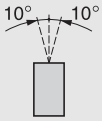
Variable speed drives
Altivar 312

Environmental characteristics

Conformity to standards			Altivar 312 drives have been developed to conform to the strictest international standards and the recommendations relating to electrical industrial control devices (IEC), in particular: IEC 61800-5-1 (low voltage), IEC 61800-3 (EMC immunity and conducted and radiated EMC emissions).
EMC immunity			IEC 61800-3, Environments 1 and 2 (EMC requirement and specific test methods) IEC 61000-4-2 level 3 (electrostatic discharge immunity test) IEC 61000-4-3 level 3 (radio-frequency radiated electromagnetic field immunity test) IEC 61000-4-4 level 4 (electrical fast transient/burst immunity test) IEC 61000-4-5 level 3 (surge immunity test)
Conducted and radiated EMC emissions for drives	ATV 312H●●●●●		IEC 61800-3, Environments: 2 (industrial power supply) and 1 (public power supply), restricted distribution
	ATV 312H018M2...HU15M2 ATV 312H037N4...HU40N4		IEC 61800-3 category C2 With additional EMC filter *(1)*: ■ IEC 61800-3 category C1
	ATV 312HU22M2, ATV 312HU55N4...HD15N4		IEC 61800-3 category C3 With additional EMC filter *(1)*: ■ IEC 61800-3 category C2 ■ IEC 61800-3 category C1
	ATV 312H018M3...HD15M3		With additional EMC filter *(1)*: ■ IEC 61800-3 category C2
CE **marking**			The drives are marked CE in accordance with the European low voltage (2006/95/EC) and EMC (2004/108/EC) directives
Product certification			UL, CSA, NOM, GOST, C-Tick and DNV
Degree of protection			IP 31 and IP 41 on upper part and IP 21 on connection terminals
Vibration resistance	Drive not mounted on ⊔ rail		Conforming to IEC 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 60068-2-27
Maximum ambient pollution Definition of insulation			Degree 2 conforming to IEC 61800-5-1
Environmental conditions Use			IEC 60721-3-3 classes 3C2 and 3S2
Relative humidity		**%**	5…95 non condensing, no dripping water, conforming to IEC 60068-2-3
Ambient air temperature around the device	Operation	**°C**	- 10…+ 50 without derating - 10…+ 60 with derating removing the protective cover on top of the drive (see derating curves, page 60430/4)
	Storage	**°C**	- 25…+ 70
Maximum operating altitude	ATV 312H●●●●●	**m**	1000 without derating
	ATV 312H●●●M2	**m**	Up to 2000 for single-phase supplies and corner grounded distribution networks, derating the current by 1% for each additional 100 m
	ATV 312H●●●M3 ATV 312H●●●N4 ATV 312H●●●S6	**m**	Up to 3000 metres for three-phase supplies, derating the current by 1% for each additional 100 m
Operating position Maximum permanent angle in relation to the normal vertical mounting position			

(1) See table on page 60426/3 to check the permitted cable lengths.

Drive characteristics

Output frequency range			**Hz**	0…500
Switching frequency			**kHz**	Nominal switching frequency: 4 kHz without derating in continuous operation. Adjustable during operation from 2…16 kHz Above 4 kHz, derate the nominal drive current. The nominal motor current should not exceed this value. See derating curves on page 60430/4
Speed range				1…50
Transient overtorque				170...200% of nominal motor torque (typical value)
Braking torque	With braking resistor	ATV 312H●●●●●		100% of nominal motor torque continuously and up to 150% for 60 s
	Without braking resistor	ATV 312H018M2		150% of nominal motor torque (typical value)
		ATV 312H037M2…H075M2 ATV 312H018M3…H075M3 ATV 312H037N4…H075N4 ATV 312H075S6		100% of nominal motor torque (typical value)
		ATV 312HU11M2, HU15M2 ATV 312HU11M3, HU15M3 ATV 312HU11N4, HU15N4 ATV 312HU15S6		50% of nominal motor torque (typical value)
		ATV 312HU22M2 ATV 312HU22M3…HD15M3 ATV 312HU22N4…HD15N4 ATV 312HU22S6…HD15S6		30% of nominal motor torque (typical value)
Maximum transient current				150% of the nominal drive current for 60 seconds (typical value)
Motor control profiles				■ Standard ratio (voltage/frequency) ■ Performance ratio (sensorless flux vector control) ■ Pump/fan ratio (Kn² quadratic ratio) ■ Energy saving ratio (specifically for ventilation)
Frequency loop gains				Factory-set with 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 inhibited or adjusted

Electrical power characteristics

Power supply	Voltage		**V**	200 - 15% … 240 + 10% single-phase for ATV 312●●●●M2 200 - 15% … 240 + 10% three-phase for ATV 312●●●●M3 380 - 15% … 500 + 10% three-phase for ATV 312●●●●N4 525 - 15% … 600 + 10% three-phase for ATV 312●●●●S6
	Frequency		**Hz**	50…60 + 5%
Prospective short-circuit current Isc	ATV 312●●●●M2		**A**	≤ 1000 (Isc at the connection point) for single-phase power supply
	ATV 312H018M3…HU40M3 ATV 312H037N4…HU40N4 ATV 312H075S6…HU40S6		**A**	≤ 5000 (Isc at the connection point) for three-phase power supply
	ATV 312HU55M3…HD15M3 ATV 312HU55N4…HD15N4 ATV 312HU55S6…HD15S6		**A**	≤ 22000 (Isc at the connection point) for three-phase power supply
Drive supply voltage and output voltage				**Drive supply voltage** / **Drive output voltage for motor**
	ATV 312H●●●M2		**V**	200…240 single-phase / 200…240 three-phase
	ATV 312H●●●M3		**V**	200…240 three-phase / 200…240 three-phase
	ATV 312H●●●N4		**V**	380…500 three-phase / 380…500 three-phase
	ATV 312H●●●S6		**V**	525…600 three-phase / 525…600 three-phase

Connection characteristics
(drive terminals for line supply, motor output, DC bus and braking resistor)

Drive terminals			**L1, L2, L3, U, V, W, PC/–, PA/+, PB**
Maximum wire size and tightening torque	ATV 312H018M2…H075M2 ATV 312H018M3…HU15M3		2.5 mm² (AWG 14) 0.8 Nm
	ATV 312HU11M2…HU22M2 ATV 312HU22M3…HU40M3 ATV 312H037N4…HU40N4 ATV 312H075S6…HU40S6		5 mm² (AWG 10) 1.2 Nm
	ATV 312HU55M3, HU75M3 ATV 312HU55N4, HU75N4 ATV 312HU55S6, HU75S6		16 mm² (AWG 6) 2.5 Nm
	ATV 312HD11M3, HD15M3 ATV 312HD11N4, HD15N4 ATV 312HD11S6, HD15S6		25 mm² (AWG 3) 4.5 Nm
Electrical isolation			Electrical isolation between power and control (inputs, outputs, power supplies)

Presentation: page 60420/2 | References: page 60422/2 | Dimensions: page 60429/2 | Schemes: page 60430/2 | Functions: page 60432/2

Electrical control characteristics

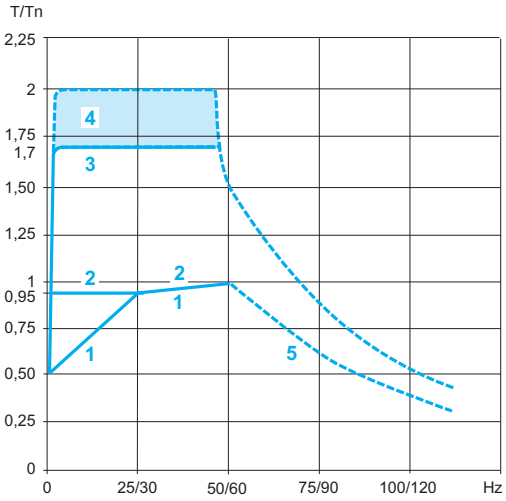
Available internal supplies			Protected against short-circuits and overloads: ■ One 10 V ⎓ (0/+ 8%) supply for the reference potentiometer (2.2 to 10 kΩ), maximum current 10 mA ■ One 24 V ⎓ supply (min. 19 V, max. 30 V) for the control logic inputs, maximum current 100 mA
Analog inputs			Sampling time < 8 ms Resolution: 10 bits Accuracy: ± 4.3% Linearity: ± 0.2% of the maximum scale value Use: ■ 100 m maximum with shielded cable ■ 25 m maximum with unshielded cable
	AI1		One 0...10 V ⎓ analog voltage input , impedance 30 kΩ, maximum safe voltage 30 V
	AI2		One ± 10 V bipolar voltage analog input, impedance 30 kΩ, maximum safe voltage 30 V
	AI3		One X-Y mA analog current input, X and Y programmable from 0 to 20 mA, with impedance 250 Ω
Analog voltage outputs or analog current outputs configurable as logic outputs			2 analog outputs: ■ 1 analog voltage output (AOV) ■ 1 analog current output (AOC) configurable as a logic output. These 2 analog outputs cannot be used at the same time
	AOV		0...10 V ⎓ analog voltage output, min. load impedance 470 Ω 8-bit resolution, accuracy ± 1%, linearity ± 0.2% of the maximum scale value
	AOC		0…20 mA analog current output, max. load impedance 800 Ω 8-bit resolution, accuracy ± 1%, linearity ± 0.2% The AOC analog output can be configured as a 24 V logic output, max. 20 mA, min. load impedance 1.2 kΩ Refresh time < 8 ms
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: ■ 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 ⎓ 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: ■ 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 ⎓ Sampling time < 8 ms Switching: 100,000 operations
LI logic inputs	LI1…LI6		6 programmable logic inputs, compatible with PLC level 1, standard IEC/EN 61131-2 Impedance 3.5 kΩ 24 V ⎓ internal or 24 V ⎓ external power supply (min. 19 V, max. 30 V) Max. current: 100 mA 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 (Source)		State 0 if < 5 V or logic input not wired State 1 if > 11 V
	Negative logic (Sink)		State 0 if > 19 V or logic input not wired State 1 if < 13 V
	CLI position		Connection to PLC output (see diagram on page 60430/2)
Maximum I/O wire size and tightening torque			2.5 mm² (AWG 14) 0.6 Nm

Electrical control characteristics (continued)

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 exceeded, possible inhibition of this adaptation (use of a braking resistor)
Braking to a standstill				By DC injection: ■ By a command on a logic input (LI1 to LI6) ■ 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 drive protection and safety features				Thermal protection against overheating Protection against short-circuits between motor phases Input phase loss protection, for three-phase supply Protection against motor phase breaks Overcurrent protection between motor output phases and earth Line supply overvoltage and undervoltage safety features
Motor protection (see page 60432/15)				Thermal protection integrated in the drive by continuous calculation of the I^2t
Dielectric strength	Between earth and power terminals	ATV 312H●●●M2 ATV 312H●●●M3		2040 V ⎓
		ATV 312H●●●N4		2410 V ⎓
		ATV 312H●●●S6		2550 V ⎓
	Between control and power terminals	ATV 312H●●●M2 ATV 312H●●●M3		2880 V ∿
		ATV 312H●●●N4		3400 V ∿
		ATV 312H●●●S6		3600 V ∿
Signalling				Display coded by one 4-digit display (messages, values) and 5 status LEDs (current mode, CANopen bus)
Frequency resolution	Display units		**Hz**	0.1
	Analog inputs		**Hz**	Resolution = ((high speed - low speed)/1024) Min. value = 0.1
Time constant on a change of reference			**ms**	5

Communication port characteristics

Available protocols			Modbus and CANopen protocols integrated in the drive. Both these protocols can be accessed via a single RJ45 connector on the underside of the drive.
Modbus protocol			
Structure	Connector		RJ45
	Physical interface		RS 485
	Transmission mode		RTU
	Transmission speed		Configurable via the Human-Machine interface, remote display terminals or SoMove setup software: 4800, 9600 or 19200 bps
	Number of subscribers		31
	Address		1 to 247, configurable via the Human-Machine interface, remote display terminals or SoMove setup software
Services	Functional profiles		CiA 402
	Messaging		Read Holding Registers (03) Write Single Register (06) Write Multiple Registers (16) Read Device Identification (43)
	Communication monitoring		Configurable
CANopen protocol			
Structure	Connector		RJ45
	Network management		Slave
	Transmission speed		Configurable via the Human-Machine interface, remote display terminals or SoMove setup software: 10, 20, 50, 125, 250, 500 kbps or 1 Mbps
	Number of subscribers		127
	Address (Node ID)		1 to 127, configurable via the Human-Machine interface, remote display terminals or SoMove setup software
Services	Number of PDOs (Process Data Objects)		2 PDOs: ■ PDO 1: cannot be configured ■ PDO 6: can be configured
	PDO modes		PDO 1: asynchronous PDO 6: asynchronous, Sync, cyclic asynchronous
	Number of SDOs (Service Data Objects)		1 receive SDO and 1 transmit SDO
	Functional profiles		CiA 402
	Communication monitoring		Node guarding and Heartbeat, Boot-up messages, Emergency messages, Sync and NMT
Diagnostics	Using LEDs		On Human-Machine interface
Description file			An eds file is available on our website www.schneider-electric.com or the “Description of the Motion & Drives offer” DVD-ROM



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.

1 Self-cooled motor: continuous useful torque *(1)*
2 Force-cooled motor: continuous useful torque
3 Transient overtorque for 60 s
4 Transient overtorque for 2 s
5 Torque in overspeed at constant power *(2)*

Special uses

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

The device can power any motor which has a lower rating than that for which the drive was 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.

Testing 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.

Use of motors in parallel

The drive rating must be greater than or equal to the sum of the currents and powers of the motors to be controlled.
In this case, it is necessary to provide external thermal protection for each motor using probes or thermal overload relays.
If three or more motors are connected in parallel, it is advisable to install a motor choke between the drive and the motors.
See page 60427/2.

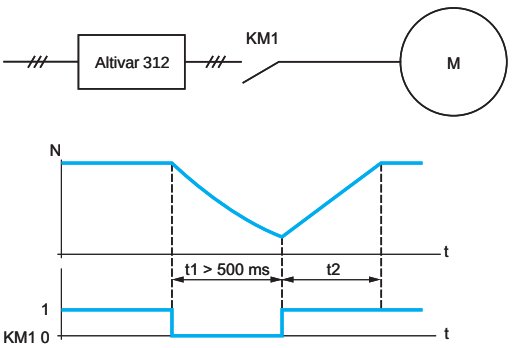
Motor switching at the drive output

Switching can be carried out with the drive locked or unlocked. In the case of switching on-the-fly (drive unlocked), the motor is controlled and accelerated 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”) and activation of the function which manages the presence of an output contactor.

***Note**: Depending on the drive rating, downstream ferrite suppressors may be required between the drive and the output contactor (see page 60427/2).*

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

Recommendations for use: synchronize control of the output contactor with that of a freewheel stop request from the drive on a logic input.



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

Example of loss of output contactor

(1) For power ratings ≤ 250 W, less derating is required (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. The mechanical overspeed characteristics of the selected motor must be checked with the manufacturer.