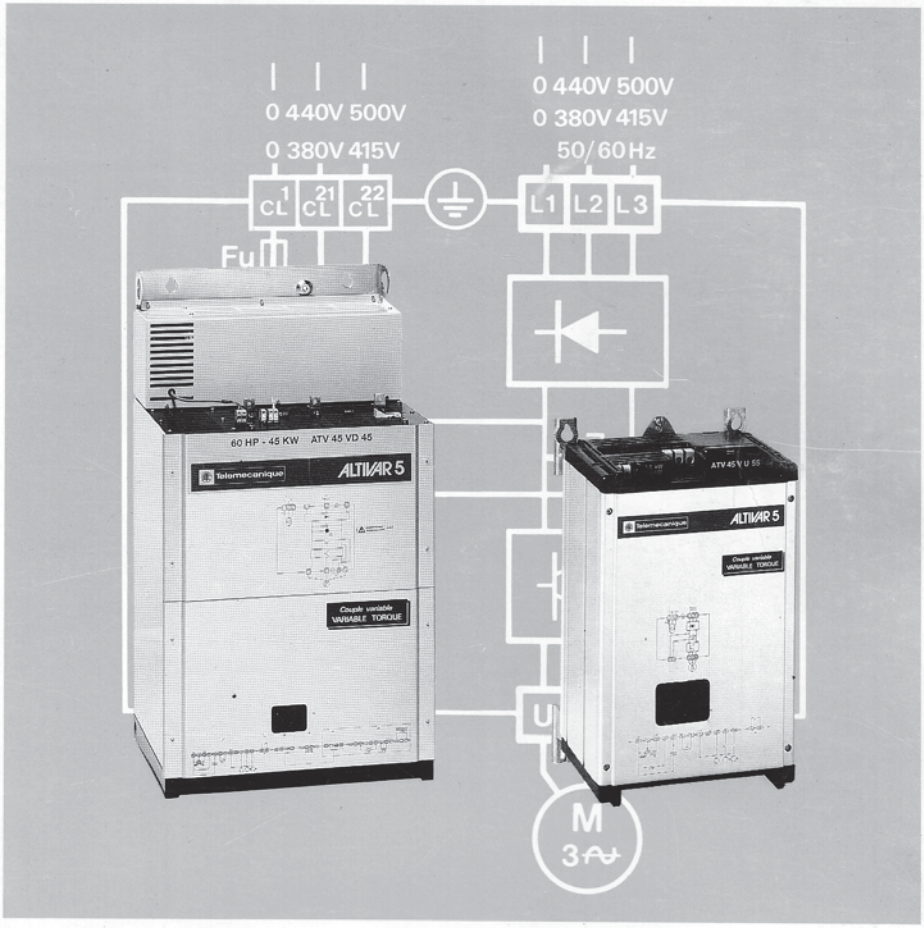
altivar 5 series 45 speed controller user manual

ALTIVAR® 5

series 45V variable torque variable speed controllers for asynchronous motors

user's manual



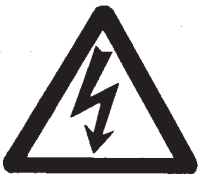
from 1,1 to 110 kW

three phase supply

380/415V → ATV-45V...

440/500V → ATV-45V...N

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WARNING

When the speed controller power supply is switched on, the power units, as well as a certain number of control components are connected to the mains supply ; contact with these parts is extremely dangerous.

After disconnecting the ALTIVAR from the mains voltage, wait 5 minutes before carrying out any operation inside the controller. This period corresponds to the time constant for the discharge of the capacitors. The + and – terminals (or PA and PB on the 45 to 110 kW speed controllers) are also connected to the potential of the capacitors.

During operation, the motor can be stopped by cancelling the run command or the speed reference, while the speed controller remains energized. If untimely restarting needs to be prevented for personnel safety reasons, this electronic interlock is inadequate. Provision must be made for the disconnection of the power circuit.

NOTE

The speed controller includes safety devices which, in the event of a fault, can trigger the stopping of the controller, and hence the motor. The motor itself can also be subject to stoppage by mechanical jamming. Finally, voltage fluctuations and power supply failures in particular, can also cause the motor to stop.

The disappearance of the fault causing the stoppage can initiate a restart involving a hazard for certain types of machines or installations, especially those which must conform to specific safety regulations.

It is important that in such cases the user should take appropriate steps to prevent such restarting possibilities. For example, by the use of an underspeed detector, causing the disconnection of the speed controller power supply in the event of a non-programmed motor stoppage.

As a general rule, the speed controller power supply must always be switched off before carrying out any operation on either the electrical or the mechanical parts of the installation or the machine.

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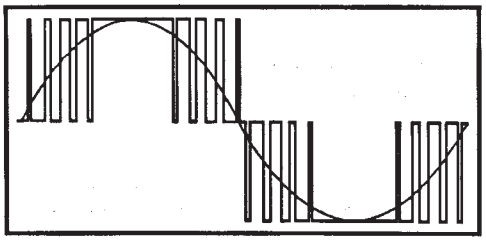
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Contents

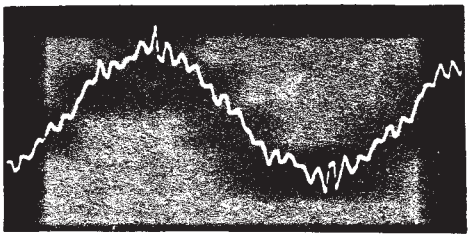
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General information

The ALTIVAR ATV-45V is a frequency inverter operating on the principle of synthesizing a sine wave by pulse width modulation (PWM).



The resulting waveform of the current is very close to a sine wave.



When associated with a standard three phase asynchronous squirrel cage motor, the ALTIVAR ATV-45V provides a simple and reliable motor/speed controller combination.

In order to obtain the best possible results from the ALTIVAR ATV-45V, read this guide carefully and apply all the relevant information and recommendations given.

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Preliminary checks

Remove the ALTIVAR ATV-45V from its packing, and check that it shows no signs of having been damaged during transport.

Make sure that the speed controller label conforms to the delivery note corresponding to the purchase order.

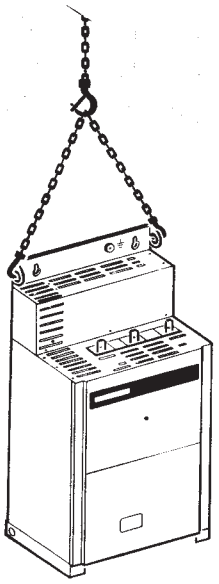
ALTIVAR 45 to 110 kW

The device is fitted with two crossed straps which enable it to be removed from its packing.

It can be handled :

- either using a hoist, attaching it to the two lifting rings to be found on the upper part,
- or in a horizontal position, with its back resting on a pallet.

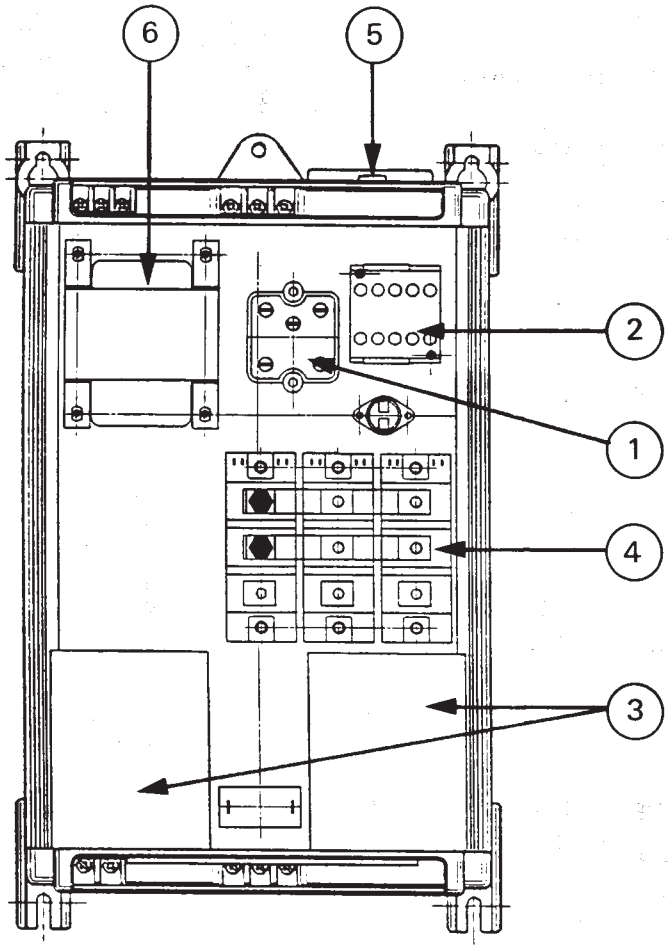
The variable speed controller can be placed on the ground in an upright position.

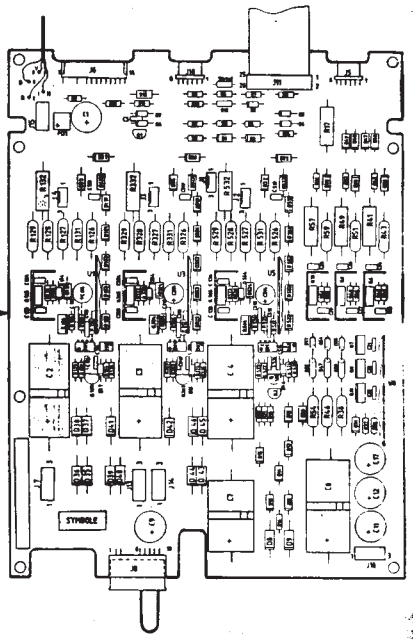


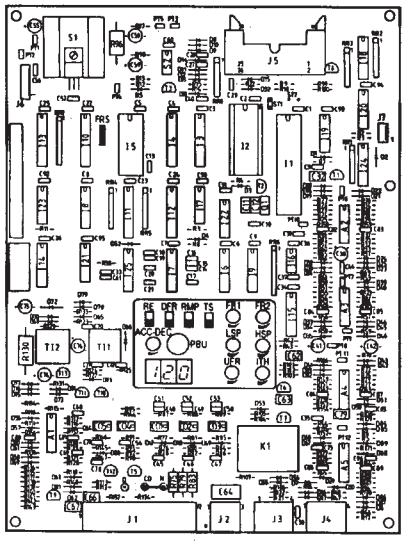
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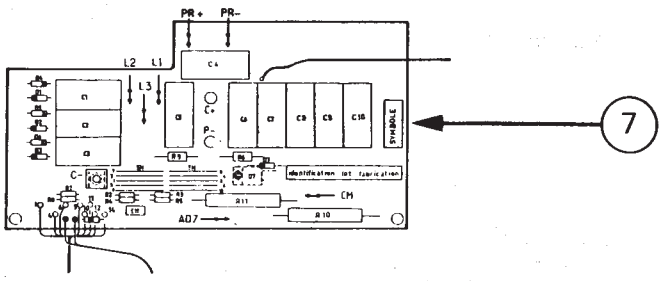
ALTIVAR 1,1 to 22 kW

Technology





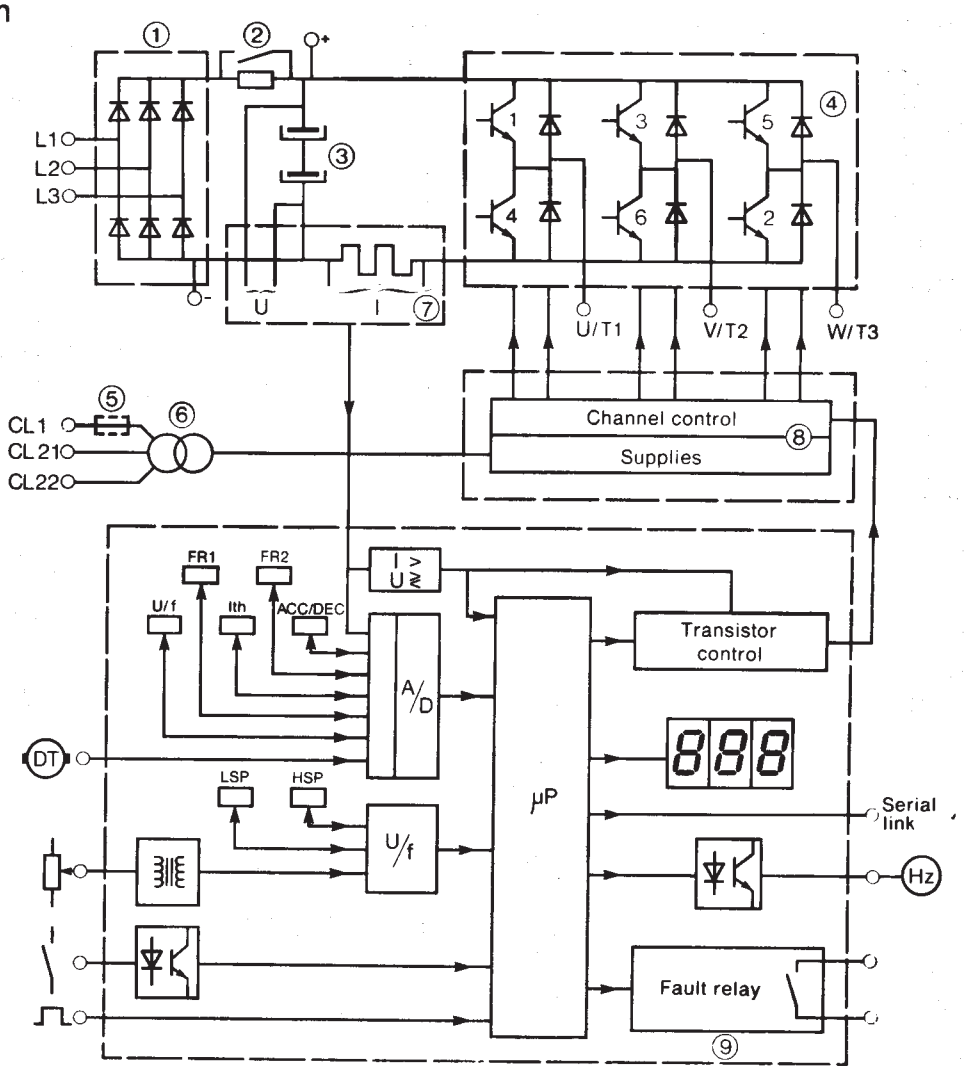




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ALTIVAR 1,1 to 22 kW

Functional block diagram



Description of functions

① Rectifier

② Charge current limiting device

③ Filter capacitors

④ Transistorised inverter bridge

⑤ Control circuit fuse (except for the ATV-45V•••N speed controllers)

⑥ Control circuit transformer

⑦ Measuring board

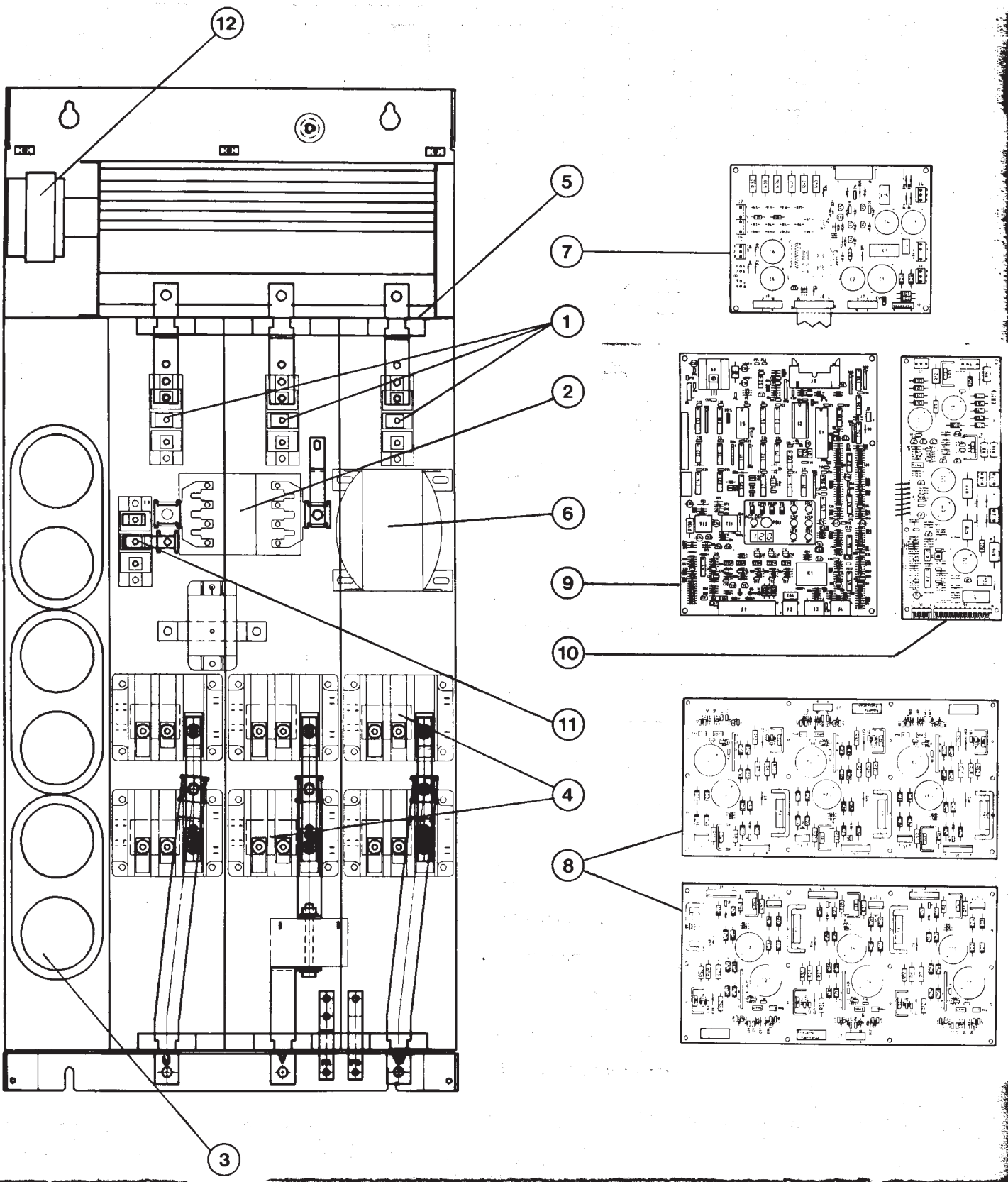
⑧ Transistor control power board

⑨ Microprocessor control board

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ALTIVAR 45 to 110 kW

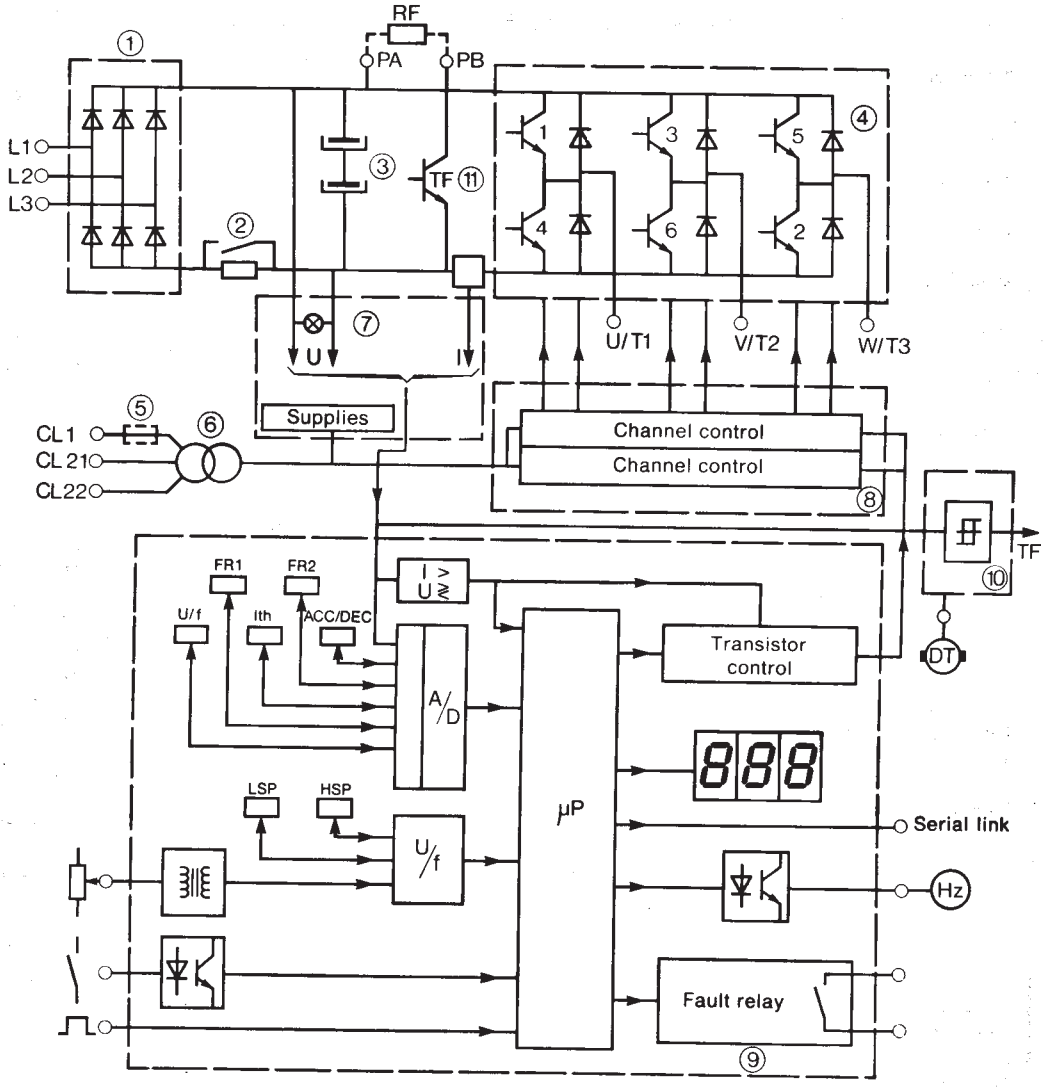
Technology



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ALTIVAR 45 to 110 kW

Functional block diagram



Description of functions

① Rectifiers

② Charge current limiting device

③ Filter capacitors

④ Transistorised inverter bridge

⑤ Control circuit fuse (except for the ATV-45V•••N speed controllers)

⑥ Control circuit transformer

⑦ Measuring board

⑧ Transistor control power boards

⑨ Microprocessor control board

⑩ Slow-down braking and speed regulation option board

⑪ Braking transistor

⑫ Fan

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Technical characteristics

Reference **ATV-45V...** 380/415V	**U11**	**U15**	**-**	**U30**	**U40**	**U55**	**D11**	**D15**	**D22**	**D45**	**D75**	**D90**	**C11**
Reference **ATV-45V...N** 440/500V	**U11N**	**-**	**U22N**	**-**	**-**	**U55N**	**D11N**	**D15N**	**D22N**	**D45N**	**D75N**	**D90N**	**C11N**
Motor power (kW)	1,1	1,5	2,2	3	4	5,5	11	15	22	45	75	90	110
Motor power (HP)	1,5	2	3	4	5,5	7,5	15	20	30	60	100	125	150
Supply voltage	ATV-45V... 380/415V + 10 % – 15 % ATV-45V...N 440/500V + 10 % – 15 %												
Mains frequency	50/60 Hz												
Line current (A) ATV-45V...	4,5	6	-	12	16	20	36	48	72	140	228	280	348
Line current (A) ATV-45V...N	3,9	-	7	-	-	16	31	40	60	115	186	234	270
Output voltage	maximum value equal to mains voltage												
Frequency range	1 to 67/80 Hz												
Rated current (A) ATV-45V...	3	4	-	8	10,5	13	24	32	48	94	152	187	232
Transient current (A) ATV-45V...	3,3	4,4	-	8,8	11,5	14	26	35	53	103	167	205	255
Rated current (A) ATV-45V...N	2,6	-	4,8	-	-	11	21	27	40	77	124	156	180
Transient current (A) ATV-45V...N	2,9	-	5,3	-	-	12	23	30	44	85	136	170	200
Total dissipated power at rated load (W)	75	95	115	115	135	165	270	360	480	850	1250	1700	2000
Torque / overtorque	(see p. 24)												
Speed set-point inputs	0-10V, 0-20 mA, 4-20 mA (see p. 22)												
Low speed / high speed limits	adjustable (see p. 30)												
Acceleration / deceleration ramps	2 adjustment ranges : 1 - 120 s or 5 - 600 s, selection by switch (see p. 29) time identical in acceleration and deceleration, adjustment by potentiometer (see p. 30)												
Speed regulation	with tachogenerator (see p. 42/54)												
Reversing	control inputs (see p. 20/21)												
Braking to standstill	by d.c. injection { automatic during 0,5 s if the frequency becomes < 1 Hz manual by external signal (see p. 20/21)												
Slow-down braking	by optional resistance (see p. 44)												
Speed controller protections	against short circuits { between output phases * between output phases and earth against mains supply under / overvoltage (automatic restarting, see p. 27) against excessive overheating (vigitherm)												
Motor protection	incorporated electronic thermal protection (see p. 20/30)												
Control system communication	optional serial link (see p. 56)												
Operating temperature	0°C to + 40°C												
Storage temperature	– 25°C to + 70°C												
Humidity	90 % maximum without condensation or dripping water (see recommendations on p. 19)												
Altitude	≤ 1000 m (above this, derating by 3 % for each additional 1000 m)												
Degree of protection	IP20 (ALTIVAR 1,1 to 22 kW) IP10 (ALTIVAR 45 to 110 kW)												

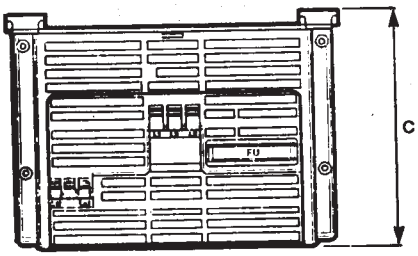
* ATV-45VD90N and VC11N : length of motor-speed controller cables ≥ 25 m, if not, fit inductances (consult TELEMECANIQUE).

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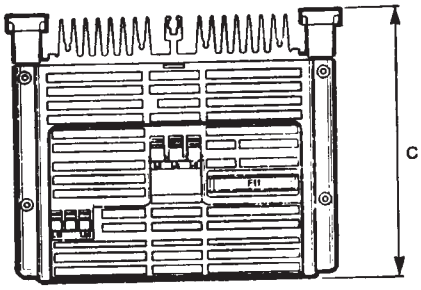
ALTIVAR 1,1 to 22 kW

Dimensions
Weights

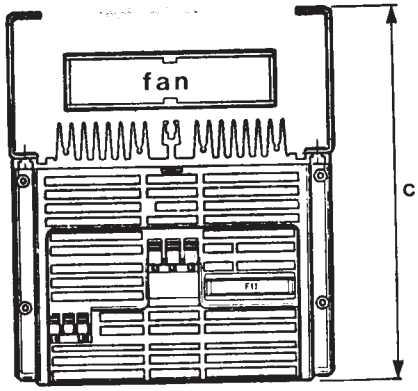
ATV-45VU11 (N)
ATV-45VU15

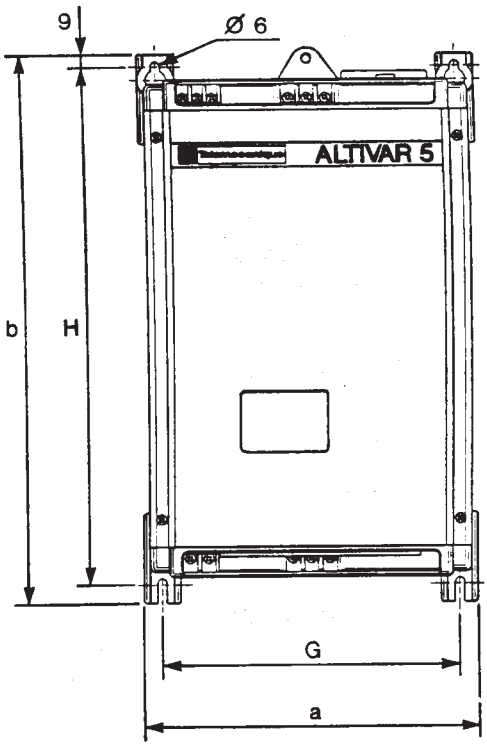


ATV-45VU22N
ATV-45VU30
ATV-45VU40
ATV-45VU55 (N)



ATV-45VD11 (N)
ATV-45VD15 (N)
ATV-45VD22 (N)





Reference	a mm	b mm	c mm	G mm	H mm	Weight kg
ATV-45VU11 (N) ATV-45VU15	239	382	170	212	360	8,5 8,5
ATV-45VU22N ATV-45VU30 ATV-45VU40 ATV-45VU55 (N)	239	402	192	212	380	11,5 11,5 11,5 11,5
ATV-45VD11 (N)	234	405	268	208	360	15
ATV-45VD15 (N)	234	555	268	208	510	21
ATV-45VD22 (N)	234	595	268	208	550	23,5

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ALTIVAR 1,1 to 22 kW

Climatic environment

Temperature
Humidity
Altitude
Degree of protection
} see technical characteristics (p. 8)

Pollution : protect the speed controller against
- dust,
- corrosive gases,
- splashing liquid.

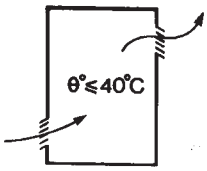
Mounting precautions

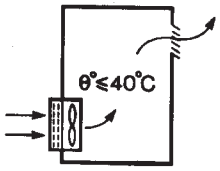
- Mount the controller vertically.
- Do not locate near heat radiating elements.

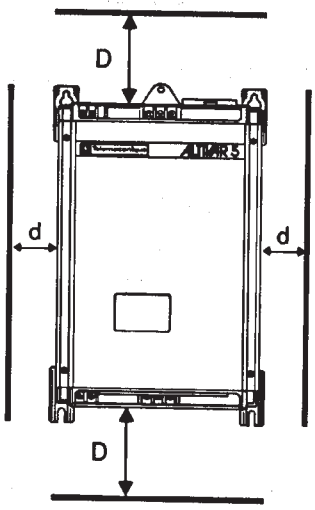
Mounting in general purpose metal enclosure

Degree of protection IP23.

In order to ensure adequate air flow inside the product :
- leave sufficient space around the speed controller :
  - d ≥ 50 mm,
  - D ≥ 100 mm,
- provide ventilation louvres,
- verify that the ventilation is sufficient, if not, fit a cooling fan with filter.





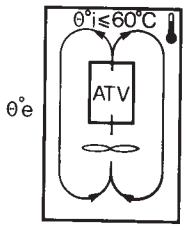


Mounting in dust and damp protecting metal enclosure

Degree of protection IP54.

Provide a ventilating fan to circulate the air inside the enclosure and prevent hot spots in the speed controller :
- flow : 100 dm³/s, fan mounted beneath the speed controller at a distance ≤ 50 mm.

This arrangement enables utilisation of the speed controller in an enclosure with a maximum internal temperature of 60°C.



Alternatively, use the optional ventilation kit (see p. 59).

Calculation of the enclosure size

Maximum thermal resistance Rth (°C/W) :

$$Rth = \frac{60 - \theta°e}{P}$$

θ°e = maximum external temperature in °C,
P = total power dissipated in the enclosure in W.

For the power dissipated by the controllers at rated load, see characteristics, page 8.

Useful heat exchange surface of the enclosure S (m²) :
(sides + top + front for a wall mounted enclosure)

$$S = \frac{K}{Rth}$$

K = thermal resistance per m² of the enclosure
(K = 0,12 for a metal enclosure type DE1-HB).

Insulated enclosures should not be used, due to their poor thermal conduction.

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ALTIVAR 1,1 to 22 kW

Calculation example

ATV-45VU55 (5,5 kW) mounted in a dust and damp protecting enclosure with internal cooling fan.
Maximum external temperature : 30 °C.

- Power dissipated inside the enclosure : 165 W.
- Maximum thermal resistance

$$Rth = \frac{60 - 30}{165} = 0{,}18°C/W$$

Minimum useful heat exchange surface area :

$$S = \frac{0{,}12}{0{,}18} = 0{,}67\ m^2$$

Useful heat exchange surface area of a DE1-HB543 wall mounted enclosure :

- height : 600 mm,
- width : 500 mm,
- depth : 250 mm.

$S = (0{,}6 \times 0{,}5) + (0{,}25 \times 0{,}5) + 2\ (0{,}6 \times 0{,}25) = 0{,}725\ m^2$

Based on the initial hypotheses, the enclosure is suitable.

Recess mounting

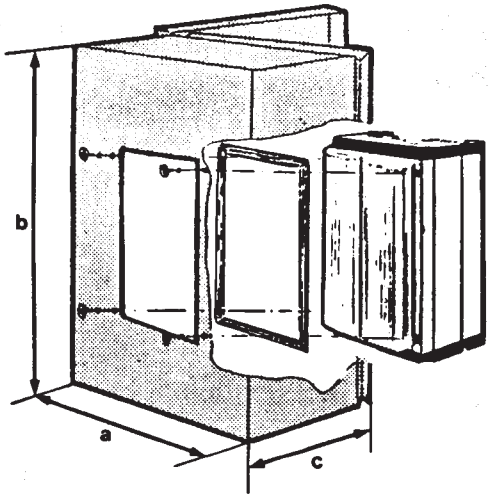
In order to reduce power dissipated in the enclosure, the speed controller can be recess mounted in the back of the enclosure, with the radiator on the outside.

This arrangement necessitates a cut out and a mounting kit as defined in the section on mounting in a dust and damp protecting enclosure (see p. 58).

As before, in order to obtain a temperature which does not exceed 60°C, the air inside the enclosure must be kept cool by the addition of a cooling fan, which can have a lower flow (44 dm^3/s), or by the use of the ventilation kit (see p. 59).

The minimum metal enclosure dimensions enabling the mounting of one speed controller only, with an internal fan, in an external ambient air temperature < 30°C, are given in the table below :

Mounting kit reference	ALTIVAR reference	a mm	b mm	c mm	Pi * W
VY1-A451U1501	ATV-45VU11 (N) ATV-45VU15	300 300	500 500	200 200	70 85
VY1-A451U4001	ATV-45VU22N ATV-45VU30 ATV-45VU40 ATV-45VU55 (N)	400 400 400 400	500 500 500 500	250 250 250 250	85 85 90 105
VY1-A451U7501	ATV-45VD11 (N)	400	600	250	80
VY1-A451D1101	ATV-45VD15 (N)	500	700	250	95
VY1-A451D1501	ATV-45VD22 (N)	500	700	250	110



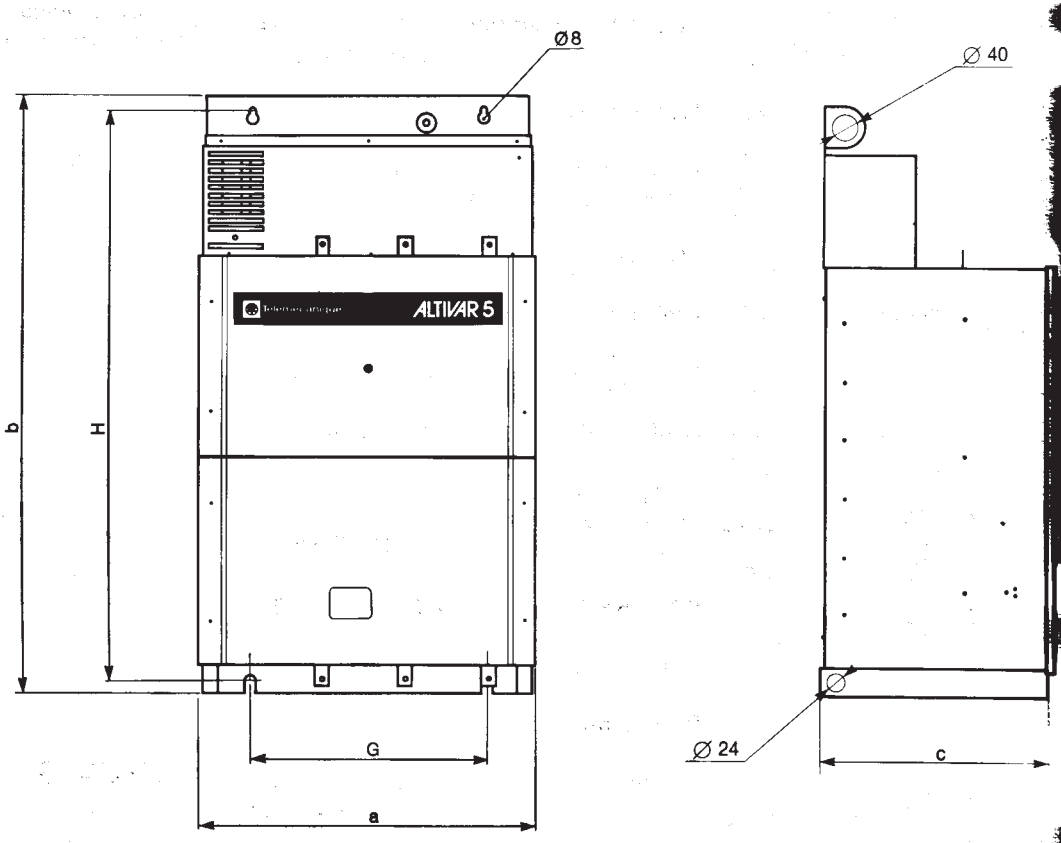
* Pi = power dissipated in the enclosure by a recess mounted speed controller.

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Installation

ALTIVAR 45 to 110 kW

Dimensions
Weights



Reference	a mm	b mm	c mm	G mm	H mm	Weight kg
ATV-45VD45 (N)	484	860	350	335	820	86
ATV-45VD75 (N)	484	1040	350	335	1000	105
ATV-45VD90 (N)	595	1188	350	445	1160	140
ATV-45VC11 (N)	595	1188	350	445	1160	140

Climatic environment

Temperature
Humidity
Altitude
Degree of protection

} see technical characteristics (p. 8)

Pollution : protect the speed controller against
- dust,
- corrosive gases,
- splashing liquid.

Mounting precautions

- Mount the controller vertically.
- Do not locate near heat radiating elements.

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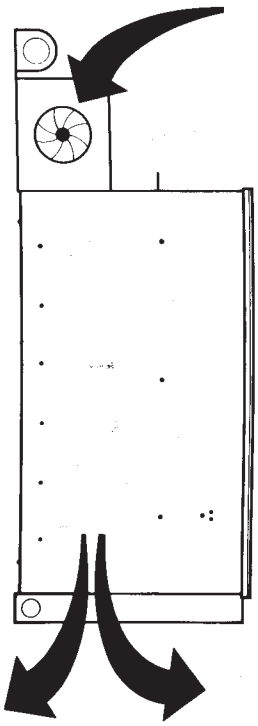
Installation

ALTIVAR 45 to 110 kW

Speed controller ventilation

ALTIVAR speed controllers belonging to the ATV-45VD45 (N) to VC11(N) range, are fitted with a forced air ventilation cooling device.

A tangential fan placed in the upper part of the controller, and protected by a perforated cover, sucks in the ambient air, and expels it vertically from the top to the bottom onto the radiator's cooling fins, which carry the power components. When mounting the device, ensure that the air inlets and outlets are not obstructed.



Fan characteristics :

- flow rate : 210 dm^3/s,
- supply : from control voltage,
- controlled by thermocontact fixed onto the radiator :
  - which closes when the temperature reaches 50°C,
  - which opens when the temperature falls to around 30°C.

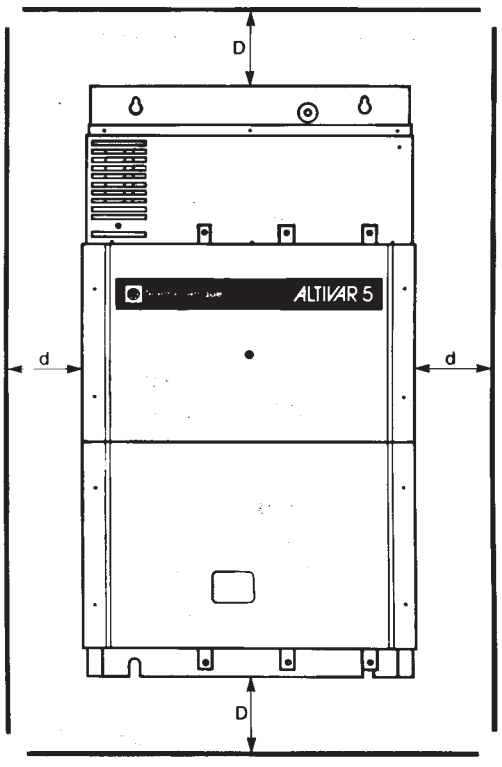
Thermal protection of the speed controller is ensured by another thermocontact fixed on the radiator, which opens when the temperature reaches about 75°C :

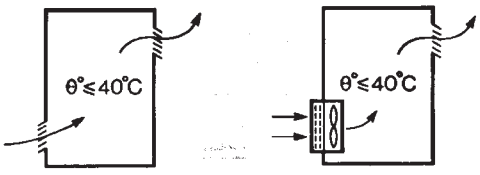
- the speed controller locks, and the fault code OHF appears on the dialogue panel displays,
- the ventilation continues operating if the control supply is maintained, enabling the controller to be rapidly cooled down.

Mounting in general purpose metal enclosure

Degree of protection IP23.

In order to ensure adequate air flow inside the product :
- leave sufficient space around the speed controller :
  . d ≥ 50 mm,
  . D ≥ 200 mm,
- provide ventilation louvres,
- verify that the ventilation is sufficient, if not, fit a cooling fan with filter.





Mounting in dust and damp protecting metal enclosure

Degree of protection IP54.

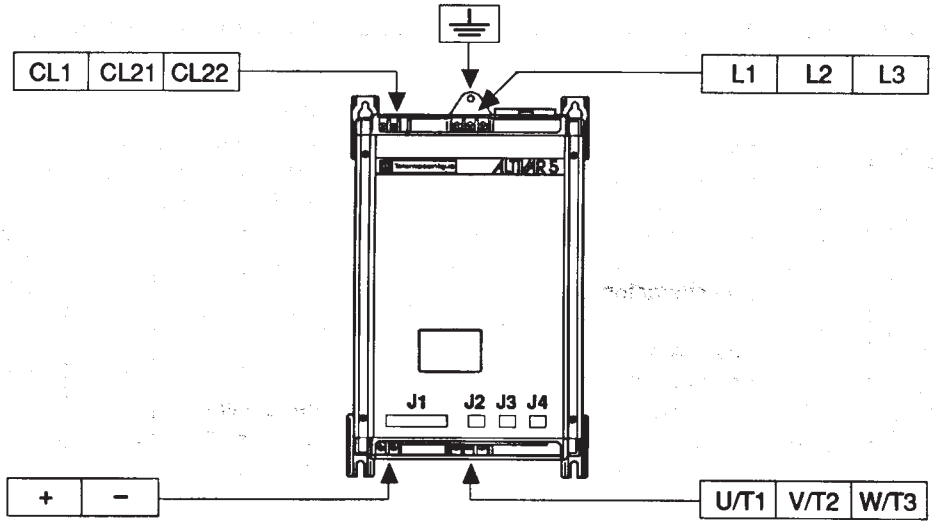
Provide a ventilating fan to circulate the air inside the enclosure and prevent hot spots in the speed controller. See power dissipated by speed controllers (table p. 8).

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Connections

ALTIVAR 1,1 to 22 kW

Terminal strips



	Item	Function		Characteristics	
				ATV-45V...	ATV-45V...N
	L1	Power supply - three phase		380/415V + 10 % – 15 % 50/60 Hz	440/500V + 10 % – 15 % 50/60 Hz
	L2				
	L3				
	CL1	Control supply - single phase		0V	0V
	CL21			380V (mains ≤ 400V)	440V (mains ≤ 480V)
	CL22 *			415V (mains > 400V)	500V (mains > 480V)
	U/T1	Output connections to the motor		380/415V at 50/60 Hz	440/500V at 50/60 Hz
	V/T2				
	W/T3				
	+	Filtered intermediary d.c. voltage		500 to 750V	550 to 800V
	–				
J1	OE1	Speed set-point inputs common		0V	
	E1	Input 1 - Speed set-point voltage		0-10V, Ze = 28 kΩ	
	P10	Output voltage		10V, Is = 10 mA	
	E2	Input 2 - Speed set-point voltage		0-10V, Ze = 28 kΩ	
	EC	Input 3 - Speed set-point current		0-20 mA, 4-20 mA, Ze = 100 Ω	
	FA	Frequency output signal		2,5V at 50 Hz, Is = 1 mA	
	FB				
	PL	Control inputs supply		24V, Is = 60 mA	
	OE2(NL)	Control inputs common		0V (do not connect to OE1, see page 21)	
	FW	Forward control input		24V (minimum 19V, maximum 30V) Ze = 1,5 kΩ	
	RV	Reverse control input			
	DCB	Standstill braking control input			
J2	SA	Fault relay output	- closes when supply is switched on - opens on fault	Voltage free contact 220/240V - 50/60 Hz - 2A	
	SB				
J3	SN+	Speed signal	Speed regulation option (see p. 54)	0-5V, Ze = 10 kΩ	
	OVN	Common			
	SGN	Speed sign			
	PN	Option present			
J4	RX	Reception	Serial link option (see p. 56)		
	TX	Transmission			
	PX	Option present			
	OX	Common			

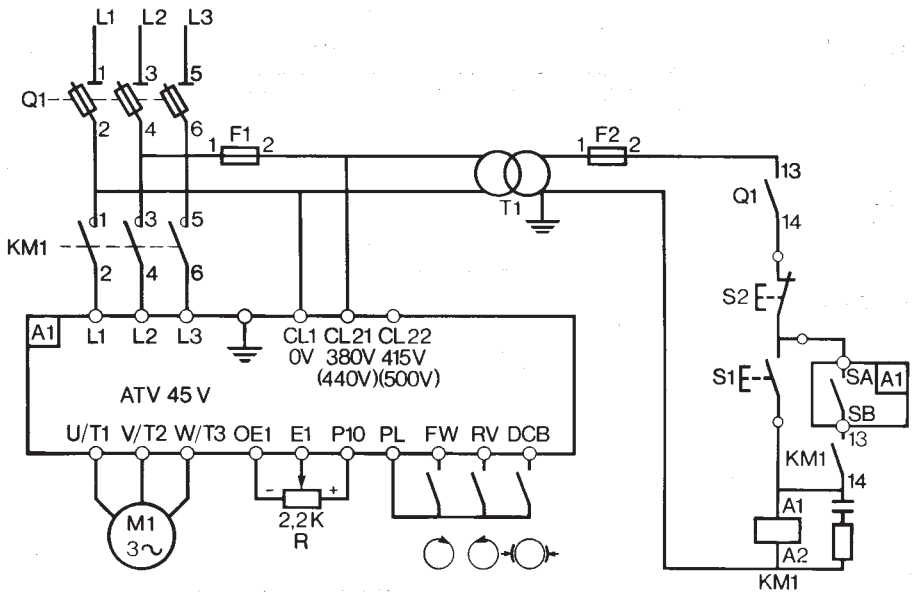
* If necessary : remove the terminal cover.

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Connections

ALTIVAR 1,1 to 22 kW

Recommended circuit diagram
(without automatic restarting)



Equipment required

This list is valid for both possible versions of the circuit diagram (see p. 19).

M1	Motor (kW / HP)	1,1 / 1,5	1,5 / 2	2,2 / 3	3 / 4	4 / 5,5	5,5 / 7,5	11 / 15	15 / 20	22 / 30
A1	ALTIVAR **ATV-45V**	**U11 (N)**	**U15**	**U22N**	**U30**	**U40**	**U55 (N)**	**D11 (N)**	**D15 (N)**	**D22 (N)**
Q1	Isolator	LS1-D2531A65						GK1-EK	DK1-FB	DK1-GB
	+ 3 fuses type g1 DF2-	CN06	CN06	CN08	CN12	CN16	CN20	EN40	FN50	FN80
KM1	Contactor LC1-D	093•A65	093•A65	093•A65	093•A65	123•A65	173•A65	323•A65	403•	633•
	Suppressor	LA9-D09980								
F1 **F2**	Fuse type aM Fuse type g1 * (if control 220V) Fuse carriers	DF2-CA02 DF2-CN02 DF6-AB10								
T1	Transformer	63 VA						100 VA	160 VA	
R	Potentiometer	SZ1-RV1202								
S1-S2	Push-buttons	XB2-B•••								

* Or circuit breaker type GB2-C•••

Cabling

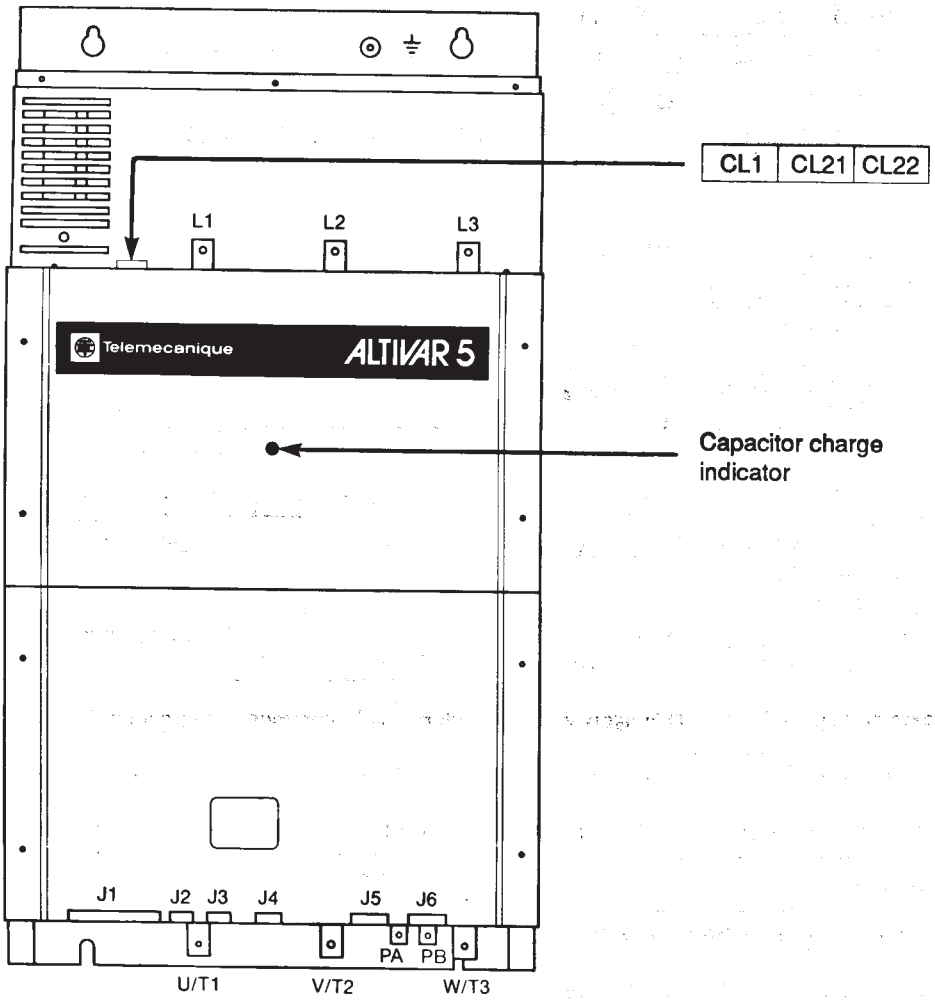
Terminals	For ALTIVAR	Recommended section	
		mm²	AWG
CL1-CL2•-PL-FW-RV-DCB-SA-SB	All ratings	1	18
OE1-E1-P10-E2-EC	All ratings	1 (twisted cable)	18
L1-L2-L3-U/T1-V/T2-W/T3	ATV-45VU11 (N), U15	1,5	16
	ATV-45VU22N, U30	2,5	14
	ATV-45VU40, U55 (N)	2,5	14
	ATV-45VD11 (N), D15 (N)	6	10
	ATV-45VD22 (N)	10	8

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Connections

ALTIVAR 45 to 110 kW

Terminal strips



Reference	Terminal size (in mm)	
	L1-L2-L3-U/T1-V/T2-W/T3	PA-PB
ATV-45VD45 (N) ATV-45VD75 (N) ATV-45VD90 (N) ATV-45VC11 (N)	20 x 3 - M6 screw 25 x 3 - M8 screw 25 x 3 - M10 screw 25 x 3 - M10 screw	15 x 3 - M6 screw

Protection of terminals against direct finger contact :

- the speed controller is delivered with insulating covers which must be fitted to the power terminals after wiring,

- the PA and PB terminals are covered with an insulating material. Should the slow-down braking option be used, remove the insulation so that the external resistance can be connected.

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Connections

ALTIVAR 45 to 110 kW

Terminal strips

	Item	Function		Characteristics	
				ATV-45V...	ATV-45V...N
	L1	Power supply - three phase		380/415V + 10 % - 15 % 50/60 Hz	440/500V + 10 % - 15 % 50/60 Hz
	L2				
	L3				
	CL1	Control supply - single phase		0V	0V
	CL21			380V (mains ≤ 400V)	440V (mains ≤ 480V)
	CL22 *			415V (mains > 400V)	500V (mains > 480V)
	U/T1	Output connections to the motor		380/415V at 50/60 Hz	440/500V at 50/60 Hz
	V/T2				
	W/T3				
	PA	Braking resistance		500 to 750V	550 to 800V
	PB				
J1	OE1	Speed set-point inputs common		0V	
	E1	Input 1 - Speed set-point voltage		0-10V, Ze = 28 kΩ	
	P10	Output voltage		10V, Is = 10 mA	
	E2	Input 2 - Speed set-point voltage		0-10V, Ze = 28 kΩ	
	EC	Input 3 - Speed set-point current		0-20 mA, 4-20 mA, Ze = 100 Ω	
	FA	Frequency output signal		2,5V at 50 Hz, Is = 1 mA	
	FB				
	PL	Control inputs supply		24V, Is = 60 mA	
	OE2(NL)	Control inputs common		0V	
	FW	Forward control input		24V (minimum 19V, maximum 30V) Ze = 1,5 kΩ	
	RV	Reverse control input			
	DCB	Standstill braking control input			
J2	SA	Fault relay output	- closes when supply is switched on - opens on fault	Voltage free contact 220/240V - 50/60 Hz - 2A	
	SB				
J3	SN+	Speed signal	Speed regulation option (see p. 54)	0-5V, Ze = 10 kΩ	
	OVN	Common			
	SGN	Speed sign			
	PN	Option present			
J4	RX	Reception	Serial link option (see p. 56)		
	TX	Transmission			
	PX	Option present			
	OX	Common			
J5	SN+	Speed signal	Speed regulation and braking option (see p. 44/54)	To be connected to J3 when the speed regulation option is being used (see p. 54)	
	SGN	Speed sign			
	PN	Option present			
J6	300V	Tachogenerator		Ze = 530 kΩ	
	145V			Ze = 260 kΩ	
	70V			Ze = 140 kΩ	
	10V			Ze = 20 kΩ	
	0V				
	PZ	Thermocontact braking resistance			
	PY				
	LB	Mechanical brake control relay		Voltage free contact 220/240V - 50/60 Hz - 2A	
	LA				

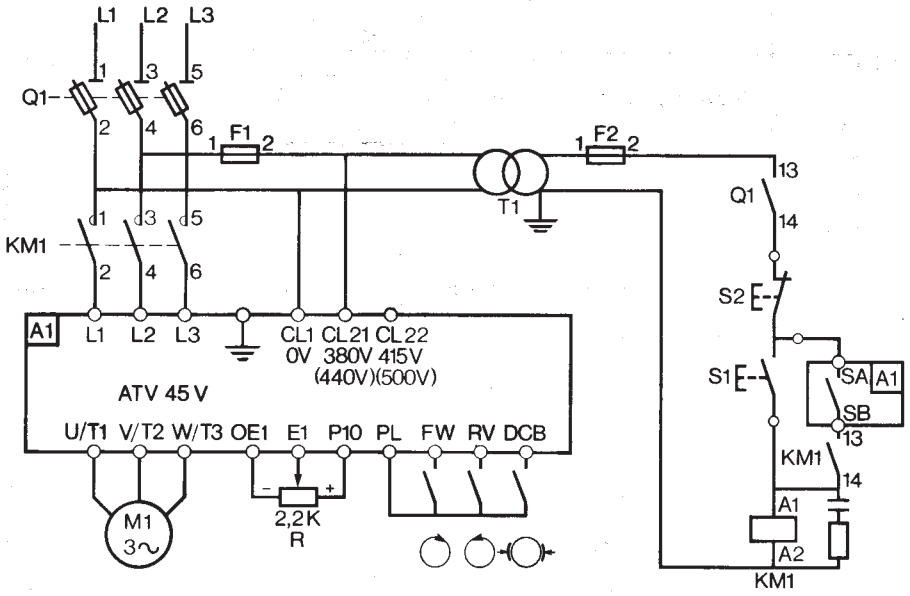
* If necessary : remove the terminal cover.

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Connections

ALTIVAR 45 to 110 kW

Recommended circuit diagram
(without automatic restarting)



Equipment required

This list is valid for both possible versions of the circuit diagram (see p. 19).

M1	Motor (kW / HP)	45 / 60	75 / 100	90 / 125	110 / 150
A1	ALTIVAR **ATV-45V**	**D45 (N)**	**D75 (N)**	**D90 (N)**	**C11 (N)**
Q1	Isolator + 3 fuses type g1	DK1-HC DF2-GN1161	DK1-JC DF2-HN1201	DK1-JC DF2-HN1251	DK1-KC DF2-JN1311
KM1	Contactor + coil Suppressor	LC1-FF43 + LX1-FF••• LA9-F980	LC1-FF43 + LX1-FF••• LA9-F980	LC1-FG43 + LX1-FG••• LA9-F980	LC1-FH43 + LX1-FH••• LA9-F980
F1 **F2**	Fuse type aM Fuse type g1* (if control 220V) Fuse carriers	DF2-CA02 DF2-CN04 DF6-AB10	DF2-CA02 DF2-CN04 DF6-AB10	DF2-CA02 DF2-CN04 DF6-AB10	DF2-CA02 DF2-CN06 DF6-AB10
T1	Transformer	250VA	250VA	400VA	630VA
R	Potentiometer	SZ1-RV1202	SZ1-RV1202	SZ1-RV1202	SZ1-RV1202
S1-S2	Push-buttons	XB2-B•••	XB2-B•••	XB2-B•••	XB2-B•••

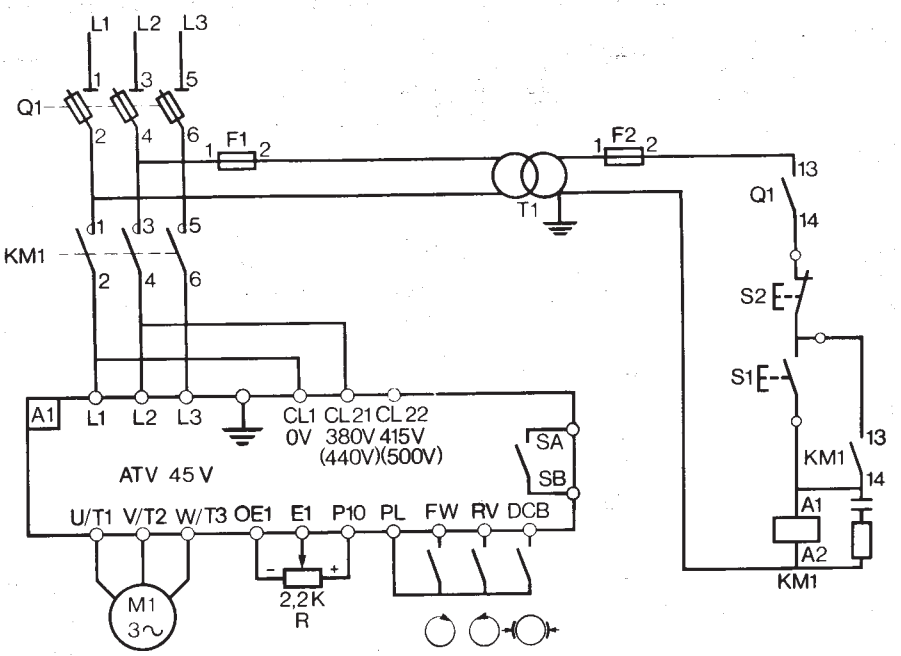
* Or circuit breaker type GB2-C•••

Cabling

Terminals	For ALTIVAR	Recommended section	
		mm²	AWG
CL1-CL2•-PL-FW-RV-DCB-SA-SB	All ratings	1	18
OE1-E1-P10-E2-EC	All ratings	1 (twisted cable)	18
L1-L2-L3-U/T1-V/T2-W/T3	ATV-45VD45 (N)	25	4
	ATV-45VD75 (N)	50	00
	ATV-45VD90 (N)	70	000
	ATV-45VC11 (N)	95	0000
PA-PB	ATV-45VD45 (N), D75 (N)	25	4
	ATV-45VD90 (N), C11 (N)	2 x 25 in //	2 x 4

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Alternative circuit diagram



The power and the control circuits are supplied simultaneously. The drawback of this solution lies in the fact that there is no fault signal memory in the event of line contactor drop out.

This solution is inadvisable if the line contactor is frequently operated.

It is advisable to use the fault relay for signalling, should the speed controller lock (terminals SA-SB).

Other alternative : replace the isolator-fuses-contactor with either a circuit breaker, or a contactor breaker type integral 32/63 (ALTIVAR 1,1 to 22 kW).

Automatic restarting (see p. 27)

Some installations require automatic restarting of the speed controller after locking on fault, followed by the disappearance of the causes for the stop (for example : fans operating at night without supervision). In that case, the supply must be maintained. Avoid using a line contactor which, when short supply failures occurs, needs to be restarted manually, and replace the isolator-fuses-contactor group with a circuit breaker.

Recommendations

WARNING :



- Check the power connections before switching on.
  If, owing to a wiring error, mains voltage is applied to output terminals U/T1, V/T2, and W/T3, the speed controller will be damaged.
- **Do not connect terminals OE1 and OE2 (NL) (see p. 21).**
- Avoid on-load switching between the speed controller output and the motor.
- If utilisation requirements necessitate the mounting of a contactor between the speed controller and the motor, provide a special sequence (see p. 25).

INTERMITTENT DUTY

In order to avoid frequent operation of the line contactor through the use of push-buttons S1-S2, use the control inputs (terminals FW-RV) instead.

HUMIDITY

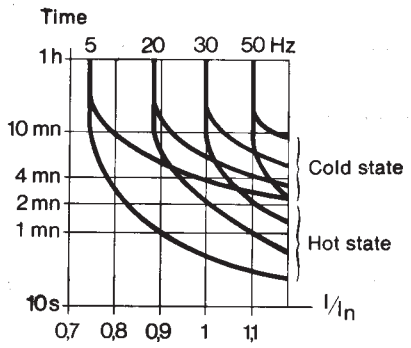
If there is danger of condensation, it is advisable to maintain the control supply of the speed controller switched on during periods when the machine is switched off; alternatively, fit a heating system.

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Connnections

Thermal protection of the motor

Indirect thermal protection of the motor is incorporated in the speed controller, taking into acco



- the current absorbed by the motor,
- the motor speed (ventilation),
- an ambient air temperature of 40°C.

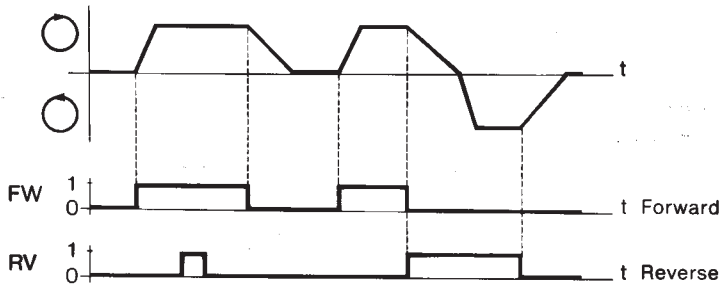
See tripping curves on the left.

For adjustment and monitoring of the thermal state of the motor, see p. 30. Provide direct thermal protection, us PTC thermistor probes embedded in the motor wind associated with an LT2-S protection relay, for operatic severe ambient conditions :

- high ambient temperature (θ ≥ 40°C),
- risk of cooling fins clogging,
- insufficient ventilation.

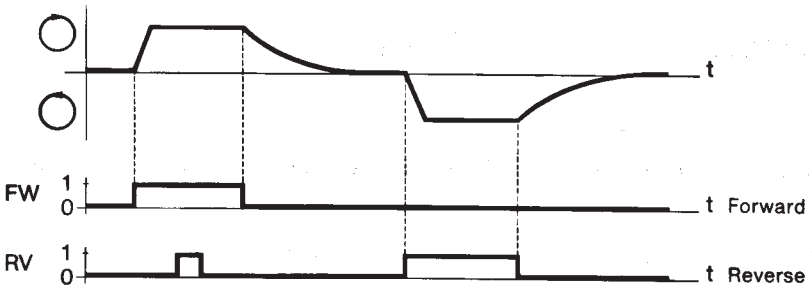
Function of the control inputs

Direction of rotation

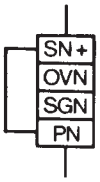


- the direction control selected first takes priority over the other,
- ramp deceleration, and braking to standstill by automatic d.c. injection during 0,5 s if the frequency becomes < 1 Hz,
- to stop on "free wheel", switch off the speed controller power supply.

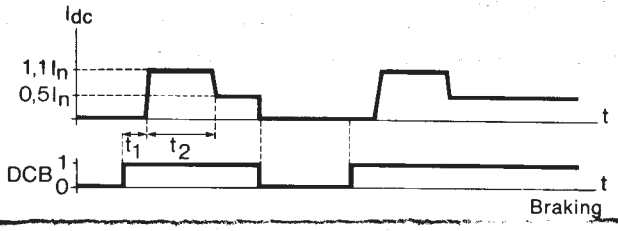
In the setting zone P00 to P10 of the UFR potentiometer (quadratic torque load), joining the SN+ and PN terminals enables "freewheel" stopping by the control inputs.



Terminal strip J3 control board

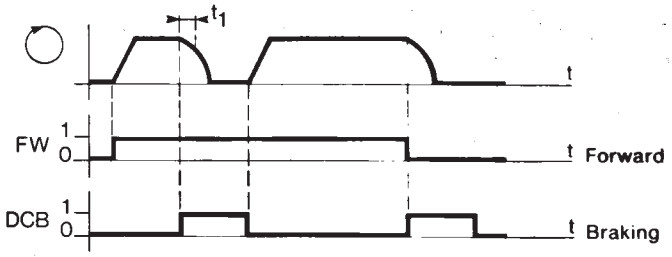


Braking to standstill by d.c. injection



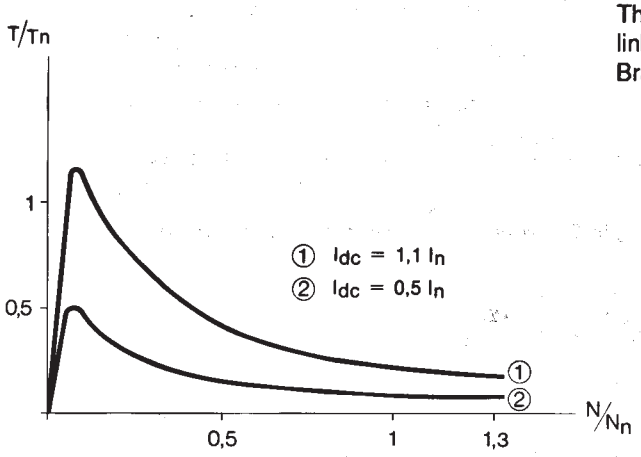
- t_1 dead time - waiting for the motor to demagnetise, t_1 depends on motor speed and power (between 0 and 4 seconds),
- t_2 = 3 seconds.

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The braking control takes priority over the directional control.

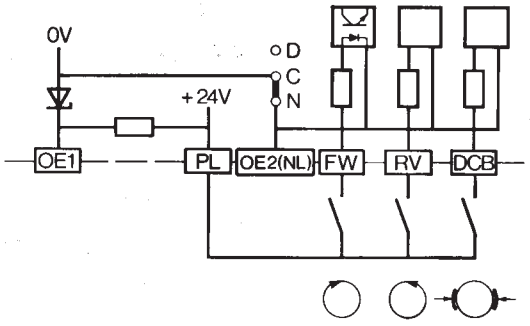
Typical braking curves



The braking torque curves are linked to the motor characteristics. Braking torque is zero at standstill.

Utilisation of the control inputs

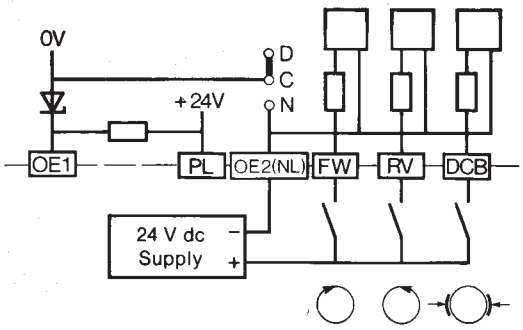
Operating on internal supply



The control inputs :
- are isolated from the mains,
- have a common point with the set-point inputs.

Terminals OE1 and OE2 are at different potentials.
Do not connect together.

Operating on external supply



The control inputs :
- are isolated from the mains,
- are isolated from the set-point inputs.

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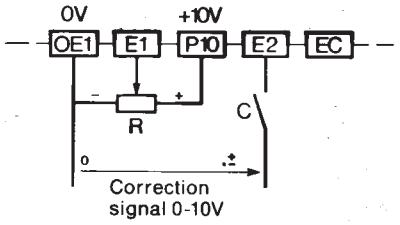
Connections

Function of the speed set-point inputs

- The set-point fixes the speed of the rotating field in the motor.
  The real speed remains dependent on the acceleration and deceleration ramps as well as on the torque capabilities of the motor / speed controller combination.
- The resulting set-point value is the algebraic sum of the different set-points applied simultaneously, within the limits of the frequency range selected.
- The speed range is linked to the low and high speed threshold settings, see p. 30.
- The speed set-point inputs are isolated from the mains.
- The 10V internal supply (terminals OE1-P10) is protected against short-circuits.

Utilisation of the speed set-point inputs

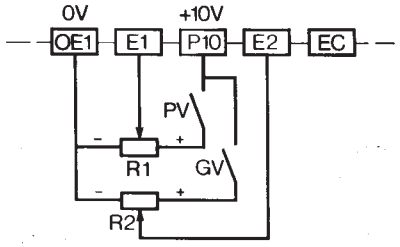
Example 1 : manual set-point with correction signal



$1\ k\Omega \leq R \leq 10\ k\Omega$

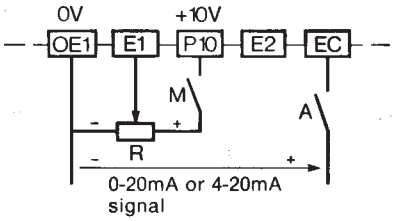
C : correction while operating

Example 2 : selection of two manual set-points



PV : low speed
GV : high speed

Example 3 : automatic set-point, from 0-20 mA or 4-20 mA sensor



A : automatic
M : manual

For selection of 0-20 mA/4-20 mA see settings p. 29.

Adaptation for ± 10V control

The speed controller can be controlled using ± 10V via an interface module (see p. 43).

This module transforms the ± 10V control into a 0-10V speed set-point and a rotation direction (forward or reverse) control.

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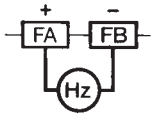
Stator frequency display

Function : remote display of speed. The speed indication is only approximate ; it does not take motor slip into account.

Signal :



Connection : - moving scale magneto-electric voltmeter,
mean voltage : U = 6,6V for 132 Hz,
U = 2,5V for 50 Hz.



- digital frequency meter :

fs = f/6 fs : stator frequency
f : signal frequency

Adaptation of the frequency output signal

The frequency output signal can be transformed into an 0-20 mA or 4-20 mA analogue signal via an interface module (see p. 43).

Wiring precautions

Power

The frequency inverter emits high frequency electromagnetic waves of low intensity. These cause interference signals, which may affect the operation of audio-frequency equipment.

This interference can be reduced by screening the motor cables, using a good earth connection, and by installing suppression filters on the supply side of the controller, see page 57.

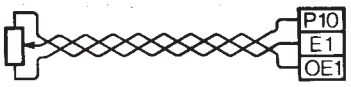


Control

Although the control inputs are protected and filtered, it is recommended to reduce interference to a minimum by separating control circuits from power circuits.

Speed set-point inputs

These circuits must be protected against interference signals.
The use of twisted cable is recommended, with a pitch of 25 to 50 mm.



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Recommendations for use

of the motor/speed controller combination

Available torque

Continuous duty : motor derating is linked to two causes.

- Although the current waveform is very close to a sine wave, motor heating is slightly greater than that obtained by direct supply from the mains. The resulting reduction in torque is of the order of 5%. This is lower than manufacturing tolerance limits.

- For self-ventilating motors, the ventilation needed for the cooling of the motor is linked to the motor speed.
  This results in derating, which occurs at approximately half of the rated speed.

Transient operation periods

Overtorque possibilities are linked to the maximum peak current which the controller can provide, and the extent to which these overloads are repeated.

Overspeed operation (f ≥ 50/60 Hz)

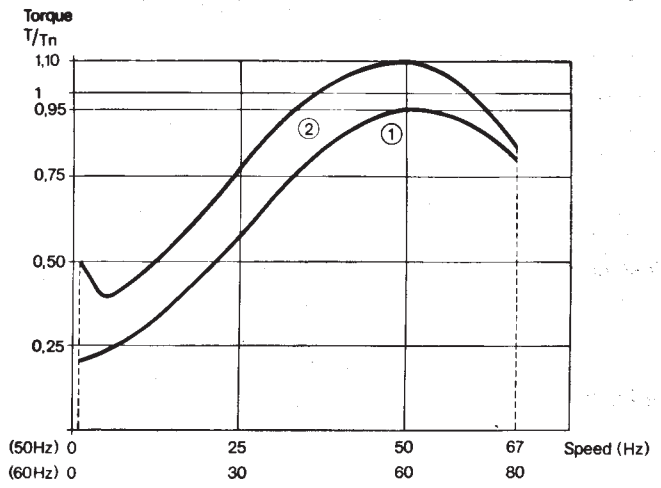
As the voltage can no longer change with frequency, this results in a decrease of the induction in the motor, which causes a loss in torque. The manufacturer will advise whether the motor is capable of operating in overspeed conditions.

Torque-speed curves

Self-ventilating motor ① Permanent useful torque
② Transient overtorque

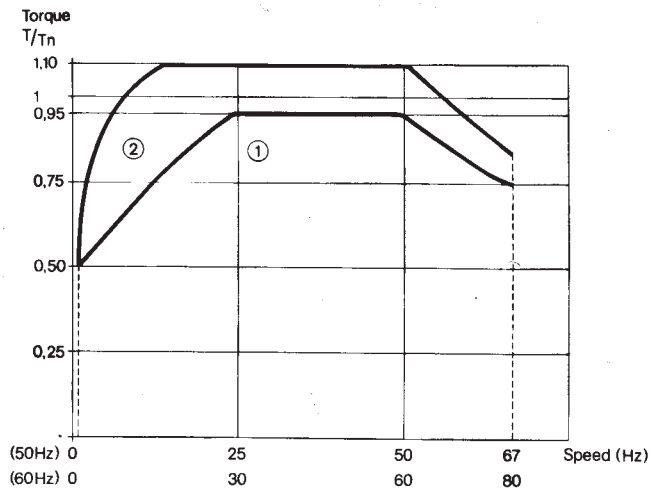
Operation with quadratic torque load
(fans and centrifugal pumps)

UFR potentiometer (voltage/frequency ratio)
in the P00 to P10 setting zone (see p. 31)
(slip compensation override)



Operation with constant torque load
(conveyors,...)

UFR potentiometer (voltage/frequency ratio)
in the n00 to n10 setting zone (see p. 31)



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Recommendations for use

of the motor/speed controller combination

Association with different motors

ALTIVAR speed controllers are designed to drive motors with a corresponding power rating. They can, however, be used with motors having different power ratings providing that certain precautions are observed.

Motor power ≤ rated power of the controller

This combination is possible. As compensation is not at the optimum level, this can lead to a reduction in continuous torque at low speed. Adjust the U/f ratio if necessary (see p. 31).

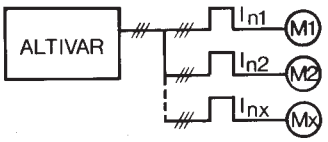
If motor power is < 0,5 controller rated power, correct adjustment of motor thermal protection is impossible (see p. 30).
Cancel the internal protection and use standard external protection (overload relay or thermistors).

Motor power > rated power of the controller

Magnetising current peaks limit this combination to the motor power immediately above the controller rating.

Again, compensation is not at the optimum level, and the U/f ratio should be adjusted if necessary (see p. 31). The motor current must remain lower than, or equal to the rated current of the speed controller.

Motors in parallel

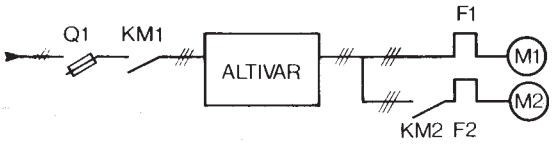


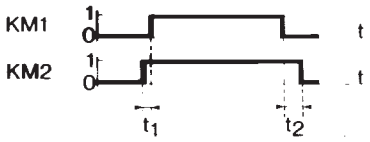
Speed controller selection :
controller In ≥ In1 + In2 + ... Inx.

Each motor should be protected by a thermal overload relay.

Compensation is not at the optimum level. Adjust the U/f ratio if necessary (see p. 31).
If the motors have different power ratings, the ratio adjustment can only be a compromise. If the load is to be shared between the motors, override the slip compensation (see p. 42).

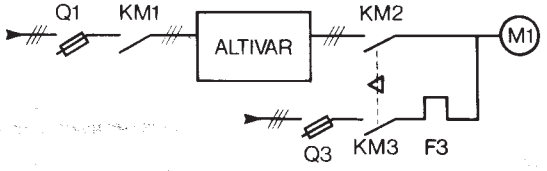
Additional motor connected downstream of the speed controller

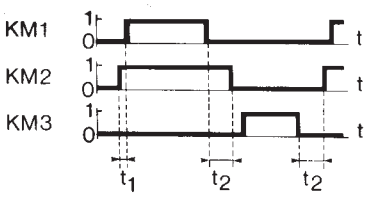




- Comply with the sequence shown : t_1 = 20 ms,
  t_2 = 1,5 s (demagnetisation of the motor).
- If the power of the motor to be connected is low in comparison with the rating of the speed controller, and it produces an acceptable overload (maximum current ≤ controller transient current), connection on the run is possible.

Direct coupling of the motor to the mains : "BY-PASS"





- Comply with the sequence shown : t_1 = 20 ms,
  t_2 = 1,5 s (demagnetisation of the motor).

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Recommendations for use

of the motor/speed controller combination

Use of a brake motor

- Electric brake

Make sure that the brake winding is brought out to terminals, without a common point with the stator.
The brake should be supplied separately at its rated voltage and switched on simultaneously with the motor.

- Tapered rotor motor

The brake is released by the magnetic field of the motor.
Experience shows that this kind of motor can be used with a frequency inverter.
The brake is released at a frequency ≥ 5 Hz.

Motor installation

Mount and couple the motor carefully, so as to eliminate any possible problems with vibrations and resonance.

Adaptation to the driven machine

The motor/speed controller combination must be adequately rated to :

- overcome the load torque of the driven machine over the whole speed range used,
- supply the transient overtorque needed for the required accelerations, see curves p.24.

If braking is required for rapid deceleration, refer to the following possibilities :

- d.c. injection braking (see p. 20/21),
- slow-down braking (see p. 44).

Precautions to be taken according to the type of machine load :

- quadratic torque load (fans and centrifugal pumps) : adjust the U/f ratio (see p. 31) ;
  the torque increases rapidly with the speed, and it may be necessary to limit the maximum speed so that the capabilities of the motor / speed controller combination are not exceeded,

- constant torque load (conveyors) : adjust the U/f ratio (see p. 31) ;
  ensure that the starting torque is compatible with the available overtorque,

- driving load / high inertia :
  examine the braking possibilities (see p.44).

Adaptation to the mains supply

If a suitable mains supply is not available, the controller can be supplied via a three phase transformer or autotransformer rated as follows :

ATV-45VU11 (N)	3 kVA	ATV-45VD15 (N)	28 kVA
ATV-45VU15	4 kVA	ATV-45VD22 (N)	45 kVA
ATV-45VU22N	5,5 kVA	ATV-45VD45 (N)	90 kVA
ATV-45VU30	7,5 kVA	ATV-45VD75 (N)	135 kVA
ATV-45VU40	10 kVA	ATV-45VD90 (N)	165 kVA
ATV-45VU55 (N)	12,5 kVA	ATV-45VC11 (N)	200 kVA
ATV-45VD11 (N)	22 kVA		

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Recommendations for use

of the motor/speed controller combination

Automatic restarting

Some installations require automatic restarting of the speed controller after locking on fault followed by the disappearance of the causes for the stop.

EXAMPLE : fans operating at night without supervision.

In that case, the supply must be maintained.

Follow the instructions below for application of the circuit diagram :

- operation with line contactor (recommended circuit diagram page 15 or 18) : in order to avoid mains disconnection by line contactor drop out where the controller has locked on fault, avoid connecting the safety relay contact (terminals SA-SB) in series with the maining contact of the line contactor,

- operation without line contactor : as contactor drop out can be caused by a drop in voltage or a short mains supply failure, replace the isolator-fuses-contactor combination with a circuit breaker.



WARNING

These instructions only apply to machines or installations where automatic restarting is not dangerous, either for personnel, or the equipment (see appropriate safety regulations).

Special characteristic of the ALTIVAR series 45V

In the setting zone [P00] to [P10] of the UFR potentiometer (see p.31), for operation with quadratic torque load, the controller presents the following characteristic :

- in the event of filter capacitor overload, the speed controller locks for 1 minute, the code [ObF] being displayed ; then, once the fault has disappeared, automatic restarting occurs given that the other operating conditions permit this,

- if the overvoltage persists, the sequence "lock for 1 minute + order to restart" is repeated 4 times (giving a maximum of 5 sequences) before the controller locks definitively.

This characteristic is cancelled in the setting zone [n00] to [n10].

In the event of a [OhF], [OLF] or [OcF] fault, automatic restarting is impossible (see p. 35).

Restarting while running

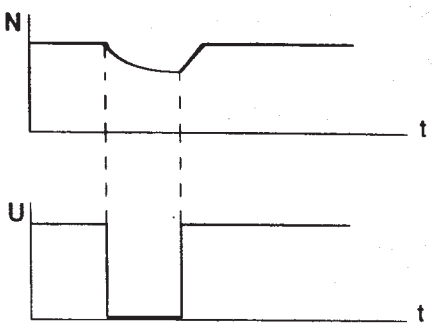
In the setting zone [P00] to [P10] of the UFR potentiometer (see p. 31), the speed controller has the following characteristic :

- in the event of short mains supply failure, the motor decelerates in "free wheel",

- when mains supply returns, speed pick up occurs smoothly.

This is also the case in the setting zone [n00] to [n10] (operation with constant torque load), if the controller is used in speed regulation with a tachogenerator :

- non-reversing (see p. 42),
- reversing with option (see p. 54).



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Initial setting up

The ALTIVAR ATV- 45V is factory preset for use with quadratic torque load.

The preset values are marked below with an asterisk *.
The specific ATV-45V•••N values are marked with two asterisks **.
Check that they are compatible with your requirements.

If so, after checking the connections (see circuit diagrams pages 15, 18 and 19), the speed controller can be switched on.

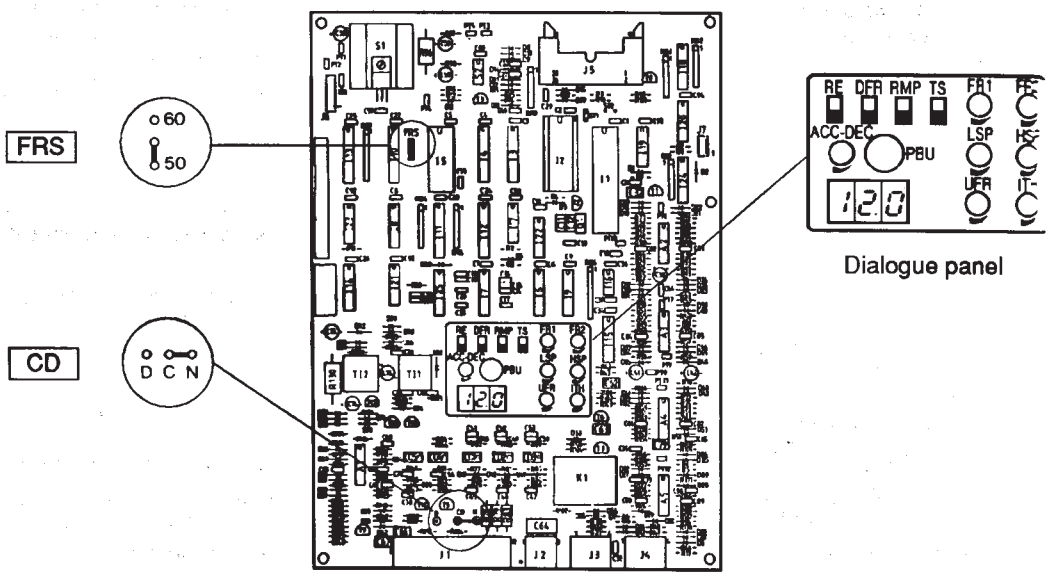
If not, readjust the settings.

The setting controls are grouped on the front of the control board, and are accessible after removing the protective cover.

The cover is fixed at 4 points { 1/4 turn fastening → ALTIVAR 1,1 to 22 kW
by captive screws → ALTIVAR 45 to 110 kW

WARNING { switch off the speed controller before removing the cover,
do not touch the components.

Layout of the setting controls



Dialogue panel

Modification of the settings

Links

Select with power and control circuits switched off.

CD - selection of the control inputs supply (see p. 21)

* D C N selection of internal supply

D C N selection of 24V DC external supply

FRS - selection of the output frequency at rated voltage

* 60 / 50 rated output frequency 50 Hz

** 60 / 50 rated output frequency 60 Hz

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Selector switches

The data selected is only registered at control circuit switch on. The selector switches are inoperative when the controller is switched on, except for RE, which remains functional.

RE - selection of the speed set-point input on terminal EC (see p. 22)

* 4-20 mA / RE / 0-20 mA — reference 0-20 mA

4-20 mA / RE / 0-20 mA — reference 4-20 mA

DFR - selection of extent of resonance frequency suppression (see p. 31)

5 Hz / DFR / 2 Hz — extent 2 Hz

5 Hz / DFR / 2 Hz — extent 5 Hz

RMP - selection of ramp time adjustment range (see p. 30)

* 5-600s / RMP / 1-120s — range 1-120 s

5-600s / RMP / 1-120s — range 5-600 s

TS - selection of the test sequence (see p. 36)

* ON / TS / OFF — normal operation

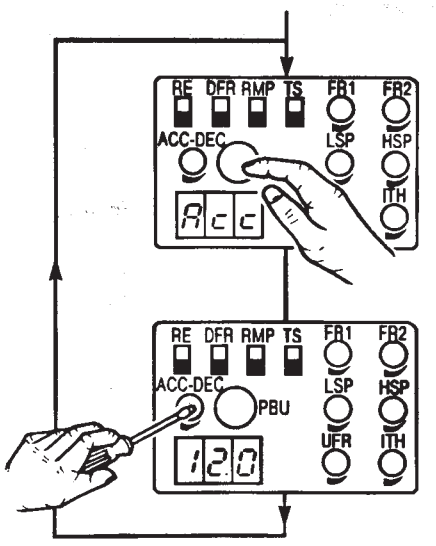
ON / TS / OFF — self-diagnostic

WARNING : do not switch TS to the ON position while the controller is operating (see p. 34).

Potentiometers

The potentiometers are permanently operative ; the set values are displayed on the dialogue panel.

Use of the dialogue panel



Search for the code corresponding to the parameter to be set (PBU push-button).

Set to the required value, which is shown on the display.

The sequence and signification of the codes are given on page 33.

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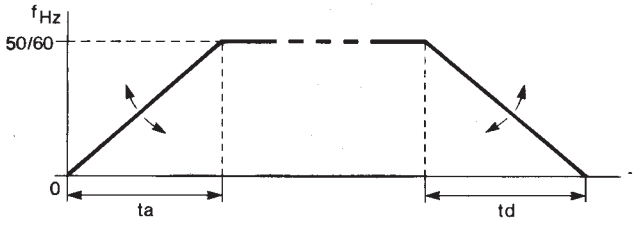
FUNCTION OF THE POTENTIOMETERS

Acceleration - Deceleration

ACC - DEC

ta = td

* preset value 10 s



Setting range : 1-120 s or 5-600 s according to the position of the RMP switch.

The acceleration ramp adapts itself automatically, depending on the overtorque possibilities.

In the setting zone [P00] to [P10] of the UFR potentiometer (see p. 31), for operation with quadra: torque load, the deceleration ramp adjusts itself automatically, depending on the braking possibilitie:

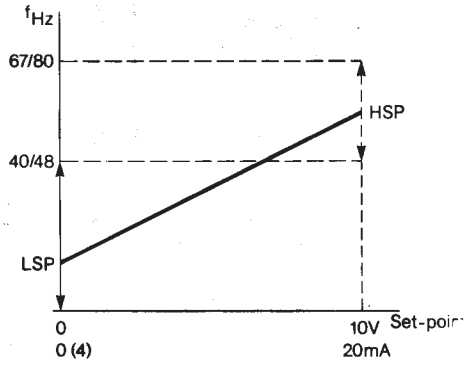
This characteristic is cancelled in the setting zone [n00] to [n10].

Low speed - High speed

LSP HSP

When the low speed is at minimum, the controller remains locked for set-point values lower than 1 Hz.

preset values LSP * at minimum
HSP * 50 Hz
** 60 Hz



Thermal protection of the motor

ITH

Setting the thermal motor protection (see p. 20).
Setting range : 0,45 to 1,05 of the speed controller's rated current.

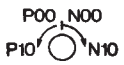
* preset to 0,9 of the speed controller's rated current (see p. 8).
Set to the rated motor current.

When the potentiometer is at maximum, against the stop in the clockwise direction, the protection is cancelled. Corresponding code : [nth].

If the motor power is too low, cancel the internal protection and use standard external protection (overload relay or thermistors).

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Voltage/frequency ratio

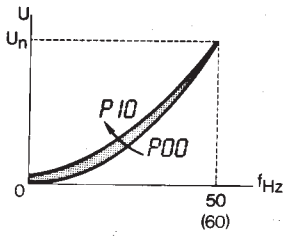
UFR 

* P00 : factory preset for operation with quadratic torque load.

- Operation with quadratic torque load : fans and centrifugal pumps.

In order to improve motor efficiency, set the potentiometer between P00 and P10 so as to obtain correct and silent operation with minimum current.

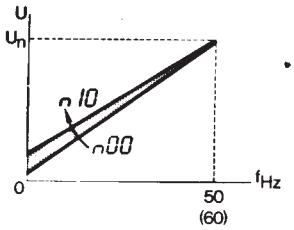
In this setting zone, automatic slip compensation is overridden.



- Operation with constant torque load : applications with overtorque at low speed.

Adjust the potentiometer to n00 .

If the torque is inadequate, increase progressively from n00 to n10 until the correct operation is obtained.

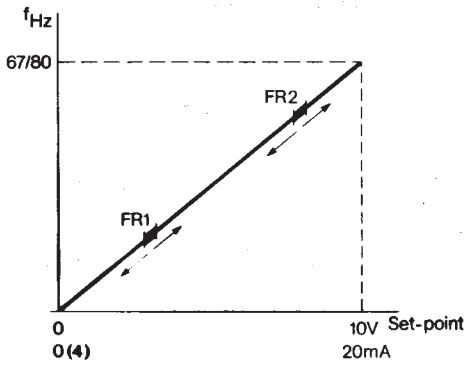


Critical operating frequencies

FR1  FR2 

The FR1 and FR2 potentiometers enable the positioning on the operating range of one or two 2 or 5 Hz frequency suppressor bands (according to the position of the DFR switch).

Aim : suppression of the critical operating frequencies which cause the resonance phenomena at machine or installation level.



Adjustment:
- act on the speed set-point to determine the critical frequency, or frequencies (noise and mechanical resonance),
- adjust one of, or both the potentiometers FR1 and FR2 to the 1 or 2 determined values,
- if the resonance phenomena continues to persist, extend the frequency range from 2 to 5 Hz, using the DFR selector switch.

FR1
FR2 } factory preset to maximum, against the stop in the clockwise direction, at * 67 Hz or ** 80 Hz

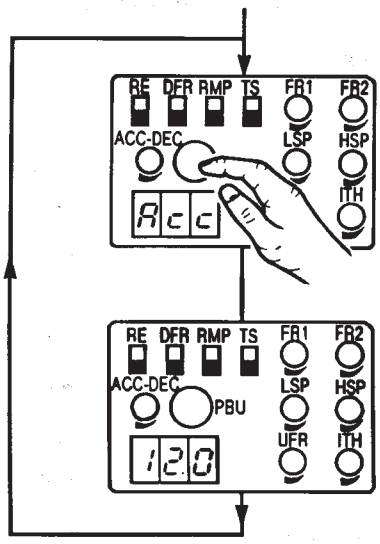
EXAMPLE : motor 1500 rpm at 50 Hz
critical frequency given at 30 Hz
DFR selector switch to 2 Hz } FR1 adjusted at 30 Hz

For a frequency reference of 30 Hz, rotation frequency will be { 29 Hz on acceleration
31 Hz on deceleration

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Using the dialogue panel

The setting and operating parameters can be displayed on the dialogue panel.



Search for the code corresponding to the parameter to be displayed (PBU push-button).

Read the value of the parameter selected.

The sequence and signification of the codes are given on page 33.

Note :

- If the control remains switched on, each time the device starts up the display will go back to the selected parameter.
- Once the frequency reference has been selected, a flashing display indicates overload. The speed reference is no longer followed.
  If this data appears in transitional mode, increase the corresponding ramp time.
- Other messages may appear during operation.

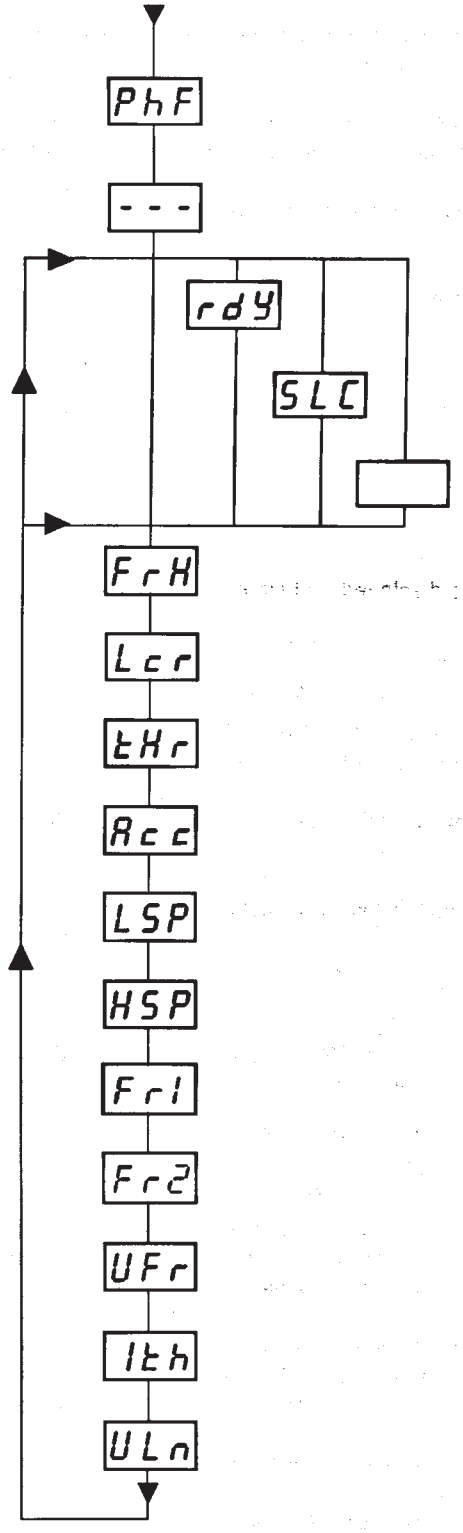
  obr Over braking.
  Capacitor overvoltage caused by excessive braking.
  Increase the deceleration time.

  dcb D.C. injection braking.
  This code indicates acceptance of the brake signal.

- The supply voltage value ULn can only be used when the speed controller is locked.

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Operational and setting parameter codes



Phase failure (see p. 35)

Capacitor charge

Ready

Serial link connection

Possible fault code (see p. 35)

Stop

Frequency reference (Hz)

Motor current (A)

Thermal state (% of nominal θ)

Acceleration / Deceleration time (s)

Low speed (Hz)

High speed (Hz)

Frequency jump (Hz)

Voltage / frequency ratio

Thermal current rating (A)

Line voltage (V)

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Maintenance



Before carrying out any operation inside the controller, switch off the supply circuits and make sure that the capacitors are fully discharged (about 5 minutes after switch off).
For ALTIVAR 45 to 110 kW, wait until the LED on the front of the controller goes off.
CAUTION : the d.c. voltage across the + and – (or PA and PB) terminals can reach 800V on load.

- The ALTIVAR ATV-45V does not require preventive maintenance, nevertheless the following operations are recommended at regular intervals :

  • check the condition and tightness of the connections,
  • make sure that the ventilation is effective and that the temperature around the controller remains at an acceptable level,
  • remove the dust from the controller, if necessary.

- Should anything unusual occur when putting the controller into service, or during operation, make sure that all the recommendations relating to the environment and to mounting and connecting the controller have been complied with.

Maintenance assistance facilities

The ALTIVAR is able to detect a certain number of faults and display them in the form of codes.

Fault codes : see table page 35.

Fault storage

The first fault detected is displayed and stored if the control circuit voltage stays on. The fault relay drops out.

Fault storage erasure

The fault code may be steady or flashing.
In either case, switch off the power supply to the controller.

If the fault code is steady, switch the power supply back on ; this has the effect of erasing the fault storage and resetting the controller.

If the fault code is flashing, this indicates that the fault is still present. Find the cause and wait for the code to be steady before switching the power supply back on to reset the controller.

Special case : code [OcF]

With this type of fault, it is essential to switch off the power and control supplies of the controller and check the connecting cables and the motor insulation. Carry out the self-diagnostic programme before resetting (see p. 36).

Special codes

[InF] This code may appear when the controller is switched on. If so, switch off the supply circuits and wait for the capacitors to discharge. Remove the protective cover and check the control board's J5 connector, and the power board's J6 connector for the ALTIVAR 1,1 to 22 kW.

This code may also appear if the selector switch TS is moved to the ON position, while the speed controller is operating. In that case, switch off the supply circuits, return the selector switch TS to the OFF position, and switch the control supply back on to reset the controller.

[CrF] This fault code applies specifically to the ALTIVAR 45 to 110 kW. Switch off the supply circuits and wait for the capacitors to discharge. Remove the protective covers and check the current load limiting contactor's connections.

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Fault codes

Codes	Signification	Probable cause	Trouble-shooting procedure
[ ]	No display or partial display	- no control supply	→ check : the control voltage the supply fuses the internal fuse the connectors (see p. 38/40)
		- control voltage too low	
PhF	Phase failure	- no supply to controller L1-L2-L3	→ check : the power voltage the supply fuses
		- power fuses blown	→ check the rectifiers (see p. 37/39)
		- short power cut (t ≥ 200 ms)	→ reset
		- internal connections	→ check the connectors (see p. 38/40)
USF	Under voltage	- supply too low U ≤ 320V or 380V (N)	→ check the power voltage
		- temporary voltage drop (t ≥ 200 ms)	→ reset
		- internal connections	→ check the connectors (see p. 38/40)
OSF	Over voltage	- supply too high U ≥ 460V or 550V (N)	→ check the power voltage
		- capacitor overvoltage following excessive braking	→ reset if [ULn] ≤ 460V or 550V (N)
		- ATV-45V•••N on 500V - 50Hz supply	→ check the FRS link position
OhF	Over temperature	- radiator temperature too high ≥ 75°C	→ check the motor load, the fan and the climatic environment around the controller ; wait for it to cool down before resetting
		- power board's J8 connector disconnected (ALTIVAR 1,1 to 22 kW)	→ check the connector (see p. 38)
		- measuring board link displaced (ALTIVAR 45 to 110 kW)	→ check its position (see p. 52)
		- overheating of the braking resistance (if braking option fitted and thermocontact)	→ check the braking conditions and change the resistance if necessary
OLF	Motor overload	- thermal trip owing to prolonged overload or loss of phase if [tHr] ≥ 118 %	→ check the [ItH] setting and compare with motor In - check the load and compare with the operating speed - check the motor connections - wait for approximately 7 mn before resetting
		- phase U failure (1,1 to 22 kW) or phase V (45 to 110 kW) if [tHr] < 118 %	→ check the motor connections
		- motor power too low	→ cancel the internal protection
ObF	Excessive braking	- capacitor overvoltage owing to excessive braking or a driving load (even with braking option)	→ increase the deceleration time - add the braking option if necessary - reset if [ULn] ≤ 460V or 550V (N)
OcF	Over current	- short-circuit or earthing on the controller output	→ switch off power and control - check the connecting cables and motor insulation, with the controller disconnected
		- internal controller fault	→ use the self-diagnostic
		- excessive transient operation	→ reset

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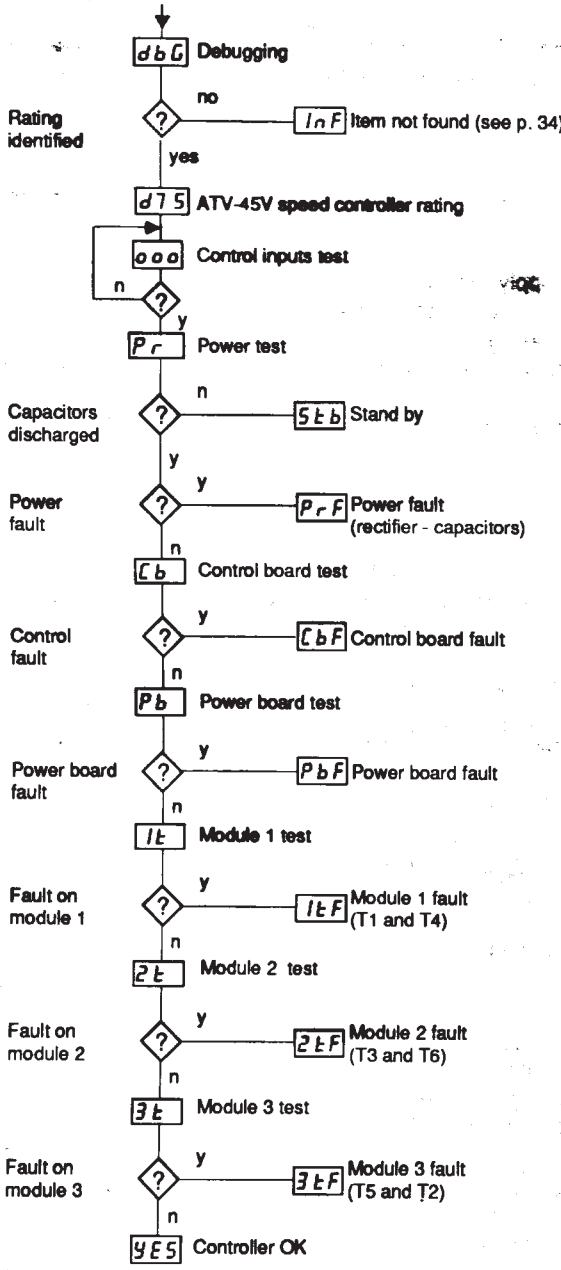
Self-diagnostic

The speed controller has a self-diagnostic system incorporated. It enables the main functions to be checked.

Procedure

- Switch off power and control circuits.
- Wait for about 5 minutes for the capacitors to discharge.
- Disconnect the motor.
- Select the test sequence : selector switch TS to ON (see p. 29).
- Switch the controller back on.

Codes



	FW	RV	DCB
0V	0	0	0
24V	1	1	1

Validate the inputs to test them (time available = 6s)

CAUTION :

Do not switch the power supply back on during the test sequence.

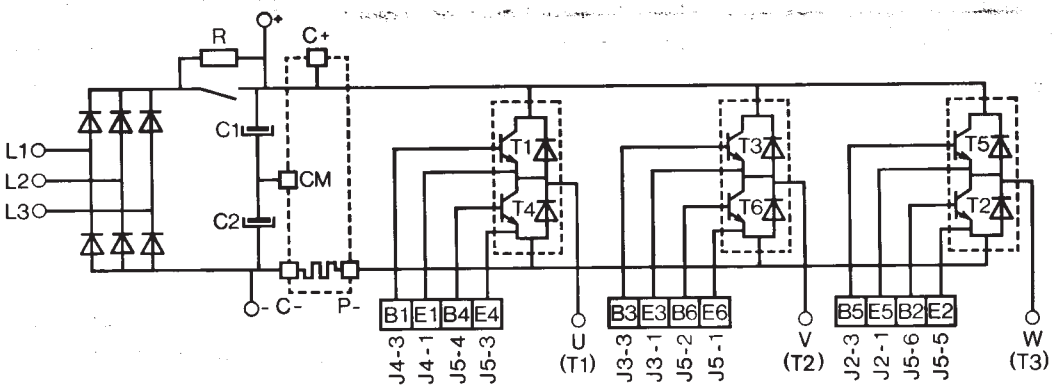
- Switch off the control to reset the test sequence to zero.
- After rectifying the fault, run a second test to check the controller condition.
- It is essential to put TS back to the OFF position before switching the power supply back on.

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ALTIVAR 1,1 to 22 kW

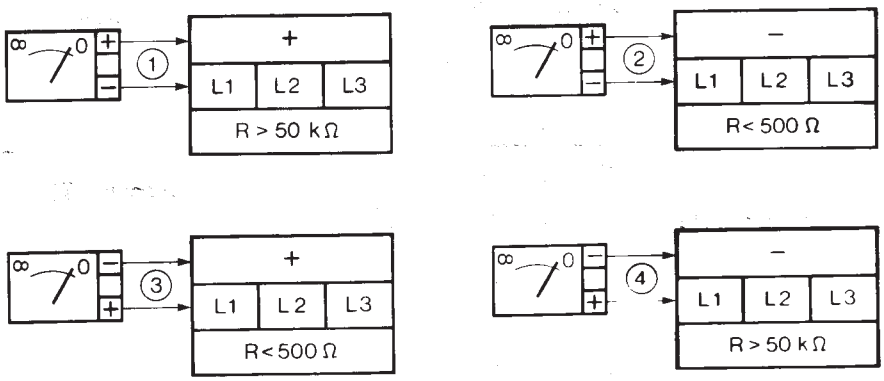
Checking the power components

Circuit diagram



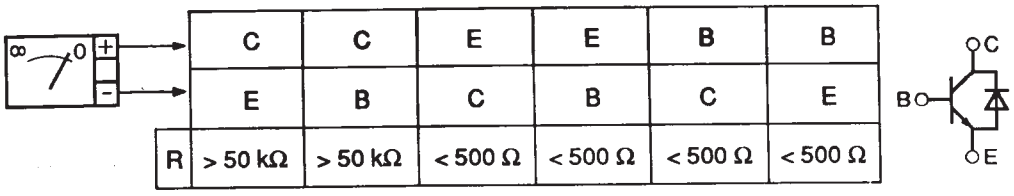
Checking the rectifier

Test instrument : digital or moving scale ohmmeter.
Under no circumstances must a magneto type ohmmeter (megger) be used.



If the results are abnormal, disconnect the rectifier and test directly on the terminals.
Tests ① and ③ are carried out using a load resistor.
If R ≥ 500 Ω in test ③, check the state of this resistance.

Example of a power transistor check



	C	C	E	E	B	B
	E	B	C	B	C	E
R	> 50 kΩ	> 50 kΩ	< 500 Ω	< 500 Ω	< 500 Ω	< 500 Ω

These tests enable a fault to be detected, but cannot give the assurance that the component is correct.

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ALTIVAR 1,1 to 22 kW

Connectors

Control board

Connector	Conductors		Function	Interconnection
	number	colour		
J1	12	-	user terminals (see p. 14)	control sequence
J2	2	-		
J3	4	-		speed regulation option
J4	4	-		serial link option
J5	26	blue	control signals	power board
J6	4	red black green blue	control board supply	

Power board

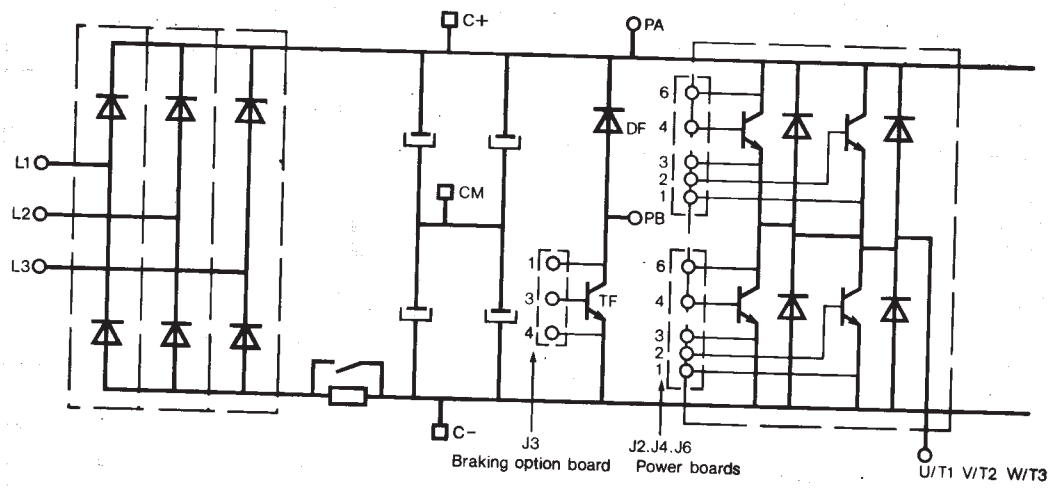
J1	1	red	common C +	measuring board
J2	2	red black	E5 B5 } transistor control T5	transistor modules
J3	2	red white	E3 B3 } transistor control T3	
J4	2	red blue	E1 B1 } transistor control T1	
J5	6	red yellow red purple red green	E6 B6 } transistor control T6 E4 B4 } transistor control T4 E2 B2 } transistor control T2	
J6	8	red	control signals	measuring board
J7	2	blue	upper channel supply T1	transformer
J13	2	red	upper channel supply T3	
J14	2	yellow	upper channel supply T5	
J15	2	grey	input circuit supply	
J16	3	green black green	lower channels and control supply	
J8	10	-	control signals	braking option
J10	4	black black red red	} heating } monitoring } fully } charged	vigitherm charge relay

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ALTIVAR 45 to 110 kW

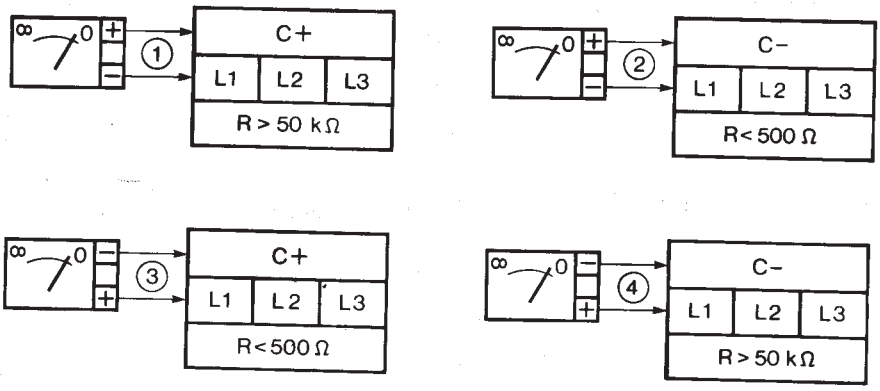
Checking the power components

Circuit diagram



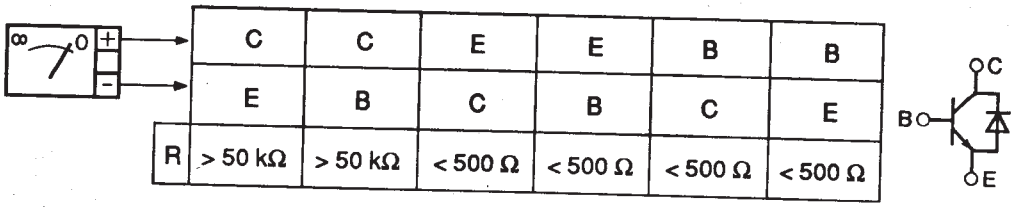
Checking the rectifiers

Test instrument : digital or moving scale ohmmeter.
Under no circumstances must a magneto type ohmmeter (megger) be used.



If the results are abnormal, disconnect the rectifiers and test directly on the terminals.
Tests ① and ③ are carried out using a load resistor.
If R ≥ 500 Ω in test ③, check the state of this resistance.

Example of a power transistor check



	C	C	E	E	B	B
	E	B	C	B	C	E
R	> 50 kΩ	> 50 kΩ	< 500 Ω	< 500 Ω	< 500 Ω	< 500 Ω

These tests enable a fault to be detected, but cannot give the assurance that the component is correct.

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ALTIVAR 45 to 110 kW

Connectors

Control board

Connector	Conductors number	Function	Interconnection
J1	12	user terminals (see p. 17)	control sequence
J2	2		
J3	3		speed regulation option
J4	4		serial link option
J5	26	control signals	measuring board
J6	4	control board supply	

Measuring board

J1	3	supply	transformer
J2	2	power voltage measuring	power sub-assemblies
J3	9	measuring signals	
J4	3	supply	transformer
J5	3	load contactor control	contactor coil
J6	3	supply	transformer
J7	10	command signals	low channel power board
J8	26	control signals	control board
J9	10	command signals	high channel power board
J10	4	control board supply	control board
J13	7	command signals	braking option board
J14	2	measuring signals	power sub-assembly

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ALTIVAR 45 to 110 kW

Power boards

Connector	Conductors number	Function	Destination
J1	2	supply	transformer
J2	3 or 5	transistor control	power transistor modules
J3	2	supply	transformer
J4	3 or 5	transistor control	power transistor modules
J5	2	supply	transformer
J6	3 or 5	transistor control	power transistor modules
J7	10	command signals	measuring board

Braking and speed regulation option board

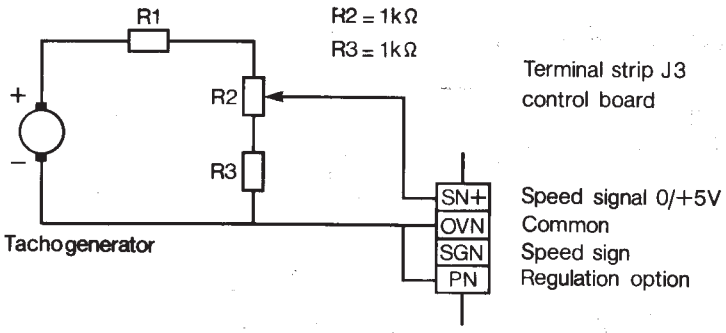
J1	3	supply	transformer
J2	-	-	-
J3	3	braking transistor control	braking transistor module
J4	7	command signals	measuring board
J5	3	speed feedback signals	control board
J6	6	user terminals (see p. 17)	
J7	2	option board resistance	power sub-assemblies
J8	2	measuring signals	

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Unidirectional speed regulation

Measuring the real motor speed with a tachogenerator allows the speed to be regulated. This being the case, automatic slip compensation depending on load incorporated in the ALTIVAR ATV-45V ≤ cancelled and replaced by the speed regulation loop.

When the motor is used in one direction only, the tachogenerator can be connected to the speed controller via a simple adaptation circuit.



Utilisation safety measures

- Comply with the polarities shown for the tachogenerator connections.
- The SN+ terminal voltage must be ≤ + 5V.
- Link PN to 0VN.
- Use the controller in the forward direction only (terminal FW).
- Connect the tachogenerator using twisted cables.

CAUTION : neither this adaptation circuit, nor that of the tachogenerator are isolated from the supply.

Accuracy : ± 0,1 % of the maximum speed for : - a torque variation from 0,2 Tn to Tn,
- a speed range from 1 to 50.

Calculation of R1 : calculate the maximum voltage provided by the tachogenerator.

EXAMPLE : motor 1500 rpm at 50 Hz
tachogenerator 0,06 V/rpm
frequency range 67 Hz

$$U = 0{,}06 \times 1500 \times \frac{67}{50} = 120{,}6\ V$$

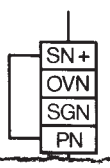
R2 slide in median position : $R1 = 1{,}5 \times \frac{120{,}6}{5} - 2 = 34\ k\Omega$. Use 33 kΩ.

Adjustments

Connect a voltmeter to the tachogenerator terminals.
Adjust the R2 potentiometer to its minimum setting, in fully anti-clockwise position.
Start the motor and set maximun speed using the reference potentiometer.
Turn R2 clockwise until the corresponding voltage is obtained.

Slip compensation override

Where the speed regulation facilities are not used, a link connecting terminals SN+ and PN will effectively override the automatic slip compensation incorporated into the ALTIVAR ATV-45V, but only in the setting zone [n00] to [n10] of the UFR potentiometer.
In fact the slip compensation is suppressed in the setting zone [P00] to [P10] (quadratic torque load), and in this zone, connection of the terminals causes "free wheeel' stopping (see p. 20).



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Adaptation for ± 10V control

The interface module, reference VW3-A45108, changes the ± 10V into a 0 - 10V speed set-point and a rotation direction (forward or reverse) control.

Dimensions : - height 96 mm,
- width 48 mm,
- depth 42 mm.

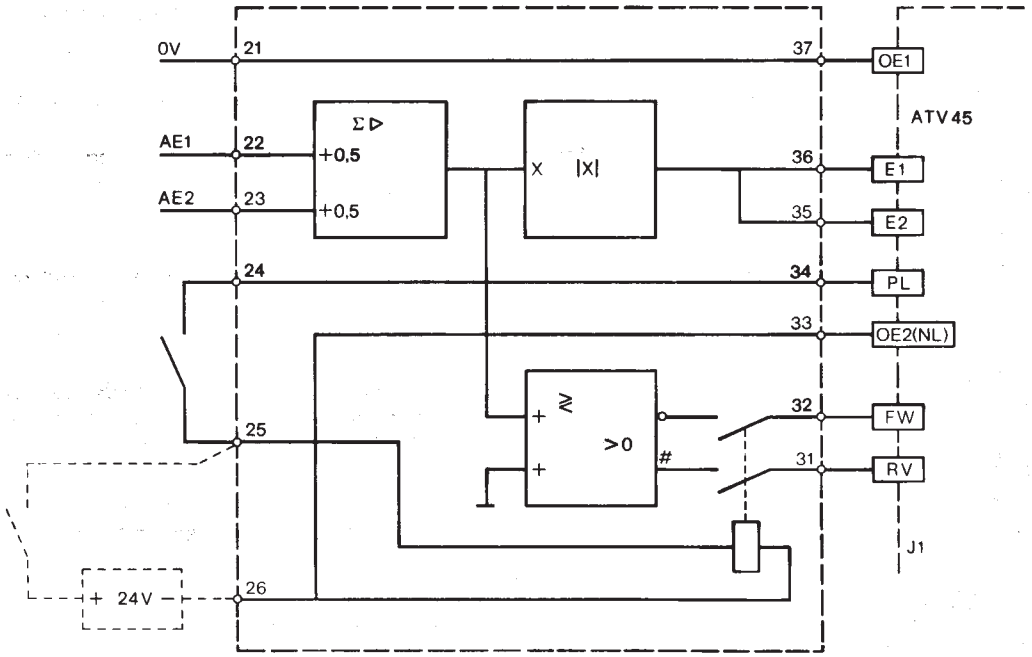
Clip-on fixing onto 35 mm ⊓⊔ omega rail.

Characteristics :

- two summing analogue inputs terminals 22 and 23 (Ze = 28 kΩ) : the resulting speed set-point is equal to the absolute value of the sum of set-points AE1 and AE2,
- the + or – sign of the sum of the set-points decides the direction of rotation.

Validation of the module :

- either by a normally open contact or a direct link between terminals 24 and 25,
- or by a 24V d.c. external supply between terminals 25 (+) and 26 (–).



Adaptation of the frequency output signal

The interface module, reference VW3-A45110, changes the frequency output signal (terminals FA-FB of the speed controller) into a 0-20 mA (terminals 1-2) or 4-20 mA (terminals 3-4) current signal.

Dimensions : - height 96 mm,
- width 48 mm,
- depth 42 mm.

Clip-on fixing onto 35 mm ⊓⊔ omega rail.

A potentiometer enables the current to be adjusted to 20 mA in a frequency range from 32 to 132 Hz. The receiver impedance must be ≤ 300 Ω.

Characteristics : - time delay < 400 ms,
- offset current < 0,3 mA.

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Slow-down braking
Speed regulation

These two options are regrouped, and are available in two technologies according to the power :

- a module, reference VW3-A45101, for ALTIVAR 1,1 to 22 kW : ATV-45VU11(N) to D22(N),
- a board, reference VW3-A45101D90, for ALTIVAR 45 to 110 kW : ATV-45VD45(N) to C11(N).

In both cases, the braking resistance is supplied separately.
For installation and connection of the resistance : see p. 48/50.

Module VW3-A45101

This module is mounted on the left side of the speed controller by clip-on fixing. It is supplied with :

- two multi-cores cables with connectors for connection to the speed controller :
  - slow-down braking option : J8 connector of the power board,
  - speed regulation option : J3 connector of the control board,
- instructions for mounting and connecting.

Two interdependent conductors on the module enable linking to the + and – terminals of the speed controller.

Environmental conditions identical to those of the ALTIVAR. Degree of protection IP20.
Dimensions : height 255 mm, width 55 mm. Weight : 1,2 kg.

Board VW3-A45101D90

This board is supplied with the connection cable to the control board when used in conjunction with the speed regulation option. For mounting and connecting the board : see p. 52.

Slow-down braking

When the frequency produced by the controller decreases rapidly, the motor behaves like an asynchronous generator and produces a braking torque. The motor feeds energy back to the controller. Braking power depends on the rate of deceleration, the inertia of the moving mass and the resistive torque.

As the controller cannot feed the energy back into the supply, this causes an increase in the voltage of the filter capacitors, which limits the braking effect, potentially causing the controller to lock into overvoltage (code [ObF]).

Part of the braking energy is dissipated as losses in the motor, the corresponding braking torque varying from 10 to 35% of the rated motor torque.

The slow-down braking option allows a higher braking torque to be obtained, and ensures that part of the braking energy is dissipated in an external resistance.

Composition

The slow-down braking option comprises :

- a power transistor, which ensures the transfer of braking resistance onto the filter capacitor terminals,

- the control electronics,

- a low speed relay, which will control a brake, if necessary :

  - pick up at f > 5 Hz and I motor ≥ 0,7 rated speed controller current,
  - drop out at f ≤ 5 Hz,

- a separate braking resistance, to be supplied if necessary.

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For the ALTIVAR 1,1 to 22 kW, the VW3-A45101 module contains the elements making up the option, with a display on the front showing capacitor load.

For the ALTIVAR 45 to 110 kW, power transistor is incorporated directly into the speed controller, the other elements making up the option are located on the VW3-A45101D90 board.

Characteristics

Maximum transmissible current is linked to :

- the braking resistance ohmmic value,
- the associated controller's current limitation,
- the maximum power transistor current :
  - 50A for ATV-45VU11(N) to D22(N) speed controllers,
  - 100A for ATV-45VD45(N) and D75(N) speed controllers,
  - 200A for ATV-45VD90(N) and C11(N) speed controllers.

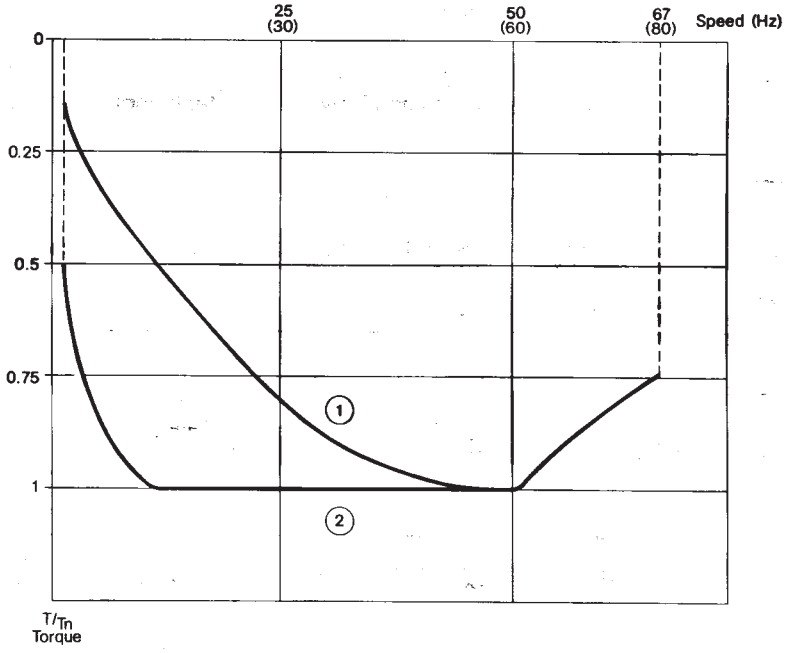
Protection

The power transistor is protected against short-circuits at the braking resistance terminals.

Available braking torque

Typical braking curves :

① Operation with quadratic torque load : UFR potentiometer in zone [P00] to [P10]
② Operation with constant torque load : UFR potentiometer in zone [n00] to [n10]



When frequency is < 10 Hz, braking torque decreases rapidly.

Slip compensation does not exist with hypersynchronous braking.

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Braking power calculation

- High inertia machine, non driving load

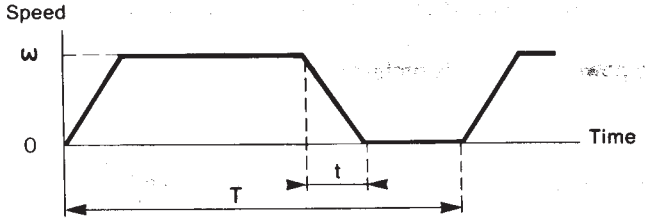
Braking torque on deceleration : $Tf = J \frac{\Delta\omega}{\Delta t}$ in N.m,

J : total moment of inertia referred to the motor shaft in kg.m²,
$\Delta\omega$: speed difference in rad/s,
Δt : deceleration time in seconds.

Instantaneous braking power : $Pf = Tf\ \omega$ in W.
Average braking power during deceleration : $Pfd = 0{,}5\ Tf\ \Delta\omega$ in W.

Average braking power during one cycle : $Pfm = Pfd \frac{t}{T}$ in W.

t : braking time in seconds, T : time of one cycle in seconds.



- Driving load, continuous operation of unspecified duration

Braking is treated as continuous braking : $Pf = Pfm = Tb\ \omega$ in W,

Tb: braking torque in N.m,
ω : speed in rad/s.

CAUTION : whatever the application, the instantaneous braking power necessary must be ≤ the rated torque of the speed controller.

Braking resistance selection

The braking resistance is defined by its ohmic value and power dissipation capacity.

Ohmic value of resistance

Reference **ATV-45V...**	U11	U15	-	U30	U40	U55	D11	D15	D22	D45	D75	D90	C11
Braking resistance Minimum value (Ω)	100						27		22	8	7	4	
Reference **ATV-45V...N**	U11N	-	U22N	-	-	U55N	D11N	D15N	D22N	D45N	D75N	D90N	C11N
Braking resistance Minimum value (Ω)	100						27		22	10	8	5	

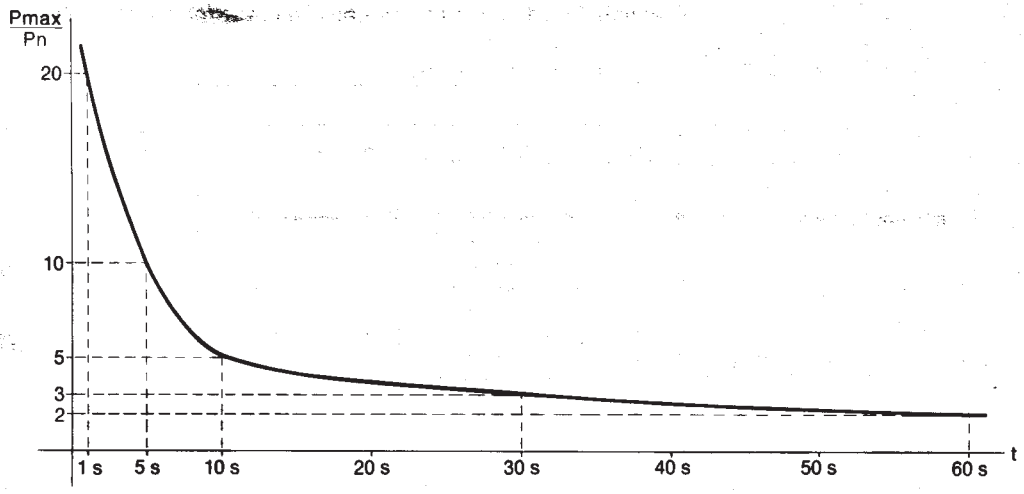
Power of the resistance :

- rated Pn : power that can be dissipated continuously ; it must be greater than the average braking power Pfm,

- maximum Pmax : power that can be dissipated over a short period on intermittent duty ; it must be greater than braking power Pf.

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Possibilities of resistance overload according to braking time t



For a resistance of rated power Pn, a maximum Pmax power, equal to ten times Pn would be acceptable if the braking lasts 5 seconds, or twice Pn if the braking lasts 60 seconds.

Standardised resistances (for the most common operating conditions)

Reference **ATV-45V...**	U11	U15	-	U30	U40	U55	D11	D15	D22	D45	D75	D90	C11
Reference **ATV-45V...N**	U11N	-	U22N	-	-	U55N	D11N	D15N	D22N	D45N	D75N	D90N	C11N
Standardised resistance Recommended value (Ω)	100						27			10		5	
Rated power (W)	72						280			1800		3600	
Reference VY1-AD	R100W072						R027W280			R010W2000*			
Dimensions (mm) H x L x P**	153 x 20 x 60						306 x 30 x 80			see p. 48			
Cabling : recommended section (mm^2)	2,5						4			25		2 x 25 in //	

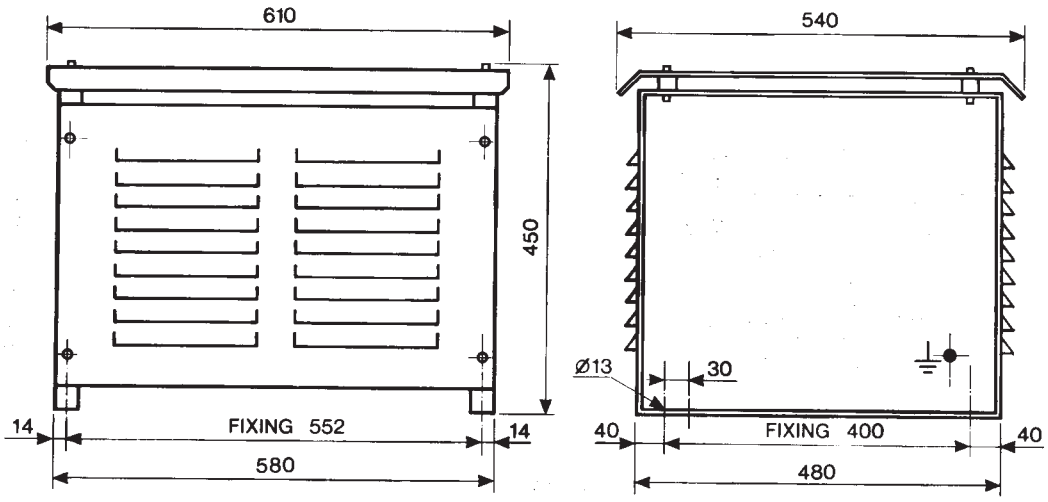
* The ohmic values are obtained by using 1 or 2 standardised resistances, connecting the elements in series / parallel, see p. 48.

** Dimensions of resistance with thermocontact and fixing brackets, see p. 50.

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Standardised resistance VY1-ADR010W2000

Presentation : louvred enclosure, with cover (painted in grey RAL 7032), weight 26 kg.



Composition : 12 stainless steel elements 1,7 Ω (cold state) and average power 250 to 300 W for a steady state temperature of the elements of about 300°C.

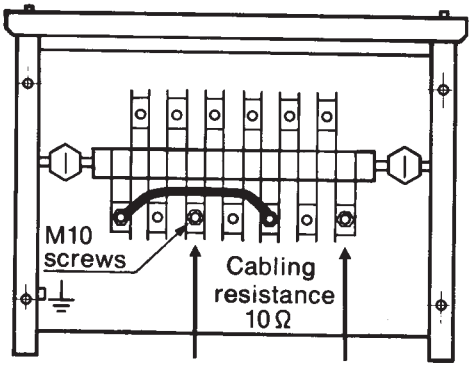
The elements are connected in series. A parallel connecting strip enables the following characteristics to be obtained :

- ohmic value when cold : 10 Ω,
- rated power : 1800 W,
- maximum power : 40 kW, 1s.

For connecting, take off the louvered cover on the same side as the earth terminal, fixed with 4 M6 screws.

Cabling safety measures :

- the resistance terminals d.c. voltage can reach 750 to 800V ; use higher insulation rating conductors (1000V),
- recommended section : 25 mm²,
- connect the resistance to the PA-PB terminals, having removed the protection insulator.



Utilisation

Reference **ATV-45V...**	D45 (N)	D75 (N)	D90 (N)*	C11 (N)*
Resistance	VY1-ADR010W2000		2 x VY1-ADR010W2000 in //	
Characteristics	10 Ω - 1800 W		5 Ω - 3600 W	

* If the average braking power is < 3000 W during one cycle, a single standardised resistance may prove sufficient. In that case, remove the connecting strip, and connect in parallel the 2 units of 6 elements to obtain 5 Ω - 3000 W.

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Resistance calculation example

A motor with the following characteristics : - **power** : 4 kW,
- rated speed : 1450 rpm
- **moment** of inertia : 0,0135 kg.m²,

drives a machine with : - inertia ten times that of the motor,
- resistive torque one tenth of the rated motor torque.

The requirement is to stop in 5 seconds from rated speed at a rate of 2 cycles per minute.

Rated angular speed : $\omega n = \frac{2\pi N}{60} = \frac{2\pi\ 1450}{60} = 152$ rad/s

Rated motor torque : $Tn = \frac{Pn}{\omega n} = \frac{4000}{152} = 26,3$ N.m

Resistive torque : $Tr = \frac{26,3}{10} = 2,63$ N.m

Total inertia : $J = 0,0135 + 10 \times 0,0135 = 0,1485$ kg.m²

Braking torque : $T = J \frac{\Delta\omega}{\Delta t} = 0,1485 \times \frac{152}{5} = 4,52$ N.m

Motor braking torque : $Tf = T - Tr = 4,52 - 2,63 = 1,89$ N.m

Instantaneous braking power : $Pf = Tf\ \omega = 1,89 \times 152 = 287$ W

Average braking power during deceleration : $Pfd = 0,5\ Tf\ \Delta\omega = 0,5 \times 1,89 \times 152 = 144$ W

Cycle time : $T = \frac{60}{2} = 30$ s

Average braking power during one cycle : $Pfm = Pfd \frac{t}{T} = 144 \times \frac{5}{30} = 24$ W

Standardised resistance VY1-ADR100W072 is suitable :

- rated power : Pn = 72 W, thus > Pfm,
- maximum power possible for 5 seconds (see curve p. 47) :
  Pmax = 10 x 72 = 720 W, thus > Pf.

WARNING



If the power values permitted by the standardised resistance are lower than the calculated values, choose a similar ohmic resistance value (see table p. 47), able to dissipate the necessary braking powers.

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Options

ALTIVAR 1,1 to 22 kW

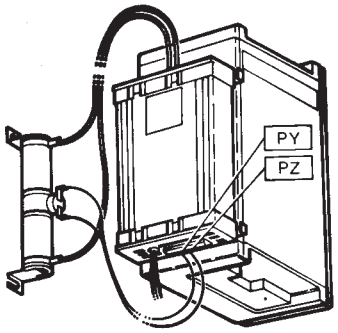
Installation of the resistance

Supplied with the standardised resistance are : - a thermocontact and two clamping collars,
- two fixing brackets,
- mounting and connecting instructions.

When installing, make sure that there is a free space of 50 mm minimum around the resistance to ensure evacuation of the heat dissipated.



In order to avoid all accidental contact with the braking resistance (maximum d.c. voltage of 800V between terminals, and a heightened temperature, capable of reaching 350°C when operating), the installation of a protective cover is recommended. Provide openings for circulation of the air required for evacuating dissipated heat.

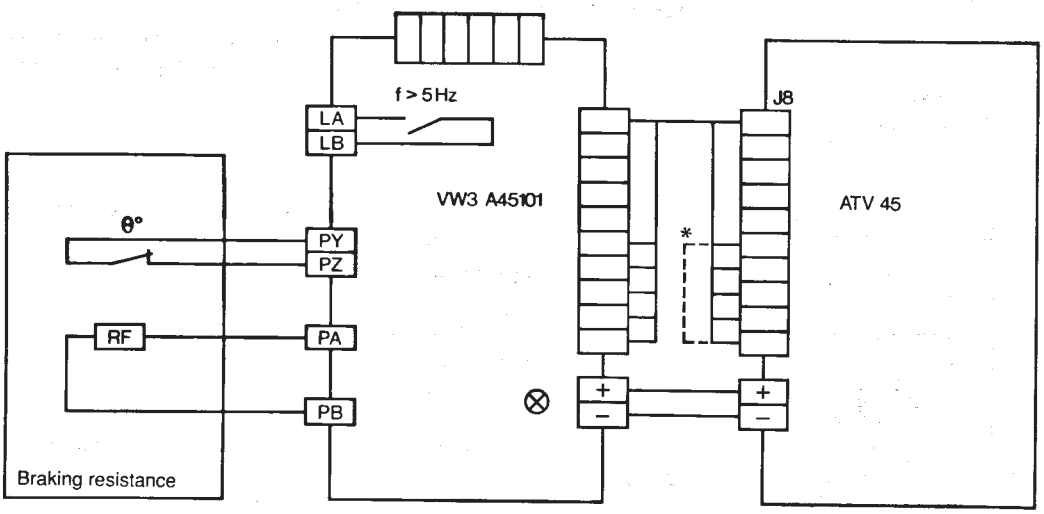


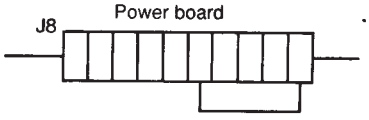
Installation and connection of the optional module

Follow the procedure described in the instructions delivered with the module.

Safety precautions to take when wiring the resistance :

- as the d.c.voltage at the resistance terminals can reach 750 to 800V at the start of braking, use conductors with a high insulation class (1000V),
- ensure that the thermocontact is connected to the PY-PZ terminals of the braking module ; if this is not done, the data "contact open" will cause the controller to lock when switched on, displaying the code OhF.





* If the braking option is not to be used, the connector delivered with the speed controller must be plugged into J8, in order to cancel the temperature control of the braking resistance.

If the speed regulation is not to be used, do not connect the wire between the module and the J3 connector of the speed controller's control board.

If the motor is fitted with a brake whose windings are accessible via terminals, connect the contact of the low speed relay available at terminals LA-LB into the control sequence ; characteristics : 220/240V - 50/60Hz - 2A.

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ALTIVAR 1,1 to 22 kW

Initial setting up

The initial setting up of the braking option needs no adjusting.

After checking the connections, and perhaps adjusting the speed controller settings (see p.28 onwards), the ALTIVAR can be switched on.

Should there be any doubt as to the braking power, proceed in the following manner :

- preset a deceleration ramp time longer than the required braking time,
- start up the machine and carry out successive braking operations, gradually reducing the ramp time until the final adjustment is reached, making sure that the braking cycles are identical to those for real use.

If the resistance heats up to an abnormal level, the thermocontact should open and the controller will lock, displaying the code [OhF].

If this occurs, check the braking conditions, and change the resistance if necessary, for a resistance with the same ohmic value, and higher rated power.

Maintenance

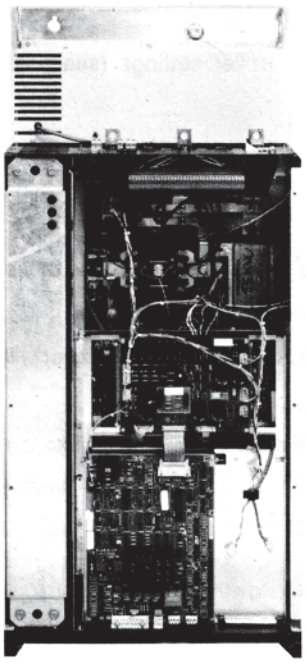
Where there is excessive braking, the speed controller may display the following codes :

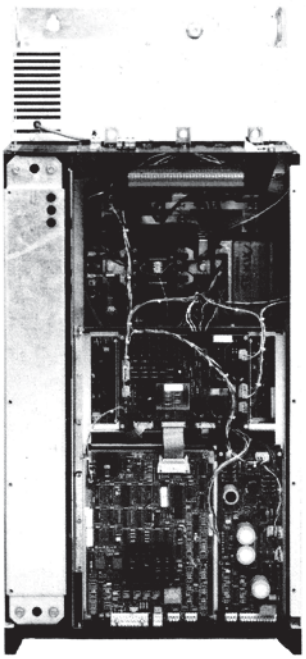
[Obr]	Deceleration ramp not followed	Increase the deceleration time
[ObF]	Capacitor overvoltage owing to excessive braking or a driving load	

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Options

ALTIVAR 45 to 110 kW





Installing the VW3-A45101D90 option board

Switch off the ALTIVAR, and wait for the capacitors to discharge (about 5 minutes after switch off, once the LED on the front goes off).

Remove the speed controller's protective covers.

The location intended for the option board is to be found to the right of the control board. 4 internal links to J1, J3, J7, and J8 connectors on the option board are fixed to the support sheet, and must be released before mounting the option board.

Unplug the removable J5 and J6 connectors from the option board.

Take the board, holding it so that the components face the operator, and the connectors face downwards ; via the lower part, slide it onto the two positioning blocks situated in the bottom part of the location, and then click into position in the upper part.

Connections

Connect the option board's flying leads to the measuring board's J13 connector.
Connect the female connectors of the internal links to the corresponding male connectors on the board (J1, J3, J7 and J8).

WARNING : attach the connectors without forcing them, making sure they have been fitted the right way round, then check that they are correctly attached.

If the speed regulation option is not to be used, do not connect the wire between the option board's J5 connector and the control board's J3 connector.

Put the plug-in terminal block back on to the J6 connector.

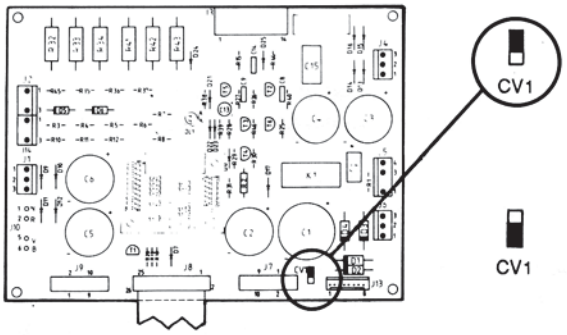
If the motor is fitted with a brake whose windings are accessible via terminals, connect the contact of the low speed relay available at LA-LB terminals into the control sequence.

If the resistance is protected by thermocontact (see following page) connnect it to the PY-PZ terminals.

Preliminary checks

A CV1 link on the measuring board allows the braking resistance thermal protection to be selected.

Measuring board



Use with resistance
without thermocontact
Preset in factory

Use with resistance protected
by thermocontact
Put the link into this position

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ALTIVAR 45 to 110 kW

Special case : braking resistance with thermal protection.

The standardised resistance does not have thermal protection.

The elements making it up can, without damage, reach temperatures higher than the steady state temperature of 300°C noted on page 48.

The ALTIVAR ATV-45V however, furnished with a braking option, enables the resistance to be protected against overheating, by using a normally closed thermocontact.

This protection can be necessary in the following cases :

- utilisation of resistances of a kind whose insulation risks being damaged or destroyed if heating is abnormally high,

- applications in which higher or more frequent braking than planned, can prove dangerous for the installation or the driven machine.

Choice of thermocontact :

- minimum continuous electrical characteristics on resistive load : 10V-5 mA,
- tripping temperature : to be determined according to the resistance used, and the location chosen for the attachment.

EXAMPLE : standardised resistance. Choose a 260°C thermocontact and attach it to the upper metal band joining the two elements on the right.

Initial setting up

The initial setting up of the braking option needs no adjusting.

After checking the connections, and perhaps adjusting the speed controller settings (see p. 28 onwards), the ALTIVAR can be switched on.

Should there be any doubt as to the braking power, proceed in the following manner :

- preset a deceleration ramp time longer than the required braking time,
- start up the machine and carry out successive braking operations, gradually reducing the ramp time until the final adjustment is reached, making sure that the braking cycles are identical to those for real use.

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Speed regulation

Measuring the real motor speed with a tachogenerator allows the speed to be regulated. This being the case, automatic slip compensation depending on load incorporated in the ALTIVAR ATV-45V is cancelled and replaced by the speed regulation loop.

The speed regulation option ensures the following functions :

- adapting the voltage value provided by the tachogenerator,
- developing the absolute value and the sign of the voltage signal to ensure regulation in both directions.

CAUTION : neither this adaptation circuit, nor that of the tachogenerator are isolated from the supply.

Accuracy : ± 0,1 % of the maximum speed for : - a torque variation from 0,2 Tn to Tn,
- a speed range from 1 to 50.

Presentation

The speed regulation option is associated with the slow-down braking option (see p. 44), and is available in two technologies according to the power :

- a module, reference VW3-A45101, for ALTIVAR 1,1 to 22 kW: ATV-45VU11(N) to D22(N),
- a board, reference VW3-A45101D90, for ALTIVAR 45 to 110 kW : ATV-45VD45(N) to C11(N).

Installation and connections

ALTIVAR 1,1 to 22 kW : - installation and connections of the module : see p. 50,
- use the cable supplied with the option to connect the module to the J3 connector of the control board.

ALTIVAR 45 to 110 kW : - for mounting and connecting the board in the speed controller : see p. 52,
- use the cable supplied with the option to connect the option board's J5 connector to the J3 connector of the control board.

Connecting the tachogenerator :

- calculate the maximum voltage provided by the tachogenerator :

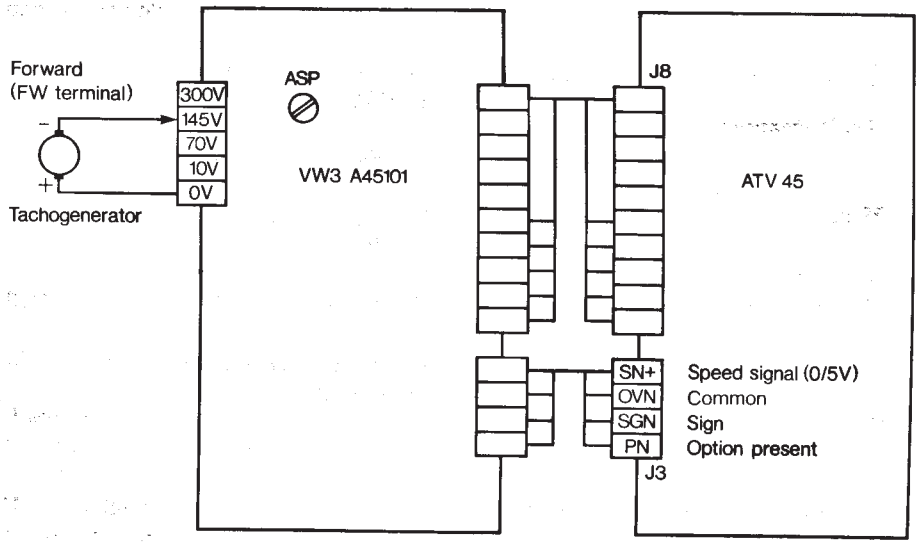
EXAMPLE : motor 1500 rpm at 50 Hz
tachogenerator 0,06 V/rpm
frequency range 67 Hz

$$U = 0{,}06 \times 1500 \times \frac{67}{50} = 120{,}6\ V$$

- using a twisted cable, connect the tachogenerator to the option module or board terminals (J6 connector), with values immediately above the value calculated, 0V-145V in the example above.

See following page for connection diagram for ALTIVAR 1,1 to 22 kW.

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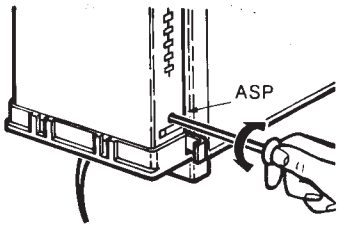
Adjustments

Connect a voltmeter to the tachogenerator terminals.
Turn the ASP potentiometer to the fully anti-clockwise position.
Start the motor and set maximum speed using the reference potentiometer.
Turn ASP clockwise until the corresponding voltage is obtained.

If the setting remains inoperative, reverse the tachogenerator connections.

ALTIVAR 1,1 to 22 kW

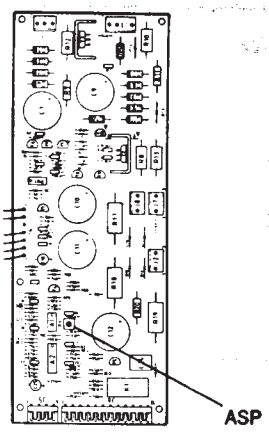
The ASP potentiometer is accessible at the front of the option module.



ALTIVAR 45 to 110 kW

The ASP potentiometer is located on the option board.





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Communication by serial link

The exchange of data between an ALTIVAR ATV-45V and an automation control system (programmable controller, computer) is carried out by a single asynchronous serial link.

The speed controller can be controlled either by the serial link in LINE mode, or by the control and speed set-point inputs in LOCAL mode.

In LINE operating mode, certain adjustments are modifiable :

- speed limits LSP and HSP : from 0 to the maximum value of the selected range,
- ramp times ACC and DEC : from 0,2 to 997 seconds.

Two kinds of link are feasible :

- point to point by interposing an isolating interface module,
- multidrop, via a serial communication coupler.

Isolating interface

The isolating interface unit reference VW3-A45104 enables an ALTIVAR ATV-45V to be linked to a TSX 47/67/87 range PC fitted with a TSX SCM coupler. It is delivered with a connecting cable for the speed controller and a special manual.

The link is in a 0-20 mA current loop (half duplex).The exchanges are made in ASCII at 9600 bauds, with a special question/answer type protocol.

Serial communication coupler

Equipped with a microprocessor, the multidrop communication coupler authorises more sophisticated transmissions and ensures the control of various protocols (UNI-TELWAY, MODBUS...) with the most current standards :

- RS 232 C,
- 20 mA current loop (serial or parallel),
- RS 485.

Its usage enables a TSX 47/67/87 range PC fitted with a UNI-TELWAY version TSX SCM coupler to be connected to one or more speed controllers by a single link (in that case, one coupler should be provided for each ALTIVAR). It ensures the galvanic isolation of the link with regard to the associated controller.

Presentation : metal case ; size (in mm) : H 192, W 47, D 158 (fixing H 170/180).
Reference : VW3-A45103FM for 110-127 / 220-240 V 50/60 Hz supply,
VW3-A45103BD for 24 V d.c. supply.

The coupler is delivered with a connecting cable for the speed controller and a special manual.
On the front are fitted :
- 3 LEDs : normal operation, addressing fault, link fault,
- 12 configuration switches depending on protocol, standard of transmission, data format, and transfer speed (300 to 19200 bauds).

Transmissible data (point to point or multidrop link) :

- operating mode (reading or writing) : LOCAL, LINE,
- commands (reading or writing) : start, frequency reference (signal and value), braking, LSP and HSP speed limits, ACC and DEC ramp times,
- signalling (reading only) : supply voltage, motor current, thermal state, frequency, state register, fault register, operating mode register,
- configuration (reading of the potentiometers) : adjustment of the thermal protection, ramp times, voltage/frequency ratio, critical operating frequencies.

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Options

ALTIVAR 1,1 to 22 kW

Attenuating input filters
(380/415V mains supply)

The input filters are intended to limit development of interference in the mains supply which can be created by the ALTIVAR and which can affect receivers (radio, television, interphone,...).

Characteristics

These filters enable the speed controllers to conform to international standards (CISPR 14, VDE 0875-1/11-84), as far as radio-electrical interference in conduction mode is concerned.

The application range is limited to devices whose maximum current is less than 25A.
This limits use to the controller ATV-45VD11.

Installation, connections

Mount the filter near the controller, at a distance ≤ 15 cm.

Join the filter and speed controller earths and link them to the protective earth. The connections should be as short as possible and of low impedance. A good quality earth is required.

To limit the radiation effect, twist the filter's input and ouput conductors, and use screened and twisted cables for connection with the speed controller (motor, reference, controls,...), taking care that the screening is connected to the protective earth.

Notes

In order to limit radiation produced by the cables connecting the ALTIVAR to the motor, install the controller as near as possible to the motor.

Separate the power circuits from the control circuits.

If the supply to the control circuit of the controller (CL1-CL2•) is located upstream of the input filter, it is necessary to mount an additional filter on the supply ; otherwise, link the L1-CL1 and L2-CL2• terminals.

References, dimensions

ALTIVAR reference	Filter	Reference	Dimensions* mm	Weight kg
ATV-45VU11 ATV-45VU15	Input	VY1-A451U1502	150 x 125 x 65	1,5
ATV-45VU30 ATV-45VU40 ATV-45VU55	Input	VY1-A451U5502	250 x 150 x 65	2
ATV-45VD11	Input	VY1-A451D1102	350 x 220 x 70	2,5
ATV-45VU11 to VD11	Control	VY1-A05102	48 x 48 x 30	0,1

* The dimensions are given as a guide, and are liable to change.

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Options

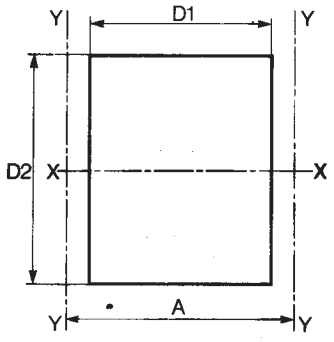
ALTIVAR 1,1 to 22 kW

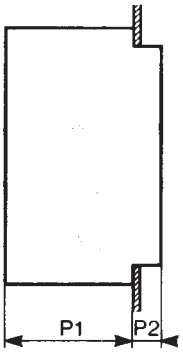
Mounting in dust and damp protecting metal enclosure

In order to reduce power dissipated in the enclosure, the speed controller can be recess mounted in the back of the enclosure, with the radiator on the outside.

Follow the mounting instructions given on pages 10 and 11.

Diagram of cut out to be made







Provide sufficient free space at the back of the enclosure for ventilation.

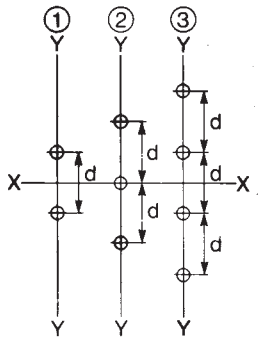
ALTIVAR reference	D1 mm	D2 mm	A mm	P1 mm	P2 mm	Dwg	Drilling d mm	Drilling Ø mm	Mounting kit reference
ATV-45VU11 (N) ATV-45VU15	194	278	212	160	0	①	160	7	VY1-A451U1501
ATV-45VU22N ATV-45VU30 ATV-45VU40 ATV-45VU55 (N)	172	342	212	165	25	②	150	7	VY1-A451U4001
ATV-45VD11 (N)	172	382	212	165	104	②	150	7	VY1-A451U7501
ATV-45VD15 (N)	172	532	212	165	104	③	150	7	VY1-A451D1101
ATV-45VD22 (N)	172	572	212	165	104	③	150	7	VY1-A451D1501

Contents of kit according to drawings :

① - Self-adhesive flat gasket

② and ③ - Self-adhesive flat gaskets
- Dust and damp protective plates
- Screw and accessories

Each kit is delivered with mounting instructions.



WARNING : for the ATV-45VD11 (N), D15 (N) and D22 (N), the fan located outside the enclosure remains IP20.

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Options

ALTIVAR 1,1 to 22 kW

Ventilation kit

This combination comprises a single phase fan with a protection grid and mounting accessories. It is fitted to the upper part of the speed controller.

This arrangement enables hot spots to be avoided and the speed controller to be used in an enclosure with a maximum internal temperature of 60°C.

WARNING : this combination should only be used if the speed controller is installed in a dust and damp protecting enclosure : **degree of protection IP54**.

Combination reference : VY1-A05107.

The kit is delivered with mounting instructions.

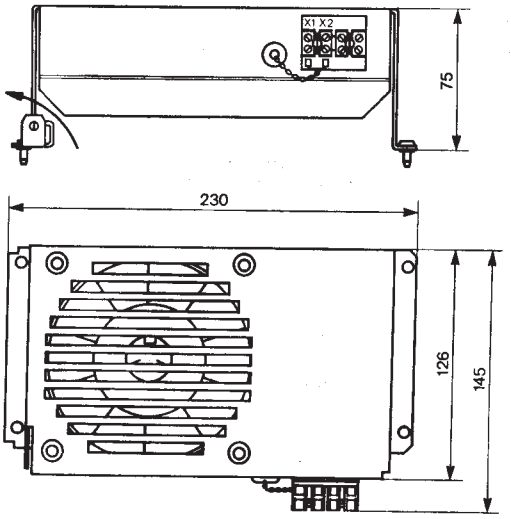
Fixing to the upper part of the speed controller by 20 mm pillars, leaving an area free for wiring.

Overall thickness : 75 + 20 = 95 mm.

Provide a free space of 50 mm minimum above the speed controller for air flow.

Characteristics of fan :

- flow : 44 dm³/s,
- supply (terminals X1-X2) : 208-240V, 50/60 Hz,
- consumption : 125/105 mA.



To enable easy access to the speed controller, the kit can be pivoted once the right hand screws have been removed.

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Spare parts

	Description	For ALTIVAR	Reference
Boards	Control board	ATV-45VU11 (N) to VC11 (N)	VX4-AV452
	Measuring board	ATV-45VD45 (N) to VC11 (N)	VX4-A45101
		ATV-45VU15	VX4-A45102
		ATV-45VU30, VU22N	VX4-A45103
		ATV-45VU40, VU55N	VX4-A45104
		ATV-45VU55	VX4-A45105
		ATV-45VD11 (N)	VX4-A45107
		ATV-45VD15	VX4-A45108
		ATV-45VD22	VX4-A45109
		ATV-45VU11 (N)	VX4-A45111
		ATV-45VD15N	VX4-A45112
		ATV-45VD22N	VX4-A45113
	Power board	ATV-45VU11, VU15, VU30, VU40	VX5-A451U30
		ATV-45VU11N, VU22N	VX5-A451U40N
		ATV-45VU55, VD11	VX5-A451U75
		ATV-45VU55N, VD11N	VX5-A451U75N
		ATV-45VD15, VD22	VX5-A451D15
		ATV-45VD15N, VD22N	VX5-A451D15N
		ATV-45VD45 (N) to VC11 (N)	VX5-A451D90
	Braking option board	ATV-45VD45 (N) to VC11 (N)	VW3-A45101D90
Rectifier (6 diodes)	25A-1200V	ATV-45VU11, VU15, VU30, VU40	VZ3-DM6025M1201
	25A-1600V	ATV-45VU11N, VU22N, VU55N	VZ3-DM6025M1601
	30A-1200V	ATV-45VU55	VZ3-DM6030M1201
	60A-1200V	ATV-45VD11, VD15, VD22	VZ3-DM6060M1201
	60A-1600V	ATV-45VD11N, VD15N, VD22N	VZ3-DM6060M1601
Rectifiers (2 diodes)	80A-1200V	ATV-45VD45	VZ3-DM2080M1201
	80A-1600V	ATV-45VD45N	VZ3-DM2080M1601
	160A-1200V	ATV-45VD75, VD90	VZ3-DM2160M1201
	160A-1600V	ATV-45VD75N, VD90N	VZ3-BM2160M1601
	200A-1200V	ATV-45VC11	VZ3-DM2200M1201
	200A-1600V	ATV-45VC11N	VZ3-DM2200M1601
Modules with 2 transistors	30A-1000V	ATV-45VU11, VU15, VU30, VU40	VZ3-BM2030M1001
	30A-1200V	ATV-45VU11N, VU22N, VU55N	VZ3-BM2030M1201
	50A-1000V	ATV-45VU55, VD11	VZ3-BM2050M1001
	50A-1200V	ATV-45VD11N	VZ3-BM2050M1201
	75A-1000V	ATV-45VD15	VZ3-BM2075M1001
	75A-1200V	ATV-45VD15N	VZ3-BM2075M1201
	100A-1000V	ATV-45VD22	VZ3-BM2100M1001
	100A-1200V	ATV-45VD22N	VZ3-BM2100M1201
	200A-1000V	ATV-45VD75	VZ3-BM2200M1001
	200A-1200V	ATV-45VD75N	VZ3-BM2200M1201
	300A-1000V	ATV-45VD45, VD90, VC11	VZ3-BM2300M1001
	300A-1200V	ATV-45VD45N, VD90N, VC11N	VZ3-BM2300M1201
Braking transistor module	100A-1000V	ATV-45VD45 (N), VD75 (N)	VZ3-BM1100M1001
	200A-1000V	ATV-45VD90 (N), VC11 (N)	VZ3-BM1200M1001
Control fuse	1A g1 (8,5 x 31,5)	ATV-45VU11 to VD22	DF2-BN0100 *
	2A aM (8,5 x 31,5)	ATV-45VD45 to VC11	DF2-BA0200 *
Cooling fan	Flow 100 dm³/s	ATV-45VD11, VD15, VD22	SZ1-XH07
	Flow 44 dm³/s	ATV-45VD11N, VD15N, VD22N	SZ1-XH23
	Flow 210 dm³/s	ATV-45VD45 (N) to VC11 (N)	VZ3-V002

* Sold in lots of 10.

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