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# Variable speed drives for asynchronous motors **Altivar 38**

Catalogue  
April

# 2002



Mastering *elements*  
for *more comfort*



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# Variable speed drives for asynchronous motors

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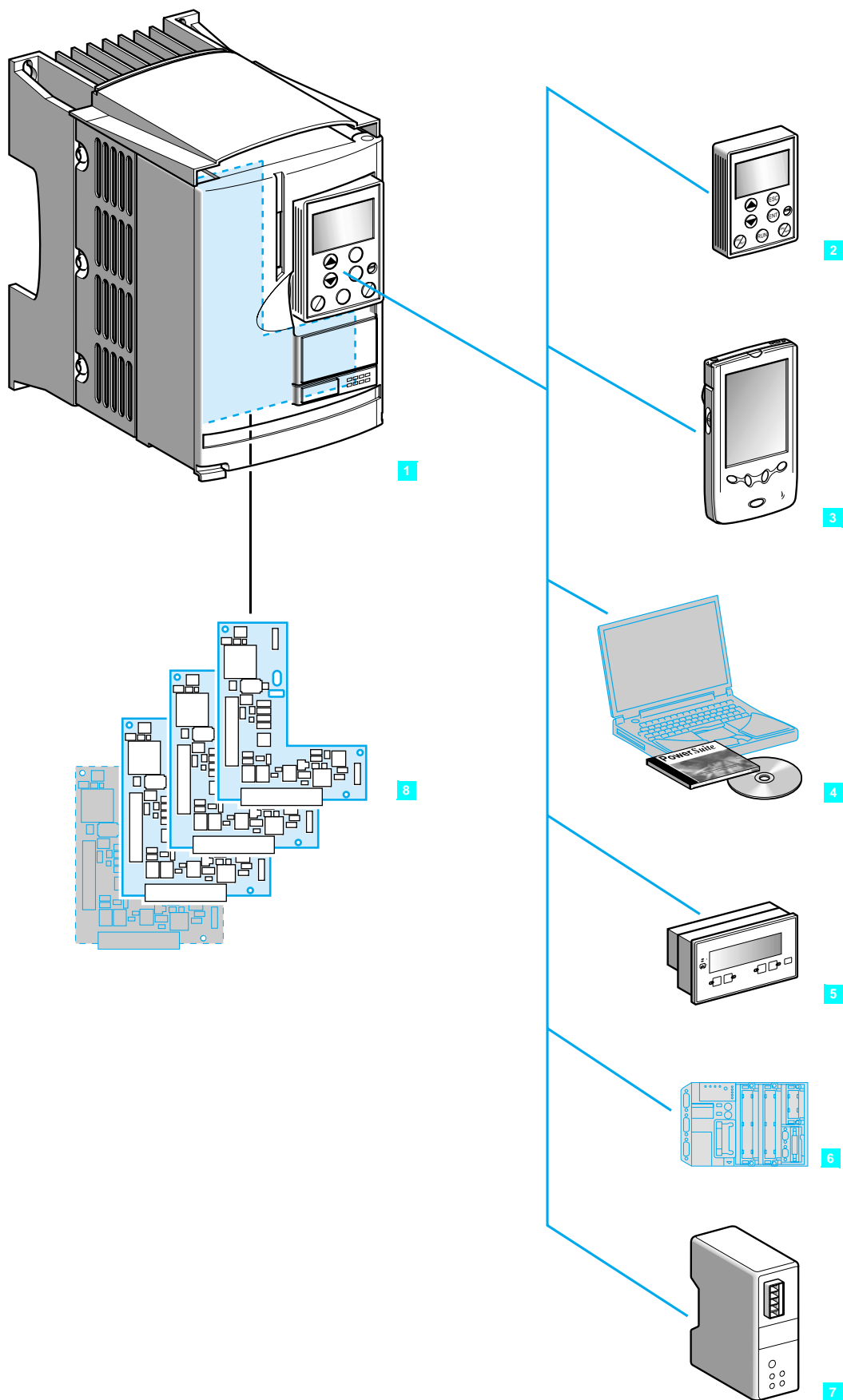
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# Variable speed drives for asynchronous motors

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## Altivar 38

### Applications

The Altivar 38 is a frequency inverter for three-phase asynchronous motors powered by a three-phase supply 360 V to 460 V in the power range 0.75 kW to 315 kW.

The Altivar 38 has been designed for state-of-the-art applications in heating, ventilation and air conditioning (HVAC) in industrial and commercial buildings:

- ventilation
- air conditioning
- pumping

The Altivar 38 can reduce operating costs in buildings by optimizing energy consumption whilst improving user comfort.

Its numerous integrated options enable it to be adapted to and incorporated into electrical installations and sophisticated control systems.

The need for **electromagnetic compatibility** was taken into account at the outset of designing the drive. Depending on the drive rating, filters and chokes are either built-in or available as optional accessories.

### Functions

The Altivar 38 (1) is supplied ready for use in pumping and ventilation applications. It comprises a terminal (2) which can be used to modify programming, adjustment, control or monitoring functions in order to adapt and customize the application to meet individual customer requirements.

#### ■ Specific functions for pumping/ventilation:

- Energy saving
- Automatic catching a spinning load with speed detection (catch on the fly)
- Adaptation of current limiting according to speed
- Faster/slower, preset speeds
- Integrated PI control, with preset PI references
- Electricity and service hours meter
- Motor noise reduction

#### ■ Protection functions:

- Motor and fan thermal protection via PTC thermal probe
- Protection against overloads and overcurrents in continuous operation
- Machine mechanical protection via jump frequency function
- Protection via multiple fault management and configurable alarms

#### ■ Easy to integrate into control systems:

- 4 logic inputs, 2 relay outputs, 2 analog inputs and 1 analog output
- Plug-in I/O connectors
- Display of electrical variables and operating indicators
- An RS 485 multidrop serial link with Modbus protocol as standard in the drive This serial link can be used to connect PLCs (6), a PC, communication gateways or one of the available programming tools.

### Options

#### ■ PowerSuite advanced dialogue solutions:

3 solutions are available, with plain text display in 5 languages (English, French, German, Spanish, Italian) and configuration memory:

- Power Suite Pocket PC (3),
- PowerSuite software workshop (4),
- Magelis display unit (5).

#### ■ Customizing the application:

- I/O extension cards (8).
- Application cards (8):  
pump switching, multi-motor function, multiple parameter settings and cycles
- Communication cards for bus or network (8):  
METASYS N2, Ethernet, Fipio, Uni-Telway/Modbus, Modbus Plus, AS-i, Profibus DP, Interbus-S, CANopen, DeviceNet
- Communication module for LonWorks bus (7)

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### Environment

<b>Conformity to standards</b>		Altivar 38 drives have been developed to conform to the strictest national and international standards and the recommendations relating to electrical industrial control devices (IEC, EN, NFC, VDE), in particular: <ul style="list-style-type: none"> <li>● Low voltage EN 50178</li> <li>● EMC immunity: <ul style="list-style-type: none"> <li>- IEC 1000-4-2/EN 61000-4-2 level 3</li> <li>- IEC 1000-4-3/EN 61000-4-3 level 3</li> <li>- IEC 1000-4-4/EN 61000-4-4 level 3</li> <li>- IEC 1000-4-5/EN 61000-4-5 level 3</li> <li>- IEC 1800-3/EN 61800-3, environments 1 and 2</li> </ul> </li> <li>● EMC, radiated and conducted emissions: <ul style="list-style-type: none"> <li>- IEC 1800-3/EN 61800-3, environments: 2 (industrial supply) and 1 (public supply), restricted distribution</li> <li>- EN 55011 class A (drives with built-in radio interference filters)</li> <li>- EN 55022 class B, with additional filters</li> </ul> </li> </ul>	
<b>CE marking</b>		The drives have been designed to meet the requirements of the European low voltage (73/23/CEE and 93/68/CEE) and EMC (89/336/CEE) directives. Altivar 38 drives are therefore permitted to carry the CE European Union mark.	
<b>Product certification</b>		UL and CSA	
<b>Degree of protection</b>	Conforming to EN 50178	ATV 38HU18N4 to HD23N4 and ATV 38HD25N4● to HD79N4● drives	IP 21 and IP 41 on upper part
<b>Vibration resistance</b>	Conforming to IEC 60068-2-6	ATV 38HC10N4X to HC33N4X drives	IP 00 on lower part (1), IP 20 on other sides
		ATV 38HU18N4 to HD23N4 and ATV 38HD25N4● to HD79N4● drives	1.5 mm peak from 2 to 13 Hz 1gn from 13 to 200 Hz
<b>Shock resistance</b>	Conforming to IEC 60068-2-27	ATV 38HC10N4X to HC33N4X drives	0.6 gn from 10 to 55 Hz 1 gn from 55 to 150 Hz
		All ratings	15 g for 11 ms
<b>Maximum ambient pollution</b>	Conforming to UL 508C	ATV 38HD25N4 to HD79N4 and HD25N4X to HD79N4X drives	Level 3
	Conforming to IEC 664-1 and EN 50718	ATV 38HU18N4 to HD23N4 and ATV 38HC10N4X to HC33N4X drives	Level 2
<b>Maximum relative humidity</b>	Conforming to IEC 60068-2-3		93% without condensation or dripping water
<b>Ambient air temperature around the device</b>	Storage	All ratings	°C - 25...+ 65
	Operation	ATV 38HU18N4 to HU90N4 drives	°C - 10...+ 50 without derating Up to +60 with current derating of 2.2% per °C above 50°C
		ATV 38HD12N4 to HD23N4 and ATV 38HC10N4X to HC33N4X drives	°C - 10...+40 without derating Up to +50 with current derating of 2.2% per °C above 40°C
		ATV 38HD25N4 to HD79N4 and HD25N4X to HD79N4X	°C - 10...+40 without derating Up to +60 with ventilation kit, current derating of 2.2% per °C above 40°C
<b>Maximum operating altitude</b>		m	1000 without derating (above this, derate the current by 1% per additional 100 m)
<b>Operating position</b>			Vertical
<b>Drive characteristics</b>			
<b>Output frequency range</b>			Hz 0.1...500
<b>Configurable switching frequency</b>	Without derating, in continuous operation	ATV 38HU18N4 to HD46N4 and HD25N4X to HD46N4X drives	kHz 0.5-1-2-4
		ATV 38D54N4 to HD79N4 and HD54N4X to HC33N4X drives	kHz 0.5-1-2
	Without derating with intermittent operating cycle or with derating by one power rating in continuous operation	ATV 38HU18N4 to HD23N4	kHz 8-12-16
		ATV 38HD25N4 to HD46N4 and HD25N4X to HD46N4X drives	kHz 8-12
		ATV 38HD54N4 to HD79N4 and HD54N4X to HD79N4X drives	kHz 4-8
ATV 38HC10N4X to HC33N4X drives	kHz 4		
<b>Speed range</b>			1...10
<b>Transient overtorque</b>	110% of the nominal motor torque (typical value at ± 10 %) for 60 s		
<b>Braking torque</b>	30% of nominal motor torque without braking resistor (typical value) for low power ratings		

(1) A protection device to prevent direct contact by personnel must be added.

# Variable speed drives for asynchronous motors

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Electrical characteristics			
Power supply	a.c. voltage	V	ATV 38●●●●N4 et ●●●●N4X drives: 380 - 10% to 460 + 10% 3-phase
	Frequency	Hz	50 ± 5% or 60 ± 5%
Output voltage			Maximum voltage equal to line supply
Electrical isolation			Electrical isolation between power and control (inputs, outputs, power supplies)
Available internal supplies			Protected against short-circuits and overloads - 1 x + 10 V (0, + 10%) supply for the reference potentiometer (1...10 kΩ), maximum current 10 mA - 1 x + 24 V supply (min. 20 V, max. 30 V) for control inputs, maximum current 200 mA
Analog inputs AI			1 analog voltage input AI1: 0-10 V, impedance 30 kΩ 1 analog current input AI2: 0-20 mA, impedance 100 Ω (reassignable to X-Y mA by programming X and Y with a precision of 0.1 mA) Frequency resolution at analog reference: 0.1 Hz for 100 Hz (10 bits) Accuracy ± 1%, linearity ± 0.5 % of the maximum output frequency Sampling time: max. 4 ms Other analog inputs: see option cards
Analog output AO1			Assignable analog output 0-20 mA, max. load impedance 500 Ω (reassignable to X-Y mA by programming X and Y from 0 to 20 with a precision of 0.1 mA) Resolution 0.04 mA (9 bits), linearity ± 0.1 mA, accuracy ± 0.2 mA Max. sampling time 2 ms Other analog inputs: see option cards
Logic inputs LI			4 assignable logic inputs, impedance 3.5 kΩ, compatible with PLC level 1, standard IEC 65A-68. Maximum length of shielded cable: 100 m + 24 V power supply (min. 11 V, max. 30 V). State 0 if < 5 V, state 1 if ≥ 11 V Sampling time: 2 ms max. Other logic inputs: see option cards
Logic outputs			2 relay logic outputs R1 (fault relay) and R2 (assignable) 1 C/O contact protected against overvoltages (relay R1) 1 N/O contact protected against overvoltages (relay R2) Minimum switching capacity: 10 mA for ~ 24 V Maximum switching capacity: - on resistive load (cos φ = 1): 5 A for ~ 250 V or ~ 30 V, - on inductive load (cos φ = 0.4 and L/R = 7 ms): 1.5 A for ~ 250 V or ~ 30 V Other outputs: see option cards
Maximum I/O connection capacity			1.5 mm <sup>2</sup> (AWG 14)
Communication			RS 485 multidrop serial link with Modbus protocol integrated into the drive Transmission speed: 9600 or 19200 bps, no parity Use: - connecting a terminal (option) or - connecting a microprocessor card or - connecting a PC or a pocket PC (options) or - connecting one or more PLCs
Acceleration and deceleration ramps			Ramp profiles can be selected: linear, S or U. Possibility of 2 ramp ranges which can be switched via frequency threshold or logic input. Can be adjusted separately between 0.05 and 999.9 s (precision 0.1 s). Automatic adaptation of deceleration ramp times if the braking capacity is exceeded (configurable option).
Braking to a standstill			By d.c. injection: - by a signal on an assignable logic input - automatically on stopping as soon as the frequency drops below 0.1 Hz, for a time which can be set between 0 and 30 s or alternately set - continuous
Main protection and safety features of the drive			Short-circuit protection: - between output phases - between output phases and earth - on internal supply outputs Thermal protection against excessive overheating and overcurrents Mains undervoltage and overvoltage safety circuits Loss of supply phase safety circuit (prevents single phase operation of 3-phase drives)
Motor protection			Thermal protection integrated into the drive via continuous calculation of I <sup>2</sup> t taking the speed into account: - The motor thermal state is saved when the drive is powered down. - The function can be modified via the terminal or by using the PowerSuite advanced dialogue solutions, depending on the type of motor (force-cooled or self-cooled). Protection against loss of motor phase Protection via PTC probes with option card
Insulation resistance to earth		MΩ	> 500 (electrical isolation)

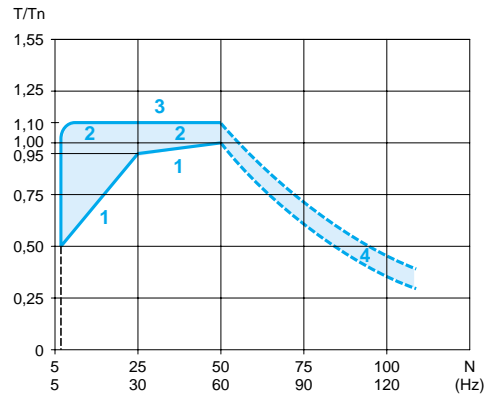
# Variable speed drives for asynchronous motors

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### Torque characteristics (typical curves)

The 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
- 4 Torque in overspeed at constant power

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

### Motor thermal protection

The Altivar 38 drive features motor thermal protection designed specifically for self-cooled or forced-cooled variable speed motors.

This motor thermal protection is designed for a maximum ambient temperature of 40°C around the motor.

If the temperature around the motor exceeds 40°C, thermal protection should be provided directly by thermistor probes integrated into the motor using one of the available option cards.



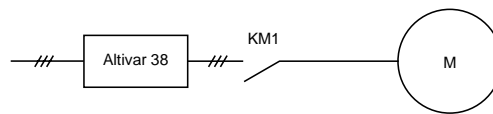
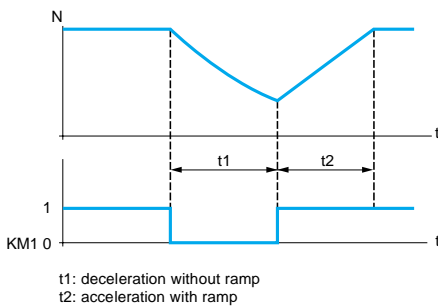
### Special uses

#### 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 locked), the motor is controlled and accelerates until it reaches the reference speed smoothly following the acceleration ramp. The "flying restart" must be configured for this type of use and the "loss of motor phase" protection function must be disabled.

Example: breaking of downstream contactor

**Typical applications:** breaking safety circuit at drive outputs, "bypass" function, switching of motors connected in parallel



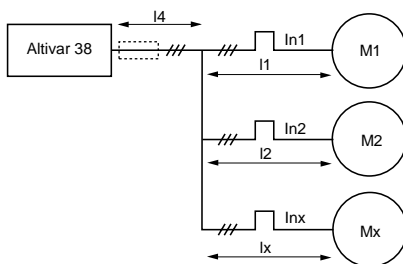
#### Operation with intermittent cycle and high switching frequency

If the operating conditions are intermittent and the maximum cumulative running time is 36 s per 60 s cycle (load factor 60%), it is possible to operate at a high switching frequency without derating the power.

Switching frequencies (in kHz)

- 8-12-16 for ATV 38HU18N4 to HD23N4 drives
- 8-12 for ATV 38HD25N4● to HD46N4● drives
- 4 for ATV 38HD54N4● to HC33N4X drives

#### Connecting motors in parallel



Calculating the drive rating:  
 $I_n \text{ drive} > I_{n1} + I_{n2} + \dots + I_{nx}$

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, provide external thermal protection for each motor using thermal probes or relays. If the number of motors connected in parallel is  $\geq 3$ , it is advisable to install an output filter between the drive and the motors or to reduce the switching frequency.

If several motors are used in parallel, there are 2 possible scenarios:

- the motors have equal power ratings, in which case the torque characteristics will remain optimised after the drive has been configured
- the motors have different power ratings, in which case the drive configuration will be incompatible for the motors with the lowest power ratings and the overtorque at low speed will be considerably reduced.

**Ensure** that the cables are the correct length.

As the leakage currents are proportional to the total length of the cable between the drive and the motors, ensure  $L \leq 100 \text{ m}$  by  $L = l_1 + l_2 + \dots + l_x$ . For longer lengths, please consult your Regional Sales Office.

# Variable speed drives for asynchronous motors

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### Variable torque applications (110% T<sub>n</sub>)



ATV 38HU18N4



ATV 38HD28N4



ATV 38HC19N4X

### 3-phase supply voltage: 380...460 V 50/60 Hz

Motor Power (1)	Mains (2) Line current at 400 V	Altivar 38			Power dissipated at nominal load (4)	Reference		Weight
		Nominal drive current	Max. transient current (3)			With integral EMC filters	No EMC filters	
kW	A	A	A	W			kg	
0.75	3.1	2.1	2.3	55	ATV 38HU18N4	–	3.800	
1.5	5.4	3.7	4.1	65	ATV 38HU29N4	–	3.800	
2.2	7.3	5.4	6	105	ATV 38HU41N4	–	3.800	
3	10	7.1	7.8	145	ATV 38HU54N4	–	6.900	
4	12.3	9.5	10.5	180	ATV 38HU72N4	–	6.900	
5.5	16.3	11.8	13	220	ATV 38HU90N4	–	6.900	
7.5	24.3	16	17.6	230	ATV 38HD12N4	–	13.000	
11	33.5	22	24.2	340	ATV 38HD16N4	–	13.000	
15	43.2	30	33	410	ATV 38HD23N4	–	15.000	
18.5	42	37	41	670	ATV 38HD25N4	–	34.000	
					–	ATV 38HD25N4X	34.000	
22	49	44	49	750	ATV 38HD28N4	–	34.000	
					–	ATV 38HD28N4X	34.000	
30	65	60	66	925	ATV 38HD33N4	–	34.000	
					–	ATV 38HD33N4X	34.000	
37	79	72	80	1040	ATV 38HD46N4	–	34.000	
					–	ATV 38HD46N4X	34.000	
45	95	85	94	1045	ATV 38HD54N4	–	57.000	
					–	ATV 38HD54N4X	57.000	
55	118	105	116	1265	ATV 38HD64N4	–	57.000	
					–	ATV 38HD64N4X	57.000	
75	158	138	152	1730	ATV 38HD79N4	–	57.000	
					–	ATV 38HD79N4X	57.000	
90	156 (5)	173	190	2250	–	ATV 38HC10N4X	49.000	
110	191 (5)	211	232	2750	–	ATV 38HC13N4X	75.000	
132	229 (5)	253	278	3300	–	ATV 38HC15N4X	77.000	
160	279 (5)	300	330	4000	–	ATV 38HC19N4X	77.000	
200	347 (5)	370	407	5000	–	ATV 38HC23N4X	159.000	
220	384 (5)	407	448	5500	–	ATV 38HC25N4X	166.000	
250	433 (5)	450	495	6250	–	ATV 38HC28N4X	168.000	
280	485 (5)	503	553	7000	–	ATV 38HC31N4X	168.000	
315	536 (5)	564	620	7875	–	ATV 38HC33N4X	168.000	

(1) Value indicated on the motor rating plate. These power levels are for the maximum switching frequency permitted by the drive (2 or 4 Hz depending on the rating) in continuous operation. For switching frequencies above this level, the drive must be in intermittent operation or it must be set one rating lower (see special uses on the previous pages).

(2) The prospective short-circuit current at 400 V is 5 kA for ATV 38HU18N4 to HU90N4 drive ratings and 22 kA for ATV 38HD25N4 to HC33N4X drive ratings.

(3) For 60 seconds

(4) These power levels are given for the maximum switching frequency permitted by the drive in continuous operation (2 or 4 kHz, depending on the rating).

(5) The addition of a line choke is recommended in particular for these drive ratings. The current values given include the addition of a line choke.

# Variable speed drives for asynchronous motors

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Options: dialogue

## Operator terminal

The removable operator terminal fits into a designated slot on the front panel of the drive. The operator terminal is supplied with the drive or can be ordered separately.

The operator terminal can be used:

- in 5 languages (English, French, German, Spanish, Italian)
- to control, adjust and configure the drive
- for visible remote signalling
- to save and download configurations (4 files can be saved)

Its maximum operating temperature is 60°C.



### Display (backlit)

- ↻ Flashing: indicates the selected direction of rotation
- ↻ Steady: indicates the direction of motor rotation
- LOC Indicates control via the display module
- PROG Appears in setup and programming mode  
Flashing: indicates that a value has been modified but not saved
- 4 digits visible at 5 m: displays numeric values and codes
- One line of 16 characters: displays messages in plain text

### The keys are used:

- To adjust and configure the drive
- To control the drive

Description	Reference (if ordered separately)	Weight kg
Operator terminal	VW3 A58101	0.200

## Kit for remote operator terminal

The removable operator terminal can be used remotely, mounted on an enclosure door, using this kit.

Description	Reference	Weight kg
Kit comprising: - 1 cable fitted with connectors, length 3 m - seals and screws for IP 65 mounting on an enclosure door - installation guide	VW3 A58103	0.200

## PowerSuite advanced dialogue solutions

See pages 18 and 19.

### Connection kit for RS 485

This kit can be used to connect the drive to PLCs, operator terminals, etc., via the RS 485 multidrop serial link. The kit is connected instead of the operator terminal (the two cannot be used simultaneously).

Description	Reference	Weight kg
Connection kit for RS 485 comprising: - 1 x 3 m cable with 1 male 9-way SUB-D connector and 1 male 15-way SUB-D connector - installation guide	VW3 A58106	0.200

# Variable speed drives for asynchronous motors

## Altivar 38 Accessories



VW3 A58823

### Control card fan kit

The fan kit enables the drive to operate in a 60°C environment, for example if it is installed in an IP 54 enclosure. The circulation of air around the electronic cards prevents hot spots from forming.

This kit is mounted on the upper part of the drive. It is powered by the drive.

The kit comprises:

- a fan subassembly
- mounting accessories

For drives	Reference	Weight kg
ATV 38HU18N4, HU29N4, HU41N4	<b>VW3 A58822</b>	0.450
ATV 38HU54N4, HU72N4, HU90N4	<b>VW3 A58823</b>	0.450
ATV 38HD12N4, HD16N4, HD23N4	<b>VW3 A58824</b>	0.500
ATV 38HD25N4, HD28N4, HD33N4, HD46N4 ATV 38HD25N4X, HD28N4X, HD33N4X, HD46N4X	<b>VW3 A58825</b>	1.200
ATV 38HD54N4, HD64N4, HD79N4 ATV 38HD54N4X, HD64N4X, HD79N4X	<b>VW3 A58826</b>	1.200

### NEMA type 1 kit

The kit permits the connection of cables conforming to the NEMA type 1 standard.

This kit is mounted on the lower part of the drive.

The kit comprises:

- a cover made up of two metal parts
- mounting accessories

For drives	Reference	Weight kg
ATV 38HU18N4, HU29N4, HU41N4	<b>VW3 A58852</b>	0.950
ATV 38HU54N4, HU72N4, HU90N4	<b>VW3 A58853</b>	1.000
ATV 38HD12N4, HD16N4	<b>VW3 A58854</b>	1.100
ATV 38HD23N4	<b>VW3 A58855</b>	1.100
ATV 38HD25N4, HD28N4, HD33N4, HD46N4	<b>VW3 A58856</b>	1.120
ATV 38HD54N4, HD64N4, HD79N4	<b>VW3 A58857</b>	3.200

### Presentation



VW3 A6650



VW3 A6850

Line chokes can be used to provide improved protection against overvoltages on the line supply and to reduce harmonic distortion of the current produced by the drive. The recommended chokes are used to limit the line current.

The use of line chokes is recommended in particular under the following circumstances:

- Line supply with significant interference from other equipment (interference, overvoltages)
- Line supply with voltage imbalance between phases > 1.8% of the nominal voltage
- Line with very low impedance (in the vicinity of power transformers 10 times more powerful than the drive rating)
- Large number of frequency converters on the same line in order to reduce the line current
- Use of cos  $\varphi$  correction capacitors or a power factor correction unit

ATV 38HD25N4 (18.5 kW) to HD79N4 (75 kW) and HD25N4X (18.5 kW) to HD79N4X (75 kW) drives have a built-in line choke which limits the line current to the value of the nominal current of the motor.

### Characteristics

Chokes		VW3 A66501 to VW3 A66503	VW3 A66504	VW3 A6850
Conformity to standards		EN 50178 (VDE 0160 level 1 high energy overvoltages on the line supply)		IEC 60076 (with HD 398)
Voltage drop		Between 3 and 5% of the supply voltage. Values higher than this will cause loss of torque.		
Degree of protection	Choke	IP 00	IP 00	IP 00
	Terminals	IP 20	IP 10	-

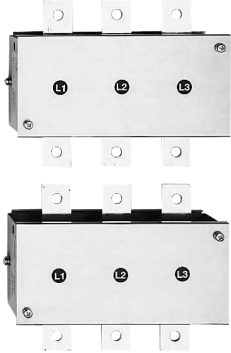
### References

Drive	Prospective Isc line kA	Line current without choke at 400 V A	Line current with choke A	Choke Value of the choke mH	Nominal current A	Loss W	Reference	Weight kg
<b>3-phase supply voltage: 380 V - 10%...460 V + 10%</b>								
ATV 38HU18N4	5	3.4	1.8	10	4	45	VW3 A66501	1.500
ATV 38HU29N4	5	6	3.3	10	4	45	VW3 A66501	1.500
ATV 38HU41N4	5	7.8	4.8	4	10	65	VW3 A66502	3.000
ATV 38HU54N4	5	10.2	6.4	4	10	65	VW3 A66502	3.000
ATV 38HU72N4	5	13	8.3	4	10	65	VW3 A66502	3.000
ATV 38HU90N4	5	17	11.6	2	16	75	VW3 A66503	3.500
ATV 38HD12N4	22	26.5	15.4	2	16	75	VW3 A66503	3.500
ATV 38HD16N4	22	35.4	22.7	1	30	90	VW3 A66504	6.000
ATV 38HD23N4	22	44.7	29.4	1	30	90	VW3 A66504	6.000
ATV 38HD25N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD28N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD33N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD46N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD54N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD64N4 (1)	22	-	-	-	-	-	-	-
ATV 38HD79N4 (1)	22	-	-	-	-	-	-	-
ATV 38HC10N4X	22	-	156 (2)	0.220	160	220	VW3 A68501	35.000
ATV 38HC13N4X	22	-	191 (2)	0.155	195	220	VW3 A68502	35.000
ATV 38HC15N4X	22	-	229 (2)	0.120	235	220	VW3 A68503	40.000
ATV 38HC19N4X	22	-	279 (2)	0.098	280	245	VW3 A68504	50.000
ATV 38HC23N4X	22	-	347 (2)	0.066	365	270	VW3 A68505	50.000
ATV 38HC25N4X, ATV 38HC28N4X	22	-	384 (2)	0.049	455	270	VW3 A68506	55.000
ATV 38HC31N4X, ATV 38HC33N4X	22	-	433 (2)	0.038	540	280	VW3 A68507	60.000

(1) The line choke is integrated into these drives.

(2) The addition of a line choke is recommended in particular for these drive ratings. The current values given include the addition of a line choke.

#### Presentation



VW3 A68403



VW3 A68465

#### Function

##### ■ Note about built-in filters:

ATV 38HU18N4 to HD79N4 drives have a built-in radio interference filter to meet EMC "product" standards for speed drives IEC 1800-3 and EN 61800-3. Compliance with these standards is sufficient to meet the requirements of the European EMC (electromagnetic compatibility) directive.

##### ■ Additional input filters:

The additional radio interference input filters enable the drives to meet more stringent requirements.

These filters are designed to reduce emissions conducted on the line supply below the limits of standards EN 55011 class A or EN 55022 class B. They can be added to the following drives:

- ATV 38HU18N4 to ATV 38 D23N4 which already have a built-in filter, if the motor cable is more than 5 m long
- ATV 38HD25N4● to ATV 38 D79N4● (1), available with or without built-in filters, if the motor cable is more than 25 m long
- ATV 38HC10N4X to ATV 38HC33N4X without built-in filters

Additional input filters should be installed on the line supply, upstream of the drive, if the surrounding environment is subject to electromagnetic interference and radio-electric frequencies above 150 kHz.

VW3 A58402 to VW3 A58408 filters can be installed on ATV 38H●●●● drives. They act as supports for the drives and are fixed to them via tapped holes.

VW3 A68401 to VW3 A68403 and VW3 A68415, A68435 and A68465 filters should be installed next to the drives.

The motor cables should be shielded and not exceed the maximum length given in the reference table.

For the filter to operate efficiently, the installation conditions must be carefully respected.

#### Use according to the type of mains supply

The **built-in filters** are compatible with IT connection (impeding or isolated neutral) up to 460 V. They help to attenuate interference even in conditions not defined by the EMC standard.

These **additional input filters** may only be used on TN (connected to neutral) and TT (neutral to earth) type supplies. They are not permitted on IT (impedance or isolated neutral) supplies.

(1) If EMC conformance is not required, replace ● with an X in the drive reference.

#### Characteristics

Filters			VW3 A5840●	VW3 A684●●
Conformity to standards			EN 133200	
Degree of protection			IP 21 and IP 41 on upper part	IP 00
Maximum relative humidity			93% without condensation or dripping water conforming to IEC 68-2-3	
Maximum operating temperature	Operation	°C	- 10...+ 60	0...+ 45, up to + 55 with current derating of 2% per °C above 45°C.
	Storage	°C	- 25...+ 70	
Maximum operating altitude	Without derating	m	1000 (above this, derate the current by 1% per additional 100 m)	

# Variable speed drives for asynchronous motors

Altivar 38

Radio interference input filters

## Reference

For drives	Filters		Nominal filter current	Reference	Weight	
	Maximum length of motor cable (1)					
	EN 55011 class A	EN 55022 class B	A		kg	
<b>3-phase supply voltage: 380 V - 10%...460 V + 10% 50-60Hz</b>						
ATV 38HU18N4, HU29N4, HU41N4	50	20	25	VW3 A58402	3.600	
ATV 38HU54N4, HU72N4, HU90N4	50	20	25	VW3 A58403	5.000	
ATV 38HD12N4, HD16N4	50	20	45	VW3 A58404	10.000	
ATV 38HD23N4	50	20	45	VW3 A58405	13.000	
ATV 38HD25N4	200	100	50	VW3 A58406	13.000	
ATV 38HD25N4X	50	20	50	VW3 A58406	13.000	
ATV 38HD28N4	200	100	50	VW3 A58406	13.000	
ATV 38HD28N4X	50	20	50	VW3 A58406	13.000	
ATV 38HD33N4, HD46N4	200	100	80	VW3 A58407	13.000	
ATV 38HD33N4X, HD46N4X	50	20	80	VW3 A58407	13.000	
ATV 38HD54N4, HD64N4, HD79N4,	200	100	160	VW3 A58408	20.000	
ATV 38HD54N4X, HD64N4X, HD79N4X	50	20	160	VW3 A58408	20.000	
For drives	Filters		Nominal filter current	Loss	Reference	Weight
	Maximum length of motor cable (1)					
	With motor choke	Without motor choke	A	W		kg
<b>Supply voltage: 400 V (± 15%)</b>						
ATV 38HC10N4X	120	40	170	20	VW3 A68401 (2)	5.000
ATV 38HC13N4X and HC15N4X	150	40	300	40	VW3 A68402 (2)	5.500
ATV 38HC19N4X	100	40	300	40	VW3 A68402 (2)	5.500
ATV 38HC23N4X, HC25N4X, HC28N4X, HC31N4X et HC33N4X	120	40	570	60	VW3 A68403 (2)	6.000
<b>Supply voltage: 440 V...460 V (± 15%)</b>						
ATV 38HC10N4X	100	25	180	38	VW3 A68415	6.500
ATV 38HC13N4X, HC15N4X et HC19N4X	120	25	320	40	VW3 A68435	10.500
ATV 38HC23N4X, HC25N4X, HC28N4X, HC31N4X et HC33N4X	100	25	600	65	VW3 A68465	11.000

(1) The length of the shielded cables connecting the motor to the drive is limited. If motors are connected in parallel, it is the total length that should be taken into account. The limits are given as examples only as they vary depending on the interference capacity of the motors and the cables used.

ATV 38HU18N4 to ATV 38HD79N4 drives: cable length limits given for a switching frequency between 0.5 and 12 kHz.

ATV 38HC10N4X to ATV 38HC33N4X drives: cable length limits given for a modulation frequency of 2.5 kHz. They should be multiplied by 0.6 for a frequency of 5 kHz and by 0.3 for 10 kHz. If the motor cable is longer, the addition of a motor choke enables the length to be multiplied by 2.5, and the use of a single cable with a larger cross-section instead of several cables in parallel enables it to be multiplied by 1.5 or 2 if it is not shielded. In this case the radiated emissions are not limited.

(2) Filters VW3 A68401 to 403 have 2 parts: the line choke should be mounted between them.

# Variable speed drives for asynchronous motors

## Altivar 38

Options: output filters and motor chokes

### Presentation

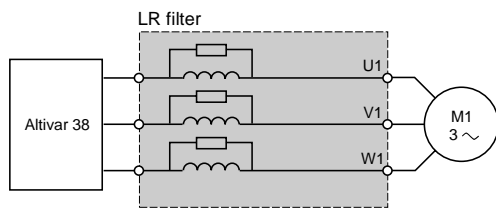
By inserting an output filter between the drive and the motor, it is possible to:

- Limit  $\frac{dv}{dt}$  to 500 V/ $\mu$ s at 400 V
  - Limit overvoltages on the motor terminals to 1000 V at 400 V
  - Filter interference caused by opening a contactor placed between the filter and the motor
  - Reduce the motor earth leakage current
- The offer comprises three types of filters and motor chokes.

### Principle

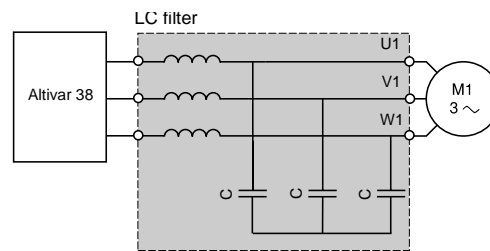
#### LR filter cell

This cell comprises 3 high frequency chokes and 3 resistors.



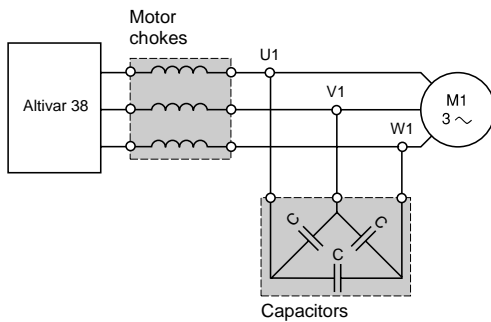
#### LC filter cell

This cell comprises 3 high frequency chokes and 3 capacitors.



#### Chokes + capacitors combination

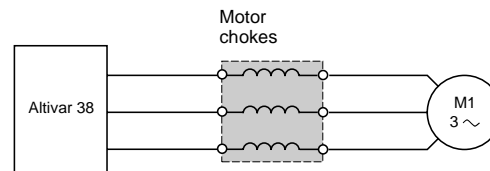
This combination comprises 3 capacitors installed in a delta connection in a junction box to be connected to a VW3 A6650● 3-phase line choke.



#### Motor choke

Overvoltages on the motor terminals can be limited by inserting an output choke between the drive and the motor. This is recommended for motor cable lengths over:

- 50 m (shielded cables) or 100 m (unshielded cables) for ATV 38HU18N4 to ATV 38HD79N4● drives
- 50 m (shielded cables) or 80 m (unshielded cables) for ATV 38HC10N4X to ATV 38HC33N4X drives



### Characteristics (1)

		LR filter cells (2)		LC filter cells		Chokes + capacitors combinations		Motor chokes	
			VW3 A6641●		VW3 A6650● + VW3 A66421	VW3 A6650●	VW3 A6855●		
Drive switching frequency	kHz	0.5 ... 4 max.	2 or 4	12	2 or 4	12	4		–
Length of motor cable	shielded cables	m	≤ 100	≤ 40	≤ 20	≤ 100	≤ 50	≤ 100	–
	unshielded cables	m	≤ 80	≤ 40	≤ 100	≤ 200	≤ 100	–	–
Degree of protection		IP 20	IP 00	IP 00	IP 00	IP 00	IP 20	IP 00	

(1) Filter performance is ensured if the cable lengths between the motor and the drive given in the above table are not exceeded. If motors are connected in parallel, it is the total length that should be taken into account. If a cable longer than that recommended is used, the filters may overheat.

(2) For frequencies greater than 4 kHz or cable lengths longer than 100 m, please consult your Regional Sales Office.



# Variable speed drives for asynchronous motors

Altivar 38

Options: output filters and motor chokes

## LR filter cells

For drives	Nominal current		Reference	Weight kg
	A	W		
ATV 38HU18N4 to HU72N4	10	150	VW3 A58451	7.400
ATV 38HU90N4	16	180	VW3 A58452	7.400
ATV 38HD12N4 to HD23N4	33	220	VW3 A58453	12.500

## LC filter cells

For drives	Reference	Weight kg
ATV 38HD25N4 to HD33N4, ATV 38HD25N4X to HD33N4X	VW3 A66412	35.000
ATV 38HD46N4 to HD64N4 ATV 38HD46N4X to HD64N4X	VW3 A66413	40.000

## Chokes (1) + capacitors combination

For drives	Description	Reference	Weight kg
ATV 38HD25N4 to HD46N4	Motor chokes	VW3 A66506	16.000
ATV 38HD25N4X to HD46N4X	Capacitors (2)	VW3 A66421	0.250
ATV 38HD54N4 to HD79N4	Motor chokes	VW3 A66507	45.000
ATV 38HD54N4X to HD79N4X	Capacitors (2)	VW3 A66421	0.250

## Motor chokes

For drives	Reference	Weight kg
ATV 38HD23N4 to HD46N4 ATV 38HD25N4X to HD46N4X	VW3 A66506	16.000
ATV 38HD54N4 to HD79N4 ATV 38HD54N4X to HD79N4X	VW3 A66507	45.000

For drives	Maximum length of motor cable (3)		Nominal current	Max. loss	Reference	Weight kg
	unshielded	shielded				
	m	m	A	W		

### Power supply voltage 400 V ± 15%

ATV 38HC10N4X	250	150	170	500	VW3 A68551	11.500
ATV 38HC13N4X	300	200	300	650	VW3 A68552	18.000
ATV 38HC15N4X	300	200	300	650	VW3 A68552	18.000
ATV 38HC19N4X	250	150	300	650	VW3 A68552	18.000
ATV 38HC23N4X	300	250	580	800	VW3 A68553	40.000
ATV 38HC25N4X	300	250	580	800	VW3 A68553	40.000
ATV 38HC28N4X						
ATV 38HC31N4X	250	200	580	800	VW3 A68553	40.000
ATV 38HC33N4X						

### Power supply voltage 440 V - 10%...460 V +10%

ATV 38HC10N4X	200	150	170	500	VW3 A68551	11.500
ATV 38HC13N4X	250	200	300	650	VW3 A68552	18.000
ATV 38HC15N4X	250	200	300	650	VW3 A68552	18.000
ATV 38HC19N4X	200	150	300	650	VW3 A68552	18.000
ATV 38HC23N4X	280	200	580	800	VW3 A68553	40.000
ATV 38HC25N4X	250	200	580	800	VW3 A68553	40.000
ATV 38HC28N4X						
ATV 38HC31N4X	220	180	580	800	VW3 A68553	40.000
ATV 38HC33N4X						



VW3 A68553

(1) It is not recommended to connect option VW3 A66421 to drive terminals without chokes as this could cause a drive fault to be displayed.

(2) Connected to terminals S1, S2, S3 of the selected choke using wires with a cross-section of 1.5 mm<sup>2</sup>.

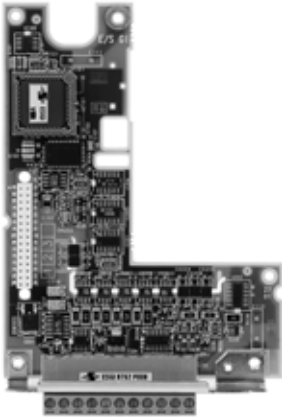
(3) For longer cables, please consult your Regional Sales Office.

Choke performance is ensured if the cable lengths above are not exceeded. If motors are connected in parallel, it is the total length that should be taken into account. If a cable longer than that recommended is used, the motor chokes may overheat.

# Variable speed drives for asynchronous motors

## Altivar 38

### I/O extension and application cards



VW3 A5820

#### Presentation

The Altivar 38 drive can be fitted with option cards:

- I/O extension cards
- application cards

#### I/O extension cards

The Altivar 38 can be adapted to meet the individual requirements of certain areas of application by installing an I/O extension card in the drive.

#### Application cards

The following application cards are available to meet the requirements of specific applications:

- pump switching card
- multi-motor card
- multi-parameter card
- positioning card for simple applications

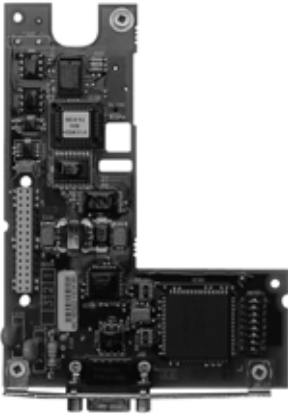
#### References

Description	Reference	Weight kg
<b>I/O extension cards</b>		
Card with analog input	VW3 A58201	0.200
Card with inputs for encoder	VW3 A58202	0.200
<b>Application cards</b>		
Pump switching card	VW3 A58210	0.200
Multi-motor card	VW3 A58211	0.200
Multi-parameter card	VW3 A58212	0.200
Positioning card for simple applications	VW3 A58213	0.200

# Variable speed drives for asynchronous motors

## Altivar 38

### Communication options



VW3 A58302



VW3 A58310

#### Presentation

The Altivar 38 can be connected on line supplies or communication buses. 11 communication card models and one module are available.

#### References

Card for protocol	Reference	Weight kg
<b>Fipio:</b> the card is equipped with a 9-way male SUB-D connector, which will take a TSX FP ACC 12 removable connector with TSX FP CC●● connecting cable or TSX FP CA●● tap cable. Configuration and adjustment access to predefined functions in the PL7 software screens	<b>VW3 A58301</b>	0.300
<b>Fipio:</b> hardware description identical to reference VW3 A58301. The card is used for read/write access to all functions via the application program of the PLC.	<b>VW3 A58311</b>	0.300
<b>Modbus Plus:</b> the card is equipped with a female 9-way SUB-D connector, which can take a Modbus Plus drop cable with connectors, reference 990NAD21110 or 990NAD21130. This cable should be connected to a Modbus Plus junction box, reference 990NAD23000 for connection to the Modbus Plus trunk cable, reference 490NAA271●●.	<b>VW3 A58302</b>	0.300
<b>Uni-Telway/Modbus:</b> the card is equipped with a female 9-way SUB-D connector and supplied with a 3 m cable fitted with a male 9-way SUB-D connector and a male 15-way SUB-D connector for connection on the TSX SCA 62● junction box.	<b>VW3 A58303</b>	0.300
<b>Interbus-S:</b> the card is equipped with one male and one female 9-way SUB-D connector for connection with cables with connectors and 2 screw terminals for separate $\pm$ 24 V supplies. Power supply: $\pm$ 24 V, 200 mA min., to be ordered separately.	<b>VW3 A58304E</b>	0.300
<b>AS-i:</b> the card is equipped with a removable terminal. Example of connection accessory: use a tap-off for the AS-i cable, reference XZ-CG0122.	<b>VW3 A58305</b>	0.300
<b>Profibus DP:</b> the card is equipped with a female 9-way SUB-D connector for connection to cables with connectors.	<b>VW3 A58307</b>	0.300
<b>Ethernet:</b> the card is equipped with an RJ 45 connector for connection to cables with connectors, reference 490NTW000●●.	<b>VW3 A58310</b>	0.300
<b>CANopen:</b> the card is equipped with a removable screw terminal.	<b>VW3 A58308</b>	0.300
<b>DeviceNet:</b> the card is equipped with a removable screw terminal. The card supports: <ul style="list-style-type: none"> <li>■ the ODVA (Open Device Vendor Association) profile</li> <li>■ the drive profile defined previously</li> </ul>	<b>VW3 A58309</b>	0.300
<b>METASYS N2:</b> the card is equipped with a female 9-way SUB-D connector.	<b>VW3 A58354U</b>	0.300

#### Protocol module

Protocol module	Reference	Weight kg
<b>LonWorks:</b> the module is equipped with a removable 5-way screw terminal for the mains supply. The LonWorks module is connected either on the Modbus VW3 A58303 card via a cable supplied with the module, or on the drive terminal port. If the LonWorks module is connected on the drive terminal port, it will not be possible to use the operator terminal. The module must be powered with a $\pm$ 24 V supply. Power supply $\pm$ 24 V, 140 mA min., to be ordered separately.	<b>VW3 A58812PU</b>	0.300

**Note:** The communication cards are fitted with terminals or connectors which are compatible with the corresponding line supplies or communication buses. Connect them using the appropriate PLC accessories. To order connection cables and accessories, please consult our specialist catalogue, your Regional Sales Office or the manufacturers' catalogues.

# PowerSuite advanced dialogue solutions

The PowerSuite advanced dialogue solutions can be used for Schneider Electric drives and starters. They enable communication with the product from a Pocket PC, a PC or a dedicated terminal.

The solutions, with a Pocket PC or PC, enable files to be prepared for uploading to the drives and the starters. The PowerSuite software creates its files ensuring consistency between the configuration/adjustment functions of the product.

## PowerSuite Pocket PC

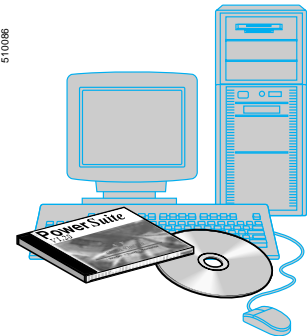
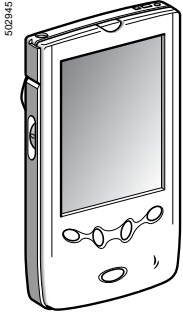
The Pocket PC can be used during preparation, programming, setup and maintenance.

It comprises a Palm size PC terminal and corresponding connection accessories. The software is integrated into a Windows CE environment, for which the operating system language can be selected on ordering (English, French, German, Spanish, Italian).

The software incorporates all the functions of integrated and remote terminals (drive or starter configuration and adjustment, control, signalling, etc.).

The Pocket PC can be used:

- alone to prepare and store configuration/adjustment files (integral battery or line supply)
- connected to a PC for uploading configuration/adjustment files from the Pocket PC to the PC or downloading from the PC to the Pocket PC
- connected to the drive or to the starter for configuration, adjustment or control purposes or to upload a configuration/adjustment file from the Pocket PC to the product or download a configuration/adjustment file from the product to the Pocket PC.



## PowerSuite software workshop for PC

The PowerSuite software workshop is used to set up a drive or a starter from a PC in a Microsoft Windows 95, 98, NT4 or 2000 environment.

The software incorporates all the functions of integrated and remote terminals (drive or starter configuration and adjustment, control, signalling, etc.) with assisted, guided operator dialogue in 5 languages (English, French, German, Spanish, Italian) in a Windows environment.

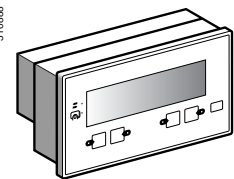
It can be used:

- alone to prepare and store drive or starter configuration files on diskette, CD-ROM or hard disk

The drive or starter configuration can be printed out on paper or can be exported to office automation software.

- connected to the drive or starter for configuration, adjustment or control purposes, or for uploading a configuration/adjustment file from the PC to the product or downloading from the product to the PC.

Connection is via a link between the drive or starter connector and the serial port on the PC.



## Magelis display unit with matrix screen

The Magelis display unit with matrix screen can be used to monitor, diagnose and adjust up to 8 Altivar 28, 38, 58 or 58F drives in 5 languages (English, French, German, Spanish, Italian). It can display variables in alphanumeric format with European, Cyrillic or Asian fonts in 4 sizes, or it can display icons or background images in black and white as well as animations in bargraph or gauge format. The application is preloaded in the factory.

## Compatibility

Compatibility of advanced dialogue solutions with drives and starters

		Drives		Starter	TeSys model U controller-starters
		ATV 28, ATV 58, ATV 58F	ATV 38	ATS 48	
<b>PowerSuite Pocket PC</b>					
Pocket PC	VW3 A8108●●				
Setup kit	VW3 A8102				
Connection kit	VW3 A8111				
<b>PowerSuite software workshop for PC</b>					
CD-ROM	VW3 A8104 ▲	≥ V 1.0	≥ V 1.40	≥ V 1.30	≥ V 1.40
Connection kit	VW3 A8106				
<b>Magelis display unit with matrix screen</b>					
Display unit	XBT HM017010A8				
<b>Accessories</b>					
CD-ROM	VW3 A8105 ▲	≥ V 1.0	≥ V 1.40	≥ V 1.30	≥ V 1.40
Operator terminal	VW3 A8103●●				

● Incompatible products

■ Compatible products and versions

▲ V 1.40 software version available 2<sup>nd</sup> quarter 2002.



VW3 A8103●●

## PowerSuite Pocket PC

Several solutions are available to meet the needs of individual users:

- The complete Pocket PC
- The setup kit
- The connection kit

The complete Pocket PC is used to set up drives and starters. It comprises:

- 1 Palm size "Jordana 525" PC terminal, with multilingual operating system (1), supplied with PC synchronisation cable and mains power supply
- 1 CD-ROM containing the multilingual (1) setup software which can be ordered separately
- 1 connection kit for the Palm size PC terminal

The setup kit comprises:

- 1 CD-ROM containing the multilingual (1) setup software which can be ordered separately
- 1 connection kit for the Palm size PC terminal

The connection kit for the Palm size PC terminal comprises:

- 2 connection cables, length 0.6 m, with 2 RJ45 connectors, marked respectively "PowerSuite" and "ATV 28 before 09/01"
- 1 RJ45/9-way SUB-D adaptor for connecting ATV 58 and ATV 58F
- 1 converter marked "RS 232/RS 485 PPC" with one 9-way male SUB-D connector and 1 RJ45 connector.

Description	Reference	Weight kg
<b>Complete Pocket PC</b>	<b>VW3 A8108●● (2)</b>	1.000
<b>Setup kit</b>	<b>VW3 A8102</b>	0.400
<b>Connection kit for the Palm size PC terminal</b>	<b>VW3 A8111</b>	0.300

## PowerSuite software workshop for PC

The software workshop is used to set up the drives and starters from a PC. It comprises:

- 1 CD-ROM containing the multilingual (1) setup software
- 1 connection kit for PC

The PC connection kit comprises:

- 2 connection cables, length 3 m, with 2 RJ45 connectors, marked respectively "PowerSuite" and "ATV 28 before 09/01"
- 1 RJ45/9-way SUB-D adaptor for connection of ATV-58 and ATV-58F drives
- 1 converter marked "RS 232/RS 485 PC" with one 9-way male SUB-D connector and 1 RJ45 connector

Description	Reference	Weight kg
<b>1 CD-ROM containing the multilingual setup software (1)</b>	<b>VW3 A8104 ▲</b>	0.100
<b>Connection kit for PC</b>	<b>VW3 A8106</b>	0.350

## Magelis display unit with matrix screen

The terminal has a backlit LCD with 8 lines of 40 characters.

The RS 458 connection kits for ATV 28 (VW3 A28301), ATV 38 and ATV 58 (VW3 A58306) drives, as well as other connection accessories, should be ordered separately according to the number and type of drives connected. Please consult your Regional Sales Office.

Description	Reference	Weight kg
<b>Magelis display unit with matrix screen</b>	<b>XBT HM017010A8</b>	0.600

## Accessories

Description	Reference	Weight kg
<b>1 upgrade CD-ROM for multilingual (1) setup software (3)</b>	<b>VW3 A8105 ▲</b>	0.100
<b>Palm size "Jordana 525" PC terminal supplied with PC synchronisation cable and mains power supply</b>	<b>VW3 A8103●● (2)</b>	0.300
<b>VW3 A8103●● (2)</b>	<b>VW3 A8110</b>	0.100

(1) English, French, German, Spanish, Italian.

(2) To order the operating system in your chosen language, replace ●● by EN for English, FR for French, DE for German, SP for Spanish and IT for Italian.

(3) To find out about the latest available version, please consult your Regional Sales Office.

(4) This card enables the software to be run immediately without synchronising with a PC.

▲ V 1.40 software version available 2<sup>nd</sup> quarter 2002.

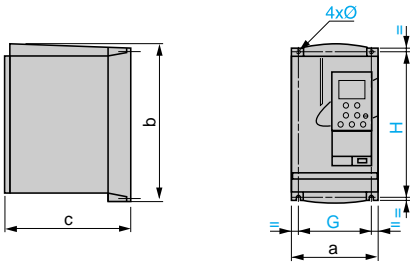


XBT HM017010A8

# Variable speed drives for asynchronous motors

## Altivar 38

### ATV 38HU18N4 to ATV 38HD23N4

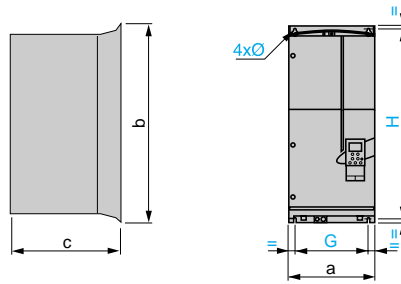


ATV 38H	a	b	c	G	H	Ø
U18N4, U29N4, U41N4	150	230	184	133	210	5
U54N4, U72N4, U90N4	175	286	184	155	270	5.5
D12N4, D16N4	230	325	210	200	310	5.5
D23N4	230	415	210	200	400	5.5

Maximum connection capacity: all terminals  
ATV 38H

U18N4 to U90N4: 6 mm<sup>2</sup> (AWG 8)  
D12N4 to D23N4: 10 mm<sup>2</sup> (AWG 6)

### ATV 38HD25N4 to ATV 38HD79N4

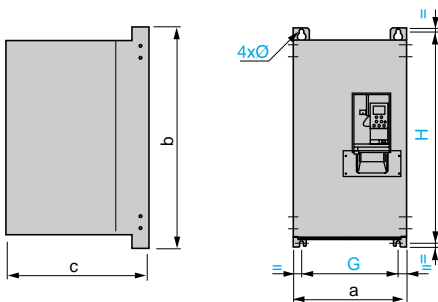


ATV 38H	a	b	c	G	H	Ø
D25N4, D28N4, D33N4, D46N4	240	550	283	205	530	7
D54N4, D64N4, D79N4	350	650	304	300	619	9

Maximum connection capacity: all terminals  
ATV 38H

D25N4, D28N4: 16 mm<sup>2</sup> (AWG 4)  
D33N4, D46N4: 35 mm<sup>2</sup> (AWG 2)  
D54N4 to D79N4: 70 mm<sup>2</sup> (AWG 2/0)

### ATV 38HC10N4X to ATV 38HC33N4X

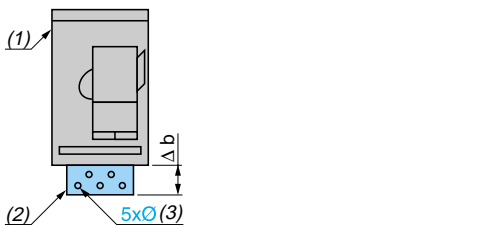


ATV 38H	a	b	c	G	H	Ø
C10N4X	370	630	360	317.5	609	12
C13N4X, C15N4X, C19N4X	480	680	400	426	652	12
C23N4X, C25N4X, C28N4X, C31N4X, C33N4X	660	950	440	598	920	15

Maximum connection capacity

ATV 38H	Earth connection	Power terminal
C10N4X to C15N4X	60 mm <sup>2</sup>	100 mm <sup>2</sup>
C19N4X	100 mm <sup>2</sup>	150 mm <sup>2</sup>
C23N4X to C25N4X	100 mm <sup>2</sup>	200 mm <sup>2</sup>
C28N4X to C33N4X	150 mm <sup>2</sup>	150 x 2 mm <sup>2</sup>

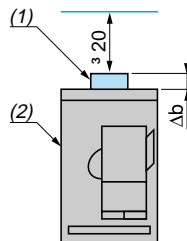
### EMC mounting plate (supplied with drive)



Mounting on ATV 38H	Δb	Ø (3)
U18N4 to U90N4	64.5	M4
D12N4 to D23N4	62	M4
D25N4 to D46N4	80	M5
D54N4 to D79N4	110	M5

(1) Drive  
(2) Mounting plate  
(3) Tapped holes for fixing the EMC clamps

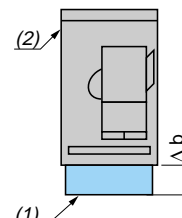
### Control card fan kit



VW3	Δb
A58822	25
A58823	25
A58824	25
A58825	60
A58826	60

(1) VW3 A58822 to VW3 A58826  
(2) Drive

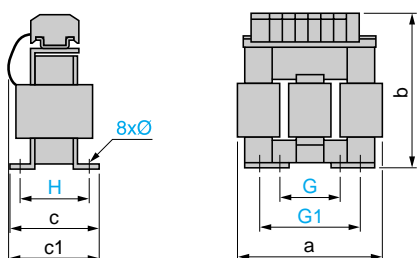
### NEMA type 1 kit



VW3	Δb
A58852	71
A58853	75
A58854	75
A58855	75
A58856	89
A58857	171

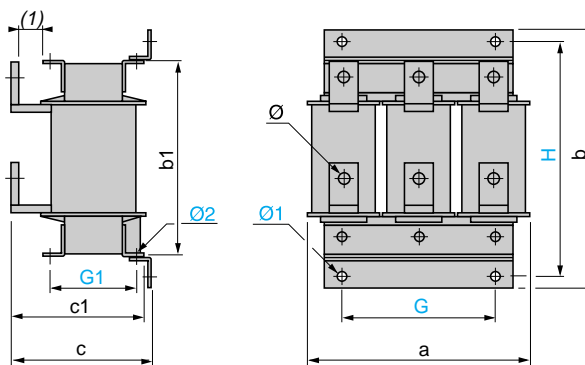
(1) VW3 A58852 to VW3 A58857  
(2) Drive

**3-phase chokes (line and motor)**  
VW3 A66501 to VW3 A66507



VW3	a	b	c	c1	G	G1	H	Ø
<b>Line chokes</b>								
A66501	100	135	55	60	40	60	42	6 x 9
A66502	130	155	85	90	60	80.5	62	6 x 12
A66503	130	155	85	90	60	80.5	62	6 x 12
A66504	155	170	115	135	75	107	90	6 x 12
<b>Motor chokes</b>								
A66506	275	210	130	160	105	181	100	11 x 22
A66507	320	290	172	215	190	230	142	-

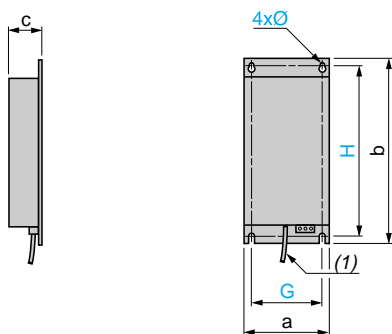
**3-phase line chokes**  
VW3 A68501 to VW3 A68507



VW3	a	b	b1	c	c1	G	G1	H	Ø	Ø1	Ø2
A68501	280	305	240	210	200	200	125	275	9	9	9
A68502	280	330	260	210	200	200	125	300	11	9	9
A68503	320	380	300	210	200	225	150	350	11	9	9
A68504	320	380	300	210	200	225	150	350	11	9	9
A68505	320	380	300	250	230	225	150	350	13	11	11
A68506	320	380	300	250	230	225	150	350	13	11	11
A68507	320	380	300	250	230	225	150	350	13	11	11

(1) min. 25 mm

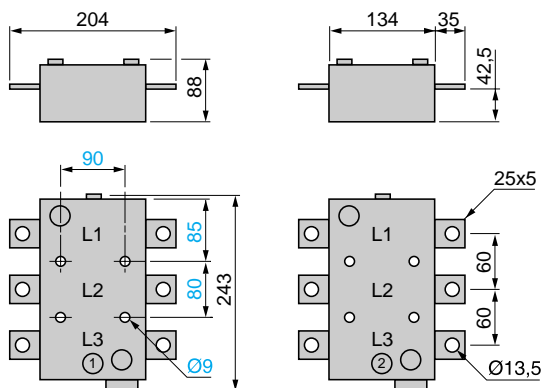
**Radio interference suppression filters (EMC)**  
VW3 A58402 to VW3 A58408



VW3	a	b	c	G	H	Ø
A58402	150	276	50	133	260	5
A58403	175	340	60	153	320	6
A58404	230	390	60	200	370	6
A58405	230	480	60	200	460	6
A58406	240	690	85	205	650	7
A58407	240	690	85	205	650	7
A58408	350	770	90	300	770	9

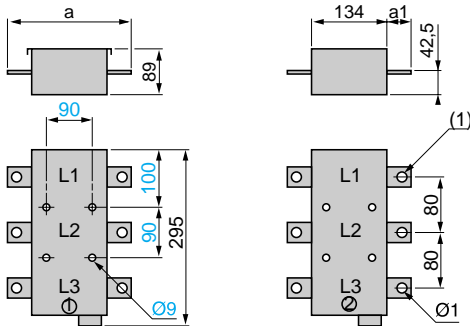
(1) Cable

**VW3 A68401 (2 elements)**



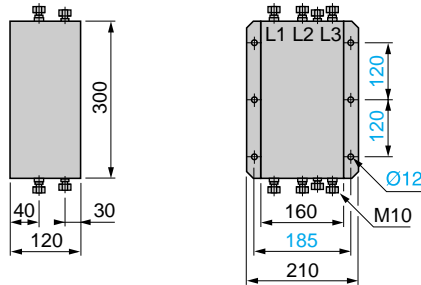
**Radio interference suppression filters (EMC) (continued)**

**VW3 A68402, A68403 (2 elements)**

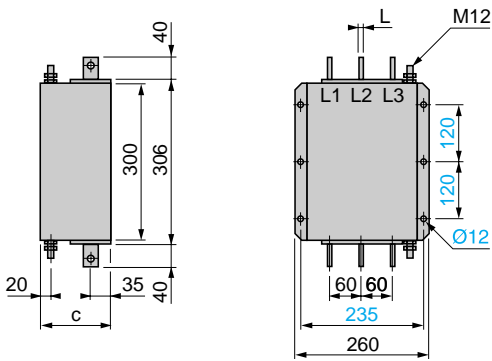


VW3	a	a1	Ø	(1)
A68402	204	35	11	bar 30 x 5
A68403	224	40	13.5	bar 40 x 5

**VW3 A68415**



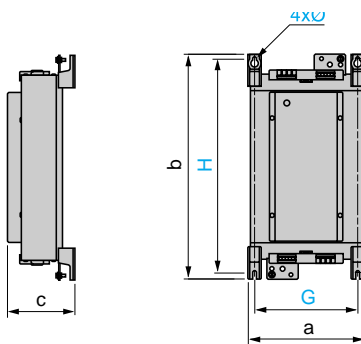
**VW3 A68435 and A68465**



VW3	c	L
A68435	115	6
A68465	135	8

**Output filters**

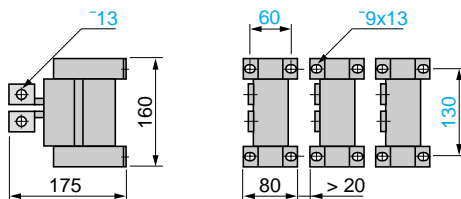
**VW3 A58451 to A58453**



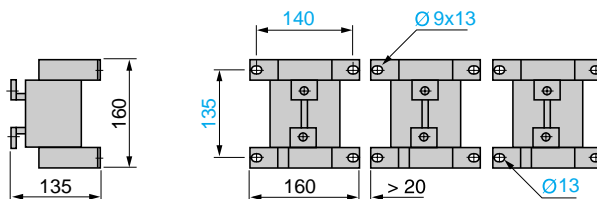
VW3	a	b	c	G	H	Ø
A58451	169.5	420	123	150	315	7
A58452	169.5	420	123	150	315	7
A58453	239	467.5	139.5	212	444	7

**Additional motor chokes**

**VW3 A68551**

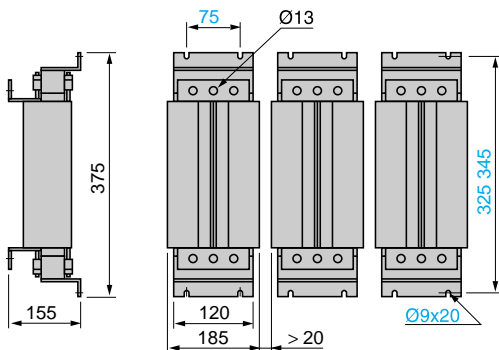


**VW3 A68552**



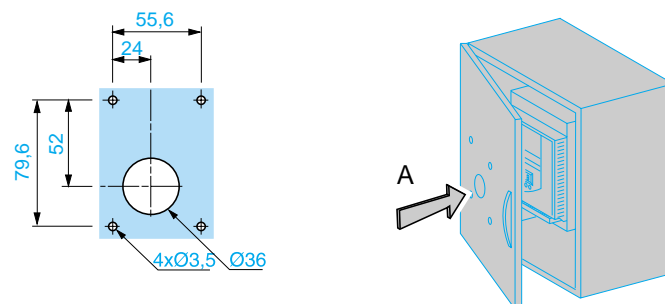
**Additional motor chokes**

**VW3 A68553**



**Mounting the remote operator terminal**

**VW3 A58103**



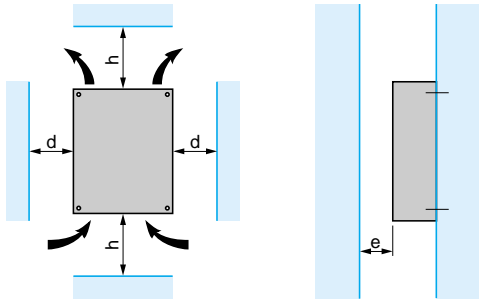


### Mounting recommendations

Depending on the conditions in which the drive is to be used, its installation will require certain precautions and the use of appropriate accessories. Install the unit vertically, at  $\pm 10^\circ$ .

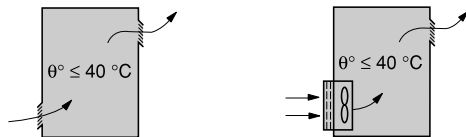
Do not place it close to heating elements.

Leave sufficient free space to ensure that the air required for cooling purposes can circulate from the bottom to the top of the unit.



Drive	Mounting recommendations
ATV 38HU18N4 to ATV 38HU90N4	$e \geq 10$ mm, $h \geq 50$ mm -10...+40°C $d \geq 50$ mm, no special precautions $d = 0$ mm, remove the drive's protective blanking cover (the degree of protection will then be IP 20) +40...+50°C $d \geq 50$ mm, remove the drive's protective blanking cover (the degree of protection will then be IP 20) +50...+60°C $d \geq 50$ mm, add the VW3 A5882 control card fan kit. Derate the current by 2.2 % per °C above 50°C.
ATV 38HD12N4 to ATV 38HD23N4	$e \geq 10$ mm, $h \geq 50$ mm -10...+40°C $d \geq 50$ mm, no special precautions $d = 0$ mm, remove the drive's protective blanking cover (the degree of protection will then be IP 20) +40...+50°C $d \geq 50$ mm, remove the drive's protective blanking cover (the degree of protection will then be IP 20). Derate the current by 2.2 % per °C above 40°C. $d = 0$ mm, add the VW3 A5882 control card fan kit. Derate the current by 2.2 % per °C above 40°C.
ATV 38HD25N4 to ATV 38HD79N4	$e \geq 50$ mm, $h \geq 100$ mm, $d \geq 50$ mm -10...+40°C, no special precautions +40...+50°C, add the VW3 A5882 control card fan kit. Derate the current by 2.2 % per °C above 40°C.
ATV 38HC10N4X to ATV 38HC33N4X	$e \geq 50$ mm, $h \geq 100$ mm, $d \geq 50$ mm -10...+40°C, no special precautions +40...+50°C, add the VW3 A5882 control card fan kit. Derate the current by 2.2 % per °C over 40°C.

### Mounting in a metal wall-mounted or floor-standing enclosure with degree of protection IP 23 or IP 54



- Observe the mounting recommendations above.
- To ensure proper air circulation in the drive: fit ventilation grilles, ensure that the ventilation is adequate - if not, install forced ventilation with a filter.
- Use special filters with IP 54 protection.

### Fan flow rate depending on the drive rating

ATV 38 drive	Flow rate m <sup>3</sup> /hour
ATV 38HU18N4	not cooled
ATV 38HU29N4, HU41N4, U54N4	36
ATV 38HU72N4, HU90N4, HD12N4, HD16N4, HD23N4	72
ATV 38HD25N4, HD28N4, HD33N4, HD46N4	292
ATV 38HD54N4, HD64N4, HD79N4	492
ATV 38HC10N4X	600
ATV 38HC13N4X, HC15N4X, HC19N4X	900
ATV 38HC23N4X, HC25N4X, HC28N4X, HC31N4X, HC33N4X	900

### Metal wall-mounted or floor-standing enclosure with IP 54 degree of protection

The drive must be mounted in a dust and damp proof casing in certain environmental conditions: dust, corrosive gases, high humidity with risk of condensation and dripping water, splashing liquid, etc.

To avoid hot spots in the drive, add a fan to circulate the air inside the enclosure, reference VW3 A5882 (see page 10). This enables the drive to be used in an enclosure where the maximum internal temperature can reach 60°C.

### Calculating the size of the wall-mounted or floor-standing enclosure

#### Maximum thermal resistance R<sub>th</sub> (°C/W)

$$R_{th} = \frac{\theta - \theta_e}{P}$$

$\theta$  = maximum temperature inside the enclosure in °C,  $\theta_e$  = maximum external temperature in °C,  
 $P$  = total power dissipated in the enclosure in W

Power dissipated by drive: see page 8. Add the power dissipated by the other equipment components.

#### Effective exchange surface area of enclosure S (m<sup>2</sup>)

(sides + top + front panel if wall-mounted)

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

K is the thermal resistance per m<sup>2</sup> of casing

For ACM type metal enclosures: K = 0.12 with internal fan, K = 0.15 without fan

**Caution:** Do not use insulated enclosures as they have a poor level of conductivity.

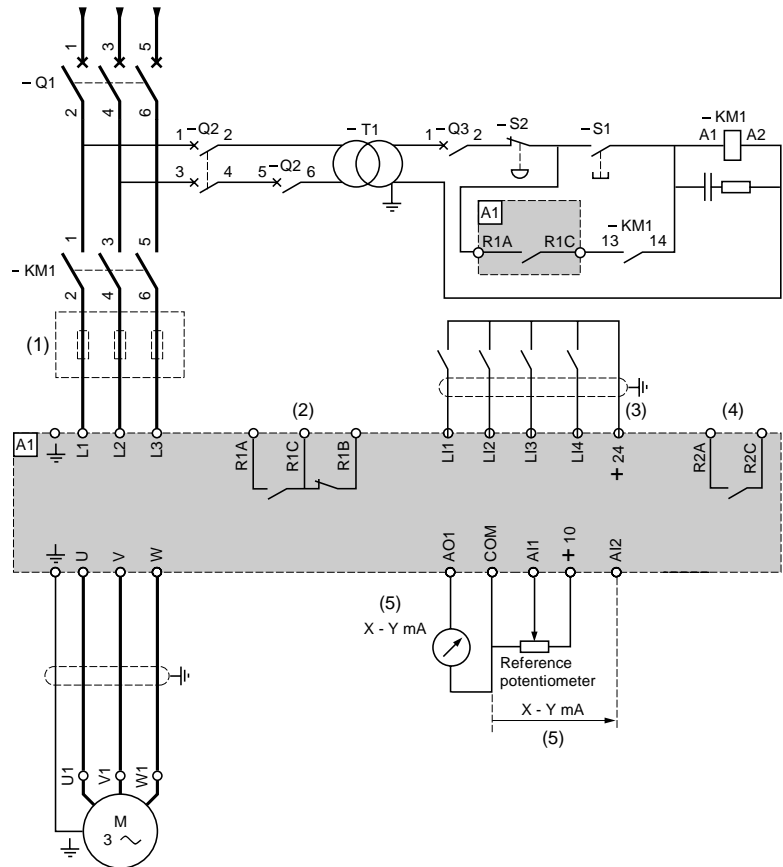
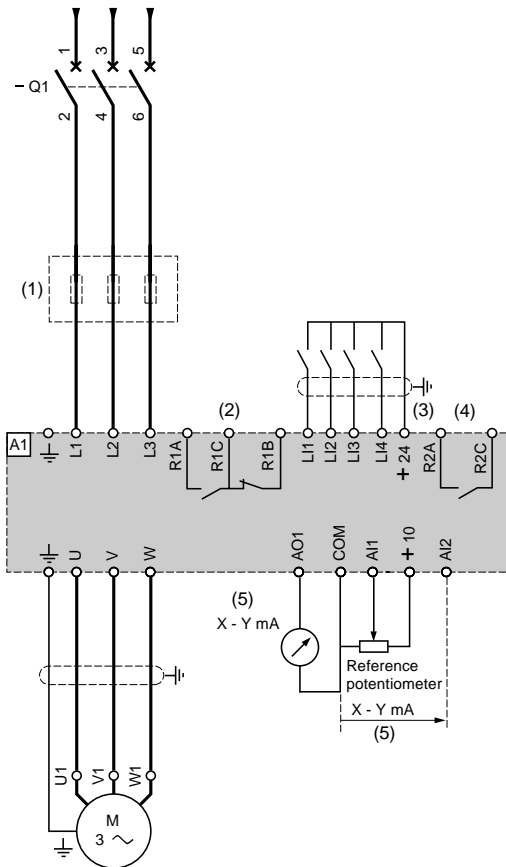
**Scheme without line contactor, recommended for machines which are not dangerous**

**Scheme with line contactor, recommended for dangerous machines which are switched off and on infrequently**

ATV 38H●●●●

3-phase power supply

3-phase power supply



(1) Line choke recommended

(2) Fault relay contacts for remote signalling of drive status

(3) Internal +24 V. If an external +24 V supply is used, connect the 0 V on the external supply to the COM terminal, do not use the +24 terminal on the drive, and connect the common of the LI inputs to the +24 V of the external supply.

(4) Relay R2 can be reassigned

(5) X and Y can be configured between 0 and 20 mA independently for AI2 and AO1.

**Note:**

1 All terminals are located at the bottom of the drive.

2 Fit interference suppressors to all specific circuits near the drive or connected on the same circuit, such as relays, contactors, solenoid valves, fluorescent lighting, etc.

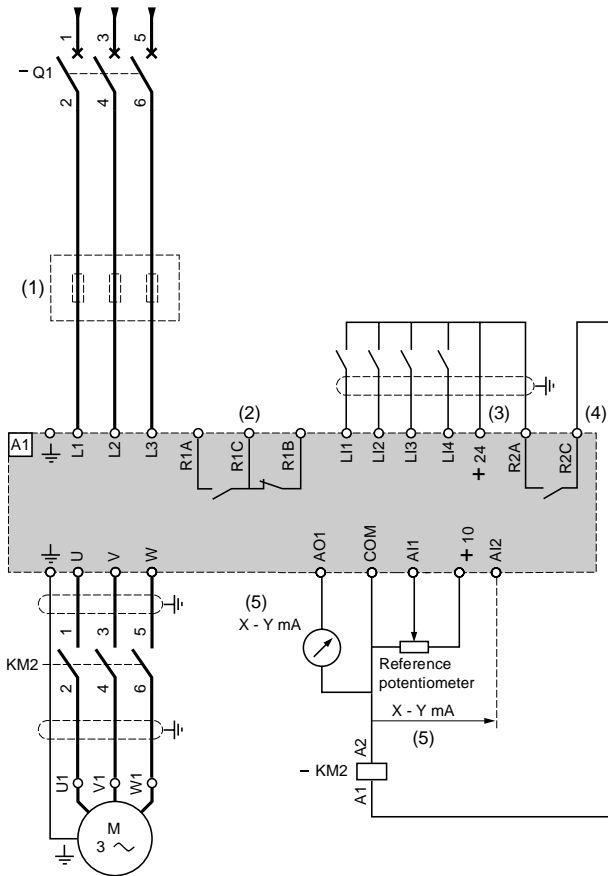
**Compatible components**

Code	Description
A1	Drive
Q1	GV2-L or Compact NS circuit-breaker (see pages 28 and 29)
KM1	LC1-D●● contactor with interference suppressor (see pages 28 and 29)
S1, S2	XB2-B or XA2-B pushbuttons
T1	100 VA transformer 220 V secondary
Q2	GV2-L circuit-breaker rated at twice the nominal primary current of T1
Q3	GB2-CB05

**Scheme with downstream contactor, recommended for dangerous machines which are switched off and on frequently**

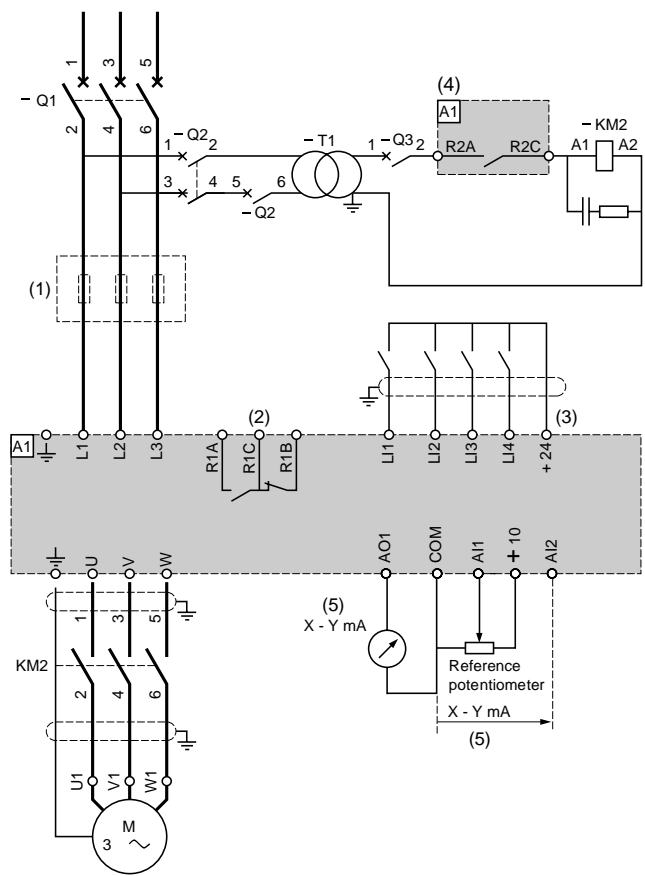
ATV 38HU18N4 to ATV 38HD23N4

3-phase power supply



ATV 38HD25N4● to ATV 38HC33N4●

3-phase power supply



(1) Line choke recommended

(2) Fault relay contacts for remote signalling of drive status

(3) Internal +24 V. If an external +24 V supply is used, connect the 0 V on the external supply to the COM terminal, do not use the +24 terminal on the drive, and connect the common of the LI inputs to the +24 V of the external supply.

(4) Use the "downstream contactor control" function with relay R2 (or with the logic output LO of one of the "I/O extension" cards, when connecting).

(5) X and Y can be configured between 0 and 20 mA independently for AI2 and AO1.

**Note:**

1 All terminals are located at the bottom of the drive.

2 Fit interference suppressors to all specific circuits near the drive or connected on the same circuit, such as relays, contactors, solenoid valves, fluorescent lighting, etc.

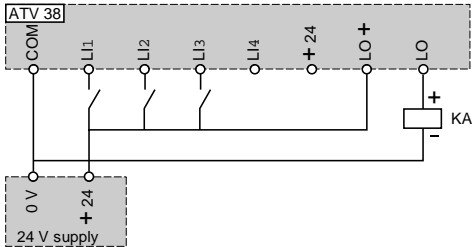
**Compatible components**

Code	Description
A1	Drive
Q1	GV2-L or Compact NS circuit-breaker (see pages 60236/2 and 60236/3)
KM2	LC1-D●● contactor with interference suppressor (see pages 60236/2 and 60236/3)
T1	100 VA transformer 220 V secondary
Q2	GV2-L circuit-breaker rated at twice the nominal primary current of T1
Q3	GB2-CB05

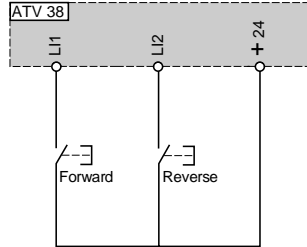
# Variable speed drives for asynchronous motors

## Altivar 38

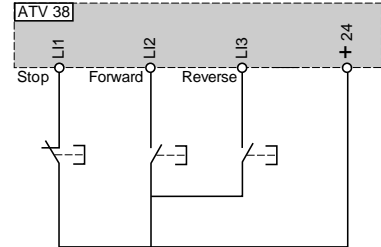
### External 24 V supply for the logic inputs and/or the logic output



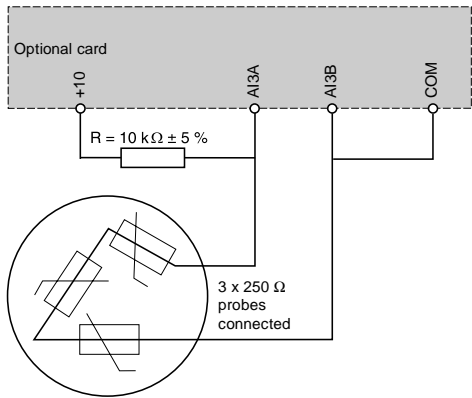
### 2-wire control



### 3-wire control

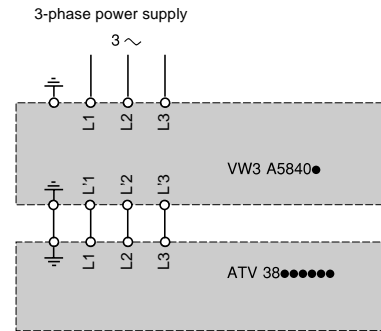


### Motor protection via PTC probes, with optional analog input extension card



### Additional radio interference suppression input filters

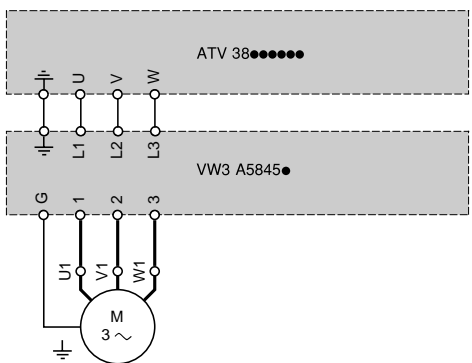
#### VW3 A5840



### Output filters

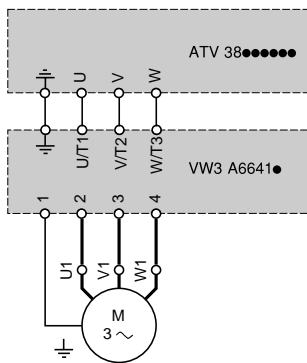
#### VW3 A5845

LR cell



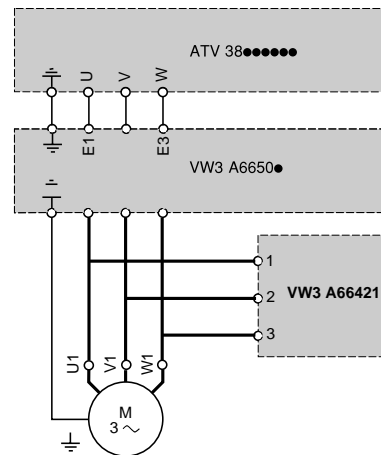
#### VW3 A6641

LC cell



#### VW3 A6650 + VW3 A66421

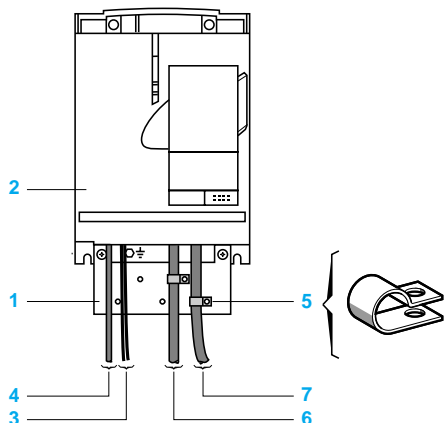
Motor chokes motor + capacitors



#### Principle

- Grounds between drive, motor and cable shielding must have "high frequency" equipotentiality.
- Use shielded cables with shielding connected to earth over 360° at both ends for the motor cable and the control-command cables. Conduit or metal ducting 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 (mains supply) and the motor cable.

#### Installation diagram for ATV 38HU18N4 to HD79N4 drives



- 1 Steel plate supplied with the drive, to be fitted on it (machine ground)
- 2 Altivar 38
- 3 Non-shielded power supply wires or cable
- 4 Non-shielded wires for the output of the fault relay contacts
- 5 Fix and earth the shielding of cables 6 and 7 as close as possible to the drive:
  - strip the shielding
  - use the correct size clamps on the stripped part of the shielding to fix to metal sheet 1. The shielding must be clamped tightly enough on the metal sheet to ensure good contact.
  - types of clamp: stainless steel
- 6 Shielded cable (1) for connecting the motor.
- 7 Shielded cable (1) for connecting the control/command system For applications requiring several conductors, use small cross-sections (0.5 mm<sup>2</sup>).

(1) The shielding of cables 6 and 7 must be connected to earth at both ends.  
The shielding must be continuous and intermediate terminals must be in EMC shielded metal boxes.

#### Note:

- 1 Although there is an HF equipotential earth connection between the drive, the motor and the cable shielding, it is still necessary to connect the PE protective conductors (green-yellow) to the appropriate terminals on each of the devices.
- 2 If using an additional input filter, it should be mounted beneath the drive and connected directly to the mains supply via an unshielded cable. The connection 3 is then made via the filter cable.

#### Wiring recommendations for ATV 38HC10N4X to HC33N4X drives

Line chokes must be used if the prospective short-circuit line current is less than 22 kA. These chokes provide improved protection against overvoltages on the mains supply and reduce harmonic distortion of the current produced by the drive. The chokes are used to limit the line current.

#### Power wiring

The power wiring should consist of cables with 4 conductors or individual cables maintained as close as possible to the PE cable. Take care to route the motor cables well away from the power supply cables.

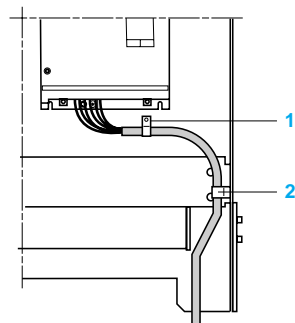
The power supply cables are not shielded. If a radio interference filter is used, the grounds for the filter and the drive should be at the same potential with low-impedance links at high frequency (fixed to unpainted steel plate with anti-corrosion treatment/machine ground wiring). The filter should be fitted as close as possible to the drive.

If the environment is sensitive to radiated radio interference, the motor cables should be shielded. On the drive side, fix and connect the shielding to the machine ground with rustproof clamps. The main function of the motor cable shielding is to limit their radio frequency radiation. Therefore, use 4-pole cables for the motor, connecting each end of the shielding in accordance with established practice for High Frequency wiring. The type of protective material (copper or steel) is less important than the quality of the connection at both ends. An alternative is to use a metal cable duct with good conductivity and no break in continuity.

**Note:** When using a cable with a protective sleeve (NYCY type) which fulfils the dual function of PE + screen, it must be connected correctly to both the drive and the motor (its radiation efficiency is reduced).

#### Note:

#### Control wiring



- 1 Shielding clamp
- 2 Cable grip. Check that the cable follows the path indicated by the clips.

# Variable speed drives for asynchronous motors

## Altivar 38 Motor starters



NS80HMA  
+  
LC1 D  
+  
ATV 38

### Applications

Circuit-breaker/contactor/drive combinations can be used to ensure continuous service of the installation with optimum safety.

The selected circuit-breaker/contactor combination can reduce maintenance costs in the event of a short-circuit by minimising the time required to make the necessary repairs and the cost of replacement equipment. The combinations suggested correspond to type 2 coordination:

**Type 2 coordination:** A short-circuit will not damage the device or affect its settings. The motor starter should be able to operate once the electrical fault has been removed. The electrical isolation provided by the circuit-breaker will not be affected by the short-circuit. Welding of the contactor contacts is permissible if they can be separated easily.

The downstream contactor is not affected by type 2 coordination.

The drive controls the motor, provides protection against short-circuits between the drive and the motor and protects the motor cable against overloads. This overload protection is provided by the drive's motor thermal protection.

If this protection is removed, external thermal protection should be provided.

Before restarting the installation, the cause of the trip must be removed.

### 3-phase supply voltage: 380 to 415 V (for 0.75 to 315 kW motors)

**Motor circuit-breaker:** NS●●●●MA: product sold under the Merlin Gerin brand

**Composition of contactors:**

LC1-D09 to LC1-D115: 3 poles + 1 "N/O" auxiliary contact and 1 "N/C" auxiliary contact

LC1-F●● to LC1-D115: 3 poles + 1 "N/O" auxiliary contact and 1 "N/C" auxiliary contact

Motor (1)	Circuit-breaker	Line contactor	Downstream contactor	Variable speed drive
Power kW	Reference (2) Rating A	Reference (3)	Reference (4)	Reference (5)
0.75	GV2 L08 4	LC1 D18●●	LC1 D09BL	ATV 38HU18N4
1.5	GV2 L10 6.3	LC1 D18●●	LC1 D09BL	ATV 38HU29N4
2.2	GV2 L14 10	LC1 D18●●	LC1 D09BL	ATV 38HU41N4
3	GV2 L16 14	LC1 D18●●	LC1 D09BL	ATV 38HU54N4
4	GV2 L16 14	LC1 D18●●	LC1 D09BL	ATV 38HU72N4
5.5	GV2 L22 25	LC1 D25●●	LC1 D09BL	ATV 38HU90N4
7.5	NS80HMA50 50	LC1 D40●●	LC1 D09BL	ATV 38HD12N4
11	NS80HMA50 50	LC1 D40●●	LC1 D25BL	ATV 38HD16N4
15	NS80HMA50 50	LC1 D40●●	LC1 D25BL	ATV 38HD23N4
18.5	NS80HMA50 50	LC1 D40●●	LC1 D25●●	ATV 38HD25N4●
22	NS80HMA50 50	LC1 D50●●	LC1 D32●●	ATV 38HD28N4●
30	NS80HMA80 80	LC1 D65●●	LC1 D40●●	ATV 38HD33N4●
37	NS80HMA80 80	LC1 D80●●	LC1 D50●●	ATV 38HD46N4●
45	NS100HMA100 100	LC1 D80●●	LC1 D80●●	ATV 38HD54N4●
55	NS160HMA150 150	LC1 D115●●	LC1 D80●●	ATV 38HD64N4●
75	NS160HMA150 150	LC1 D150●●	LC1 D115●●	ATV 38HD79N4●
90	NS250●MA 220	LC1 F185●●	LC1 D115●●	ATV 38HC10N4X
110	NS250●MA 220	LC1 F225●●	LC1 D115●●	ATV 38HC13N4X
132	NS250●MA 220	LC1 F265●●	LC1 D1505●●	ATV 38HC15N4X
160	NS400●MA 320	LC1 F330●●	LC1 F225●●	ATV 38HC19N4X
200	NS400●MA 320	LC1 F400●●	LC1 F265●●	ATV 38HC23N4X
220	NS630●MA 500	LC1 F400●●	LC1 F330●●	ATV 38HC25N4X
250	NS630●MA 500	LC1 F500●●	LC1 F400●●	ATV 38HC28N4X
280	NS630●MA 500	LC1 F630●●	LC1 F400●●	ATV 38HC31N4X
315	NS630●MA 500	LC1 F630●●	LC1 F500●●	ATV 38HC33N4X

(1) Standard power ratings for 4-pole, 50/60 Hz, 400 V motors

(2) Replace ● with N, H or L, according to the breaking capacity, in the table below.

#### Breaking capacity of circuit-breakers according to standard IEC60947-2

380/415 V	Icu (kA)		
GV2 L	50		
NS80HMA	70		
380/415 V	N	H	L
NS100●MA	25	70	130
NS160●MA, NS250●MA	35	70	130
NS400●MA, NS630●MA	–	70	130

(3) Replace ●● with the control circuit voltage reference indicated in the table on the opposite page.

(4) LC1-D●●BL contactors have 24 V d.c. low consumption coils (100 mA). Up to 15 kW, they are powered by an internal drive power supply. For power ratings above this level, use an external supply and complete the contactor coil voltage as shown in the table (3).

(5) For drives without integrated EMC filter, replace the ● with an X.

**Note:** The maximum line current is determined with a maximum upstream short-circuit power rating of 5 kA at between 0.75 and 5.5 kW (22 kA between 7.5 and 315 kW).

# Variable speed drives for asynchronous motors

Altivar 38  
Motor starters



NS80HMA  
+  
LC1 D  
+  
ATV 38

## 3-phase supply voltage: 440 to 460 V (for 0.75 to 315 kW motors)

### Motor circuit-breaker

NS●●●MA: product sold under the Merlin Gerin brand

### Composition of contactors

LC1-D09 to LC1-D115: 3 poles + 1 "N/O" auxiliary contact and 1 "N/C" auxiliary contact

LC1-F●● to LC1-D115: 3 poles + 1 "N/O" auxiliary contact and 1 "N/C" auxiliary contact

Motor (1)	Circuit-breaker	Line contactor	Downstream contactor	Variable speed drive
Power kW	Reference (2)	Rating A	Reference (3)	Reference
0.75	GV2 L08	4	LC1 D1810●●	LC1 D09BL ATV 38HU18N4
1.5	GV2 L10	6.3	LC1 D2510●●	LC1 D09BL ATV 38HU29N4
2.2	GV2 L10	6.3	LC1 D2510●●	LC1 D09BL ATV 38HU41N4
3	GV2 L14	10	LC1 D2510●●	LC1 D09BL ATV 38HU54N4
4	GV2 L14	10	LC1 D2510●●	LC1 D09BL ATV 38HU72N4
5.5	NS80HMA50	50	LC1 D4011●●	LC1 D09BL ATV 38HU90N4
7.5	NS80HMA50	50	LC1 D4011●●	LC1 D09BL ATV 38HD12N4
11	NS80HMA50	50	LC1 D4011●●	LC1 D25BL ATV 38HD16N4
15	NS80HMA50	50	LC1 D4011●●	LC1 D25BL ATV 38HD23N4
18.5	NS100LMA50	50	LC1 D8011●●	LC1 D2510●● ATV 38HD25N4●
22	NS100LMA50	50	LC1 D8011●●	LC1 D3210●● ATV 38HD28N4●
30	NS100LMA50	50	LC1 D8011●●	LC1 D4011●● ATV 38HD33N4●
37	NS100LMA80	100	LC1 D8011●●	LC1 D5011●● ATV 38HD46N4●
45	NS100LMA100	100	LC1 D8011●●	LC1 D8011●● ATV 38HD54N4●
55	NS100LMA100	100	LC1 D115●●	LC1 D8011●● ATV 38HD64N4●
75	NS160HMA150	150	LC1 D115●●	LC1 D150●● ATV 38HD79N4●
90	NS160●MA	150	LC1 D115●●	LC1 D150●● ATV 38HC10N4X
110	NS250●MA	220	LC1 F185●●	LC1 D115●● ATV 38HC13N4X
132	NS250●MA	220	LC1 F185●●	LC1 F265●● ATV 38HC15N4X
160	NS400●MA	320	LC1 F265●●	LC1 F225●● ATV 38HC19N4X
200	NS400●MA	320	LC1 F330●●	LC1 F265●● ATV 38HC23N4X
220	NS400●MA	320	LC1 F400●●	LC1 F330●● ATV 38HC25N4X
250	NS630●MA	500	LC1 F400●●	LC1 F400●● ATV 38HC28N4X
280	NS630●MA	500	LC1 F500●●	LC1 F400●● ATV 38HC31N4X
315	NS630●MA	500	LC1 F500●●	LC1 F500●● ATV 38HC33N4X

(1) Standard power ratings for 4-pole motors 50/60 Hz 400 V

(2) Replace ● with N, H or L, according to the breaking capacity, in the table below.

### Breaking capacity of circuit-breakers according to standard IEC60947-2

400/460 V	Icu (kA)		
GV2 L08, L10	> 100		
GV2 L14, L16, L22	20		
NS80HMA	65		
440/460 V		N	L
NS100●MA	25	65	130
NS160●MA, NS250●MA	35	65	130
NS400●MA, NS630●MA	–	65	130

(3) Replace ●● with the control circuit voltage reference indicated in the table below.

### a.c. control circuit

Volts AC	24	48	110	115	220	230	240	400
50/60 Hz	B7	E7	F7	FE7	M7	P7	U7	V7

(4) LC1-D●●BL contactors have 24 V d.c. low consumption coils (100 mA). Up to 15 kW, they are powered by an internal drive power supply. For power ratings above this level, use an external supply and complete the contactor coil voltage as shown in the table (3).

**Note:** The maximum line current is determined with a maximum upstream short-circuit power rating of 5.5 kA at between 0.75 and 5.5 kW (22 kA between 7.5 and 315 kW).

# Variable speed drives for asynchronous motors

## Altivar 38

### Summary of functions

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Acceleration and deceleration ramp profiles	page 31
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+/- speed	page 33
Save reference	page 33
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### Drive factory setting

To facilitate installation of the drive, the functions, parameters and I/O have been assigned to meet the requirements of pumping and ventilation applications.

#### Drive I/O

- Logic input LI1: forward
- Logic input LI2: reverse
- Logic input LI3: fault reset
- Logic input LI4: not assigned
- Analog input AI1: speed reference
- Analog input AI2: summing speed reference
- Relay R1: drive fault
- Relay R2: drive running
- Analog output AO1: motor frequency

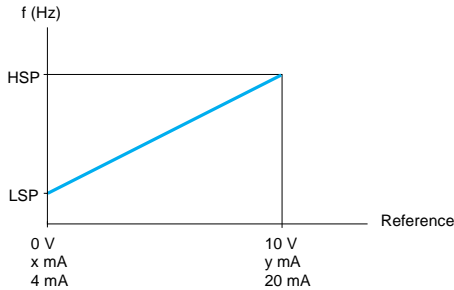
#### Extension card I/O

- Logic input LI5: ramp switching
- Logic input LI6: not assigned
- Analog input AI3 or encoder inputs: summing speed reference
- Logic output LO: high speed reached
- Analog output AO: motor current



# Variable speed drives for asynchronous motors Altivar 38

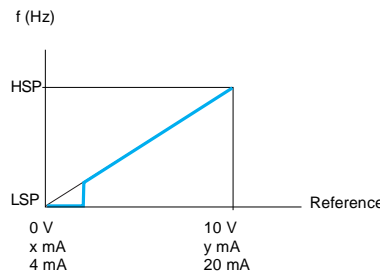
Normal mode



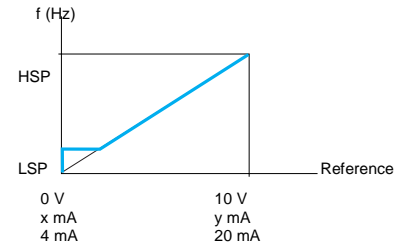
**Operating speed range**

Used to determine 2 frequency limits which define the speed range permitted by the machine under actual operating conditions. Three operating modes are possible:

Pedestal mode



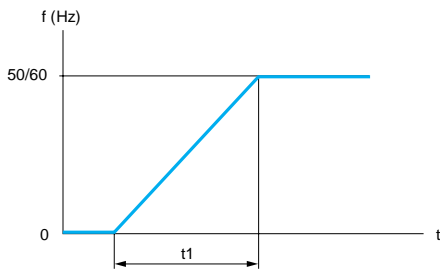
Deadband mode



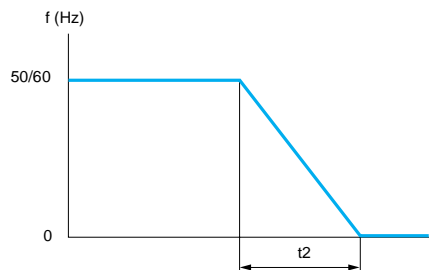
LSP: low speed, from 0 to HSP, factory setting 0  
HSP: high speed, from LSP to f max., factory setting 50/60 Hz  
x: configurable between 0 and 20 mA, factory setting 4 mA  
y: configurable between 0 and 20 mA, factory setting 20 mA

**Acceleration and deceleration ramp times**

Used to define acceleration and deceleration ramp times according to the application and the machine dynamics



Linear acceleration ramp



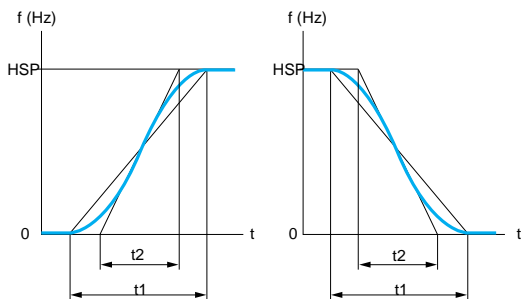
Linear deceleration ramp

Adjustment for t1 and t2 between 0.05 and 999.9 s, factory setting 3 s.

**Acceleration and deceleration ramp profiles**

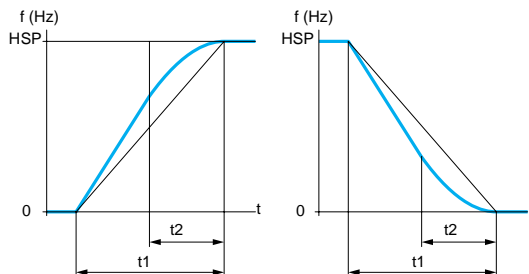
Used to gradually increase the output frequency starting from a speed reference, following a linear ratio or a preset ratio which enables the ramp to be given an S or a U profile. For a pumping application (installation with centrifugal pump and non-return valve): the closing of the valve can be controlled more accurately if U-shape ramps are used. Selecting "linear", "S", or "U" profiles will affect both the deceleration and acceleration ramps.

S-shape ramps



HSP: high speed  
The curve coefficient is fixed, with  $t_2 = 0.6 \times t_1$ , where  $t_1$  = set ramp time

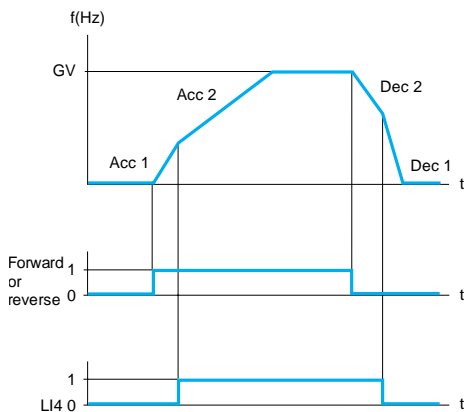
U-shape ramps



HSP: high speed  
The curve coefficient is fixed, with  $t_2 = 0.5 \times t_1$ , where  $t_1$  = set ramp time

# Variable speed drives for asynchronous motors

## Altivar 38

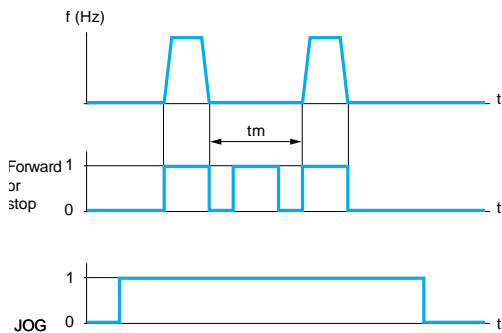


Acceleration 1 (Acc 1) and deceleration 1 (Dec 1):  
 - adjustment 0.05 to 999.9 s  
 - factory setting 3 s

Acceleration 2 (Acc 2) and deceleration 2 (Dec 2):  
 - adjustment 0.05 to 999.9 s,  
 - factory setting 5 s.

HSP: high speed

**Acceleration and deceleration**  
**Example of switching using logic input LI4**



Speed reference:  
 - adjustment 0 to 10 Hz  
 - factory setting 10 Hz

Minimum time  $t_m$  between  
 2 pulses:  
 - adjustment 0 to 2 s  
 - factory setting 0.5 s

**Jog function**

### ■ Alternate ramp switching

Used to switch 2 acceleration or deceleration ramp times, which can be adjusted separately. The function is enabled by reassigning 1 logic input or by defining 1 frequency threshold. It is suitable for machines with fast continuous speed correction and high speed lathes with acceleration and deceleration limiting above certain speeds.

### ■ Automatic adaptation of deceleration ramp

Used to automatically adapt the deceleration ramp if the initial setting is too low when the load inertia is taken into account. This function avoids the drive locking in the event of an **excessive braking** fault.

### ■ Reverse operation

Used to reverse the direction of operation by means of a logic input. LI2 is assigned to this function in the factory setting.

This function can be suppressed in non-reversing motor applications by reassigning input LI2 to a different function.

### ■ Disabling reverse direction

Used to:

- Inhibit operation in the opposite direction to that controlled by the logic inputs, even if this reversal is required by a summing or feedback control function.
  - Inhibit reverse operation if it is requested using the REV key on the terminal.
- To be used if the direction of operation should not be reversed (example: fan).

### ■ Jog operation

Used for pulse operation at minimum ramp times (0.1 s), limited speed reference and minimum time between 2 pulses.

Enabled by means of an adjustable logic input LI, assigned to this function, and pulses given by the operating direction command.

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

# Variable speed drives for asynchronous motors

## Altivar 38

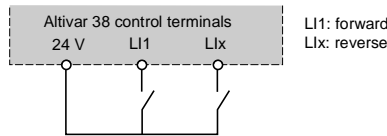
### ■ 2-wire control

Used to control the direction of operation by means of a maintained contact. Enabled by means of 1 or 2 logic inputs (one or two directions).

This function is suitable for all one or two direction applications.

3 operating modes are possible:

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



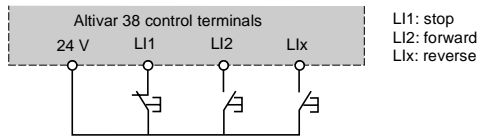
Wiring diagram for 2-wire control

### ■ 3-wire control

Used to control the operating and stopping direction by means of pulsed contacts.

Enabled by means of 2 or 3 logic inputs (non-reversing or reversing).

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

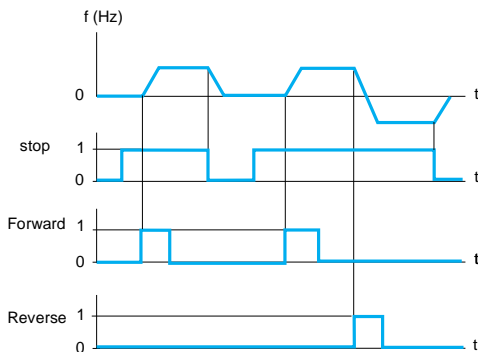


Wiring diagram for 3-wire control

### ■ +/- speed

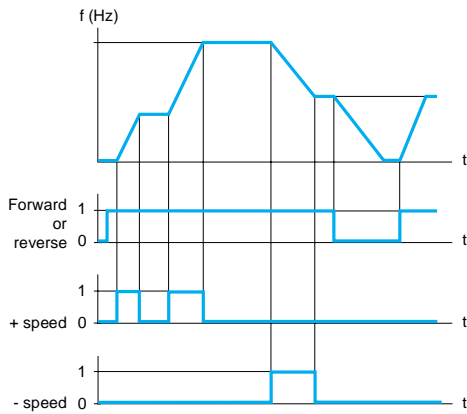
Used to increase or decrease a speed reference by means of 1 or 2 logic commands, with or without the last reference being saved (motorised potentiometer function). The maximum speed is given by the reference applied to the analog inputs. For example, connect AI1 to the +10V. Enabled by assigning 1 or 2 logic inputs.

This function is suitable for centralised control of a machine with several sections operating in one direction or for controlling pendant control station, using a handling crane in two operating directions.



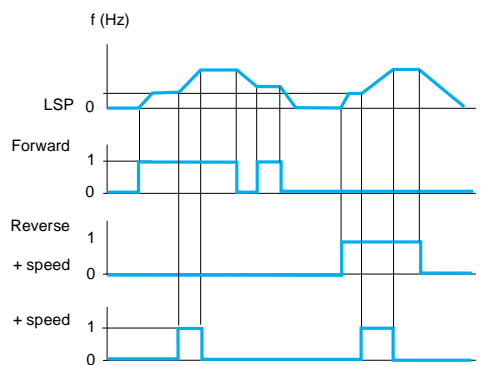
3-wire control

- With saving of the last reference and 2 logic inputs



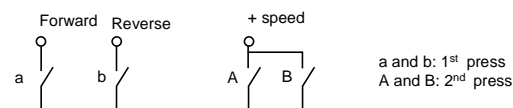
Example of "+/- speed" with 2 logic inputs

- Without saving of the last reference and a single logic input ("+" speed")



LSP: low speed

Example with double action buttons



**Note:** This type of "+/- speed" control is incompatible with 3-wire control.

### ■ Save reference

This function is associated with "+/- speed" control. Select yes or no.

Enables the new speed reference to be applied if the run command or line supply is lost. The save is applied the next time a run command is received.

# Variable speed drives for asynchronous motors

## Altivar 38

### ■ Motor switching

Allows two motors with different powers to be supplied successively 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 current
- injection current

Motor thermal protection is disabled by this function.

Enabled by assigning logic input LI to this function.

The associated parameter is the coefficient which provides the ratio between the power of the smallest motor and the power of the drive: 0.2 to 1.

### ■ Downstream contactor control

Allows the drive to control a contactor located between the drive and the motor.

The request to close the contactor is made when a run command appears.

The request to open the contactor is made when there is neither a run command nor a current present in the motor (freewheel stop, drive locked or braking terminated).

Enabled by means of logic output LO or relay R2.

- This function avoids the need for frequency switching on the power circuit upstream of the drive (otherwise premature aging of the filtering capacitors will occur) and requires a specific connection diagram (see page 25).
- This function must be used for cycles < 60 s with motor isolation on stopping.**

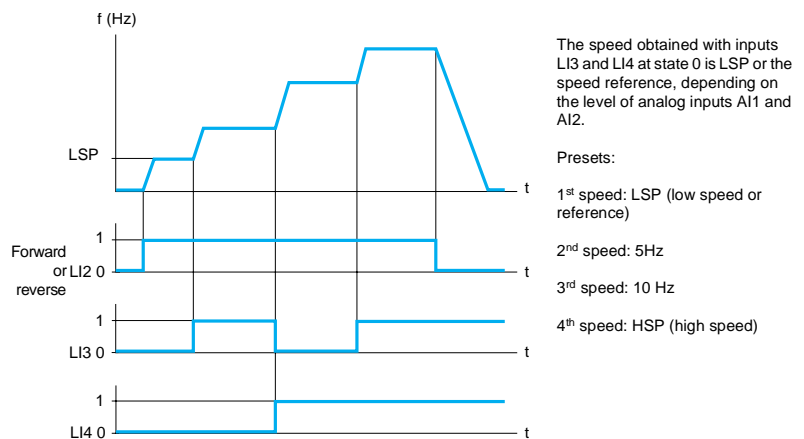
### ■ Preset speeds

Used to switch preset speed references.

2, 4, or 8 preset speeds can be selected.

Enabled by means of 1, 2 or 3 logic inputs.

The preset speeds can be adjusted in increments of 0.1 Hz to 0 Hz up to the maximum speed.



Example of operation with 4 preset speeds

### ■ Adjusting analog input AI2

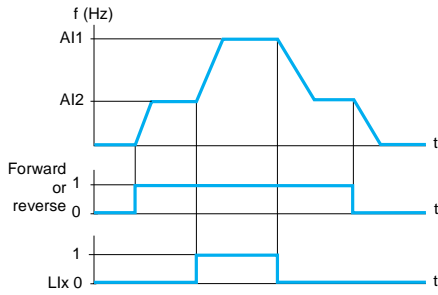
It is possible to modify the characteristics of analog current input AI2.

Factory setting: 4 -20 mA

Other values: 0-20 mA, 20-4 mA or X-Y mA by programming X and Y with a precision of 0.1 mA.

# Variable speed drives for asynchronous motors

## Altivar 38



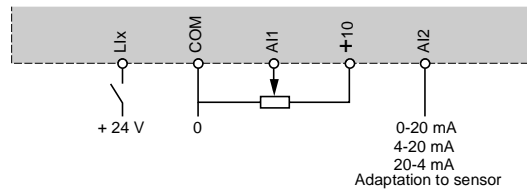
Example of reference switching

### Summing inputs

Analog input AI2 (and/or analog input AI3 with extension card) can be assigned as a summing input with AI1. The sum is limited to the value corresponding to the high speed (HSP). This function is suitable for machines on which the speed is controlled by a process controller signal on input AI2.

### Reference switching

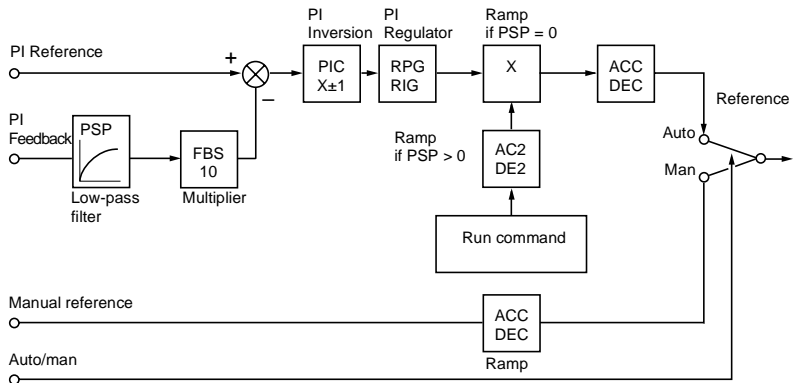
Allows 2 analog references to be switched by means of a logic command. This function avoids having to switch low level signals and makes the 2 reference inputs AI1 and AI2 independent. Enabled by means of 1 reassignable logic input LI. This function is suitable for all machines with automatic/manual operation. Automatic control via a sensor on input AI2, enabled by setting the logic input to 0. Manual control by means of potentiometer on input AI1 (local control).



Connection diagram for reference switching

### PI regulator

Used for simple control of a flow rate or a pressure with a sensor which supplies a feedback signal adapted to the drive. This function is suitable for pumping and ventilation applications.



**ACC:** Acceleration  
**AC2:** Acceleration 2  
**DEC:** Deceleration  
**DE2:** Deceleration 2  
**FBS:** PI feedback multiplication coefficient

**PIC:** Reversal of the direction of correction of the PI regulator  
**PSP:** Filter time constant setting on the PI feedback  
**RIG:** PI regulator integral gain  
**RPG:** PI regulator proportional gain

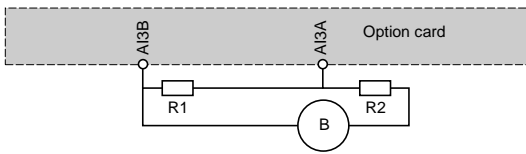
### Preset PI references:

2 or 4 preset references require the use of 1 or 2 logic inputs respectively.

2 preset references		4 preset references		
Assign: Llx to Pr2		Assign: Llx to Pr2, Lly to Pr4		
Llx	Reference	Lly	Llx	Reference
0	Analog reference	0	0	Analog reference
1	Process max (= 10 V)	0	1	PI2 (adjustable)
		1	0	PI3 (adjustable)
		1	1	Process max (= 10 V)

# Variable speed drives for asynchronous motors

## Altivar 38



Connection diagram for speed feedback via tachogenerator

### Speed feedback with tachogenerator

Used for precise speed control, irrespective of the state of the motor load.

**Assigned to logic input AI3, with extension card/analog input**

The maximum tachogenerator voltage must be between 5 and 9 V. If necessary, use an external divider bridge to adapt this value (1).

The value can be set precisely in the "Adjust" menu. Consistency between the motor frequency and the speed feedback is monitored in the drive fault management system.

This function is suitable for all applications requiring exact speed irrespective of the load.

- (1) Example: Motor 1500 rpm at 50 Hz, tachogenerator 0.06 V/rpm, max. speed set to 75 Hz (speed 2250 rpm)  
 maximum voltage  $0.06 \times 2250 = 135 \text{ V}$   
 recommended tachogenerator current 10 mA, therefore  $R1 + R2 = 135/10 = 13.5 \text{ k}\Omega$   
 average voltage on the input = 7 V, therefore  $R1 = 7/10 = 0.7 \text{ k}\Omega$  or 680  $\Omega$ , nearest standard value.  $R2 = 13.5 - R1$ , or 12  $\text{k}\Omega$ , nearest standard value  
 exact voltage on AI3 =  $135 \times R1 / (R1 + R2) = 135 \times 0.68 / 12.68 = 7.24 \text{ V}$   
 Use appropriate power resistors (min. 2 W).  
 The speed feedback should be scaled exactly by programming (when the device is set up).

### Incremental speed feedback

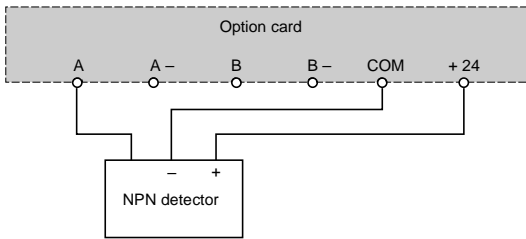
Used for precise speed control, irrespective of the state of the motor load.

Assigned to logic inputs A, A-, B, B- on the extension card/encoder inputs.

NPN type open collector output, nominal voltage 24 V ---

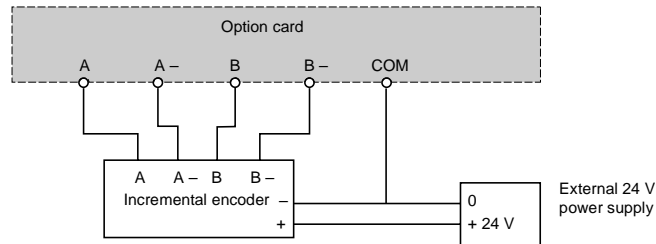
Max. read frequency 33 kHz at max. speed HSP

Use in 1 operating direction



Connection diagram with inductive sensor or simple control photoelectric sensor (not very precise at low speeds)

Use in 1 or 2 operating directions



Connection diagram with incremental encoder for precise control at low speeds

Consistency between the motor frequency and the speed feedback is monitored in the drive fault management system.

This function is suitable for applications requiring precise speed control irrespective of the load and a high level of immunity to interference.

### Incremental speed reference

Enabled by assigning the logic inputs on the above extension card/encoder inputs to the "summing inputs" function.

Synchronization of the speed of a number of drives.

Nominal voltage 24 V ---

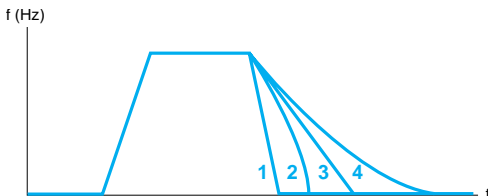
Max. reading frequency 33 kHz at max. speed HSP

### Controlled stop

Used to define stop modes in addition to the standard drive stops. These stop requests always have priority.

**Three stop modes are available for selection:**

- Freewheel stop: the drive is locked and the motor stops in accordance with the inertia and the resistive torque
- Fast stop: the motor brakes to a stop with the deceleration ramp time divided by a coefficient which can be set between 1 and 10
- d.c. injection braking: adjustment of the time (0 to 30 s, factory setting 0.5 s) and current (10% to 110% of the nominal drive current in high torque applications, factory setting 70%). Continuous braking is possible but is limited automatically to another adjustable value (10% to 100% of the nominal motor current, factory setting 50%) after 30 s.



- 1 Fast stop
- 2 d.c. injection stop
- 3 Normal stop on deceleration ramp
- 4 Freewheel stop

Examples of controlled stops

**Enable modes:**

- By means of 1 reassignable logic input LI: active at 0 for freewheel stop and fast stop, active at 1 for injection stop
- Automatically when stopping (frequency less than 0.1 Hz) for injection braking, as this function can be combined with the others. In this case, only the current after 30 s of injection can be adjusted.

# Variable speed drives for asynchronous motors

## Altivar 38

### ■ Automatic catching a spinning load with speed detection ("catch on the fly")

Used to restart the motor smoothly after one of the following events:

- loss of line supply or power off
- fault reset or automatic restart
- freewheel stop or injection stop with logic input
- uncontrolled loss of power downstream of the drive

On restarting, the effective speed of the motor is detected in order to restart on the ramp at this speed and return to the reference speed. The speed detection time can be up to 1 s depending on the initial deviation.

Factory setting: active

This function is automatically disabled if the brake sequence is configured.

This function is suitable for machines for which the loss of motor speed is negligible during the supply loss time (machines with high inertia), fans and pumps driven by a residual flux, etc.

### ■ Automatic restart

Enables the drive to be restarted automatically after locking following a fault if this fault has disappeared and if the other operating conditions permit a restart.

This restart is performed by a series of automatic attempts at 30 s intervals.

If a restart has not been possible after 6 attempts, the procedure is abandoned and it remains locked until it has been switched off and on again.

Factory setting: inactive

The faults permitting this restart are:

- supply overvoltage
- motor thermal overload
- drive thermal overload
- loss of 4-20 mA reference
- d.c. bus overvoltage
- external fault
- motor phase loss
- serial link fault
- mains voltage too low. For this fault, the function is always active, even if it is not configured.

For this type of fault, the drive fault relay remains activated if the function is configured. The speed reference and the direction of operation must be maintained for this function.

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.

### ■ Maintaining the speed following loss of the 4-20 mA reference

Enables the motor speed to be maintained following loss of the 4-20 mA reference.

This function is suitable for applications which must not be interrupted.

### ■ Limiting low speed operating time (LSP)

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 s or no limit. Factory setting 5 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 automatic stopping/starting on pressure-regulated pumps.

### ■ Fault reset

Enables faults to be reset by means of a logic input LI which can be reassigned to this function. The restart conditions after a reset to zero are the same as those of a normal power-up.

Fault reset: overvoltage, overspeed, external fault, drive overheating, loss of motor phase, d.c. bus overvoltage, loss of 4-20 mA reference, load veering, motor overload if the thermal state is less than 100%, serial link fault.

"Mains undervoltage" and "mains phase loss" faults are reset automatically when the mains supply is restored.

This function is suitable for applications with drives which are difficult to access.

### ■ General reset (inhibits all faults)

This function can be used to inhibit all faults, including thermal protection (forced operation) except short-circuit faults, to ensure operation unless irreparable damage has been caused in extreme operating conditions.

This function is suitable for applications where a restart could be vital (tunnel smoke extraction system).

### ■ Forced local mode

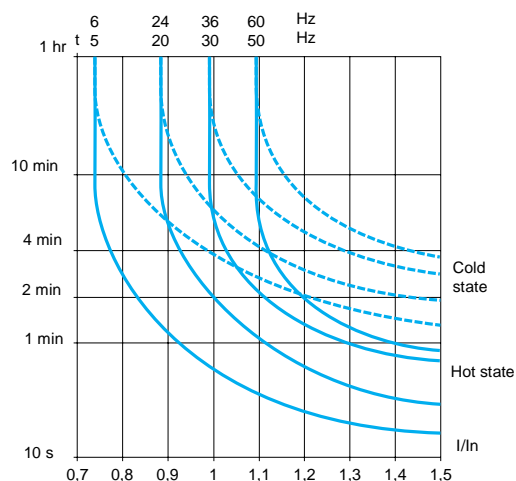
Forced local mode switches the drive from serial link control to terminal control. A logic input LI can be reassigned to this function.

### ■ External fault

When the input assigned to this function changes to 1, the motor stops in accordance with the parameter configuration and the drive locks in an "EPF external fault" fault.

# Variable speed drives for asynchronous motors

## Altivar 38



Thermal protection characteristics (warm and cold)

### ■ Fault relay, unlocking

The fault relay is energised when the drive is powered up and is not faulty. It has one "C/O" contact at the common point.

The drive can be unlocked after a fault in one of the following ways:

- by switching the drive off until the "power on" LED goes out and then switching it on again
- by assigning a logic input to the "fault reset" function
- using the "automatic restart" function (if it has been configured)

### ■ Motor thermal protection

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

The drive is locked by default if this temperature rise exceeds 118% of the nominal temperature rise.

- This function is suitable for applications with self-cooled or force-cooled motors: The microprocessor calculates the theoretical temperature rise of the motor based on various elements:
  - the operating frequency
  - the current taken by the motor
  - the operating time
  - the maximum ambient temperature around the motor (40°C)

Adjustment:

0.25 to 1.36 times the nominal current of the drive in high torque applications, factory setting 0.9 times the nominal current indicated on the motor rating plate.

- Special applications:

Adaptation of thermal protection in the fault configuration menu:

- applications with force-cooled motor: in this case, the tripping curves are those shown opposite for the nominal frequency 50/60 Hz
- suppression of thermal protection in harsh environments: temperature greater than 40°C around the motor, which may cause the cooling fins to become clogged (provide direct thermal protection via thermistor probes integrated into the motor)
- motor thermal protection using PTC probes: see "thermal protection with PTC probes" function with option card
- if several motors are connected in parallel on the same drive, fit each motor starter with a thermal relay to reduce the risk of the load being distributed unevenly.

**Note:** When the drive is switched off, calculation  $I_2t$  is saved and the amount by which it has decreased is calculated.

### ■ PTC probe protection

Used for motor thermal protection (if the motor is fitted with PTC probes).

Assigned to logic input AI3, with extension card/analog input

Maximum resistance of probe circuit at 20°C: 750 Ω (3 x 250 Ω probes connected in series)

Probe break and short-circuit faults are monitored.

This function is suitable for use in all applications.

### ■ Thermal protection of drive

Enables the drive to be protected directly via a thermistor fitted on the heatsink, ensuring that components are protected in the event of poor ventilation or excessive ambient temperatures. Locks the drive in the event of a fault.

### ■ Switching frequency, noise reduction

High frequency switching of the intermediate d.c. voltage can be used to supply the motor with a current wave with low harmonic distortion.

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

In addition, the switching frequency is random in order to avoid resonance. This function can be disabled if it causes instability.

This function is suitable for all applications which require low motor noise.

- Without derating, for continuous or intermittent operation (frequencies of 0.5 and 1 kHz should be used for long cable lengths).

Drive	Configurable switching frequency - kHz
ATV 38HU18N4 to HD46N4 ATV 38HD25N4X to HD46N4X	0.5-1-2-4
ATV 38HU54N4 to HC33N4 ATV 38HD54N4X to HC33N4X	0.5-1-2

- Without derating, with intermittent operating cycle or with derating by one power rating in continuous operation (1).

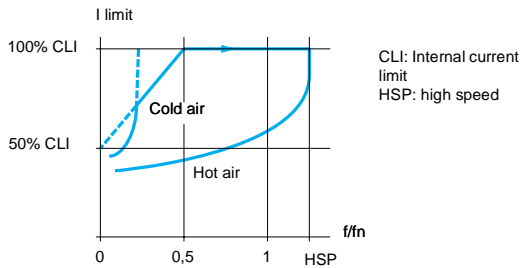
Drives	Configurable switching frequency - kHz
ATV 38HU18N4 to HD23N4	8-12-16
ATV 38HU25N4 to HD46N4 ATV 38HU25N4X to HD46N4X	8-12
ATV 38HU54N4 to HD79N4 ATV 38HU54N4X to HD79N4X	4-8
ATV 38HC10N4X to HC33N4X	4

(1) In intermittent operation, the frequency automatically decreases in the case of overheating.

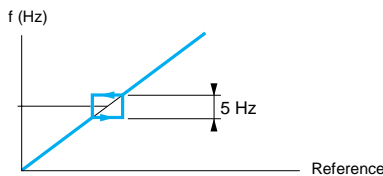


# Variable speed drives for asynchronous motors

## Altivar 38



Adaptation of the current limit



Motor speed change depending on the reference with a skip frequency

### ■ Energy saving

Enables the power consumption to be adapted according to the load, improving efficiency.

### ■ Adaptation of the current limit

The current limit can be adapted automatically according to the speed in order to avoid a motor overload fault.

This function is suitable for ventilation applications in which the load curve changes according to the air density.

### ■ Auto-tuning

Auto-tuning is only possible by means of user intervention using the dialogue tools and an assignable logic input. It is used to optimize performance.

This function is suitable for use in all applications.

### ■ Skip frequencies

Skip frequencies can be used to suppress up to three critical speeds which may be the cause of mechanical resonance.

Prolonged operation of the motor can be prohibited on one to three adjustable frequency bands (with a band width of 5 Hz), which can be set within the operating range.

This function is suitable for use in fans and centrifugal pumps.

### ■ Reassignable logic outputs

Relay R2 (or LO solid state output with I/O extension card):

- Remote signalling of the following information as required:
  - Drive operating (running or braking)
  - Frequency threshold reached (greater than or equal to an adjustable threshold)
  - 2<sup>nd</sup> frequency threshold reached
  - Frequency reference reached (motor frequency equal to the reference)
  - Current threshold reached (greater than or equal to an adjustable threshold)
  - Motor thermal threshold reached (greater than or equal to an adjustable threshold)
  - Drive thermal threshold reached (greater than or equal to an adjustable threshold)
  - High speed reached
  - Loss of 4-20 mA reference
- Remote downstream contactor control

### ■ Analog outputs AO1 (or AO with I/O extension card)

Analog outputs AO and AO1 (x-y mA) can be assigned to the following parameters:

- Motor current (y mA = twice the nominal current of the drive)
- Motor frequency (y mA = maximum frequency)
- Ramp output (y mA = maximum frequency)
- Signed ramp (x mA = maximum reversing frequency, y mA = maximum forward frequency)
- PI reference (x mA = minimum reference, y mA = maximum reference)
- PI feedback (x mA = minimum feedback, y mA = maximum feedback)
- PI error (x mA = maximum error < 0, y mA = minimum error > 0)
- PI integral (y mA = integral saturated)
- Motor power (x mA = 0% of the nominal motor power, y mA = 200% of the nominal motor power)
- Motor thermal state calculated: (x mA = 0%, y mA = 200%)
- Drive thermal state: (x mA = 0%, y mA = 200%)

**Note:** x and y can be set between 0 and 20 mA

### ■ Adjusting the analog outputs AO1 (or AO with I/O extension card)

The characteristics of analog current outputs AO and AO1 can be modified.

Factory setting: 0-20 mA

Other values: 4-20 mA, 20-4 mA or x-y mA by programming x and y with a definition of 0.1 mA.

This function is suitable for use in applications with a signal other than 0-20 mA.

# Variable speed drives for asynchronous motors

## Altivar 38




### Compatibility table for configurable I/O functions

**■ Configurable I/O**



- Functions which are not listed in this table are fully compatible.
- Stop functions have priority over run commands.
- Speed references via logic command have priority over analog references.

The selection of functions is limited:  
 - by the number of drive I/O which can be reassigned: if necessary, add an I/O extension card  
 - by the incompatibility of certain functions with one another

Functions	d.c. injection braking	Summing inputs	PI regulator	+/- speed	Reference switching	Freewheel stop	Fast stop	Jog operation	Preset speeds	Speed regulation with tachogenerator or encoder
d.c. injection braking						↑	↑			
Summing inputs					⊖					
PI regulator								⊖	⊖	⊖
+/- speed								↑	⊖	
Reference switching		⊖		⊖					⊖	
Freewheel stop	←						←			
Fast stop						↑				
Jog operation			⊖	←					←	
Preset speeds			⊖	⊖	⊖			↑		
Speed regulation with tachogenerator or encoder			⊖							

-  Incompatible functions
-  Compatible functions
-  Not applicable


**Priority functions** (functions which cannot be active at the same time)

-  The arrow indicates which function has priority.
- 

Example: The "fast stop" function has priority over the "d.c. injection braking" function

**Summary table of the configurable I/O assignments**

Functions	Drive I/O								
	Without option card				With I/O extension cards				
	Relay R2	Analog input AI2	Analog output AO1	3 logic inputs LI2-LI3-LI4	2 logic inputs LI5-LI6	Analog input AI3	Logic output LO	Analog output AO	Encoder inputs A-, A+, B-, B+
Auto-tuning									
Reverse operation									
Alternate ramp switching									
Jog operation									
+/- speed									
Preset speeds									
Reference switching									
External fault									
Freewheel stop									
Injection stop									
Fast stop									
Motor switching									
Forced local mode									
PI auto/man									
Fault reset									
General reset (inhibits all faults)									
Summing reference									
PI regulator									
2 <sup>nd</sup> speed reference									
Speed feedback									
PTC probes									
Downstream contactor control									
Frequency threshold reached									
High speed reached									
Frequency reference reached									
Current threshold reached									
Motor thermal threshold reached									
Drive thermal threshold reached									
Drive running									
Loss of 4-20 mA reference									
Motor current									
Motor frequency									
Ramp output (signed)									
PI function outputs									
Motor power									
Motor thermal state									
Drive thermal state									

 Possible assignments



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