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Steps for Setting Up the Speed Controller

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1 - Delivery of the speed controller

- Check that the speed controller reference printed on the label is the same as that on the delivery note corresponding to the purchase order.
- Remove the Altivar 28 from its packaging and check that it has not been damaged in transit.

2 - Fit the speed controller and attach its aide memoire labels (page 49)

3 - Connect the following to the speed controller :

- The line supply, ensuring that it is **off**
- The motor, ensuring that its coupling corresponds to the supply voltage

4 - Switch on the speed controller, but do not give a run command

5 - Configure :

- The nominal frequency (bFr) of the motor, if it is other than 50 Hz
- The parameters of the I/O, and drC menus but only if the factory configuration of the speed controller is not suitable for the application

6 - Set the following in the Set menu :

If the speed controller factory settings are not suitable :

- The acceleration (ACC) and deceleration (dEC) ramps
- The minimum (LSP) and maximum (HSP) speeds
- The motor thermal protection current (Ith)
- Other parameters as required, if the factory configuration has been changed

7 - Start the speed controller

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Practical recommendations

- Preparations can be made for programming the speed controller by filling in the configuration and settings tables (page 88), in particular when the factory configuration has been changed.
- Programming the Altivar 28 can be made easier by internal sequence selections and interlocks. In order to gain the maximum benefit from this, it is recommended that the menus are accessed in the following order :

1) - I/O 2) - drC 3) - Set

Not all steps are necessary in every case.



Caution : A check must be made to ensure that the functions which have been programmed are compatible with the wiring layout used.

Factory Configuration

Factory settings

The Altivar 28 is factory-set for the most common operating conditions :

- Display : speed controller ready (stopped), motor frequency (running)
- Line supply : 50Hz
- Motor voltage : 230V or 400V, depending on model
- Ramps : 3 seconds
- Low speed : 0 Hz
- High speed : 50 Hz
- Frequency loop gain : standard
- Motor thermal current = nominal speed controller current
- Standstill injection braking current = $0.7 \times$ nominal speed controller current, for 0.5 seconds
- Constant torque operation, with sensorless flux vector control
- Automatic adaptation of the deceleration ramp in the event of overvoltage on braking
- Switching frequency 4 kHz
- Logic inputs :
 - LI1, LI2 : 2 directions of operation, 2-wire control
 - LI3, LI4 : 4 preset speeds (0 Hz, 10 Hz, 15 Hz, 50 Hz)
- Analog inputs :
 - AI1 (0 + 10 V) : speed reference
 - AI2 (0 + 10 V) or AIC (0, 20 mA) : summing AI1
- Relay R2 :
 - speed reference reached
- Analog output AO (0 - 20 mA) :
 - motor frequency

If the above values are compatible with the application, the speed controller can be used without changing the settings.

Aide memoire labels

The speed controller is supplied with aide memoire labels in the cover :

- 1 label fixed inside the cover : wiring diagram
- 3 self-adhesive labels to be fixed near the speed controller if required : programming of the main parameters, meaning of the fault codes and customer customization (blank label).

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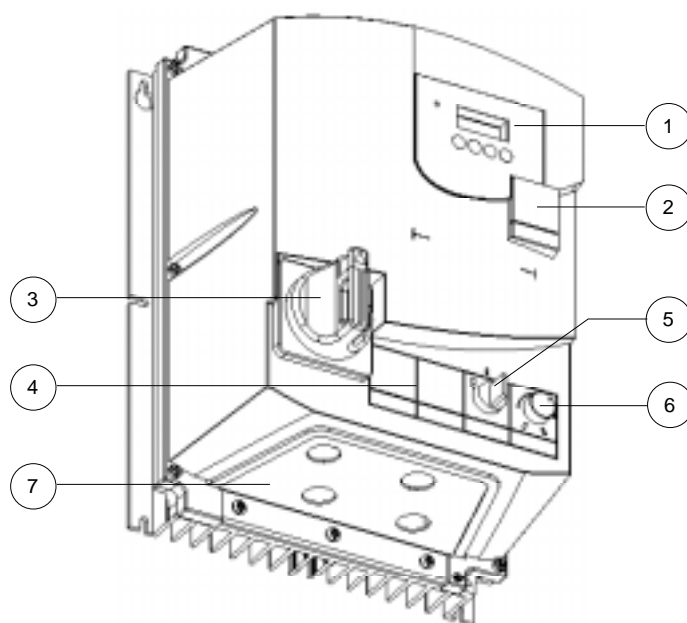
Presentation

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- 1 - Display and buttons for settings and configuration.
- 2 - Cover for access to RS485 serial link. **Caution, when this cover is removed in order to use the remote display module, the PC connection kit or the RS 485 serial link kit, the degree of protection is no longer IP55 but becomes IP43.**
- 3 - Power supply switch control knob
- 4 - Two positions available for the optional addition of control or signalling units.
- 5 - 3-position switch : Stop and two operating directions (FW, RV)
The speed controller is delivered with only one direction wired.
- 6 - Speed reference potentiometer
- 7 - Gland plate for customer cable glands

Speed Controller References

Single phase supply voltage (1) U1...U2 : 200...240 V 50/60 Hz

Motor		Line supply		Altivar 28		Reference
Power indicated on plate (2)		Line current (3)		Max. prosp. line Isc	Nominal current	
		at U 1	at U 2			Max. transient current (4)
kW	HP	A	A	kA	A	A
0.37	0.5	7.3	6.1	1	3.3	3.6
0.75	1	9.8	8.2	1	4.8	6
1.5	2	16	13.5	1	7.8	10.9
2.2	3	22.1	18.6	1	11	15
						ATV-28EU09M2
						ATV-28EU18M2
						ATV-28EU29M2
						ATV-28EU41M2

3-phase supply voltage (1) U1...U2 : 200...230 V 50/60 Hz

3	-	17.6	15.4	5	13.7	18.5	ATV-28EU54M2
4	5	21.9	19.1	5	17.5	24.6	ATV-28EU72M2

3-phase supply voltage (1) U1...U2 : 380...500 V 50/60 Hz

Motor		Line supply		Altivar 28		Reference
Power indicated on plate (2)		Line current (3)		Max. prosp. line Isc	Nominal current	
		at U 1	at U 2		at 380 to 460V	at 500V
kW	HP	A	A	kA	A	A
0.75	1	3.9	3.5	5	2.3	2.1
1.5	2	6.5	5.7	5	4.1	3.8
2.2	3	8.4	7.5	5	5.5	5.1
3	-	10..3	9.1	5	7.1	6.5
4	5	13	11.8	5	9.5	8.7
						3.5
						6.2
						8.3
						10.6
						14.3
						ATV-28EU18N4
						ATV-28EU29N4
						ATV-28EU41N4
						ATV-28EU54N4
						ATV-28EU72N4

(1) Nominal supply voltages : min. U1, max. U2.

(2) These power ratings are for a maximum switching frequency of 4 kHz, in continuous operation. The switching frequency is adjustable from 2 to 15 kHz.

Above 4 kHz derate the nominal speed controller current. The nominal motor current must not exceed this value :

- Up to 12 kHz derate by 10%
- Above 12 kHz derate by 20%.

(3) Typical value for a 4-pole motor and a maximum switching frequency of 4 kHz, with no additional line choke.

(4) For 60 seconds.

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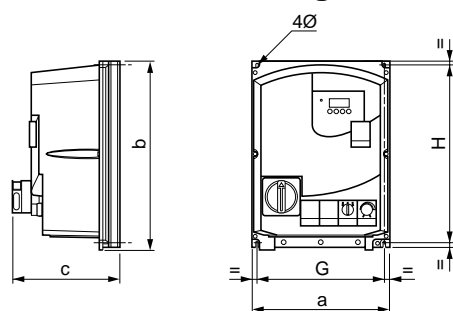
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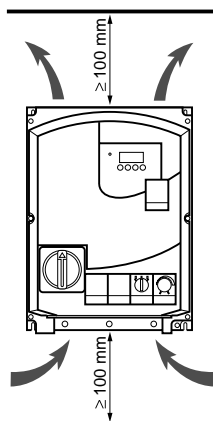
Mounting

Dimensions and weights



ATV-28E	a	b	c	G	H	Ø	weight
	mm	mm	mm	mm	mm	mm	kg
U09M2, U18M2	219	297	177	201	280	5,5	
U29M2, U18N4, U29N4	219	297	201	211	280	5,5	
U41M2, U54M2, U72M2, U41N4, U54N4, U72N4	219	347	222	212	320	5,5	

Mounting recommendations



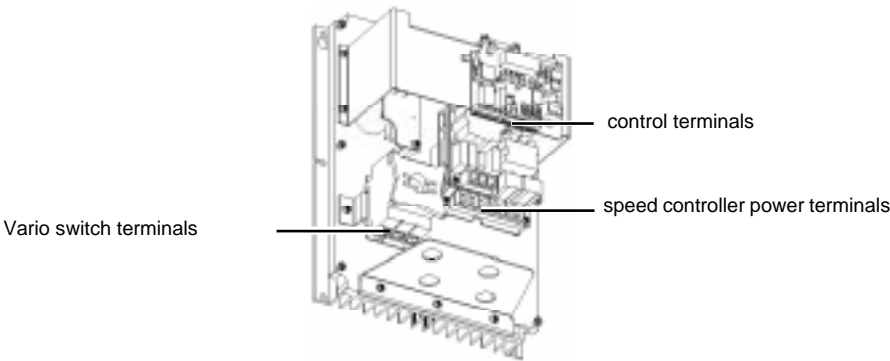
Install the unit vertically, at $\pm 10^\circ$.
Do not place it close to heating elements.
Leave sufficient free space to ensure that the air required for cooling purposes can circulate from the bottom to the top of the unit.

Minimum and maximum ambient air temperatures permissible during operation :
- 10 °C to + 40 °C

Wiring

Access to terminals

Before working on the unit, switch off the power supply upstream of the ATV28Eiii and wait 10 minutes for the capacitors to discharge.
Set the switch to OFF, then remove the cover which is screwed on. Disconnect the control wire connector to release the cover.



Power terminals

Specifications of the speed controller power terminals

Altivar ATV-28E	Maximum connection capacity		Tightening torque in Nm
	AWG	mm2	
U09M2, U18M2	AWG 14	2.5	0.8
U29M2, U18N4, U29N4	AWG 12	3	1.2
U41M2, U54M2, U72M2, U41N4, U54N4, U72N4	AWG 10	5	1.2

Specifications of the Vario switch terminals (line supply wiring)

Altivar ATV-28E	Maximum connection capacity		Tightening torque in Nm
	AWG	mm2	
All ratings	AWG 8	6	2

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Wiring

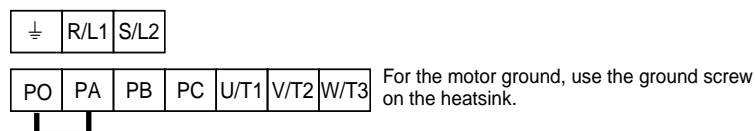
Functions of the speed controller power terminals

FRANÇAIS	Terminal	Function	For Altivar ATV-28E
	⏏	Altivar ground terminal	All ratings
	L1 L2 L3	Power supply terminals connected to the switch	All ratings
	PO	DC bus + polarity	3-phase only
	PA	Output to braking resistor	All ratings
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	PC	DC bus - polarity	All ratings
	U V W	Outputs to motor	All ratings

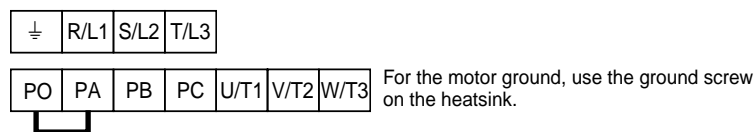
Arrangement of the speed controller power terminals

Do not remove the connector linking terminals PO and PA.

ATV-28EU09M2, U18M2, U29M2, U49M2 :



ATV-28EU54M2, U72M2, U18N4, U29N4, U41N4, U54N4, U72N4 :



Wiring

Control terminals

Arrangement, specifications and functions of the control terminals

R1A	R1B	R1C	R2A	R2C	COM	AI 1	+ 10	AI 2	AIC	AO	LI 1	LI 2	LI 3	LI 4	+ 24	
⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	

- Maximum connection capacity :
1.5 mm² - AWG 16
- Max. tightening torque :
0.5 Nm

Terminal	Function	Electrical specifications
R1A R1B R1C	Common point C/O contact (R1C) of R1 fault relay	Min. switching capacity • 10 mA for 5 V _a Max. switching capacity on inductive load (cos φ = 0.4 and L/R = 7 ms) : • 1.5 A for 250 V _~ and 30 V ₋₋₋
R2A R2C	N/O contact of R2 programmable relay	
COM	I/O common	
AI1	Analog voltage input	Analog input 0 + 10 V • impedance 30 kΩ • resolution 0.01 V • precision ± 4.3%, linearity ± 0.2%, of max. value • sampling time 4 ms max.
+10	Power supply for potentiometer with setpoint 1 to 10 kΩ	+10 V (+ 8 % - 0), 10 mA max, protected against short-circuits and overloads
AI2 or AIC	Analog voltage input or Analog current input AI2 or AIC are assignable. Use either, but not both.	Analog input 0 + 10 V, impedance 30 kΩ or Analog input X - Y mA. X and Y can be programmed from 0 to 20 mA, impedance 450 Ω Resolution, precision, and sampling time of AI2 or AIC = AI1.
AO	Analog output	Output can be programmed for 0 - 20 mA or 4 - 20 mA • Precision ± 6% of the max. value, max. load impedance 800 Ω.
LI1 LI2 LI3 LI4	Logic inputs	Programmable logic inputs • + 24 V power supply (max. 30 V) • Impedance 3.5 kΩ • State 0 if < 5 V, state 1 if > 11 V • Sampling time 4 ms max.
+ 24	Logic input power supply	+ 24 V protected against short-circuits and overloads, min. 19 V, max. 30 V. Max. customer current available 100 mA

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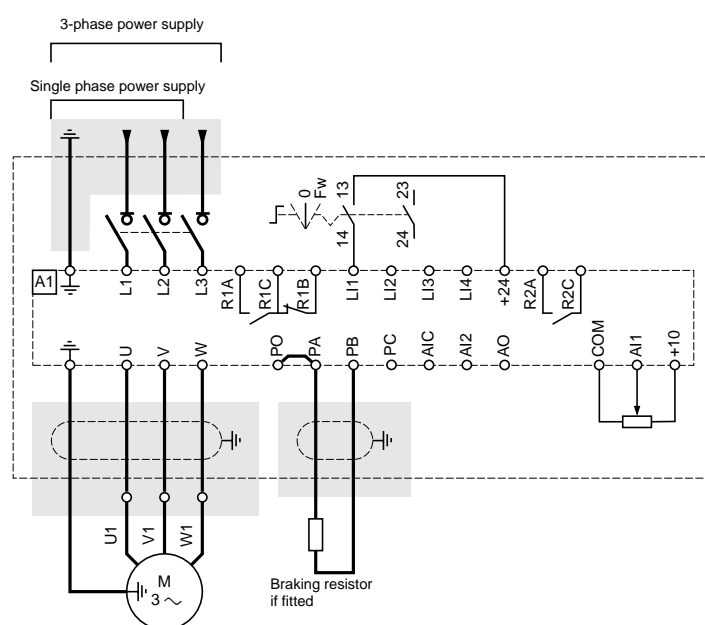
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Wiring

Wiring diagram for factory settings

The shaded parts are to be wired by the user.



Note : The 3-position switch is factory-wired for one direction of operation only. The contact (23-24) for the 2nd direction of operation is available and can be wired if necessary between the + 24 and L12.

Wiring

Wiring recommendations

Power

Observe the cable cross-sectional areas recommended in the standards.

The speed controller must be earthed, in order to comply with regulations concerning high leakage currents (over 3.5 mA). When the use of an upstream "residual current device" for protection is required by the installation standards, a "type B" device must be used, which will operate even in the presence of DC components. If the installation has several speed controllers on the same line, each controller must be earthed separately. If necessary, fit a line choke (consult the catalogue).

Keep the power cables separate from circuits in the installation with low level signals (detectors, PLCs, measuring apparatus, video, telephone).

Control

Keep the control circuits and the power cables apart. For control and speed reference circuits, we recommend using shielded twisted cables with a pitch of between 25 and 50 mm, connecting the shielding to ground at each end.

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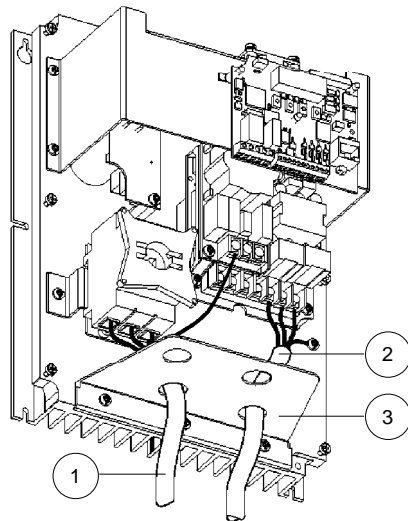
Wiring

Electromagnetic compatibility

Principle

- Grounds between speed controller, motor and cable shielding must have "high frequency" equipotentiality.
- Use shielded cables with shielding connected to ground at 360° at both ends for the motor cable, braking resistor (if used) and control-command cables. Conduit or metal ducting can be used for part of the shielding length, provided that there is no break in continuity.
- Ensure maximum separation between the power supply cable (line supply) and the motor cable.

Installation diagram



1 - Non-shielded power supply cable (2 or 3 phases to be connected to the Vario switch, and the PE conductor to be connected to the ground terminal of the speed controller).

2 - Shielded motor cable (3 phases to be connected to the speed controller U-V-W terminals, and the PE conductor to be connected to the heatsink via the ground screw). **This cable must enter the ferrite core in front of its insertion hole.**

3- Gland plate for customer cable glands.

- Shielded cables must be used for connection to the control (if required) and connection to the braking resistor (if required).
- The optional connection to the relay contacts can be made using non-shielded cables.

Wiring

Connecting the cable shielding

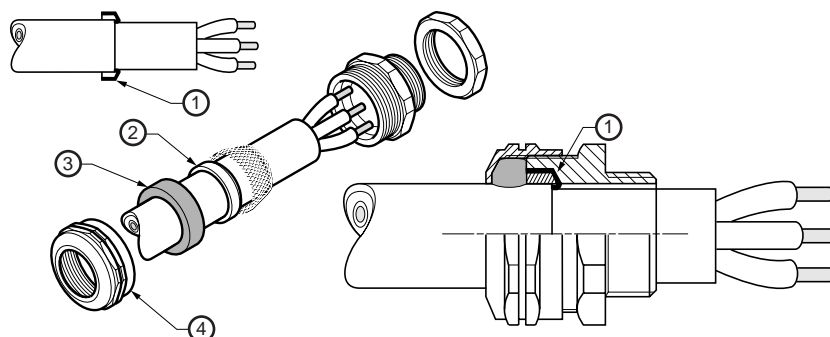
The cable shielding can be connected using metal clamps on the heatsink or metal cable glands on the gland plate.

Assembling and connecting a shielded cable with metal clamp :

- Strip the shielding.
- Use the correct size stainless steel clamp and fix it on the heatsink, so that the shielding is tightly clamped on the speed controller ground. The heatsink has tapped holes and screws provided for this purpose.

Assembling and connecting a shielded cable with metal cable gland :

- Prepare the shielded cable by stripping both ends ready for connection.
- Loosen the cover of the cable gland (4).
- Fit the shielded cable in the cable gland ensuring it is fully in contact (360°).
- Fold back the shielding (1) and clamp it between the ring (2) and the body of the cable gland, and tighten the cover.



- 1 : Shielding
2 : Tapered ring
3 : Rubber washer
4 : Cover

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Basic Functions

Fault relay, unlocking

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The fault relay is energized when the speed controller is powered up and there is no fault. It has a common point C/O contact.

The speed controller is unlocked after a fault by the following operations :

- Powering down the speed controller until the display and the red LED go off, then powering up again
- Automatically when the "automatic restart" function has been activated
- Via a logic input when this input is assigned to the "fault reset" function

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Speed controller thermal protection

Functions :

Thermal protection by thermistor fitted on the heatsink or integrated in the power module.

Indirect protection of the speed controller against overloads by current limit. Typical tripping points :

- motor current = 185 % of nominal speed controller current : 2 seconds
- motor current = maximum speed controller transient current : 60 seconds.

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Speed controller ventilation

The fan is powered automatically when the speed controller is unlocked (operating direction + reference). It is powered down a few seconds after the speed controller is locked (motor speed < 0.5 Hz and injection braking completed).

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Configurable I/O Application Functions

Logic input application functions

Direction of operation : forward / reverse

Reverse operation can be disabled for applications with a single direction of motor rotation.

2-wire control :

Run (forward or reverse) and stop are controlled by the same logic input, for which state 1 (run) or 0 (stop) is taken into account.

On power-up or a manual fault reset or after a stop command, the motor can only be powered once the "forward", "reverse" and "DC injection stop" commands have been reset. If the automatic restart function is configured (parameter Atr in the drC menu), these commands are taken into account without a reset being necessary.

3-wire control :

Run (forward or reverse) and stop are controlled by 2 different logic inputs.

LI1 is always assigned to the stop function. Stop occurs on opening (state 0).

The pulse on the run input is memorized until the stop input is opened.

On power-up or a manual fault reset or after a stop command, the motor can only be powered once the "forward", "reverse" and "DC injection stop" commands have been reset.

Ramp switching : 1st ramp : ACC, DEC ; 2nd ramp : AC2, DE2

This can be activated in 2 ways :

- By activating a logic input LIx or by detection of an adjustable frequency threshold Frt.

Step by step operation (JOG): Low speed operation pulse

If the JOG contact is closed, then the operating direction contact activated, the ramp is 0.1 s whatever the ACC, dEC, AC2 and dE2 settings. If the operating direction contact is closed, then the JOG contact activated, the configured ramps are used.

The minimum time between 2 JOG operations is 0.5 seconds

Parameter which can be accessed in the adjust menu :

- JOG speed

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Configurable I/O Application Functions

Preset speeds

2, 4 or 8 speeds can be preset, and requiring 1, 2, or 3 logic inputs respectively.

The following assignement order must be observed : PS2 (Llx), then PS4 (Lly), then PS8 (Llz).

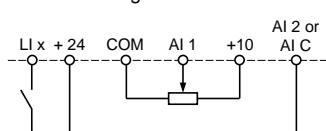
2 preset speeds		4 preset speeds			8 preset speeds			
Assign : Llx to PS2		Assign : Llx to PS2, then Lly to PS4			Assign : Llx to PS2, then Lly to PS4, then Llz to PS8			
Llx	speed reference	Lly	Llx	speed reference	Llz	Lly	Llx	speed reference
0	LSP + reference	0	0	LSP + reference	0	0	0	LSP + reference
1	HSP	0	1	SP2	0	0	1	SP2
		1	0	SP3	0	1	0	SP3
		1	1	HSP	0	1	1	SP4
					1	0	0	SP5
					1	0	1	SP6
					1	1	0	SP7
					1	1	1	HSP

To unassign the logic inputs, the following order must be observed : PS8 (Llz), then PS4 (Lly), then PS2 (Llx).

Reference switching :

Two references are switched (AI1 reference and AI2 or AIC reference) by a command on a logic input. This function automatically assigns AI2 or AIC to speed reference 2.

Connection diagram



Contact open, reference = AI2 or AIC
Contact closed, reference = AI1

If AI2/AIC is assigned to the PI function, operation combines both functions, (see page 64)

Configurable I/O Application Functions

Freewheel stop

Stops the motor by the resistive torque only. The motor power supply is cut.
The freewheel stop occurs when the logic input assigned to this function opens (state 0).

DC injection stop

This can be activated in 2 ways :
- by activation of a logic input assigned to this function (state 1)
- automatically if the frequency is below 0.5 Hz

Fast stop :

Braked stop with the current deceleration ramp time divided by 4 within the limits of the braking possibilities.
The fast stop occurs when the logic input assigned to this function opens (state 0).

Fault reset :

Clears the memorized fault and resets the speed controller if the cause of the fault has disappeared, except for OCF (overcurrent), SCF (motor short-circuit), EEf and InF (internal faults) faults, which require the controller to be powered down.
The fault is cleared when the logic input assigned to this function changes from 0 to 1.

Forced local mode when using the serial link :

Changes from line control mode (serial link) to local mode (control via the terminal block).

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Configurable I/O Application Functions

Analog input application functions

Input AI1 is always the reference.

Assignment of AI2/AIC (AI2 = 0, +10 V or AIC = X-Y mA, X and Y can be configured from 0 to 20mA)

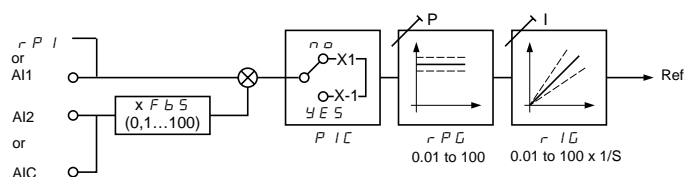
Summing speed reference : The frequency reference from AI2/AIC can be summed with AI1.

PI regulator : Can be assigned to AI2/AIC. Allows a sensor to be connected and activates the PI regulator.

The reference is input AI1 or an internal reference rPI which can be adjusted via the ATV-28 keypad.

Parameters which can be accessed in the adjust menu :

- regulator proportional gain (rPG)
- regulator integral gain (rIG)
- PI feedback multiplication coefficient (FbS) : is used to adjust the max. value of the feedback so that it corresponds to the max. value of the PI regulator reference.
- reversal of the direction of correction (PIC) : if PIC = no, the motor speed increases when the error is positive, if PIC = YES, the motor speed decreases when the error is positive.



"Manual - Automatic" operation with PI

This function combines the PI regulator and reference switching by a logic input. The speed reference is given by AI1 or by the PI function, depending on the state of the logic input.

Configurable I/O Application Functions

R2 relay application functions

Frequency threshold reached (FtA) : The relay contact is closed if the motor frequency is greater than or equal to the frequency threshold set by Ftd in the adjust menu.

Speed reference reached (SrA) : The relay contact is closed if the motor frequency is greater than or equal to the speed reference value.

Current threshold reached (CtA) : The relay contact is closed if the motor current is greater than or equal to the current threshold set by Ctd in the adjust menu.

Thermal state reached (tSA) : The relay contact is closed if the motor thermal state is greater than or equal to the thermal state threshold set by ttd in the adjust menu.

Analog output AO application functions

Analog output AO is a current output, which can be configured for 0 - 20 mA or 4 - 20 mA.

Motor current (code OCr) : supplies the image of the motor rms current.
20 mA corresponds to twice the nominal motor thermal current Ith.

Motor frequency (code rFr) : supplies the motor frequency calculated by the speed controller.
20 mA corresponds to the maximum frequency (parameter tFr).

Motor torque (code OLO) : supplies the image of the motor torque as an absolute value.
20 mA corresponds to twice the nominal motor torque (typical value).

Power (code OPPr) : supplies the image of the power supplied to the motor by the speed controller.
20 mA corresponds to twice the nominal speed controller power.

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Configurable I/O Application Functions

Function compatibility table

The choice of application functions may be limited by the number of I/O and by that fact that some functions are incompatible with one another. Functions which are not listed in this table are fully compatible.

	DC injection braking	Summing input	PI regulator	Reference switching	Freewheel stop	Fast stop	JOG operation	Preset speeds
DC injection braking					↑			
Summing input			●	●				
PI regulator		●					●	●
Reference switching		●						●
Freewheel stop	↑					↑		
Fast stop					↑			
JOG operation			●					↑
Preset speeds			●	●			↑	

●	Incompatible functions
	Compatible functions
	N/A

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

←	↑	The function marked with the arrow takes priority over the other.
---	---	---

Stop functions take priority over run commands.

Speed references via logic command take priority over analog references.

Setup - Preliminary Recommendations

Prior to powering up and configuring the speed controller



- Power down the logic inputs (state 0) to prevent any accidental startup. Otherwise, an input assigned to the run command may cause the motor to start immediately when exiting the configuration menus.

- Check that the cover has been replaced and that its connector (control wires) has been attached correctly.

Operating recommendations



The ATV-28E speed controller is delivered wired and configured to restart automatically after any fault causing a stop disappears, for example loss then restoration of the line supply.

Check that this operation is compatible with the safety conditions of the application. If it is not compatible, the wiring and configuration must be modified.

To use the available inputs and outputs, the wiring should be connected as required.

User adjustment and extension of functions

If necessary, the display and the buttons can be used to modify the settings and to extend the functions described in the following pages. It is very easy to return to the factory settings.

There are three types of parameter :

- display : values displayed by the speed controller
- adjustment : can be changed during operation or when stopped
- configuration : can only be modified when stopped and no braking is taking place. Can be displayed during operation.



Check that changes to the current operating settings do not present any danger. Changes should preferably be made with the speed controller stopped.

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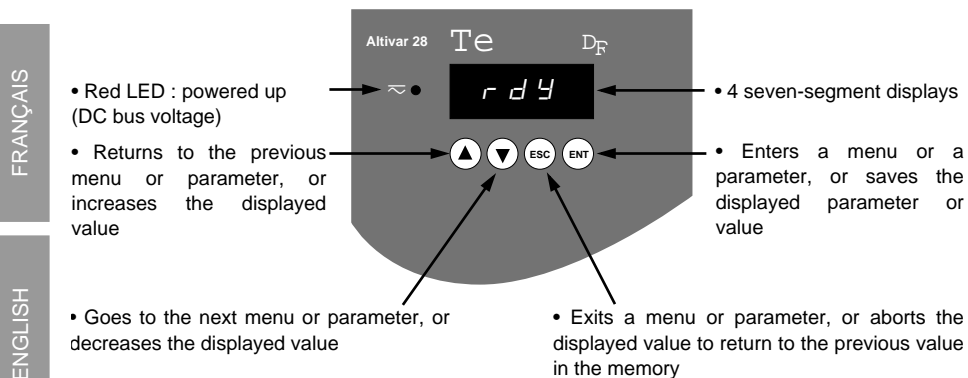
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Programming

Functions of the keys and the display



Pressing or does not store the choices.

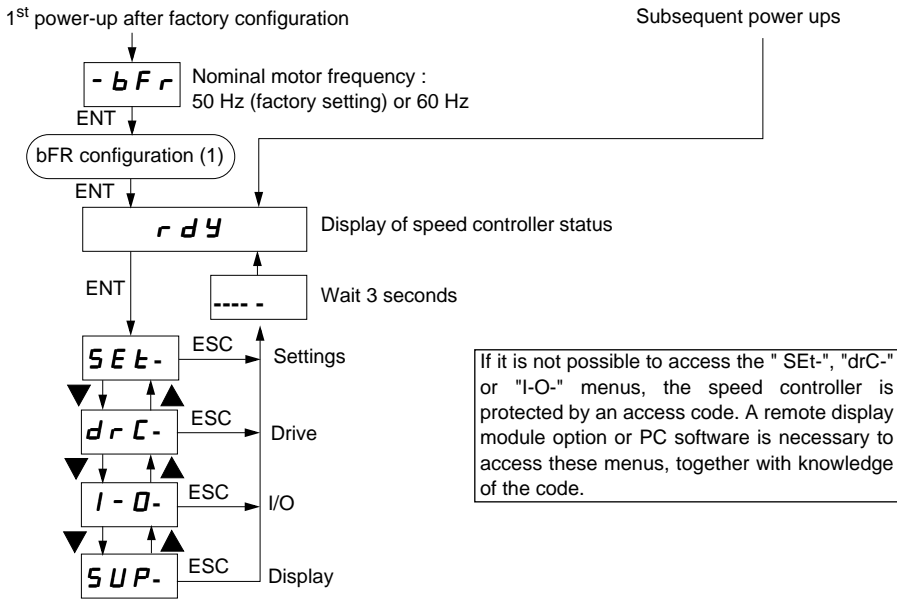
Store, save the displayed choice :
The display flashes when a value is stored.

Normal display, with no fault present and no startup :

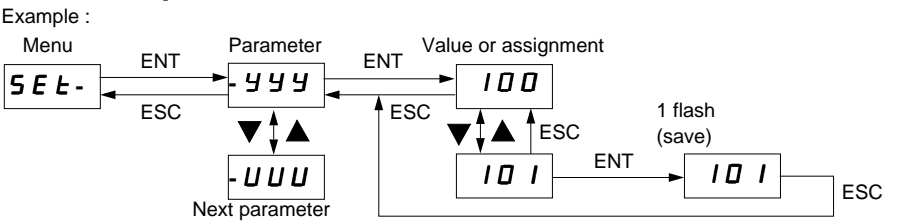
- Init : Initialization sequence.
- rdY : Speed controller ready
- 43.0 : Display of the frequency reference
- dcb : DC injection braking in progress
- rtrY : Automatic restart in progress
- nSt : Freewheel stop command
- FSt : Fast stop command

Programming

Access to menus



Access to parameters



(1) Configure bFr at the 1st power-up, using the same procedure as for the other parameters, as described above. **Caution**, bFr can only then be modified after a return to "factory settings".

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Notes

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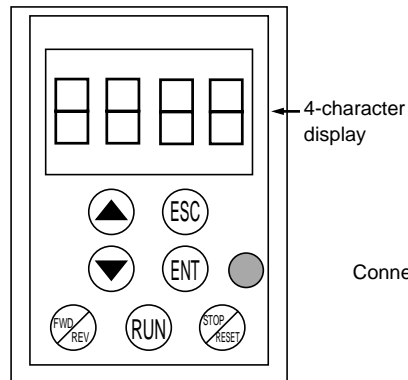
Remote Display Module Option

This module can be mounted on the door of the wall-fixing or floor-standing enclosure. It has a cable with connectors, which is connected to the speed controller serial link (see the manual supplied with the display module). It has the same display and the same programming buttons as the Altivar 28 with the addition of a switch to lock access to the menus and three buttons for controlling the speed controller :

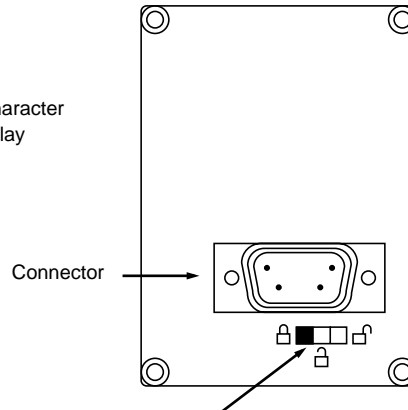
- FWD/RV : reversal of the direction of rotation
- RUN : motor run command
- STOP/RESET : motor stop command or fault reset

The first press on the button stops the motor, and if DC injection standstill braking is configured, a second press stops this braking.




View of the front panel :



View of the rear panel :



Access switch :

- position  : settings and configuration not accessible
- position  : settings accessible
- position  : settings and configuration accessible

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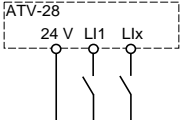
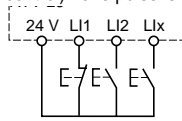

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Configuration

I/O assignment menu I - 0 -

The parameters can only be modified when the speed controller is stopped and locked. The functions are defined in the section "Configurable I/O Application Functions".

Code	Assignment	Factory setting
- tCC	<p>Configuration of terminal block control : 2-wire or 3-wire control. 2C = 2-wire, 3C = 3-wire.</p> <p>2-wire control : The open or closed state of the input controls running or stopping. Wiring example : </p> <p>LI1 : forward LIX : reverse</p> <p>3-wire control (pulse control) : one pulse is all that is needed to control start-up. Wiring example : </p> <p>LI1 : stop LI2 : forward LIx : reverse</p> <p> Changing the assignment of tCC returns the logic inputs to the factory setting :</p> <ul style="list-style-type: none"> • tCC = 2C : LI1 : "Forward", cannot be reassigned LI2 : rrS ("Reverse") LI3 : PS2 LI4 : PS4 • tCC = 3C : LI1 : Stop, cannot be reassigned LI2 : For ("Forward"), cannot be reassigned LI3 : rrS ("Reverse") LI4 : JOG 	2C
- LCC	<p>Parameter only accessible with the remote display module option : no - YES Enables control of the speed controller using the STOP/RESET, RUN and FWD/REV buttons on the display module. The speed reference is then given by parameter LFr in the SEt- menu. Only the freewheel, fast stop and DC injection stop commands remain active on the terminal block. If the speed controller / display module link is broken, the speed controller locks on an SLF fault.</p>	no

Configuration

I/O assignment menu **I - ▢ -** (continued)

Code	Assignment	Factory setting
- L 12 - L 13 - L 14	Logic inputs no : not assigned rrS : reverse rotation (2 operating directions) rP2 : ramp switching (1) JOG : "step by step" operation (1) PS2 : 2 preset speeds PS4 : 4 preset speeds (1) PS8 : 8 preset speeds (1) nSt : freewheel stop. Function active when the input is powered down. dCl : DC injection braking IdC, peak limited at 0.5 ItH after 5 seconds if the command is maintained FSt : fast stop. Function active when the input is powered down. FLO : forced local mode rSt : fault reset rFC : reference switching (when the input is powered up the speed reference is AIC/AI2 or that generated by the PI function if it is assigned) • If tCC = 3C, LI2 = For (forward), cannot be reassigned. • If a function is already assigned to another input it still appears, but its storage using (ENT) is inactive. • The 4 or 8 preset speeds must be configured in the following order of assignment : PS2 then PS4 then PS8. They must be cancelled in the reverse order (see Configurable I/O Application Functions)	rrS PS2 PS4
- R 1C	Analog input AIC / AI2 no : not assigned. SAI : summing with AI1 PII : PI regulator feedback, the PI reference being internal adjustment parameter rPI (1) PIA : PI regulator feedback, the PI reference being automatically assigned to AI1 (1) • SAI can only be assigned if a logic input is assigned to rFC (reference switching). • PII and PIA cannot be assigned if a logic input is assigned to JOG or to PS2. • If a logic input Llx is assigned to rFC (reference switching) and AIC is assigned to PII or PIA, the speed reference is taken on AI1 if Llx = 0 and is the output of PI if Llx = 1.	SAI

(1) Assigning this function displays the corresponding settings in the SEt- menu so that they can be adjusted.

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Configuration

I/O assignment menu I - 0 - (continued)

FRANÇAIS	Code	Assignment	Factory setting
	- CrL - CrH	<p>Minimum value on input AIC, adjustable from 0 to 20 mA. Maximum value on input AIC, adjustable from 4 to 20 mA. These two parameters are used to configure the input for 0-20 mA, 4-20 mA, 20-4 mA, etc.</p> <p>Frequency</p> <p>If the input used is AI2, these parameters remain proportionally active : 4 mA → 2 V 20 mA → 10 V For a 0 - 10 V input, configure CrL at 0 and CrH at 20.</p>	4 mA 20 mA
	- rD	<p>Analog output no : not assigned. OCr : motor current. 20 mA corresponds to twice the nominal motor thermal current ItH. rFr : motor frequency. 20 mA corresponds to the maximum frequency tFr. OLO : motor torque. 20 mA corresponds to twice the nominal motor torque. OPr : power supplied by the speed controller. 20 mA corresponds to twice the nominal motor power.</p>	rFr
	- rD L	<p>Analog output 0 : 0-20 mA configuration 4 : 4-20 mA configuration</p>	0

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Configuration

I/O assignment menu **I - ▢ -** (continued)

Code	Assignment	Factory setting
- r 2	Relay R2 no : not assigned FtA : frequency threshold reached. The contact is closed if the motor frequency is greater than or equal to the threshold set by Ftd (1). CtA : current threshold reached. The contact is closed if the motor current is greater than or equal to the threshold set by Ctd (1). SrA : speed reference reached. The contact is closed if the motor frequency is greater than or equal to the speed reference. tSA : thermal threshold reached. The contact is closed if the motor thermal state is greater than or equal to the threshold set by ttd (1).	SrA
- R d d	Address of the speed controller when it is controlled via the serial link. Adjustable from 1 to 31.	1
- b d r	Serial link transmission speed : 9.6 = 9600 bits / s or 19.2 = 19200 bits / s Modification of this parameter is only taken into account after the speed controller has been powered down then powered up.	19.2

(1) Assigning this function displays the corresponding settings in the SEt- menu so that they can be adjusted.

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Configuration

Drive menu

The parameters can only be modified with the speed controller stopped and locked, except for Frt, SFr, nrd and SdS, which can be adjusted with the controller running.

Drive performance can be optimized by :


- entering the values given on the rating plate,
- performing an auto-tune operation (on a standard asynchronous motor)

Code	Assignment	Adjustment range	Factory setting
- Un5	Nominal motor voltage marked on the rating plate. The adjustment range depends on the speed controller model : ATV28...M2 ATV28...N4	200 to 240V 380 to 500 V	230 V 400 V if bFr = 50 460 V if bFr = 60
- F r 5	Nominal motor frequency marked on the rating plate.	40 to 400 Hz	50 / 60Hz acc. to bFr
- tUn	Auto-tuning Only active for V/F ratios : n and nLd (Uft parameter) - no (factory parameters of standard IEC motors) - donE (auto-tuning already done) : use the parameters of the auto-tune which has already been done - YES : starts auto-tuning When auto-tuning is complete, rdY is displayed. On returning to tUn, donE is displayed. If the fault tnF appears, check that the motor is connected correctly. If the connection is correct, the motor is not suitable : use the L or the P ratio (Uft parameter). Caution : Auto-tuning will only be performed if no command has been activated. If a "freewheel" or "fast stop" function is assigned to a logic input, this input must be set to 1 (active at 0).	no-donE-YES	no
- tFr	Maximum output frequency	40 to 400 Hz	60 / 72 Hz (1.2 x bFr)

Configuration

Drive menu **d r L -** (continued)

Code	Assignment	Adjustment range	Factory setting
- U F L	Selection of the type of voltage / frequency ratio - L : constant torque for motors connected in parallel or special motors - P : variable torque - n : sensorless flux vector control for constant torque applications - nLd : energy saving, for variable torque applications	L - P - n - nLd	n
- b r A	Activating this function automatically increases the deceleration time, if this has been set at too low a value for the inertia of the load, thus avoiding the controller going into ObF fault. no : function inactive. YES : function active. This function may not be compatible with positioning on a ramp or with the use of a braking resistor.	no - YES	YES
- F r L	Ramp switching frequency When the output frequency becomes greater than Frt, the ramp times taken into account are AC2 and dE2. If Frt = 0, the function is inactive. This parameter does not appear if a logic input is assigned to the ramp switching function rP2.	0 to HSP	0 Hz
- S F r	Switching frequency The switching frequency can be adjusted to reduce the noise generated by the motor. Above 4 kHz, the speed controller output current must be derated : • up to 12 kHz : derated by 10 % • above 12 kHz : derated by 20 %.	2 to 15 kHz	4.0
- n r d	This function randomly modulates the switching frequency to reduce the motor noise. no : function inactive. YES : function active.	no - YES	YES

 Parameter can be adjusted during operation.

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Configuration


Drive menu **d r C -** (continued)

	Code	Assignment	Adjustment range	Factory setting
FRANÇAIS	- R t r	Automatic restart, after locking on a fault, if the fault has disappeared and the other operating conditions permit the restart. The restart is performed by a series of automatic attempts separated by increasingly long waiting periods : 1 s, 5 s, 10 s, then 1 min for the following attempts. If the restart has not taken place after 6 min, the procedure is aborted and the speed controller remains locked until it is powered down then powered up. The following faults permit this function : OHF, OLF, USF, ObF, OSF, PHF, OPF, SLF. The speed controller fault relay remains activated if this function is active. The speed reference and the operating direction must be maintained. This function can only be used in 2-wire control (tCC = 2C).  Check that any accidental start does not present any danger to personnel or equipment. - no : Function inactive - YES : Function active - USF : Function only active for the USF fault	no - YES - USF	no
ENGLISH	- D P L	Enables the motor phase failure fault. (Inhibition of the fault if a switch is used between the speed controller and the motor : no). no : function inactive. YES : function active.	no - YES	YES
DEUTSCH	- I P L	Enables the line supply phase failure fault. no : function inactive. YES : function active. This parameter does not exist on the ATV28HU09M2, U18M2, U29M2 and U41M2 for a single phase line supply. The fault is only detected if the motor is on-load (around 0.7 times the nominal power). At low load, single phase operation cannot be damaged.	no - YES	YES
ESPAÑOL	- S t P	Controlled stop on loss of line supply : Controls the stopping of the motor when there is a loss of line supply, following a ramp which automatically adapts according to the kinetic energy restored. no : function inactive. YES : function active.	no - YES	no

Configuration

Drive menu **d r C -** (continued)

Code	Assignment	Adjustment range	Factory setting
- F L r	Enables a smooth restart after the following events : - loss of line supply or power off - fault reset or automatic restart - freewheel stop or injection stop with logic input no : function inactive. YES : function active.	no - YES	no
- d r n	Lowest the tripping threshold of the USF fault in order to operate on a line supply with 40% voltage drops. no : function inactive. YES : function active :  <ul style="list-style-type: none"> • A line choke must be used. • The performance of the speed controller can no longer be guaranteed when operating at undervoltage. 	no - YES	no
- 5 d 5	Scale factor for the display parameter SPd (-SUP menu), used to scale a value in proportion to the output frequency, the machine speed or the motor speed. For example : 4-pole motor, 1500 rpm at 50 Hz : -SdS = 30 -SPd = 1500 at 50 Hz	1 to 200	30
- F C 5	Return to factory settings no : no YES : the next display will be InIt then bFr (start of the menus)	no - YES	no

 Parameter can be adjusted during operation.

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Settings

Adjust menu **S E L -**



These adjustment parameters can be modified with the speed controller stopped or running. Ensure that changes made during operation do not present any danger. Changes should preferably be made with the speed controller stopped.

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Code	Assignment	Adjustment range	Factory setting
- L F r	Speed reference via the display module. This parameter appears with the remote display module option if control of the speed controller via the display module is enabled : LCC parameter in I-O- menu.	LSP to HSP	
- r P I	PI reference This parameter appears if analog input AIC/AI2 is assigned to the internal PI function (AIC = PII).	0.0 to 100.0 %	0.0
- R C C	Acceleration and deceleration ramp times.	0.0 to 3600 s	3 s
- d E C	Defined to range from 0 to nominal motor frequency (FrS)	0.0 to 3600 s	3 s
- R C 2	2nd acceleration ramp time	0.0 to 3600 s	5 s
- d E 2	2nd deceleration ramp time	0.0 to 3600 s	5 s
	These parameters are accessible if the ramp switching threshold (Frt parameter in the drC- menu) is other than 0 Hz or if a logic input is assigned to ramp switching.		
- L S P	Low speed	0 to HSP	0 Hz
- H S P	High speed : ensure that this setting is appropriate for the motor and the application.	LSP to tFr	bFr
- I t H	Current used for the motor thermal protection. Set ItH to the nominal current marked on the motor rating plate. To disable thermal protection, increase the value to the maximum (ntH displayed).	0.50 to 1.15 In (1)	In (1)

(1) In is the nominal speed controller current shown in the catalogue and on the speed controller rating plate.

The parameters in shaded boxes appear if the corresponding functions have been configured in the drC- or I-O- menus.

Settings

Adjust menu **5 E L -** (continued)

Code	Assignment	Adjustment range	Factory setting
- U F r	Optimizes the torque at very low speed	0 to 100 %	20
- S L P	Adjusts the slip compensation around the value set by the nominal motor speed. This parameter only appears if parameter U Ft = n in the drC- menu.	0.0 to 5.0 Hz	According to controller rating
- F L G	Frequency loop gain Linked to the inertia and the resistive torque of the driven mechanism : - machines with high resistive torque or high inertia : gradually reduce the gain in the range 33 to 0 - machines with fast cycles, low resistive torque and low inertia : gradually increase the gain in the range 33 to 100. Too high a gain may result in operating instability.	0 to 100 %	33
- I d C	Level of DC injection braking current After 5 seconds the injection current is peak limited at 0.5 Ith if it is set at a higher value.	0.1 Ith to Ith (1)	0.7 Ith (1)
- t d C	DC injection standstill braking time If the time is increased to 25.5 s, "Cont" is displayed. The DC injection is then continuous to standstill.	0 to 25.4 s Cont.	0.5 s
- J P F	Skip frequency prevents prolonged operation at a frequency range of 2 Hz around JPF. This function prevents a critical speed which leads to resonance. Setting the function to 0 renders it inactive.	0 to HSP	0 Hz
- J O G	Jog operating frequency	0 to 10 Hz	10 Hz
- r P G	PI regulator proportional gain	0.01 to 100	1
- r I G	PI regulator integral gain	0.01 to 100 / s	1 / s
- F b S	PI feedback multiplication coefficient	0.1 to 100	1
- P I C	Reversal of the direction of correction of the PI regulator : no : normal, YES : reverse	no - YES	no

(1) Ith is the nominal speed controller current shown in the catalogue and on the speed controller rating plate.

The parameters in shaded boxes appear if the corresponding functions have been configured in the drC- or I-O- menus.

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Settings

Adjust menu **5 E L -** (continued)

FRANÇAIS

Code	Assignment	Adjustment range	Factory setting
- 5 P 2	2 nd preset speed	LSP to HSP	10 Hz
- 5 P 3	3 rd preset speed	LSP to HSP	15 Hz
- 5 P 4	4 th preset speed	LSP to HSP	20 Hz
- 5 P 5	5 th preset speed	LSP to HSP	25 Hz
- 5 P 6	6 th preset speed	LSP to HSP	30 Hz
- 5 P 7	7 th preset speed	LSP to HSP	35 Hz
- F L d	Motor frequency threshold beyond which the contact on relay R2 closes	0 to HSP	bFr
- L L d	Current threshold beyond which the contact on relay R2 closes	0.1 I _N to 1.5 I _N (1)	1.5 I _N (1)
- L L d	Motor thermal state threshold beyond which the contact on relay R2 closes	1 to 118 %	100 %
- L L 5	Low speed operating time Following operation at LSP for a defined period, a motor stop is requested automatically. The motor restarts if the frequency reference is greater than LSP and if a run command is still present. Caution : value 0 corresponds to an unlimited period	0 to 25.5 s	0 (no time limit)

ENGLISH

(1) I_N is the nominal speed controller current shown in the catalogue and on the speed controller rating plate.

The parameters in shaded boxes appear if the corresponding functions have been configured in the drC- or I-O- menus.

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Settings


Display menu **SUP-** (choice of parameter to be displayed during operation, view the last fault, speed controller software version and access code)

The display chosen is saved by :

– Pressing the ENT key once: the choice is temporary, it will be cleared at the next power up.

– Pressing the ENT key twice : the choice is permanent. The second press on ENT exits the SUP- menu.

The following parameters can be accessed, with the speed controller stopped or running.

Code	Parameter	Unit
- F r H	Display the frequency reference	Hz
- r F r	Display the output frequency applied to the motor	Hz
- S P d	Display the value calculated by the speed controller (rFr x SdS)	–
- L C r	Display the motor current	A
- P P r	Display the power supplied by the motor, estimated by the speed controller. 100 % corresponds to the nominal speed controller power.	%
- U L n	Display the line voltage	V
- t H r	Display the motor thermal state : 100% corresponds to the nominal thermal state. Above 118%, the speed controller triggers an OLF fault (motor overload).	%
- t H d	Display the speed controller thermal state : 100% corresponds to the nominal thermal state. Above 118%, the speed controller triggers an OHF fault (drive overheat). It can be reset below 70%.	%
- L F t	View the last fault which appeared. If there has been no fault, the display shows : noF.	–
- C P U	Speed controller software version	–
- C D d	<p>Parameter which can only be seen and accessed using a remote display module option or PC software. Access code : 0 to 9999. Value 0 (factory setting) does not prevent access. All other values lock access to the SEt-, drC- and I-O- menus.</p> <p>To lock access to the speed controller, the code can be incremented using (▲ ▼) then saved using (ENT).</p> <div style="display: flex; align-items: center;">  <p> <ul style="list-style-type: none"> • Do not forget to make a note of the code, as once it has been saved, it is no longer displayed. • If a code other than 0 is configured, access to the menus requires a remote display module option or PC software. </p> </div> <p>To access the menus on a speed controller which is locked by a code, the code can be incremented using (▲ ▼) and confirmed with (ENT) :</p> <ul style="list-style-type: none"> • If the correct access code is displayed, it flashes, and code 0 can then be configured in order to access the menus. • If an incorrect code is displayed, the speed controller returns to the initial display (rdY). 	

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Settings

Display menu **5 U P -** (continued)

	Code	Parameter
FRANÇAIS	- - - -	Display of speed controller status : the operating phase of the motor or a fault. <ul style="list-style-type: none">- Init : Initialization sequence- rdY : Speed controller ready- 43.0 : Display of the frequency reference- dcb : DC injection braking in progress- rtrY : Automatic restart in progress- nSt : Freewheel stop command- FSt : Fast stop command
ENGLISH		
DEUTSCH		
ESPAÑOL		

Maintenance

Servicing

The Altivar 28 does not require any preventative maintenance. It is nevertheless advisable to carry out the following operations regularly :

- Check the condition and tightness of connections.
- Check that the temperature around the unit remains at an acceptable level and that the ventilation is effective (average service life of fans : 3 to 5 years depending on operating conditions).
- Remove any dust from the speed controller.

Assistance with maintenance

If there is a problem when starting up or during operation, firstly check that the recommendations relating to the environment, mounting and connections have been followed.

The first fault detected is memorized and displayed on the screen : the speed controller locks and fault relay R1 is tripped.

Clearing faults

Switch off the speed controller power supply in the event of a fault which cannot be reset.

Wait for the LED and the display to go off completely.

Find the cause of the fault in order to correct it.

Restore the power supply : this will clear the fault if it has disappeared.

In some cases there may be an automatic restart after the fault has disappeared if this function has been programmed.

Display menu :

This is used to prevent and find the causes of faults by displaying the speed controller status and its current values.

Spares and repairs :

Consult Schneider Electric product support.

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Faults - Causes - Remedies

Speed controller does not start, no fault displayed

• The assignment of the "Fast stop" or "Freewheel stop" functions will prevent the controller from starting if the corresponding logic inputs are not powered up. The ATV-28 then displays "nSt" in freewheel stop mode and "FSt" in fast stop mode. This is normal since these functions are active at zero so that the controller will be stopped safely if there is a wire break.

On power-up or a manual fault reset or after a stop command, the motor cannot be powered up until the "forward", "reverse" and "DC injection stop" commands have been reset. If they have not been reset, the speed controller will display "rdY" but will not start. If the automatic restart function is configured (parameter Atr in the drC menu), these commands are taken into account without a reset being necessary.

Faults which cannot be reset automatically

The cause of the fault must be corrected before resetting by powering down and then powering up.

Fault	Probable cause	Remedy
- OC F overcurrent	- ramp too short - inertia or load too high - mechanical blocking	- Check the settings. - Check the motor/speed controller/load sizing. - Check the state of the mechanism.
- SC F motor short-circuit	- short-circuit or earthing at the speed controller output	- Check the cables connecting the speed controller to the motor, and the insulation of the motor.
- IF F internal fault	- internal fault	- Check the environment (electromagnetic compatibility). - Check that the "local control" option has not been connected or disconnected with the controller powered up. - Send the speed controller to be checked/repared.
- LT F auto-tuning fault	- special motor or motor whose power is not suitable for the speed controller	- Use the L or the P ratio.
- EE F internal fault	- internal fault	- Send the speed controller to be checked/repared.

Faults - Causes - Remedies

Faults which can be reset with the automatic restart function, after the cause has disappeared

Fault	Probable cause	Remedy
- OHF speed controller overload	- I^2t too high or - speed controller temperature too high	- Check the motor load, the speed controller ventilation and the environment. Wait for the controller to cool before restarting.
- OLF motor overload	- tripped by I^2t motor being too high	- Check the setting of the motor thermal protection, check the motor load. Wait for the controller to cool before restarting.
- OSF overvoltage in steady state or during acceleration	- line voltage too high - disturbed line supply	- Check the line voltage.
- USF undervoltage	- line supply too low - transient voltage dip - damaged load resistor	- Check the voltage and the voltage parameter. - Reset. - Send the speed controller to be checked/repared.
- ObF overvoltage during deceleration	- braking too sudden or driving load	- Increase the deceleration time. - Install a braking resistor if necessary. - Activate the brA function if it is compatible with the application.
- PHF line supply phase failure	- speed controller incorrectly supplied or a fuse blown - transient phase fault - 3-phase ATV28 used on a single phase line supply	- Check the power connection and the fuses. - Reset. - Use a 3-phase line supply.
- OPF motor phase failure	- loss of a phase at the speed controller output	- Check the connections from the speed controller to the motor.
- SLF serial link failure	- incorrect connection on the speed controller connector	- Check the serial link connection on the speed controller connector.

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Configuration/Settings Tables

Speed controller ATV-28.....
 Optional customer identification no.:.....
 Software version (CPU parameter in the SUP menu) :
 Optional access code :

Menu **I - 0 -** (inputs/outputs)

Code	Factory setting	Customer setting	Code	Factory setting	Customer setting
- LC	2C		- L 12	rrS	
- L 13	PS2		- L 14	PS4	
- R 1C	SAI		- CrL	4 mA	mA
- CrH	20 mA	mA	- R 0	rFr	
- R 0t	0 mA	mA	- r 2	SrA	
- R dd	1		- b dr	19.2	


Menu **dr C -** (drive)

Code	Factory setting	Customer setting	Code	Factory setting	Customer setting
- Un 5	V	V	- Fr 5	Hz	Hz
- t Un	no		- t Fr	Hz	Hz
- UF t	n		- b r R	YES	
- Fr t	0 Hz	Hz	- 5 Fr	4.0 kHz	kHz
- n r d	YES		- R t r	no	
- 0 PL	YES		- 1 PL	YES	
- 5 t P	no		- FL r	no	
- dr n	no		- 5 d 5	30	

Configuration/Settings Tables

Menu **5 E E -** (settings)

Code	Factory setting	Customer setting	Code	Factory setting	Customer setting
- r P I	0.0 %	Control	- r D E	For	Control
- R C C	3.0 s	s	- d E C	3.0 s	s
- R C 2	5.0 s	s	- d E 2	5.0 s	s
- L S P	0.0 Hz	Hz	- H S P	Hz	Hz
- I E H	A	A	- U F r	20 %	%
- S L P	Hz	Hz	- F L G	33 %	%
- I d C	A	A	- E d C	0.5 s	s
- J P F	0 Hz	Hz	- J O G	10 Hz	Hz
- r P G	1		- r I G	1 /s	/s
- F b S	1		- P I C	no	
- S P 2	10 Hz	Hz	- S P 3	15 Hz	Hz
- S P 4	20 Hz	Hz	- S P 5	25 Hz	Hz
- S P 6	30 Hz	Hz	- S P 7	35 Hz	Hz
- F E d	Hz	Hz	- C E d	A	A
- E E d	100 %	%	- E L 5	0.0 s	s

 The parameters in shaded boxes appear if the corresponding functions have been configured in the drC- or I-O- menus.

FRANÇAIS

ENGLISH

DEUTSCH

ESPAÑOL