / 3.3 ft)	VW3A8306TF10	–

Connecting Cables

Description	Length m (ft)	Connectors	Catalog Number	Weight kg (lb)
Cables for CANopen bus	0.3 (1.0)	2 RJ45 connectors	VW3CANCARR03	0.050 (0.11)
	10.0 (32.8)	2 RJ45 connectors	VW3CANCARR1	0.500 (1.10)
Cables for Modbus bus	3.0 (9.8)	1 RJ45 connector and one end stripped	VW3A8306D30	0.150 (0.33)
	3.0 (9.8)	1 RJ45 connector and 1 male 15-way SUB-D connector for TSXSACA62	VW3A8306	0.150 (0.33)
	0.3 (1.0)	2 RJ45 connectors	VW3A8306R03	0.050 (0.11)
	1.0 (3.3)	2 RJ45 connectors	VW3A8306R10	0.050 (0.11)
	3.0 (9.8)	2 RJ45 connectors	VW3A8306R30	0.150 (0.33)
	1.0 (3.3)	2 RJ45 connectors	VW3P07306R10	0.050 (0.11)
Cables for Profibus gateway LA9P307	1.0 (3.3)	2 RJ45 connectors	VW3P07306R10	0.050 (0.11)
RS-485 double shielded twisted pair cables	100 (328)	Supplied without connector	TSXCSA100	–
	200 (656)	Supplied without connector	TSXCSA200	–
	500 (1640)	Supplied without connector	TSXCSA500	–

Other communication devices

Description	Connecting Cables	Catalog Number	Weight kg (lb)
Ethernet/Modbus bridge (2) with 1 x Ethernet 10baseT port (RJ45)	VW3A8306D30	174CEV30020	0.500 (1.10)
Fipio/Modbus gateway	VW3A8306R**	LUF1	0.240 (0.53)
DeviceNet/Modbus gateway	VW3A8306R**	LUF9	0.240 (0.53)
Profibus DP/Modbus gateway Parameters set using standard Profibus DP configurator	VW3P07306R10	LA9P307	0.240 (0.53)
Profibus DP/Modbus gateway Parameters set using ABC Configurator software	VW3A8306R**	LUF7	0.240 (0.53)

1) Sold in lots of two.

2) Consult the catalog, *Premium Automation Platform*.



TSX SCA 50



TSX SCA 62



174 CEV 300 20



LUF1



LA9P307

Altivar 31 Adjustable Speed AC Drives PowerSuite Software Workshop

POWERSUITE SOFTWARE WORKSHOP

Description

The PowerSuite software workshop, for PC or Pocket PC, is designed for setting up Telemecanique® starters and adjustable speed drives.

This single program is an easy-to-use interface for configuring Altistart and TeSys® model U starters as well as all Altivar drives in a Microsoft Windows® environment, in five languages (English, Spanish, French, German, and Italian). The PowerSuite software workshop also has on-line contextual help.

Function

The PowerSuite software workshop can be used for preparing, programming, setting up, and maintaining Telemecanique starters and adjustable speed drives.

The PowerSuite software workshop can be used:

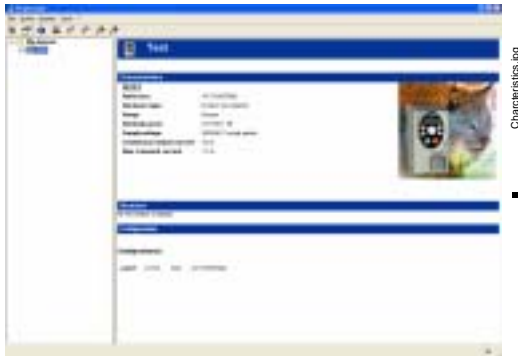
- stand alone to prepare and store starter or drive configuration files
- connected to the starter or drive to:
 - configure the initial setup
 - adjust the parameters
 - monitor and control operation (except for Altivar 11 drives)
 - transfer and compare configuration files between PowerSuite and the controller

The configuration files generated by the PowerSuite software workshop can be:

- saved to hard disk or removable media such as CD-ROM or floppy disk
- printed
- exported to office automation software applications
- protected using a password
- exchanged between a PC and a Pocket PC using standard synchronization software (PowerSuite PC and Pocket PC configuration files have the same format)

The software associated with the ATV31 drive has been enhanced to include:

- oscilloscope function
- parameter name customization
- creation of a user menu
- creation of monitoring screens
- searching and sorting on different parameters.



PowerSuite with PC screen
Characteristics



PowerSuite with PC screen
Monitoring screen

Altivar 31 Adjustable Speed AC Drives

PowerSuite Software Workshop

Connections

- The PowerSuite software workshop can be connected directly to the terminal port on the starter or adjustable speed drives, via the serial port on the PC or Pocket PC. Two types of connection are possible:
 - with a single starter or drive (point-to-point connection)
 - with a group of starters or drives (multi-point connection).
- The PowerSuite software workshop for PC can be connected to an Ethernet network. The starters and drives can then be accessed using one of the following:
 - the Ethernet-Modbus bridge, catalog number 174CEV30020 (see page 20)
 - the communication option card, catalog number VW3A58310 for Altivar 58 (ATV58) drives only

Hardware and software environment

- The PowerSuite for PC software workshop can operate in the following PC environments and configurations:
 - Microsoft Windows® 95 OSR2, Microsoft Windows® 98 SE, Microsoft Windows® NT4 X SP5, Microsoft Windows® Me, Microsoft Windows® 2000, Microsoft Windows® XP,
 - Pentium III, 800 MHz, hard disk with 300 Mb available, 128 Mb RAM,
 - SVGA or higher definition monitor
- The PowerSuite for Pocket PC software workshop, version V2.0.0, is compatible with Pocket PCs equipped with Windows for Pocket PC 2002 or 2003 operating system and an ARM or XSCALE processor. Performance tests for version V2.00 of the PowerSuite software workshop have been carried out on the following Pocket PCs:
 - Hewlett Packard® IPAQ 2210
 - Compaq® IPAQ series 3800 and 3900
 - Hewlett Packard Jornada series 560

Altivar 31 Adjustable Speed AC Drives

PowerSuite Software Workshop

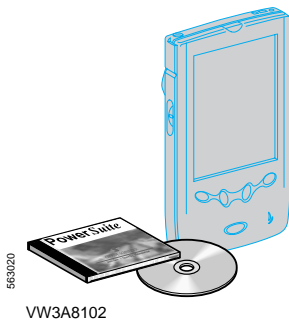
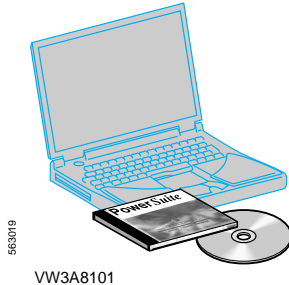
Catalog Numbers

PowerSuite software workshop for PC or Pocket PC⁽¹⁾

Description	Contents	Catalog Number	Weight kg (lb)
PowerSuite for PC kit	<ul style="list-style-type: none"> 1 PowerSuite CD-ROM 1 PC connection kit 	VW3A8101	0.400 (0.88)
PowerSuite for Pocket PC kit⁽²⁾	<ul style="list-style-type: none"> 1 PowerSuite CD-ROM 1 Pocket PC connection kit 	VW3A8102	0.400 (0.88)
PowerSuite CD-ROM	<ul style="list-style-type: none"> Software for PC and Pocket PC in English, Spanish, French, German, and Italian Technical documentation and ABC configurator program 	VW3A8104	0.100 (0.22)
PowerSuite upgrade CD	<ul style="list-style-type: none"> Software for PC and Pocket PC in English, Spanish, French, German, and Italian Technical documentation and ABC configurator program 	VW3A8105	0.100 (0.22)
PC connection kit	<ul style="list-style-type: none"> Two 3 m (9.8 ft) connection cables with two RJ45 connectors One RJ45/9-way SUB-D adapter for connecting ATV58 drives One converter marked RS-232/RS-485 PC with one 9-way female SUB-D connector and one RJ45 connector One converter for ATV11 drives with one 4-way male connector and one RJ45 connector 	VW3A8106	0.350 (0.77)
Pocket PC connection kit⁽²⁾	<ul style="list-style-type: none"> Two 0.6 m (2.0 ft) connection cables with two RJ45 connectors One RJ45/9-way SUB-D adapter for connecting ATV58 drives One converter marked RS-232/RS-485 PPC with one 9-way male SUB-D connector and one RJ45 connector One converter for ATV11 drives with one 4-way male connector and one RJ45 connector 	VW3A8111	0.300 (0.66)

1) For information on the latest available version, consult your local sales office.

2) These kits connect to the synchronization cable, which must be ordered separately from your Pocket PC supplier.



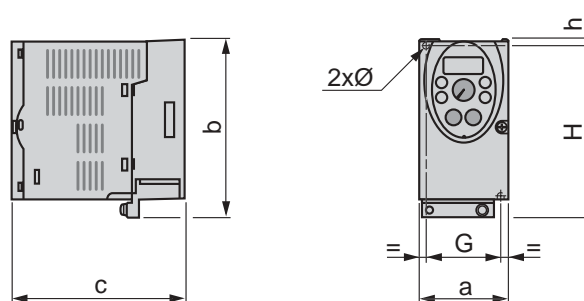
Compatibility

Compatibility of the PowerSuite Software Workshop with Starters and Adjustable Speed Drives		Starter-Controller	Soft Starter	Adjustable Speed Drives			
		TeSys model U	ATS48	ATV11	ATV28	ATV31	ATV58 TRX ATV58 Type FVC
PowerSuite software workshop with serial link for PC							
Kit and CD-ROM	VW3A8101 VW3A8104 VW3A8105	≥ V 1.40	≥ V 1.30	≥ V 1.40	≥ V 1.0	≥ V 2.0.0	≥ V 1.0
PowerSuite software workshop with Ethernet link for PC							
Kit and CD-ROM	VW3A8101 VW3A8104 VW3A8105	Not compatible	≥ V 1.50 and Ethernet-Modbus bridge	Not compatible	≥ V 1.50 and Ethernet-Modbus bridge	≥ V 2.0.0 and Ethernet-Modbus bridge	≥ V 1.50 and Ethernet V2 communication card or bridge
PowerSuite software workshop for Pocket PC							
Kit and CD-ROM	VW3A8102 VW3A8104 VW3A8105	≥ V 1.50	≥ V 1.30	≥ V 1.40	≥ V 1.20	≥ V 2.0.0	≥ V 1.20
Compatibility of the PowerSuite software workshops with Pocket PCs							
Operating system	Performance tests carried out on models	PowerSuite software version					
		V 1.30	V 1.40	V 1.50	V 2.0.0		
Windows for Pocket PC 2003	Hewlett Packard IPAQ 2210	no	no	no	yes		
Windows for Pocket PC 2002	Compaq IPAQ series 3800, 3900	no	no	yes	yes		
	Hewlett Packard Jornada series 560	no	yes	yes	yes		
Windows for Pocket PC 2000	Hewlett Packard Jornada series 525	yes	yes	yes	no		
Windows CE	Hewlett Packard Jornada 420	yes	no	no	no		

Altivar 31 Adjustable Speed AC Drives

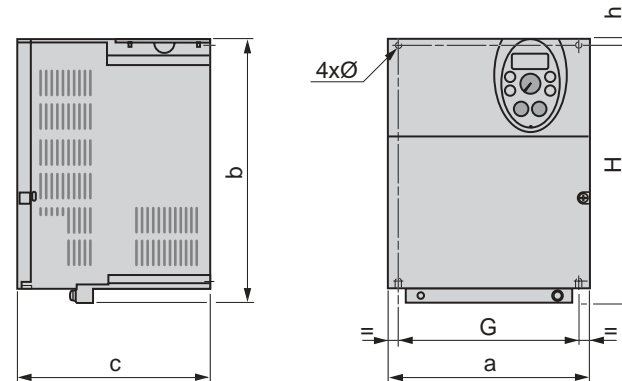
Dimensions and Weights

DIMENSIONS AND WEIGHTS



Frame Sizes 1–6

ATV31.....	Frame Size	a mm (in.)	b mm (in.)	c mm (in.)	G mm (in.)	h mm (in.)	H 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)



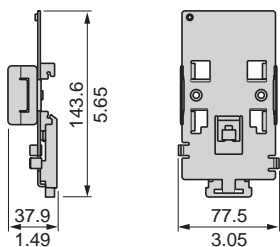
Frame Sizes 7–9

ATV31.....	Frame Size	a mm (in.)	b mm (in.)	c mm (in.)	G mm (in.)	h mm (in.)	H 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)

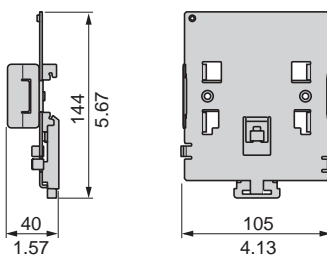
Altivar 31 Adjustable Speed AC Drives Dimensions and Weights

DIN Rail Mounting Plates

VW3A11851



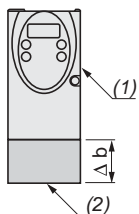
VW3A31852



Dimensions: $\frac{\text{mm}}{\text{in.}}$

UL Type 1 Conduit Entrance Kit

VW3A31811 to VW3A31817



Note: The width of the conduit entrance kit is the same as the drive.

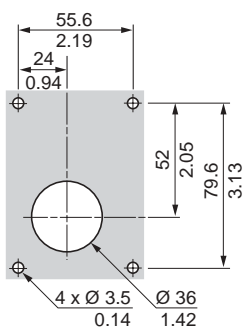
- 1) ATV31 drive
- 2) Conduit entrance kit VW3A3181•

VW3•••••	Δb , mm (in.)
A31812	77 (3.0)
A31813 and A31814	107 (4.2)
A31815	138 (5.4)
A31816	179 (7.0)
A31817	244 (9.6)

Remote Keypad Display Mounting Kit

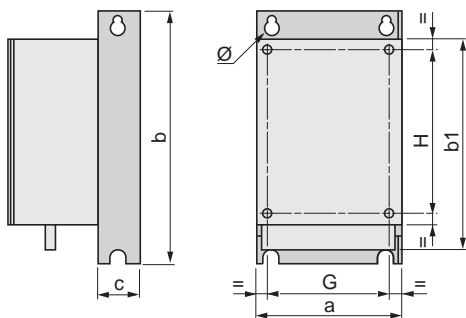
VW3A31101

Mounting footprint

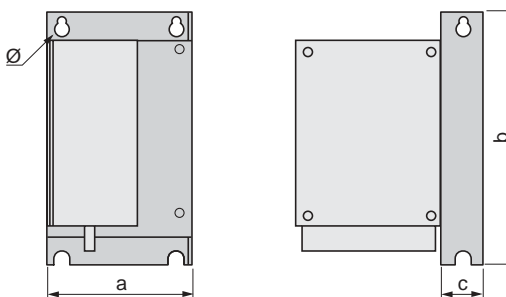


Additional EMC Input Filters

Mounting the filter underneath the drive



Mounting the filter adjacent to the drive



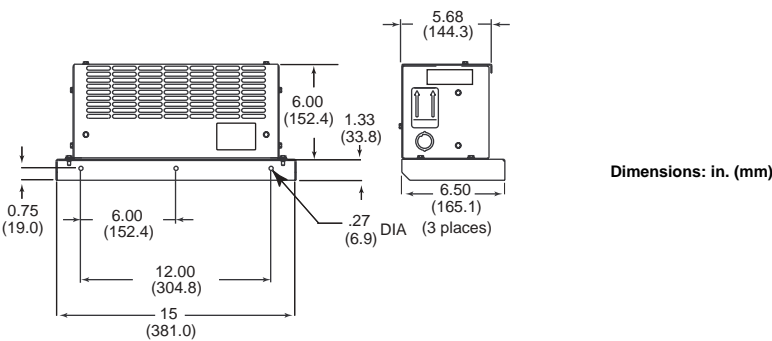
VW3•••••	a	b	b1	c	G	H	\emptyset
A31401, A31402	72 (2.83)	185 (7.28)	—	50 (1.97)	60 (2.36)	121.5 (4.78)	2 x M4
A31403, A31404	105 (4.13)	185 (7.28)	—	60 (2.36)	93 (3.66)	121.5 (4.78)	2 x M4
A31405, A31406	140 (5.51)	225 (8.86)	—	60 (2.36)	126 (4.96)	157 (6.18)	4 x M4
A31407	180 (7.09)	275 (10.83)	—	60 (2.36)	160 (6.30)	210 (8.27)	4 x M4
A31408, A31409	245 (9.65)	365 (14.37)	—	60 (2.36)	295 (11.61)	225 (8.86)	4 x M5

Dimensions: mm (in.)

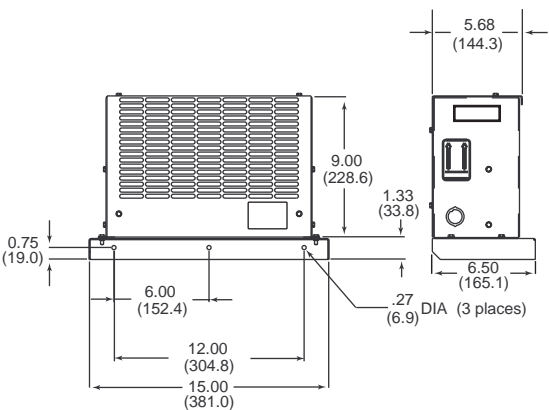
Altivar 31 Adjustable Speed AC Drives
Dimensions and Weights

Dynamic Braking Resistor Kits

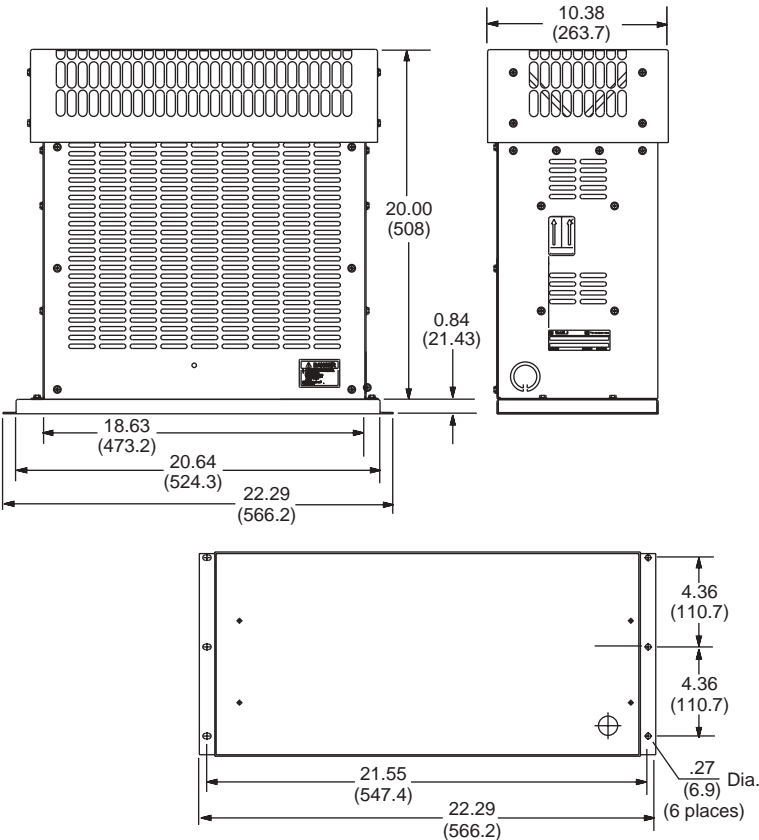
Wall mounting dimensions:
VW3A66711 and VW3A66712



Wall mounting dimensions:
VW3A66713 and VW3A66714



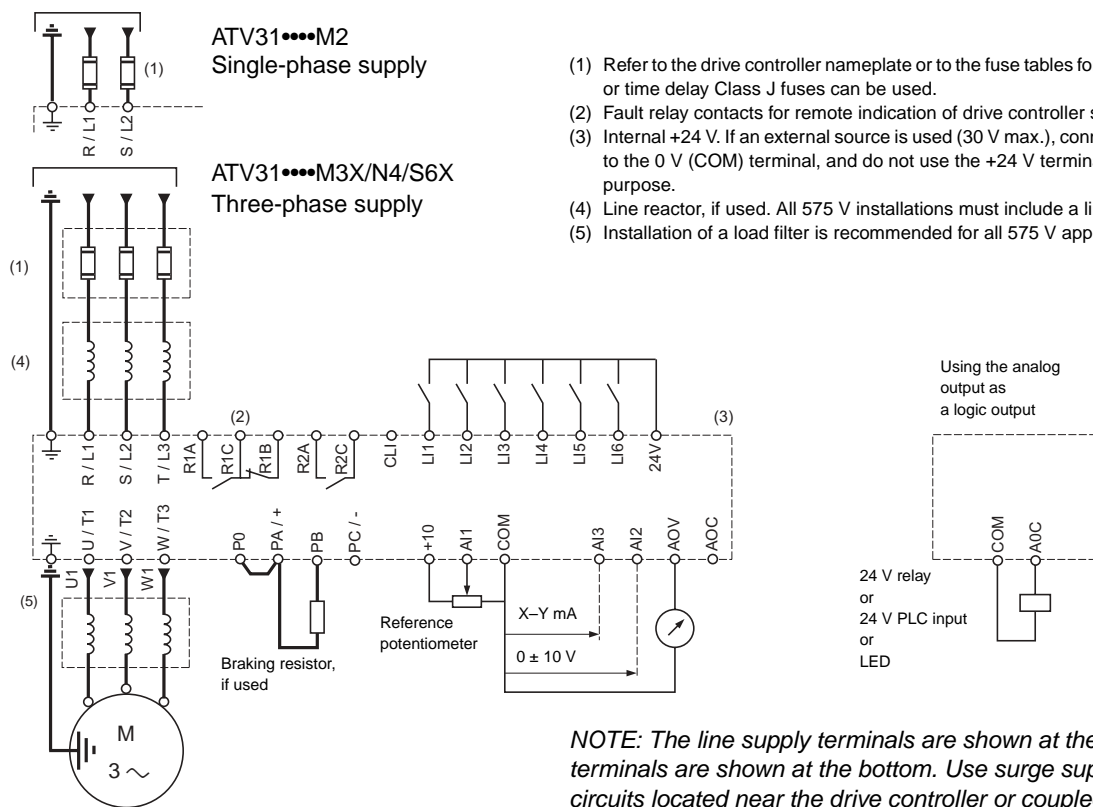
Mounting dimensions:
VW3A66715



Altivar 31 Adjustable Speed AC Drives Wiring

WIRING

Wiring Diagram



Recommended Fuses

208/230 V Drives

Motor		Drive	600 V Fuses	
kW	hp	ATV31H.....	Class CC	Class J (1)
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) Fast acting or time delay.

460 V Drive Controllers

Motor		Drive	600 V Fuses	
kW	hp	ATV31H*****	Class CC	Class J (1)
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

575 V Drive Controllers

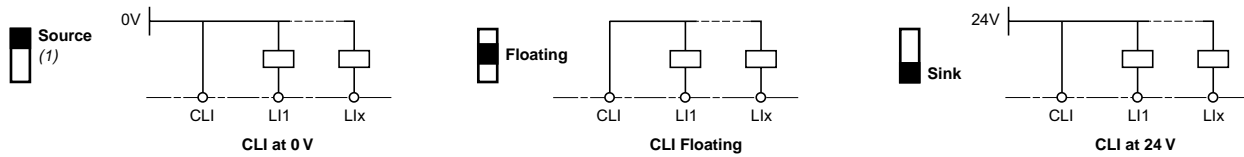
Motor		Drive	600 V Fuses	
kW	hp	ATV31H.....	Class CC	Class J (1)
0.75	1	075S6X	6 A	6 A
1.5	2	U15S6X	6 A	6 A
2.2	3	U22S6X	10 A	10 A
4	5	U40S6X	15 A	15 A
5.5	7.5	U55S6X	20 A	20 A
7.5	10	U75S6X	25 A	25 A
11	15	D11S6X	—	35 A
15	20	D15S6X	—	45 A

Altivar 31 Adjustable Speed AC Drives Wiring

Logic Input Switch

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

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

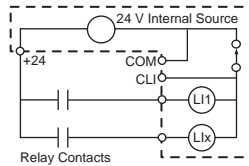


ATV31 Logic Input Switch.eps

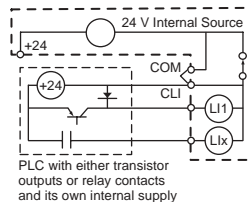
Examples of recommended circuit diagrams

Logic input switches (the heavy dashed line represents the drive controller)

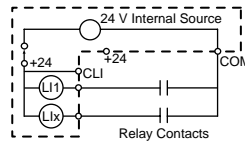
Source position (1)
Internal supply



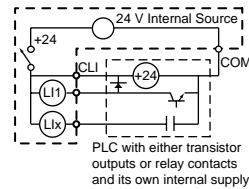
Source or Floating position
External supply or PLC (2)



Sink position
Internal supply

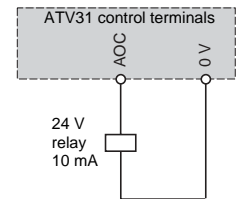


Floating position
External supply or PLC

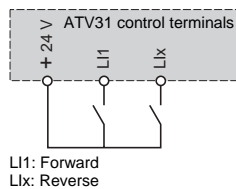


AOC output

Wired as logic output

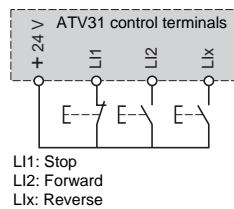


Two-wire control



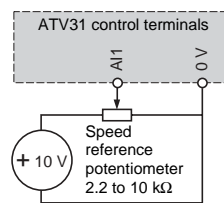
- 1) Factory setting for controllers other than ATV31.....A
- 2) Jumper installed from COM to CLI.

Three-wire control

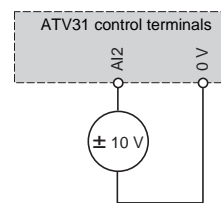


Analog voltage inputs

± 10 V external

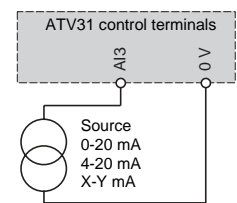


± 10 V external



Analog current input

0-20 mA, 4-20 mA, X-Y mA

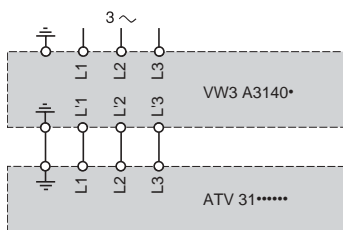


Electromagnetic Compatibility

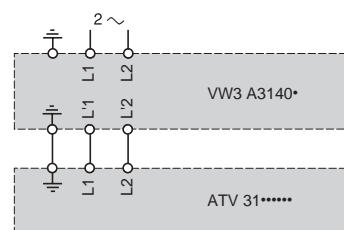
Schemes

EMC (RFI) input filters VW3A3140•

Three-phase power supply



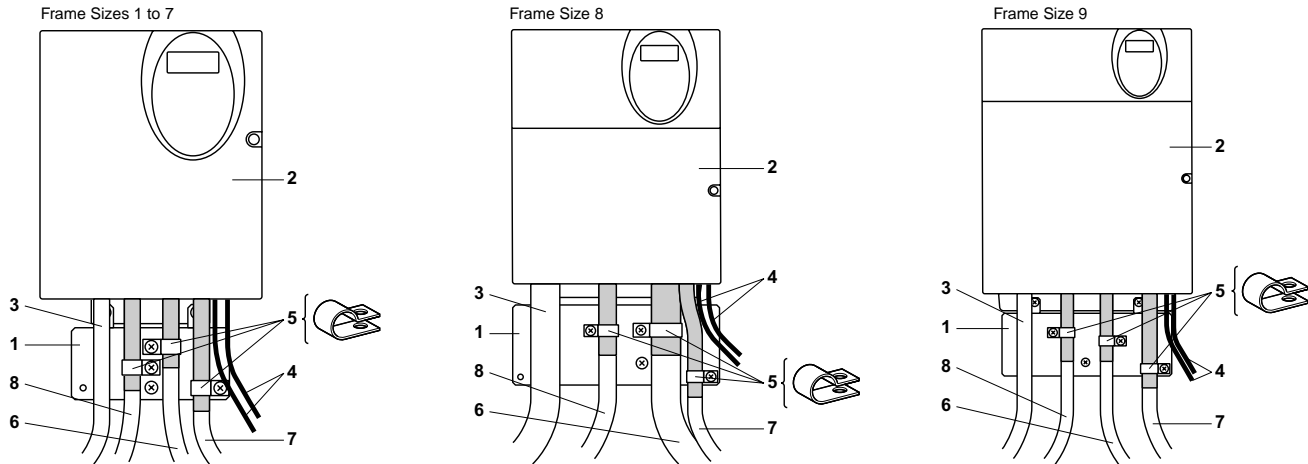
Single phase power supply



Altivar 31 Adjustable Speed AC Drives Wiring

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.



- 1) EMC plate supplied with the drive controller.
- 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, which must be securely attached to the EMC plate with stainless steel clamps (item 5).
- 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 requiring 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.

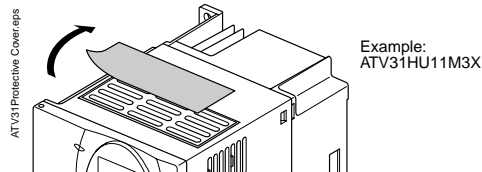
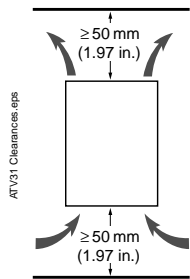
For additional information, refer to "Installation Recommendations for Meeting EN 55011 Class A" in the *Altivar® 31 Installation Manual*, bulletin number VVDED303041US.

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. For more information, refer to "Operation on an Impedance Grounded System" in the *Altivar® 31 Installation Manual*, bulletin number VVDED303041US.

Altivar 31 Adjustable Speed AC Drives Mounting



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.

Removing the Protective Cover

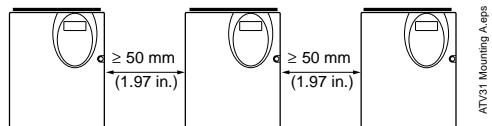
When IP20 protection is adequate, remove the protective cover on top of the drive controller as shown in the figure to the left. Consult "Mounting Methods" below to determine the type of mounting appropriate for your application before removing the protective cover from the drive controller. For UL Type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

Mounting Methods

Refer to the derating curves on page 31 to determine which mounting method best fits the application.

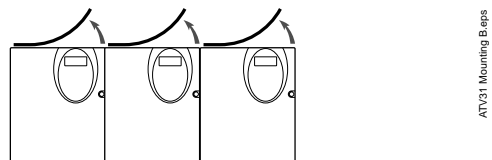
Type A Mounting

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



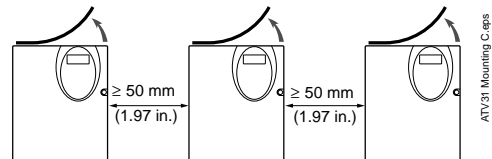
Type B Mounting

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).

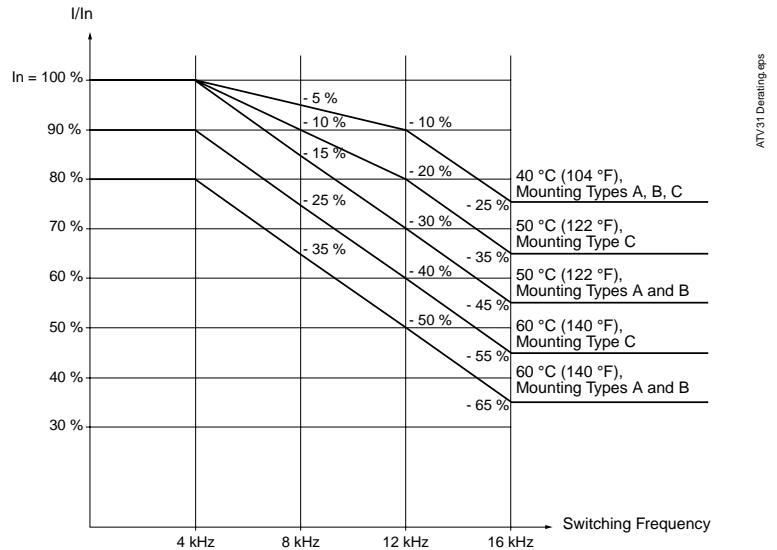


Altivar 31 Adjustable Speed AC Drives Mounting

Derating curves

The figure below 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 for drives installed in an enclosure

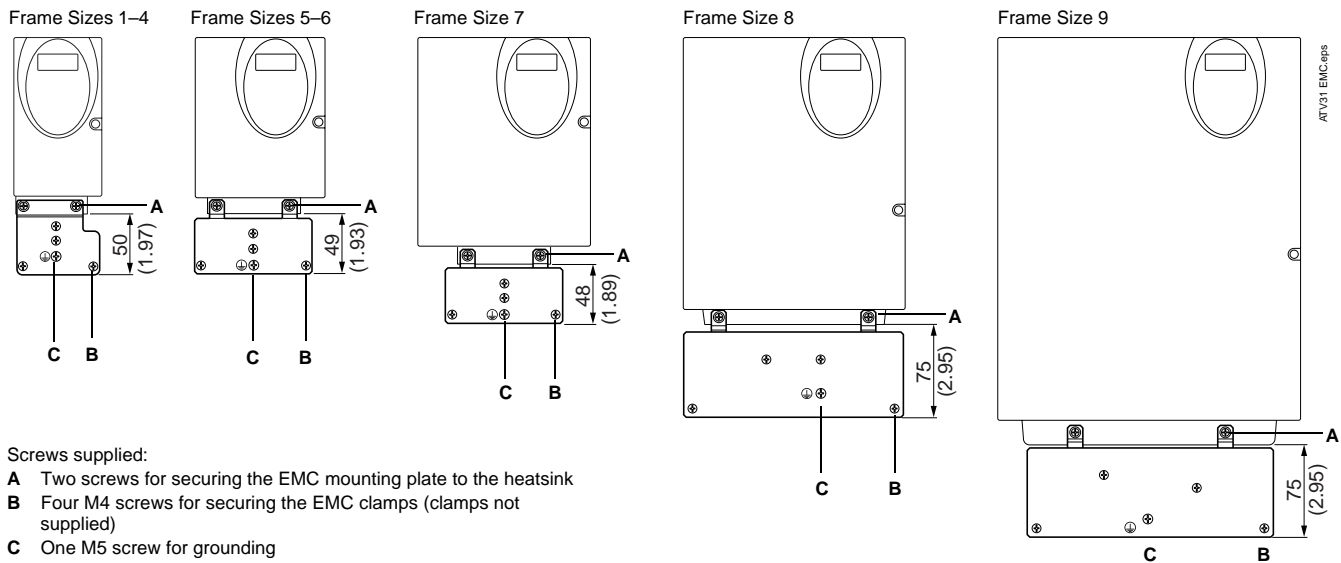
ATV31*****	Flow Rate	
	m ³ /hour	cubic feet per minute (CFM)
H018M2, H037M2, H055M2, H018M3X, H037M3X, H055M3X, H037N4, H055N4, H075N4, HU11N4, H075S6X, HU15S6X	18	10.6
H075M2, HU11M2, HU15M2, H075M3X, HU11M3X, HU15M3X, HU15N4, HU22N4, HU22S6X, HU40S6X	33	19.4
HU22M2, HU22M3X, HU30M3X, HU40M3X, HU30N4, 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

Altivar 31 Adjustable Speed AC Drives

Mounting

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. Refer to “Electromagnetic Compatibility” in the *Altivar® 31 Installation Manual*, bulletin number VVDED303041US, for instructions on securing the mounting plate and grounding the cable shields on the EMC plate.



ATV31*****	Frame Size	ATV31*****	Frame Size
H018M3X, H037M3X	1	HU22M2, HU30iM3X, HU40M3X, HU22N4, HU30N4, HU40N4, HU22S6X, HU40S6X	7
H055M3X, H075M3X	2		
H018M2, H037M2	3	HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X	8
H055M2, H075M2	4		
HU11M3X, HU15M3X	5		
HU11M2, HU15M2, HU22M3X, H037N4, H055N4, H075N4, HU11N4, HU15N4, H075S6X, HU15S6X	6	HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X	9

Mounting in a Type 12 or IP54 Metal Enclosure

Calculating Enclosure Size

The equation for calculating Rth (°C/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. (°C) around the controller
 T_o = Max. external ambient temp. (°C) around enclosure
 P = Total power dissipated in enclosure (W)

For the power dissipated by the drive controllers at rated load, see the tables on pages 10–11.

The useful heat exchange surface area, S (in²), 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)

Altivar 31 Adjustable Speed AC Drives Mounting

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

NOTE: Contact the enclosure manufacturer for K factors.

Calculate the maximum allowable thermal resistance, Rth:

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

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) front area top area side area
Width: 24 in. (610 mm) ↓ ↓ ↓
Depth: 12 in. (305 mm) $S = (24 \times 28) + (24 \times 12) + 2(28 \times 12) = 1632\text{ in.}^2$

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

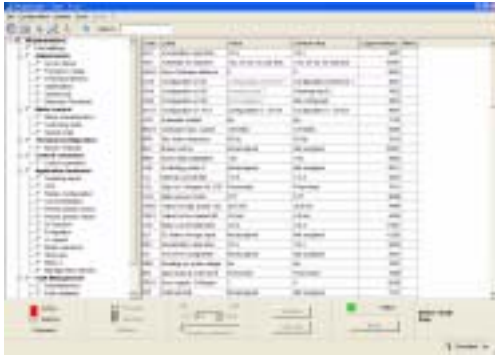
When mounting the drive controller inside a Type 12 or IP54 enclosure, follow these ventilation precautions:

- Observe the minimum clearance distances shown on page 30.
- 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.

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

Altivar 31 Adjustable Speed AC Drives

Functions



PowerSuite with PC screen
Parameters List

FUNCTIONS

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Altivar 31 Adjustable Speed AC Drives Functions

Drive factory settings

The drive is supplied ready for use in most applications, with the following functions and settings:

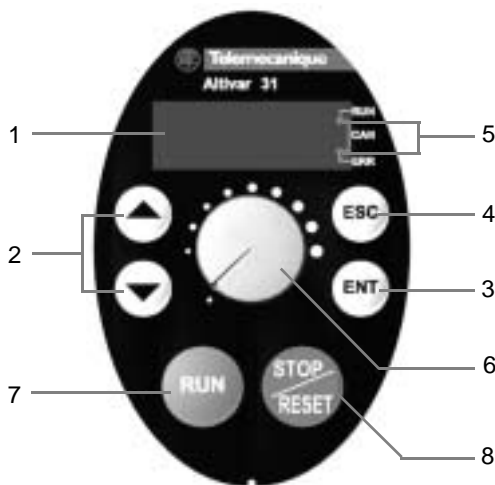
- Nominal motor frequency: 50 Hz
- Motor voltage: 230 V (ATV31H...M2 and M3X), 400 V (ATV31H...N4) or 600 V (ATV31H...S6X)
- Linear ramp times: 3 seconds
- Low speed (LSP): 0 Hz
- High speed (HSP): 50 Hz
- Normal stop mode on deceleration ramp
- Stop mode in the event of a fault: Freewheel
- Motor thermal current = nominal drive current
- DC injection braking current = 0.7 x nominal drive current, for 0.5 seconds
- Constant torque operation, with sensorless flux vector control
- Logic inputs:
 - Two directions of operation (LI1, LI2), two-wire control
 - Four preset speeds (LI3, LI4): LSP (low speed), 10 Hz, 15 Hz, 20 Hz
- Analog inputs:
 - AI1 speed reference (0 to 10 V)
 - AI2 (0 ± 10 V) summing of AI1
 - AI3 (4–20 mA) not assigned
- Relay R1: fault relay
- Relay R2: not assigned
- Analog output AOC: 0–20 mA, representation of the motor frequency
- Automatic adaptation of the deceleration ramp in the event of excessive braking
- Switching frequency 4 kHz, random frequency

Functions of the drive local keypad display

1. Four 7-segment displays showing information in the form of codes or values
2. Buttons for scrolling through the menus or modifying values
3. ENT: Validation button for entering a menu or confirming the new value selected
4. ESC: Button for exiting the menus (no confirmation)
5. Two diagnostic LEDs for the CANopen bus

For ATV31H...M2A, ATV31H...M3XA and ATV31H...N4A drives only:

6. Speed reference potentiometer
7. RUN: Local control of motor operation
8. STOP/RESET: Controls motor stopping locally and resets any faults



Altivar 31 Adjustable Speed AC Drives Functions



Remote keypad display

Remote keypad display option

The remote keypad display can be mounted on the door of a wall-mounted or floor-standing enclosure.

It contains an LCD display with programming and control keys and a switch for locking access to the menus.

NOTE: Protection via the access locking code has priority over the switch.

The drive control keys are:

- FWD/REV: reverses the rotation direction
- RUN: commands the motor to run
- STOP/RESET: commands the motor to stop, or resets a fault
- UP/DOWN arrow keys: speed reference

When the drive is configured to use the remote keypad display, only the freewheel stop, fast stop, and DC injection stop commands remain active on the terminal block. If the link between the drive and the remote keypad display is broken, the drive faults. Its subsequent action depends on the control and reference channel programming.

Menu access levels

There are three access levels:

Level 1: Access to standard functions. (This level is comparable to the ATV28 drive.)

Level 2: Access to the Level 1 functions and advanced application functions.

Level 3: Access to the Level 2 functions and management of mixed control and reference modes.

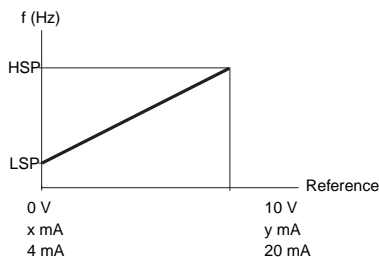
Access locking code

This function protects the drive configuration using an access code.

When access is protected, only the adjustment and monitoring parameters can be accessed.

Operating speed range

This function sets the two frequency limits that define the speed range permitted by the machine under actual operating conditions for all applications, with or without overspeed.



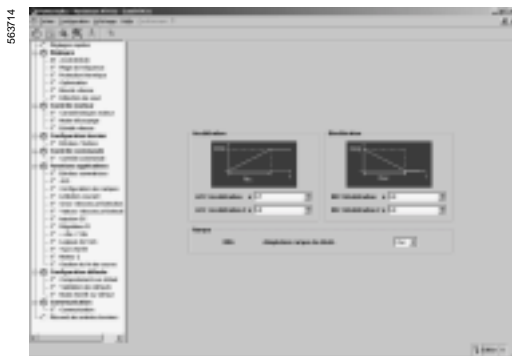
Operating speed range

LSP: low speed, from 0 to HSP, factory setting 0

HSP: high speed, from LSP to f_{max} , factory setting 50 Hz

x: configurable between 0 and 20 mA, factory setting 4 mA

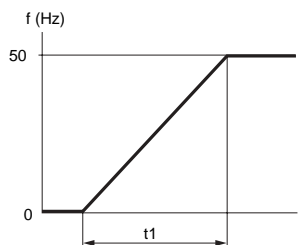
y: configurable between 4 and 20 mA, factory setting 20 mA



Ramp adjustment with PowerSuite for PC

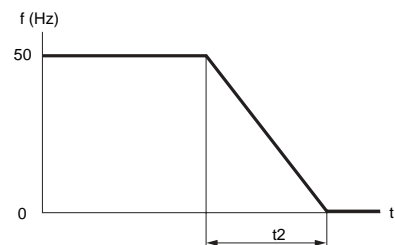
Acceleration and deceleration ramp times

This function defines the acceleration and deceleration ramp times according to the application and the machine dynamics.



Linear acceleration ramp

t1: acceleration time
t2: deceleration time



Linear deceleration ramp

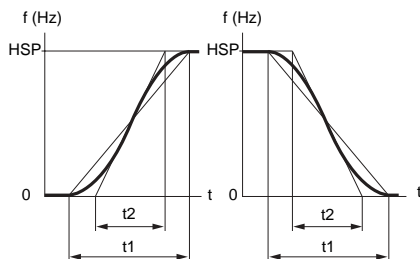
t1 and t2 can be set independently between 0.1 and 999.9 s; factory setting: 3 s

Acceleration and deceleration ramp profile

This function is used to gradually increase the output frequency starting from a speed reference, following a linear ratio or a preset ratio.

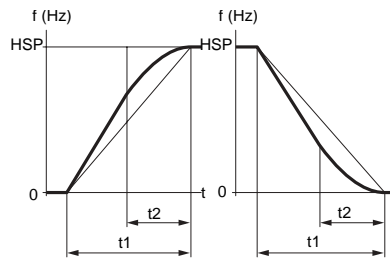
- For applications such as material handling, packaging, and the transportation of people: Using S ramps takes up mechanical play, eliminates jolts, and limits non-following of speed during rapid transient operation of high inertia machines.
- For pumping applications (installation with centrifugal pump and non-return valve): Using U ramps allows valve closing to be controlled more accurately.
- Selecting linear, S, U, or customized profiles will affect both the acceleration and deceleration ramps.

S ramps



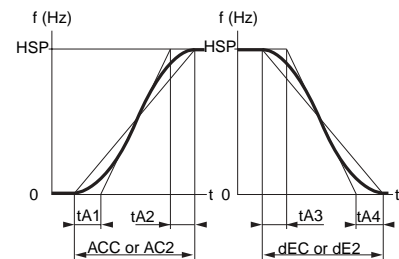
HSP: high speed
t1: ramp time set
 $t2 = 0.6 \times t1$
The curve coefficient is fixed.

U ramps



HSP: high speed
t1: ramp time set
 $t2 = 0.5 \times t1$
The curve coefficient is fixed.

Customized ramps



HSP: high speed
ACC: acceleration ramp 1 time
AC2: acceleration ramp 2 time
dEC: deceleration ramp 1 time
dE2: deceleration ramp 2 time
tA1: can be set between 0 and 100% (of ACC or AC2)
tA2: can be set between 0 and (100% - tA1) (of ACC or AC2)
tA3: can be set between 0 and 100% (of dEC or dE2)
tA4: can be set between 0 and (100% - tA3) (of dEC or dE2)

Ramp switching

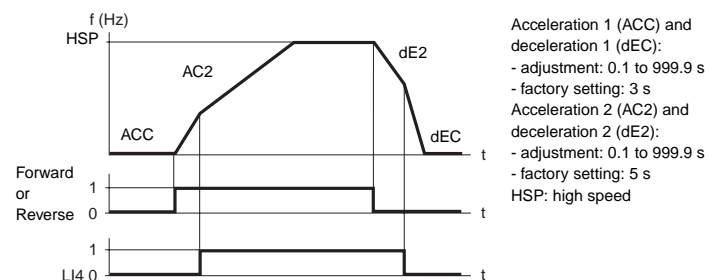
This function is used to switch two acceleration or deceleration ramp times, which can be adjusted separately.

Ramp switching can be enabled by:

- a logic input
- a frequency threshold
- a combination of logic input and frequency threshold

This function is suitable for:

- material handling with smooth starting and approach
- machines with fast steady state speed correction



Example of switching using logic input LI4

Altivar 31 Adjustable Speed AC Drives Functions

Automatic adaptation of deceleration ramp

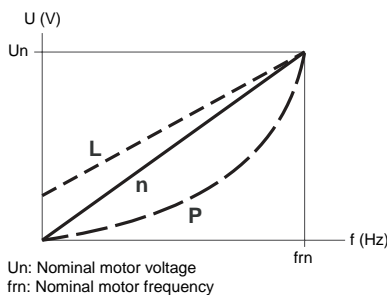
If the initial deceleration ramp setting is too low for the load inertia, this function automatically modifies the ramp, preventing the drive from faulting due to excessive braking.

This function is suitable for all applications not requiring precise stopping and not using braking resistors.

Automatic adaptation must be cancelled if the machine has position control with stopping on a ramp and a braking resistor installed. This function is automatically disabled if the brake sequence is configured.



Adjusting the voltage/frequency ratio with PowerSuite for PC



Voltage/frequency ratio

- Motor and power supply characteristics

This function is used to determine the limit values for the voltage/frequency ratio according to the line supply, the motor, and the application.

The following values should be set for variable or constant torque applications, with or without overspeed:

- the base frequency corresponding to the supply
- the nominal motor frequency (in Hz) given on the motor nameplate
- the nominal motor voltage (in V) given on the motor nameplate
- the maximum output frequency of the drive (in Hz)

- Type of voltage/frequency ratio

This function is used to adapt the voltage/frequency ratio to the application, to optimize performance for the following:

- constant torque applications (machines with average loads operating at low speed) with motors connected in parallel or special motors (e.g.: resistive cage motor): ratio **L**
- variable torque applications (pumps, fans): ratio **P**
- machines with heavy loads operating at low speed, with fast cycles, or with sensorless flux vector control: ratio **n**
- energy saving, for machines with slow speed and torque variations: ratio **nLd** Voltage is automatically reduced to a minimum according to the necessary torque

Auto-tuning

Auto-tuning is used to optimize application performance.

Auto-tuning may be performed

- by the operator, using the local or remote keypad display or the serial link
- each time the drive is powered up
- on each run command
- by enabling a logic input

Altivar 31 Adjustable Speed AC Drives Functions

Switching frequency, noise reduction

The switching frequency can be adjusted to reduce the noise generated by the motor.

The switching frequency is modulated randomly to avoid resonance. This function can be disabled if it causes instability.

High frequency switching of the intermediate DC voltage can be used to supply the motor with a current wave that has a lower harmonic distortion. The switching frequency can be adjusted during operation to reduce the noise generated by the motor.

The value ranges from 2 to 16 kHz, with a factory setting of 4 kHz.

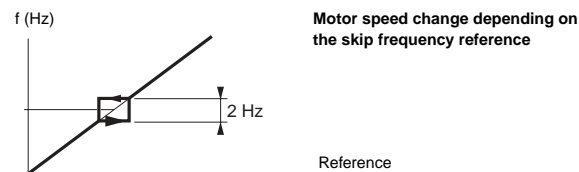
Use in all applications requiring low motor noise.

Skip frequencies

This function is used to suppress one or two critical speeds that may be the cause of mechanical resonance.

It is possible to prohibit the prolonged operation of the motor on one or two frequency bands (with a bandwidth of ± 1 Hz), which can be set within the operating range.

This function is suitable for lightweight machines, bulk product conveyors with an unbalanced motor, fans, and centrifugal pumps.



Speed reference

The speed reference can come from the following sources, depending on the drive configuration:

- the three analog inputs
- the potentiometer (for ATV31.....A drives only)
- the logic inputs using the +/- Speed function
- the drive local keypad display or remote keypad display
- the communication networks

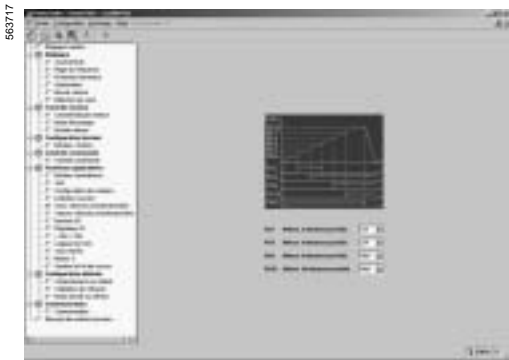
These different sources are managed by programming the reference functions and channels.

Analog inputs

There are three analog inputs:

- Two voltage inputs:
 - 0 to 10 V (AI1)
 - ± 10 V (AI2)
- One current input:
 - X-Y mA (AI3) where X is configurable between 0 and 20 mA, and Y is configurable between 4 and 20 mA.

Altivar 31 Adjustable Speed AC Drives Functions

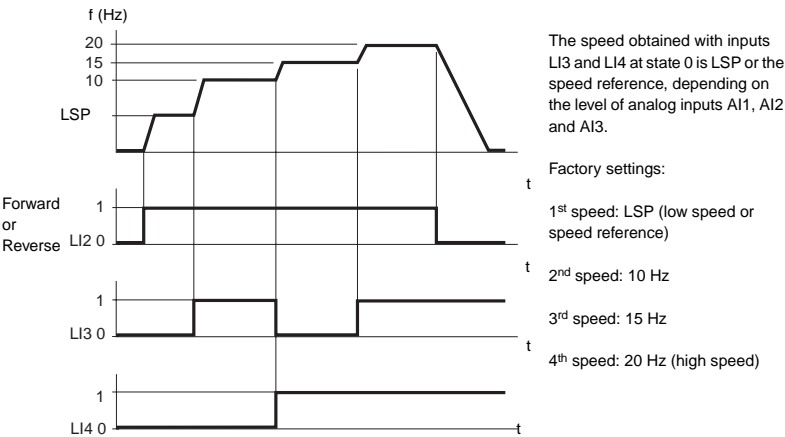


Adjusting the preset speeds with PowerSuite for PC

Preset speeds

This function is used to switch preset speed references. Two, four, eight, or sixteen preset speeds can be selected, enabled by means of one, two, three, or four logic inputs, respectively. Preset speeds are adjustable in increments of 0.1 Hz from 0 Hz to 500 Hz.

This function is suitable for material handling and machines with several operating speeds.



Example of operation with four preset speeds and two logic inputs

+/- Speed

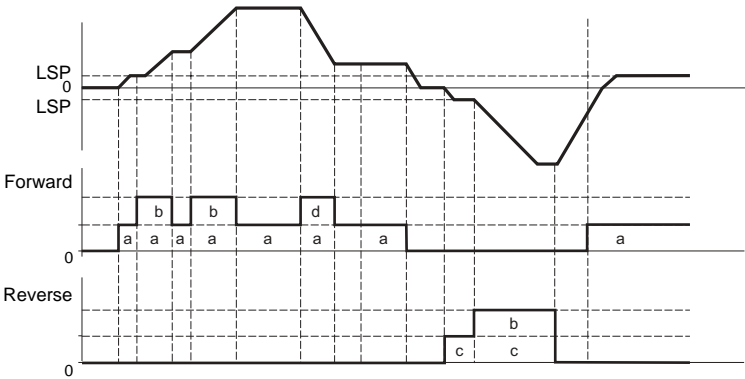
The following sections describe +/- Speed operation using single action buttons or double action buttons (such as on a pendant station).

- Single action buttons

Single action buttons require two logic inputs and two directions of rotation. The input assigned to the +speed command increases the speed; the input assigned to the -speed command decreases the speed.

	-speed	speed maintained	+speed
Forward direction	a and d	a	a and b
Reverse direction	c and d	c	c and b

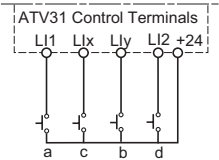
Motor frequency



The maximum speed is set by HSP.

Example of wiring:

- LI1: forward
- LIx: reverse
- LIy: +speed (USP)
- LIz: -speed (DSP)



Altivar 31 Adjustable Speed AC Drives Functions

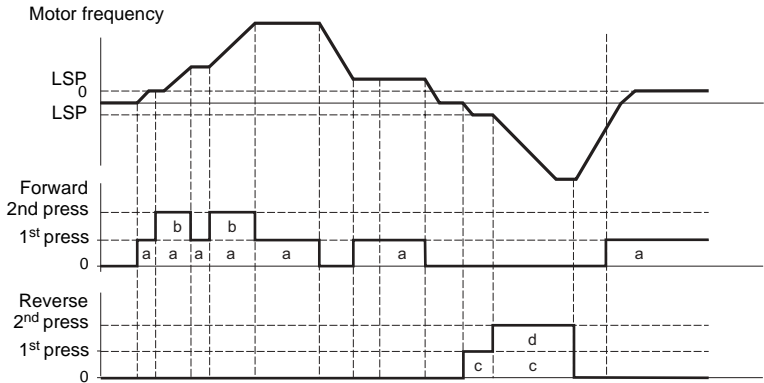
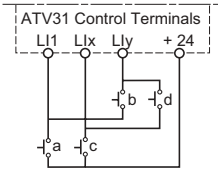
• Double action buttons

Only one logic input, assigned to +speed, is required for double action buttons. Double action buttons typically have two detents. Press the button to the first detent to maintain speed; press it to the second detent to increase speed. Each action closes a contact. Refer to the following table.

	Released (-speed)	Press to 1 st Detent (speed maintained)	Press to 2 nd Detent (+speed)
Forward button	–	a	a and b
Reverse button	–	c	c and d

Example of wiring:

- LI1: forward
- LIx: reverse
- LIy: +speed (USP)



This type of +/- Speed is incompatible with three-wire control.

The maximum speed is set by HSP.

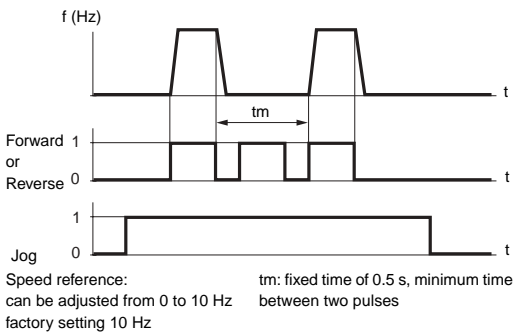
Save reference

This function is associated with +/- Speed control. It enables the reading and saving of the last speed reference. If there is a loss of the run signal or of mains supply, the saved reference is applied at the next run signal.

Jog operation

This function is used for pulse operation with minimum ramp times (0.1 s), limited speed reference, and minimum time between two pulses. It is enabled by a logic input, with pulses given by the operating direction command.

This function is suitable for machines with product insertion in manual mode (for example, gradual movement of the mechanism during maintenance operations).



Example of jog operation

Altivar 31 Adjustable Speed AC Drives Functions

Control and reference channels

Control commands (such as forward and reverse) and speed reference commands can be sent to the drive controller from the following sources:

- the logic and analog inputs
- the drive local keypad display on ATV31.....A drives only
- the remote keypad display
- the serial link
 - Modbus control word
 - CANopen control word

ATV31 drives allow you to assign control and reference sources to separate control channels and to switch between them. For example, the speed reference might be given by the CANopen serial link but the control commands given by the remote keypad display.

NOTE: The STOP keys on the local keypad display and the remote keypad display may retain priority. The Summing inputs and PI regulator functions only apply to one reference channel.

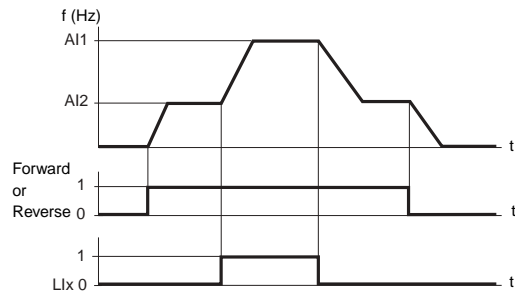
Reference switching

Switching between two speed references can be enabled via:

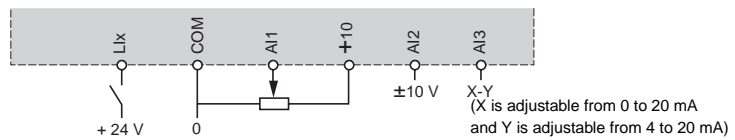
- a logic input
- a bit in a Modbus or CANopen control word

Reference 1 is active if the logic input (or control word bit) is at 0, reference 2 is active if the logic input (or control word bit) is at 1.

The reference can be switched with the motor running.



Example of reference switching



Connection diagram for reference switching

Summing inputs

This function is used to sum two or three speed references from different sources. The references to be summed can come from any of the various speed reference sources.

Example:

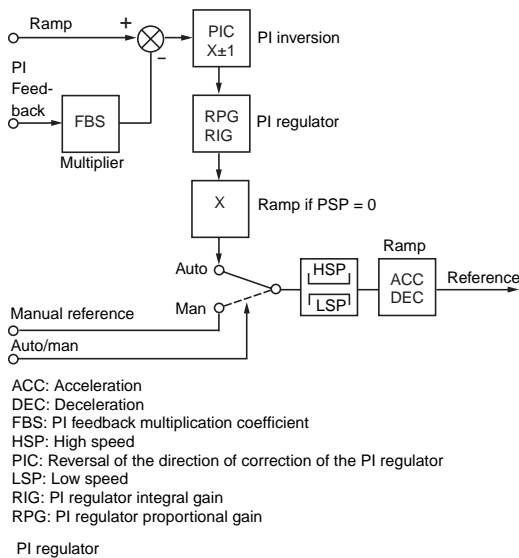
Reference 1 sent by AI1

Reference 2 sent by the potentiometer

Reference 3 sent by the CANopen serial link

Drive speed reference: reference 1 + reference 2 + reference 3.

Altivar 31 Adjustable Speed AC Drives Functions



PI regulator

This function is used for simple control of a process using a sensor that supplies a feedback signal to the drive (for example, flow rate or a pressure). This function is suitable for pumping and ventilation applications.

- **PI reference**

- internal regulator reference, adjustable from 0 to 100
- regulation reference selected from any of the possible reference sources
- preset PI references
- two or four preset PI references, adjustable from 0 to 100, require the use of one or two logic inputs respectively

- **Manual reference**

- speed reference selected from any of the possible reference sources

- **PI feedback**

- analog input AI1, AI2 or AI3

- **Auto/Manual**

- logic input LI for switching operation to speed reference (Manual) or PI regulation (Auto).

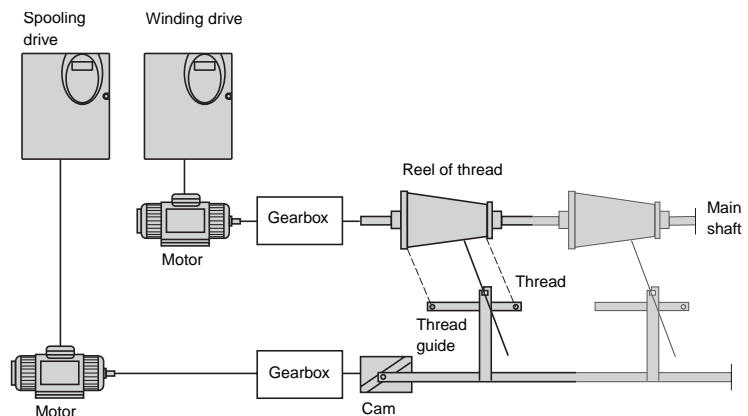
During operation in automatic mode it is possible to adapt the process feedback, to correct inverse PI, to adjust the proportional and integral gain and to apply a ramp (time = ACC - DEC) for establishing the PI action on starting and stopping.

The motor speed is limited to between LSP and HSP.

NOTE: The PI function is incompatible with the Preset speeds and Jog operation functions. The PI reference can also be transmitted on line via the Modbus RS-485 serial link or via the CANopen bus.

Spooling

This function, for winding reels of thread in textile applications, is available with ATV31...T drives only. ⁽¹⁾

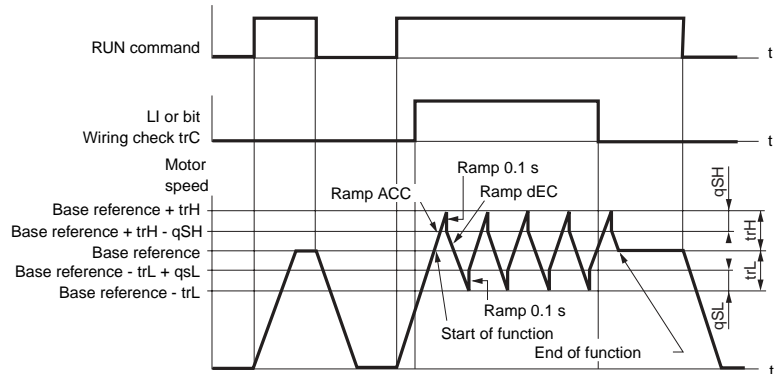


The cam's rotation speed must follow a precise profile to ensure steady winding.

continued

1) These drives are available by special order only.

Altivar 31 Adjustable Speed AC Drives Functions



When this function is configured, the ramp type is forced to linear ramp.

Current limit switching

A second current limit can be configured between 0.25 and 1.5 times the nominal drive current.

This function is used to limit the torque and the temperature rise of the motor.

Switching between two current limits can be enabled via:

- a logic input
- a bit in a Modbus or CANopen control word

Limiting low speed operating time

The motor is stopped automatically after an operating period at low speed (LSP) with zero reference and run command present. This time can be set between 0.1 and 999.9 seconds (0 corresponds to an unlimited time).

The factory setting is 0 s. The motor restarts automatically on the ramp when the reference reappears or if the run command is broken and then re-established.

This function is suitable for automatically stopping or starting pressure-regulated pumps.

Motor switching

Allows two motors with different ratings or characteristics to be supplied alternately by the same drive. Switching must take place with the drive stopped and locked, using an appropriate sequence at the drive output.

The function can be used to adapt the motor parameters. The following parameters are switched automatically:

- nominal motor voltage
- nominal motor frequency
- nominal motor current
- nominal motor speed
- motor cosine Phi (power factor)
- selection of the type of voltage/frequency ratio for motor 2
- IR compensation, motor 2
- motor frequency loop gain
- motor stability
- motor slip compensation

Motor thermal protection is disabled by this function.



Configuration of current switching with PowerSuite for PC

Altivar 31 Adjustable Speed AC Drives Functions

Motor switching can be enabled by:

- a logic input
- a bit in a Modbus or CANopen control word

With hoisting applications, this function enables a single drive to be used for vertical and horizontal movements.

Control channel switching

Control channel switching provides a choice of two control channels. Switching can be enabled by:

- a logic input
- a bit in a Modbus or CANopen control word

Two-wire control

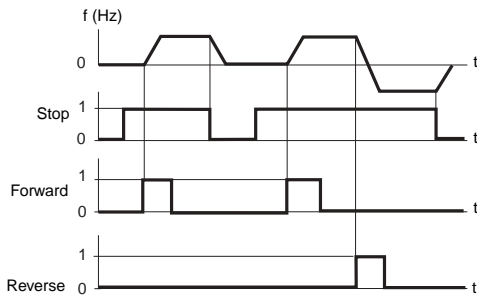
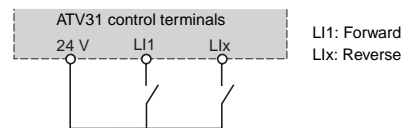
This function is used to control the direction of operation by means of a maintained contact. It is enabled by means of one or two logic inputs (one or two directions).

This function is suitable for all non-reversing and reversing applications.

Three operating modes are possible:

- detection of the logic input state
- detection of a change in the logic input state
- detection of the logic input state, with forward operation always having priority over reverse

Wiring diagram for
two-wire control

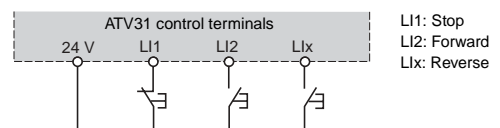


Example of operation with three-wire control

Three-wire control

This function is used to control the operating direction and stopping by means of pulsed contacts. It is enabled by means of two or three logic inputs (non-reversing or reversing). This function is suitable for all non-reversing and reversing applications.

Wiring diagram for
three-wire control



Forced local mode

Forced local mode imposes control via the terminals or the local or remote keypad display, and prohibits all other control modes.

This mode allows selection of the following reference and command channels:

- reference via AI1, AI2, or AI3 with control via the logic inputs
- reference and control via the RUN/STOP keys and potentiometer on the local keypad display (ATV31...A drives only)
- reference and control via the remote keypad display

The changeover to forced local mode is enabled by a logic input.

Altivar 31 Adjustable Speed AC Drives Functions

Freewheel stop

Stops the motor by resistive torque only if the motor power supply is cut. A freewheel stop is achieved

- by configuring a normal stop command as a freewheel stop (on the removal of a run command or the initiation of a stop command)
- by enabling a logic input

Fast stop

This function is used to achieve a braked stop with an acceptable deceleration ramp time (divided by 2 to 10) for the drive to avoid an excessive braking fault.

This function is used for conveyors with emergency stop electrical braking. A fast stop is achieved

- by configuring a normal stop as a fast stop (on the removal of a run command or the initiation of a stop command)
- by enabling a logic input

DC injection stop

This function is used to brake (at low speed) high inertia fans, or to maintain torque on stopping in the case of fans located in an airflow.

A DC injection stop is achieved

- by configuring a normal stop as a DC injection stop (on the removal of a run command or the initiation of a stop command)
- by enabling a logic input

The DC value and the injection braking time are adjustable.

Brake control

This function is used to manage control of an electromagnetic brake in synchronization with the starting and stopping of the motor to avoid jolts and load veering.

The brake control sequence is managed by the drive.

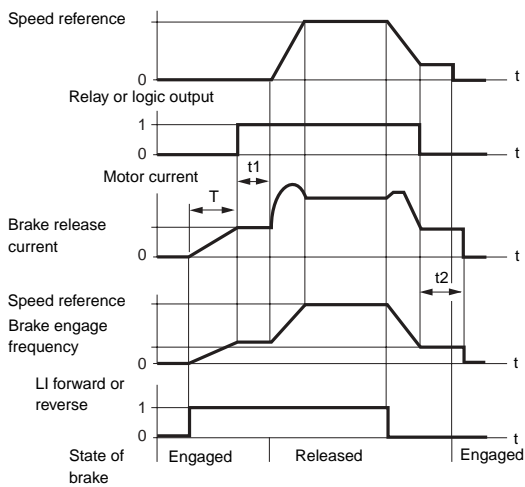
- Values that can be adjusted for releasing the brake: current threshold and time delay
- Values that can be adjusted for engaging the brake: frequency threshold and time delay

This function is enabled by relay logic output R2 or logic output AOC assigned to brake control.

This function is suitable for material handling applications with movements equipped with electromagnetic brakes (hoisting) and machines requiring a parking brake (unbalanced machines).

Principle:

- Vertical lifting movement:
Maintain motor torque in an upward direction when the brake is being released and engaged, to hold the load and start smoothly as soon as the brake is released.
- Horizontal lifting movement:
Synchronizes the brake release with the build-up of torque on starting, and brake engage with zero speed on stopping, to prevent jerking.



Accessible settings:
t1: Brake release time delay
t2: Brake engage time delay
Brake control

Altivar 31 Adjustable Speed AC Drives Functions

Below are the recommended settings for brake control for vertical lifting applications (for a horizontal lifting application, set the current threshold to 0).

- Brake release current: Set the brake release current to the nominal current indicated on the motor. If torque is insufficient during testing, increase the brake release current (the drive imposes the maximum value).
- Acceleration time: For lifting applications, set the acceleration ramps to more than 0.5 s. Ensure that the drive does not change to current limiting.

The same recommendation applies for deceleration.

NOTE: For a lifting movement, a braking resistor should be used. Ensure that the settings and configurations selected cannot cause a drop or a loss of control of the lifted load.

- Brake release time delay t1: Adjust according to the type of brake. This is the time required for the mechanical brake to release.
- Brake engage frequency: Set to twice the nominal slip then adjust based on the result.
- Brake engage time delay t2: Adjust according to the type of brake. This is the time required for the mechanical brake to engage.

Limit switch management

This function is used to manage the operation of one or two limit switches (with one or two operating directions).

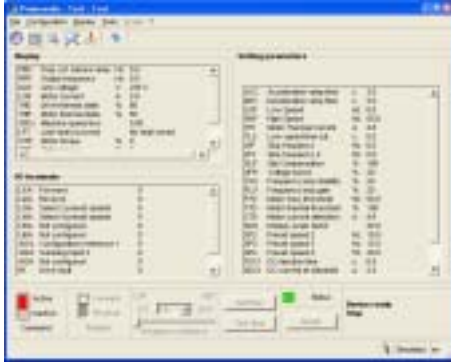
Each limit (forward or reverse) is associated with a logic input. The type of stop that occurs on detection of a limit can be configured as normal, freewheel or fast.

Following a stop, the motor is permitted to restart in the opposite direction only.

Monitoring

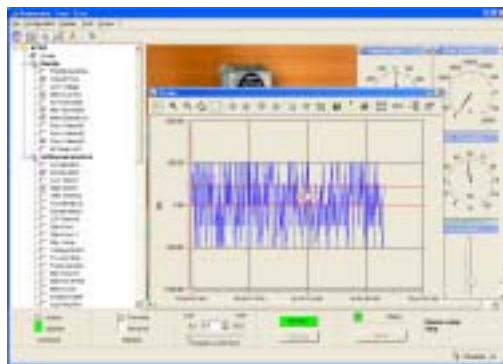
The following data can be displayed:

- frequency reference
- internal PI reference
- frequency reference (absolute value)
- output frequency applied to the motor (value signed in two's complement)
- output value in customer units
- current in the motor
- motor power: 100% = nominal power
- line voltage
- motor thermal state:
100%: nominal thermal state; 118%: motor overload threshold
- drive thermal state:
100%: nominal thermal state; 118%: drive overload threshold
- motor torque: 100% = nominal torque
- last fault
- operating time
- auto-tuning status
- configuration and state of logic inputs
- configuration of analog inputs



Monitoring the different parameters with PowerSuite for PC

operation.jpg



Monitoring the different parameters with the oscilloscope function in PowerSuite for PC

scope.jpg

Altivar 31 Adjustable Speed AC Drives Functions

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Fault management with PowerSuite for PC

Fault management

There are different modes of operation on a resettable fault:

- freewheel stop
- switch to the fallback speed
- maintain the speed at which the drive was operating when the fault occurred, until the cause of the fault is removed
- stop on a ramp
- fast stop

The detected resettable faults are as follows:

- drive overheating
- motor overheating
- CANopen bus fault
- Modbus serial link failure
- external faults
- loss of 4-20 mA signal

Fault reset

This function is used to clear the last fault by means of a logic input. The restart conditions after a reset to zero are the same as those of a normal power-up.

This function resets the following faults: Overvoltage, Overspeed, External fault, Drive overheating, Motor phase loss, DC bus overvoltage, Loss of 4-20 mA reference, Overvoltage during deceleration, Motor overload if the thermal state is less than 100%, and Serial link fault.

Line supply undervoltage and Line supply phase loss faults are reset automatically when the line supply is restored.

This function is suitable for applications where the drives are difficult to access, for example on moving parts in material handling systems.

General reset (reset all faults)

This function can be used to inhibit all faults, including thermal protection (forced operation), and may cause *irreparable* damage to the drive.

This function is suitable for applications where a restart can be vital (such as a conveyor in a furnace, a smoke extraction station, or a machine with hardening products that must be removed).

The function is enabled by a logic input. Fault monitoring is active if the logic input is at state 1. All faults are reset on a change of state \downarrow of the logic input.

Controlled stop on loss of line supply

This function is used to control the stopping of the motor on a loss of line supply. It is suitable for material handling, machines with high inertia, or continuous product processing machines.

The types of stop possible are

- a freewheel stop
- a stop using the mechanical inertia to maintain the drive power supply for as long as possible
- a stop on a ramp
- a fast stop (which depends on the inertia and the braking ability of the drive)

Altivar 31 Adjustable Speed AC Drives Functions

Stop mode in the event of a fault

The type of stop that occurs on detection of a fault can be configured as normal, freewheel, or fast for the following faults:

- external fault (detection enabled by a logic input or a bit in a Modbus or CANopen control word)
- motor phase loss fault

If a downstream contactor is used between the drive and the motor, the motor phase loss fault should be inhibited.

Automatic catch a spinning load with speed detection (catch on the fly)

This function is used to restart the motor smoothly after one of the following events, provided that the run command is still present:

- a loss of line supply (or a simple switch off)
- a fault reset or automatic restart
- a freewheel stop

When the drive restarts, it detects the effective speed of the motor. It then restarts on a ramp at this speed and returns to the reference speed. The speed detection time can be up to 1 s depending on the initial deviation. This function is automatically disabled if the brake sequence is configured. This function is suitable for machines where the speed loss is negligible during the time over which the mains supply is lost (such as machines with high inertia and fans or pumps driven by residual flow).

Automatic restart

This function enables an automatic drive restart following a fault, if operating conditions permit and the cause of the fault has been removed. This restart is performed by a series of automatic attempts separated by increasingly longer wait periods of 1 s, 5 s, and 10 s, then 1 minute for the rest.

The relay configured as a fault relay remains activated until the automatic restart is abandoned. The speed reference and the direction of operation must be maintained during the restart process.

If the restart has not taken place once the maximum duration of restart time has elapsed (adjustable from 5 minutes to an unlimited time), the procedure is abandoned and the drive controller remains locked until power is cycled.

The faults permitting this restart are:

- line supply overvoltage
- motor thermal overload
- drive thermal overload
- DC bus overvoltage
- failure of a line supply phase
- external fault
- loss of 4-20 mA reference
- CANopen bus fault
- Modbus serial link fault
- line supply voltage too low. For this fault, the function is always active, even if not configured.

This function is suitable for machines or installations in continuous operation or without monitoring, and where a restart will not endanger equipment or personnel in any way.

Altivar 31 Adjustable Speed AC Drives Functions

Derated operation in the event of an overvoltage

The line voltage monitoring threshold is lowered to 50% of the motor voltage. In this case, a line reactor must be used and the performance of the drive cannot be guaranteed.

Resetting the fault relay

The fault relay is energized when the drive is powered up and no faults are present.

It contains a C/O common point contact.

The fault can be reset in one of the following ways:

- by powering down until the ON LED extinguishes, then switching the power back on
- by assigning a logic input to the Reset faults function
- by the Automatic restart function, if it has been configured

Operating time reset to zero

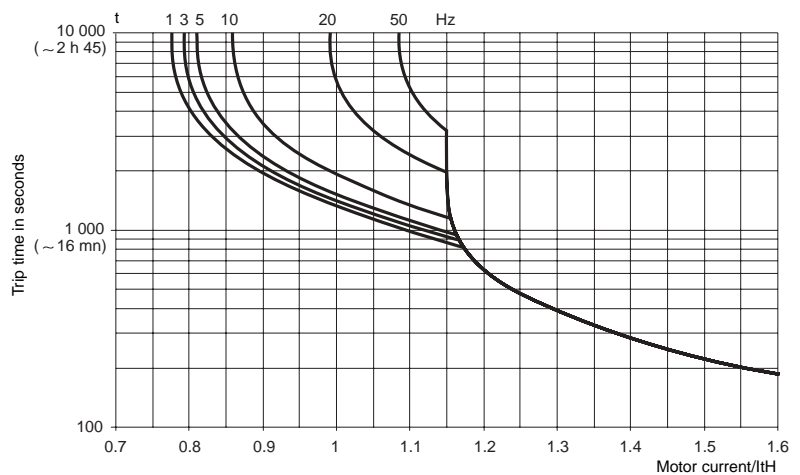
The drive operating time can be reset to zero.

Motor thermal protection

Indirect motor thermal protection is implemented via continuous calculation of its theoretical temperature rise.

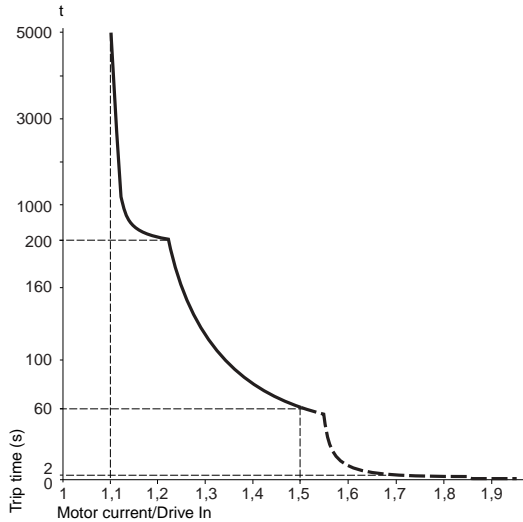
Thermal protection can be adjusted from 0.2 to 1.5 times the nominal drive current.

This function is suitable for applications with self-cooled motors.



Motor thermal protection curves

Altivar 31 Adjustable Speed AC Drives Functions



Drive thermal protection

Thermal protection, by a PTC probe fitted on the heatsink or integrated in the power module, ensures that the drive is protected in the event of poor ventilation or excessive ambient temperatures.

The drive stops in the event of a fault.

R1/R2 relay configuration

The following states are signalled when the relay is powered on:

- drive fault
- drive running
- frequency threshold reached
- high speed reached
- current threshold reached
- frequency reference reached
- motor thermal threshold reached
- brake sequence (R2 only)

AOC/AOV analog output

The same data is available on analog outputs AOC and AOV. The following assignments are possible:

- motor current
- motor frequency
- motor torque
- power supplied by the drive
- drive fault
- frequency threshold reached
- high speed reached
- current threshold reached
- frequency reference reached
- motor thermal threshold reached
- brake sequence

The setting of analog output AOC/AOV is used to modify the characteristics of the current analog output, AOC, or the voltage analog output, AOV.

AOC: can be set as 0-20 mA or 4-20 mA

AOV: can be set at 0-10 V

Saving and retrieving the configuration

A configuration can be saved to the EEPROM. This function is used to store a configuration in addition to the current configuration.

Retrieving this configuration clears the current configuration.

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Configuration of AOC/AOV outputs with PowerSuite for PC

Altivar 31 Adjustable Speed AC Drives

Drives Product Support

Function compatibility table

Configurable I/O

Functions not listed in this table are fully compatible.

Stop functions have priority over run commands.

The selection of functions is limited:

- by the number of drive I/O
- by the incompatibility of certain functions with one another

Functions	Summing Inputs	+/- Speed	Limit Switch Mgmt	Preset Speeds	Pi Regulator	Jog Operation	Brake Sequence	Dc Injection Stop	Fast Stop	Freewheel Stop
Summing inputs		■		⬆	■	⬆				
+/- Speed	■			■	■	■				
Limit Switch Management					■					
Preset speeds	⬅	■			■	⬆				
PI regulator	■	■	■	■		■	■			
Jog operation	⬅	■		⬅	■		■			
Brake sequence					■	■		■		
DC injection stop							■			⬆
Fast stop										⬆
Freewheel stop								⬅	⬅	

■	Incompatible functions
■	Compatible functions
□	Not applicable

Priority functions (functions that cannot be active at the same time)

⬅	The arrow indicates which function has priority Example: the Freewheel stop function has priority over the Fast stop function
⬆	

DRIVES PRODUCT SUPPORT

The Product Support Group is staffed from 8 am to 6 pm Eastern time for product selection, start-up assistance, or diagnosis of product problems and advice for the correct course of action. **Emergency phone support** is available 24 hours a day, 365 days a year.

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