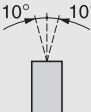


Environmental characteristics

Conformity to standards		Altivar 31 drives have been developed to conform to the strictest international standards and the recommendations relating to electrical industrial control devices (IEC, EN), in particular: low-voltage EN 50178, EMC immunity and EMC conducted and radiated emissions.
EMC immunity		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 part) IEC/EN 61800-3, environments 1 and 2
EMC conducted and radiated emissions for drives		
All drives		IEC/EN 61800-3, environments: 2 (industrial supply) and 1 (public supply), restricted distribution
ATV 31H018M2...HU15M2, ATV 31C018M2...CU15M2, ATV 31H037N4...HU40N4, ATV 31C037N4...CU40N4		EN 55011 class A group 1, EN 61800-3 category C2 With additional EMC filter: ■ EN 55022 class B group 1, EN 61800-3 category C1
ATV 31HU22M2, ATV 31CU22M2, ATV 31HU55N4...HD15N4, ATV 31CU55N4...CD15N4		EN 55011 class A group 2, EN 61800-3 category C3 With additional EMC filter (1) : ■ EN 55022 class A group 1, EN 61800-3 category C2 ■ EN 55022 class B group 1, EN 61800-3 category C1
ATV 31H018M3X...HD15M3X, ATV 31H075S6X...HD15S6X		With additional EMC filter (1): ■ EN 55011 class A group 1, EN 61800-3 category C2 ■ EN 55022 class B group 1, EN 61800-3 category C1
CE marking		The drives carry CE marking in accordance with the European low voltage (73/23/EEC and 93/68/EEC) and EMC (89/336/EEC) directives
Product certifications		
All drives		C-Tick
ATV 31H/K●●●●●, ATV 31H●●●●●X, ATV 31C●●●M2, ATV 31C037N4...CU40N4		UL, CSA, N998
Degree of protection		
ATV 31H●●●M2, ATV 31H●●●N4, ATV 31H●●●M3X, ATV 31H●●●S6X		IP 31 and IP 41 on upper part and IP 21 on connection terminals IP 20 without cover plate on upper part of cover
ATV 31C●●●M2, ATV 31C●●●N4		IP 55
Degree of pollution		2
Climatic treatment		TC
Vibration resistance		
Drive without rail option \perp		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
Shock resistance		15 gn for 11 ms conforming to IEC/EN 60068-2-27
Relative humidity		% 5...95 without condensation or dripping water, conforming to IEC 60068-2-3
Ambient temperature		°C - 25...+ 70
Storage		
Operation		
ATV 31H●●●		°C -10...+50 without derating, with protective cover on top of the drive -10...+60 with derating, without protective cover on top of the drive (see derating curves, page 60264/4)
ATV 31C/K●●●		°C -10...+40 without derating
Maximum operating altitude		m 1000 without derating (above this, derate the current by 1% per additional 100 m)
Operating position		
Maximum permanent angle in relation to the normal vertical mounting position		

Drive characteristics

Output frequency range	Hz	0...500
Switching frequency	kHz	2...16 adjustable during operation
Speed range		1...50
Transient overtorque		170 to 200% of nominal motor torque (typical value)
Braking torque		
With braking resistor		100% of nominal motor torque continuously and up to 150% for 60 s
Without braking resistor		Value of nominal motor torque (typical value) according to ratings: 30% for > ATV 31●U15●● 50% for ≤ ATV 31●U15●● 100% for ≤ ATV 31●075●● 150% for ≤ ATV 31●018M2
Maximum transient current		150% of the nominal drive current for 60 seconds (typical value)
Voltage/frequency ratio		Sensorless flux vector control with PWM (<i>Pulse Width Modulation</i>) type motor control signal Factory-set for most constant torque applications Possible options: specific ratios for pumps and fans, energy saving or constant torque U/f for special motors
Frequency loop gain		Factory-set with the speed loop stability and gain Possible options for machines with high resistive torque or high inertia, or for machines with fast cycles
Slip compensation		Automatic whatever the load. Can be suppressed or adjusted

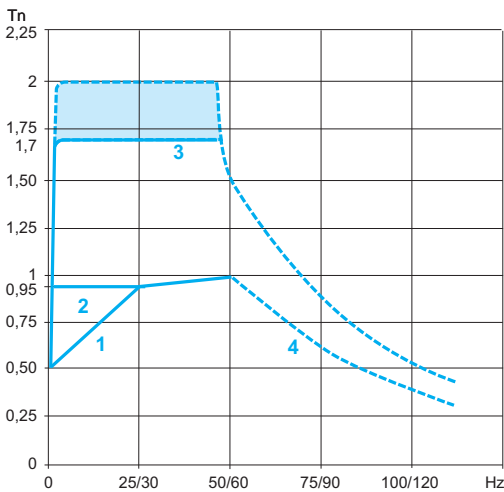
(1) See table on page 60267/3 to check permitted cable lengths.

Electrical characteristics			
Power supply	Voltage	V	200 -15% ... 240 +10% single phase for ATV 31●●●●M2 200 -15% ... 240 +10% 3-phase for ATV 31●●●●M3X 380 -15% ... 500 +10% 3-phase for ATV 31●●●●N4 525 -15% ... 600 +10% 3-phase for ATV 31●●●●S6X
	Frequency	Hz	50 -5% ... 60 +5%
Prospective short-circuit current ISC	For drives		
	ATV 31●●●●M2	A	≤ 1000 (ISC at connection point) for single phase power supply
	ATV 31H018M3X...HU40M3X, ATV 31H/C/K037N4...H/C/KU40N4, ATV 31H075S6X...HU40S6X	A	≤ 5000 (ISC at connection point) for 3-phase power supply
	ATV 31HU55M3X...HD15M3X, ATV 31HU55N4...HD15N4, ATV 31CU55N4...CD15N4, ATV 31KU55N4...KD15N4, ATV 31HU55S6X...HD15S6X	A	≤ 22000 (ISC at connection point) for 3-phase power supply
Output voltage			Maximum 3-phase voltage equal to line supply voltage
Maximum connection capacity and tightening torque of the power supply terminals, motor, braking module and DC bus	For drives		
	ATV 31H/C/K018M2...H/C/K075M2, ATV 31H018M3X...HU15M3X		2.5 mm ² (AWG 14) 0.8 Nm
	ATV 31H/C/KU11M2...H/C/KU22M2, ATV 31HU22M3X...HU40M3X, ATV 31H/C/K037N4...H/C/KU40N4, ATV 31H075S6X...HU40S6X		5 mm ² (AWG 10) 1.2 Nm
	ATV 31HU55M3X, HU75M3X, ATV 31H/C/KU55N4, H/C/KU75N4, ATV 31HU55S6X, HU75S6X		16 mm ² (AWG 6) 2.5 Nm
	ATV 31HD11M3X, HD15M3X, ATV 31H/C/KD11N4, H/C/KD15N4, ATV 31HD11S6X, HD15S6X		25 mm ² (AWG 3) 4.5 Nm
Electrical isolation			Electrical isolation between power and control (inputs, outputs, power supplies)
Internal supplies available			Short-circuit and overload protection: <ul style="list-style-type: none"> ■ One +10 V (0/+8%) supply for the reference potentiometer (2.2 to 10 kΩ), maximum current 10 mA ■ One +24 V supply (min. 19 V, max. 30 V) for logic inputs, maximum current 100 mA
Configurable analog inputs	A1		Analog voltage input 0 to +10V, impedance 30 kΩ, maximum safe voltage 30 V
	A2		Analog bipolar voltage input ±10 V, impedance 30 kΩ, maximum safe voltage 30 V
	A3		Analog current input X-Y mA by programming X and Y from 0 to 20 mA, with impedance 250Ω
			AIP: potentiometer reference for ATV 31●●●●●●A only Max. sampling time: 8 ms 10-bit resolution Precision ± 4.3% Linearity ± 0.2% of maximum value Use: <ul style="list-style-type: none"> ■ 100 m maximum with shielded cable ■ 25 m maximum with unshielded cable
Analog voltage or current outputs configurable as logic outputs	AOV		2 assignable analog outputs AOV and AOC These outputs cannot be used at the same time Analog voltage output 0...+10 V, minimum load impedance 470 Ω 8-bit resolution, precision ±1%, linearity ±0.2%
	AOC		Analog current output 0...20 mA, maximum load impedance 800 Ω 8-bit resolution, precision ±1%, linearity ±0.2% This AOC analog output can be configured as a 24 V logic output, max. 20 mA, minimum load impedance 1.2 kΩ Max. sampling time: 8 ms
Configurable relay outputs	R1A, R1B, R1C		1 relay logic output, one "N/C" contact and one "N/O" contact with common point. Minimum switching capacity: 10 mA for ~ 5 V Maximum switching capacity: <ul style="list-style-type: none"> ■ on resistive load (cos φ = 1 and L/R = 0 ms): 5 A for ~ 250 V or ~ 30 V, ■ on inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A for ~ 250 V or ~ 30 V Max. sampling time: 8 ms Switching: 100,000 operations
	R2A, R2B		1 relay logic output, one "N/C" contact, contact open on fault. Minimum switching capacity: 10 mA for ~ 5 V Maximum switching capacity: <ul style="list-style-type: none"> ■ on resistive load (cos φ = 1 and L/R = 0 ms): 5 A for ~ 250 V or ~ 30 V, ■ on inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A for ~ 250 V or ~ 30 V Max. sampling time: 8 ms Switching: 100,000 operations

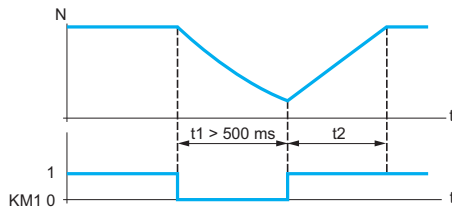
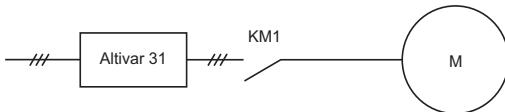
Variable speed drives for asynchronous motors

Altivar 31

Electrical characteristics (continued)			
Logic inputs LI	LI1...LI6		6 programmable logic inputs Impedance 3.5 kΩ + 24 V internal or 24 V external power supply (min. 19 V, max. 30 V) Max. current: 100 mA Max. sampling time: 4 ms Multiple assignment makes it possible to configure several functions on one input (example: LI1 assigned to forward and preset speed 2, LI3 assigned to reverse and preset speed 3)
		Positive logic	State 0 if < 5 V or logic input not wired, state 1 if > 11 V
		Negative logic	State 0 if > 19 V or logic input not wired, state 1 if < 13 V
		CLI position	Connection to PLC output (see diagram, page 60264/2)
Maximum I/O connection capacity and tightening torque			2.5 mm ² (AWG 14) 0.6 Nm
Acceleration and deceleration ramps			Ramp profiles: ■ 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)
Braking to a standstill			By d.c. injection: ■ 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
Main protection and safety features of the drive			Thermal protection against overheating Protection against short-circuits between motor phases Protection against input phase breaks Protection against motor phase breaks Protection against overcurrent between output phases and earth Line supply overvoltage and undervoltage safety circuits Line supply phase loss safety function, for 3-phase supply
Motor protection (see page 60270/15)			Thermal protection integrated in the drive by continuous calculation of the I ² t
Dielectric strength	Between earth and power terminals		2040 V ∴ for ATV 31 ●●●●M2 and M3X, 2410 V ∴ for ATV 31 ●●●●N4, 2550 V ∴ for ATV 31 ●●●●S6X
	Between control and power terminals		2880 V ∼ for ATV 31 ●●●●M2 and M3X, 3400 V ∼ for ATV 31 ●●●●N4, 3600 V ∼ for ATV 31 ●●●●S6X
Insulation resistance to earth			> 500 MΩ (electrical isolation) 500 V ∴ for 1 minute
Signalling			1 red LED on front: LED lit indicates the presence of drive voltage Display coded by four 7-segment display units displaying the CANopen bus status (RUN and ERR).
Frequency resolution	Display units	Hz	0.1
	Analog inputs	Hz	0.1 ... 100 Hz (calculate (high speed – low speed)/1024)
Time constant for reference change			5 ms
Communication			Modbus and CANopen are integrated into the drive and available via an RJ45 connector
	Modbus		RS 485 multidrop serial link Modbus in RTU mode Services supported: decimal function codes 03, 06, 16, 23 and 43 Broadcasting Number of addresses: drive address can be configured via the integrated terminal from 1 to 247 Maximum number of Altivar 31 drives connected: 31 Transmission speed: 4800, 9600 or 19200 bps Used for connecting: ■ the remote terminal (option) ■ the PowerSuite software workshop ■ a PLC ■ a microprocessor card ■ a PC
	CANopen		To connect the ATV31 drive on the CANopen bus, use the VW3 CANTAP2 adapter Services supported: ■ Implicit exchange of Process Data Object - 2 PDOs depending on DSP 402 velocity mode - 2 configurable PDOs (data and transmission type) - PDOs can be exchanged between slaves. ■ Explicit exchange of Service Data Object - 1 receive SDO and 1 transmit SDO ■ Boot-up messages, emergency messages, node guarding and producer and consumer heartbeat, sync and NMT Number of addresses: drive address can be configured via the integrated terminal from 1 to 127 Maximum number of Altivar 31 drives connected: 127 Transmission speed: 10, 20, 50, 125, 250, 500 kbps or 1 Mbps



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



KM1: contactor
t1: KM1 opening time (motor freewheeling)
t2: acceleration with ramp
N: speed

Example of breaking of downstream contactor

Torque characteristics (typical curves)

The curves opposite 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.

Special uses

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

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

For motor ratings slightly higher than that of the drive, check that the current taken 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 checked without having to switch to a motor with the same rating as the drive (particularly useful in the case of high power drives). This use requires deactivation of motor phase loss detection.

Connecting motors in parallel

The nominal current of the drive must be greater than or equal to the sum of the currents of the motors to be controlled.

In this case, external thermal protection must be provided for each motor using probes or LRD thermal bimetal overload relays designed for 1.2 times the nominal current of the motor.

If the number of motors connected in parallel is greater than or equal to 3, it is advisable to install a motor choke between the drive and the motors.

Switching the motor at the drive output

The drive can be switched when locked or unlocked. If the drive is switched on-the-fly (drive unlocked), the motor is controlled and accelerates until it reaches the reference speed smoothly following the acceleration ramp.

This use requires configuration of automatic catching a spinning load ("catch on-the-fly"), activation of the function which manages the presence of a downstream contactor and addition of ferrite suppressors at the drive output, see page 60268/3.

Typical applications: loss of safety circuit at drive output, bypass function, switching of motors connected in parallel

Operating recommendations: synchronize the control of the downstream contactor with that of a freewheel stop request sent by the drive on a logic input.

(1) For power ratings ≤ 250 W, the motor is derated to a lesser extent (20% instead of 50% at very low frequencies).

(2) The nominal motor frequency and the maximum output frequency can be adjusted from 40 to 500 Hz.

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