Altivar® 31

Adjustable Speed Drive Controllers
Variadores de velocidad ajustable
Variateurs de vitesse

Start-Up Guide
Guía de puesta en marcha
Guide de mise en service

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Altivar® 31 Adjustable Speed Drive Controllers
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ENGLISH

ESPAÑOL

FRANÇAIS

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BEFORE YOU BEGIN

Read and follow these instructions before beginning any procedure with this drive controller.

⚠ DANGER

HAZARDOUS VOLTAGE

- Read and understand this start-up guide before installing or operating the Altivar 31 drive controller. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- For more information on Altivar 31 drive controllers, see the *Altivar 31 Installation Manual*, VVDED303041US, and the *Altivar 31 Programming Manual*, VVDED303042US. Both manuals are provided on the CD-ROM shipped with the drive controller. They are also available from www.us.SquareD.com or from your Schneider Electric representative.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA and PC or across the DC capacitors.
- Install and close all covers before applying power or starting and stopping the drive controller.
- Before servicing the drive controller:
  - — Disconnect all power.
  - — Place a “DO NOT TURN ON” label on the drive controller disconnect.
  - — Lock the disconnect in the open position.
- Disconnect all power including external control power that may be present before servicing the drive controller. WAIT 3 MINUTES for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 19 to verify that the DC voltage is less than 45 Vdc. The drive controller LEDs are not accurate indicators of the absence of DC bus voltage.

Electric shock will result in death or serious injury.

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> **⚠ CAUTION**
>
> **DAMAGED EQUIPMENT**
>
> Do not operate or install any drive controller that appears damaged.
>
> **Failure to follow this instruction can result in injury or equipment damage.**

About this Document

This Start-Up Guide describes the minimum steps necessary for bringing an Altivar 31 (ATV31) drive controller into service. The CD-ROM supplied with the drive controller contains the following additional documentation:

- *Altivar 31 Installation Manual*, VVDED303041US
- *Altivar 31 Programming Manual*, VVDED303042US

The operations, parameters, and faults described in this guide assume factory configuration in the CtL-, FUn-, FLt-, and CON- menus. The drive controller may behave differently if modifications are made to the factory settings in these menus.

Consult the *ATV31 Programming Manual* for the CtL-, FUn-, FLt-, and CON- menus and for complete programming information. Consult the *ATV31 Installation Manual* for complete installation instructions.

NOTE: Throughout this guide, a dash appears after menu codes to differentiate them from parameter codes. For example, SEt- is a menu, but ACC is a parameter.

PRELIMINARY RECOMMENDATIONS

Precautions

Before powering up and configuring the drive controller, read and observe the following precautions.

CAUTION

INCOMPATIBLE LINE VOLTAGE

Before powering up and configuring the drive controller, ensure that the line voltage is compatible with the supply voltage range of the drive controller. The drive controller may become damaged if the line voltage is not compatible.

Failure to follow this instruction can result in equipment damage.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Before powering up and configuring the drive controller, ensure that the logic inputs are switched off (State 0) to prevent unintended starting.
- An input assigned to the run command may cause the motor to start immediately on exiting the configuration menus.

Failure to follow these instructions will result in death or serious injury.

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Adjustment and Extension of Functions

⚠DANGER

UNINTENDED EQUIPMENT OPERATION

- Ensure that changes to the current operating settings do not present any danger.
- It is recommended that changes to the current operating settings be made with the drive controller stopped.

Failure to follow these instructions will result in death or serious injury.

The following menus are covered in this start-up guide:

- SEt- Settings Menu (page 31)
- drC- Drive Control Menu (page 35)
- I-O- I/O Menu (page 39)
- SUP- Display Menu (page 41)

If necessary, use the display to modify the drive configuration and extend the functions. It is always possible to **return to the factory settings** by setting the FCS parameter to “InI” in the drC- menu. See page 38.

Power Up After a Manual Fault Reset or Stop Command

With the factory configuration, when the drive controller is powered up after a manual fault reset or a stop command, the forward and reverse commands must be reset for the drive controller to start. If they have not been reset, the drive controller will display “nSt” and will not start.

Test on a Low Power Motor or Without a Motor

With the factory configuration, motor phase loss detection is active. To check the drive controller in a test or maintenance environment without having to switch to a motor with the same rating as the drive controller, disable motor phase loss detection and configure the voltage/frequency ratio (UFt) to L, constant torque (see page 36). Refer to the *ATV31 Programming Manual* for more information.

Operation on an Impedance Grounded System

When using the drive controller on a system with an isolated or impedance grounded neutral, use a permanent insulation monitor compatible with non-linear loads.

ATV31•••M2 and N4 drive controllers feature built-in radio frequency interference (RFI) filters which have capacitors to ground. These filters can be disconnected from ground when using the drive controller on an impedance grounded system to increase the operating life of their capacitors. Refer to the *ATV31 Installation Manual* for more information.

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START-UP

1. Mount the drive controller (pages 15–18).
2. Make the following connections to the drive controller (pages 19–26):
   - Connect the grounding conductors.
   - Connect the line supply. Ensure that it is within the voltage range of the drive controller.
   - Connect the motor. Ensure that its rating corresponds to the drive controller's voltage.
3. Power up the drive controller, but do not give a run command.
4. Configure the following parameters in the SEt- menu (pages 31–34):
   - bFr (motor nominal frequency), if it is other than 50 Hz. bFr appears on the display the first time the drive controller is powered up. It can be accessed in the drC- menu (page 35) anytime.
   - ACC (acceleration) and dEC (deceleration)
   - LSP (low speed when the reference is zero) and HSP (high speed when the reference is at its maximum)
   - ItH (motor thermal protection)
   - SP2, SP3, SP4 (preset speeds 2, 3, and 4)
5. If the factory configuration is not suitable for the application, configure the parameters and I/O assignments in the drC- (page 35) and I-O- (page 39) menus.
6. Remove power from the drive controller, follow the bus voltage measurement procedure on page 19, then connect the control wiring to the logic and analog inputs.
7. Power up the drive controller, then issue a run command via the logic input (see page 26).
8. Adjust the speed reference.

DIMENSIONS

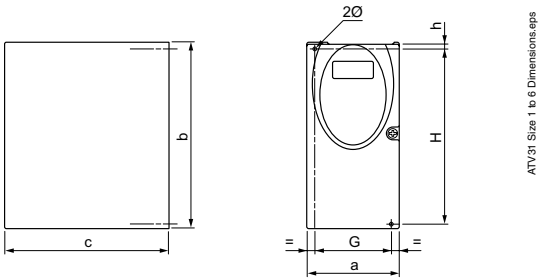

Table 1: Frame Sizes 1–6

ATV31•••••••[1]	Frame Size	a mm (in.)	b mm (in.)	c [2] mm (in.)	G [3] mm (in.)	h mm (in.)	H [3] mm (in.)	Ø mm (in.)	Weight kg (lb.)
H018M3X, H037M3X	1	72 (2.83)	145 (5.71)	120 (4.72)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	0.9 (1.99)
H055M3X, H075M3X	2	72 (2.83)	145 (5.71)	130 (5.12)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	0.9 (1.99)
H018M2, H037M2	3	72 (2.83)	145 (5.71)	130 (5.12)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.05 (2.32)
H055M2, H075M2	4	72 (2.83)	145 (5.71)	140 (5.51)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.05 (2.32)
HU11M3X, HU15M3X	5	105 (4.13)	143 (5.63)	130 (5.12)	93 (3.66)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.25 (2.76)
HU11M2, HU15M2, HU22M3X, H037N4, H055N4, H075N4, HU11N4,HU15N4, H075S6X, HU15S6X	6	105 (4.13)	143 (5.63)	150 (5.91)	93 (3.66)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.35 (2.92)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

[2] For controllers with a potentiometer and Run/Stop button, add 8 mm (0.31 in.) for the potentiometer.

[3] The values for this dimension are ±1 mm (0.04 in.).

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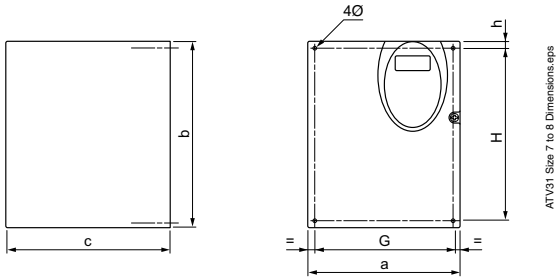

Table 2: Frame Sizes 7–9

ATV31••••••[1]	Frame Size	a mm (in.)	b mm (in.)	c [2] mm (in.)	G [3] mm (in.)	h mm (in.)	H [3] mm (in.)	Ø mm (in.)	Weight kg (lb.)
HU22M2, HU30M3X, HU40M3X, HU22N4, HU30N4, HU40N4, HU22S6X, HU40S6X	7	140 (5.51)	184 (7.24)	150 (5.91)	126 (4.96)	6.5 (0.26)	157 (6.18)	4 x 5 (0.20)	2.35 (5.19)
HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X	8	180 (7.09)	232 (9.13)	170 (6.69)	160 (6.30)	5 (0.20)	210 (8.27)	4 x 5 (0.20)	4.70 (10.39)
HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X	9	245 (9.65)	330 (13.0)	190 (7.48)	225 (8.86)	7 (1.93)	295 (11.61)	4 x 6 (0.24)	9.0 (19.89)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

[2] For controllers with a potentiometer and Run/Stop button, add 8 mm (0.31 in.) for the potentiometer.

[3] The values for this dimension are ±1 mm (0.04 in.).

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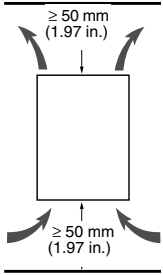
MOUNTING

Clearances



ATV31 Clearances.eps

Install the drive controller vertically, ± 10°.

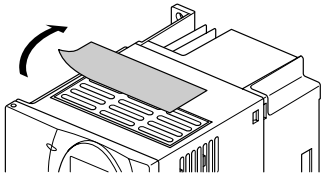
Do not place the drive controller close to heating sources.

Leave sufficient free space around the drive controller to ensure that air can circulate from the bottom to the top of the unit.

Leave a minimum of 10 mm (0.4 in.) of free space in front of the drive controller.

Removing the Protective Cover

When IP20 protection is adequate, remove the protective cover on top of the drive controller as shown below. Consult pages 16–18 to determine the type of mounting appropriate for your application before removing the protective cover from the drive controller.



ATV31Protective Cover.eps

Example: ATV31HU11M3X

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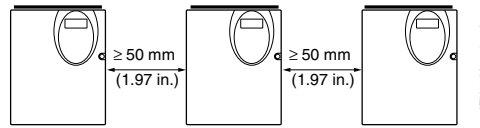
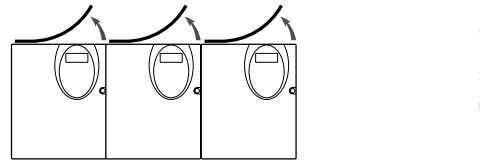
Mounting Methods

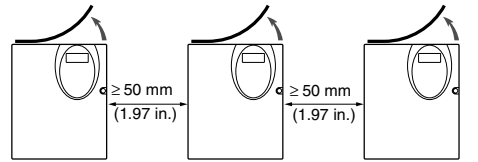
Type A Mounting Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover in place.



Type B Mounting Drive controllers mounted side-by-side, with the protective cover removed (degree of protection becomes IP20).



Type C Mounting Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover removed (degree of protection becomes IP20).



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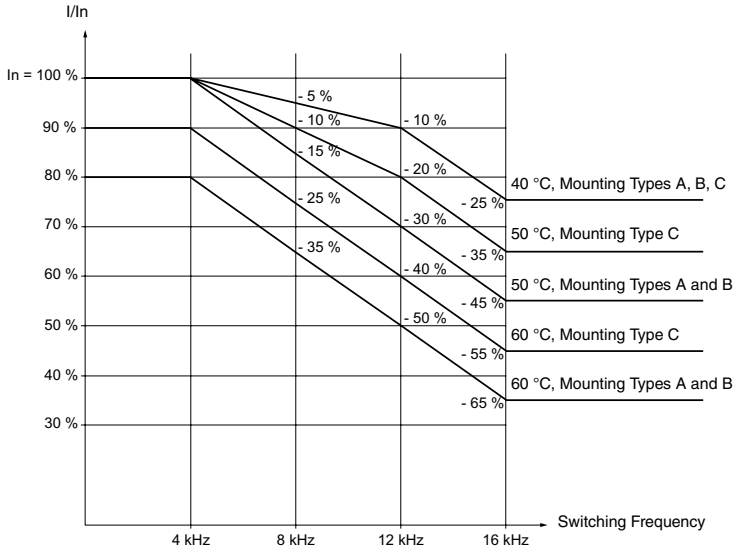
Derating Curves

The figure below illustrates derating curves for the drive current (In) as a function of temperature, switching frequency, and type of mounting. For intermediate temperatures, such as 55 °C, interpolate between two curves.

ATV31 drive controllers can be used at altitudes up to 3,300 ft. (1000 m) without derating. Derate by 1% for each additional 330 ft (100 m).



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Minimum Air Flow Rates

If you are installing the drive controller in an enclosure, provide an air flow at least equal to the value listed in Table 3 for your drive controller.

Table 3: Minimum Air Flow Rates

ATV31••••••• [1]	Flow Rate	
	m^3/hour	CFM
H018M2, H037M2, H055M2, H018M3X, H037M3X, H055M3X, H037N4, H055N4, H075N4, HU11N4 H075S6X, HU15S6X	18	10.6
H075M2, HU11M2, HU15M2 H075M3X, HU11M3X, HU15M3X HU15N4, HU22N4 HU22S6X, HU40S6X	33	19.4
HU22M2, HU22M3X, HU30M3X, HU40M3X HU30N4, HU40N4 HU55S6X, HU75S6X	93	54.8
HU55M3X HU55N4, HU75N4 HD11S6X	102	60.1
HU75M3X, HD11M3X, HD11N4, HD15N4 HD15S6X	168	99.0
HD15M3X	216	127.2

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

BUS VOLTAGE MEASUREMENT PROCEDURE

⚠DANGER

HAZARDOUS VOLTAGE

Read and understand the precautions on page 7 before performing this procedure.

Failure to follow these instructions will result in death or serious injury.

The bus voltage can exceed 1000 Vdc. Use appropriately rated measuring equipment when performing this procedure. To measure the bus capacitor voltage:

1. Disconnect all power from the drive controller.
2. Wait 3 minutes to allow the DC bus to discharge.
3. Measure the DC bus voltage between the PA (+) and PC (–) terminals to verify that the DC voltage is less than 45 Vdc. Refer to the *ATV31 Installation Manual* for the power terminal locations. **It may take up to 15 minutes for the DC bus voltage to discharge.**
4. If the bus capacitors are not fully discharged, contact your local Schneider Electric representative—do not service or operate the drive controller.

ELECTRICAL INSTALLATION

Ensure that the electrical installation of this drive controller conforms to the appropriate national and local codes.

- Verify that the voltage and frequency of the input supply line and the voltage, frequency, and current of the motor match the rating on the drive controller nameplate.

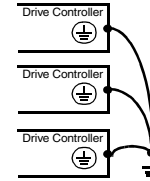
⚠DANGER

HAZARDOUS VOLTAGE

Ground equipment using the provided ground connecting point as shown in the figure on page 20. The drive controller panel must be properly grounded before power is applied.

Electric shock will result in death or serious injury.

- Verify that resistance to ground is one ohm or less. Ground multiple controllers as shown to the right. Do not loop the ground cables or connect them in series.



- Provide overcurrent protection. To achieve the short-circuit current rating listed on the drive controller nameplate, install the line power fuses recommended on the drive controller nameplate.

⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The National Electrical Code requires branch circuit protection. Use the fuses recommended on the drive controller nameplate to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the drive controller short-circuit current rating listed on the drive controller nameplate.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

- Do not use mineral-impregnated cables. Select motor cabling with low phase-to-phase and phase-to-ground capacitance.
- Motor cables must be at least 0.5 m (20 in.) long.
- Do not run control, power, or motor wiring in the same conduit. Do not run motor wiring from different drive controllers in the same conduit. Separate metallic conduit carrying power wiring from metallic conduit carrying control wiring by at least 8 cm (3 in.). Separate non-metallic conduits or cable trays used to carry power wiring from metallic conduit carrying control wiring by at least 31 cm (12 in.). Always cross power and control wiring at right angles.

⚠ WARNING

IMPROPER WIRING CONNECTIONS

- The drive controller will be damaged if input line voltage is applied to the output terminals (U, V, W).
- Check the power connections before energizing the drive controller.
- If replacing another drive controller, verify that all wiring connections to the ATV31 drive controller comply with all wiring instructions in this manual.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

- Do not immerse motor cables in water.
- Do not use lightning arrestors or power factor correction capacitors on the output of the drive controller.
- Equip all inductive circuits near the drive controller (such as relays, contactors, and solenoid valves) with electrical noise suppressors, or connect them to a separate circuit.

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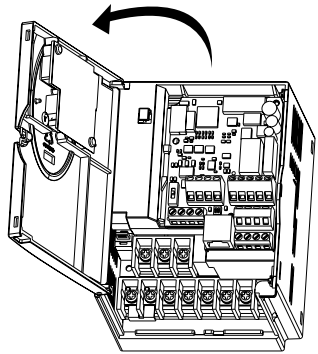
WIRING

Access to Terminals

To access the terminals, open the cover as shown below.



ATV31 Terminals.eps

Example ATV31HU11M2

Power Terminals

Connect the power terminals before connecting the control terminals.

Table 4: Power Terminal Characteristics

ATV31•••••••[1]	Maximum Connection Capacity		Tightening Torque in N•m (lb-in)
	AWG	mm^2	
H018M2, H037M2, H055M2, H075M2, H018M3X, H037M3X, H055M3X, H075M3X, HU11M3X, HU15M3X	14	2.5	0.8 (7.08)
HU11M2, HU15M2, HU22M2, HU22M3X, HU30M3X, HU40M3X, H037N4, H055N4, H075N4, HU11N4,HU15N4, HU22N4, HU30N4, HU40N4 H075S6X, HU15S6X, HU22S6X, HU40S6X	10	5	1.2 (10.62)

Table 4: Power Terminal Characteristics (Continued)

ATV31•••••••[1]	Maximum Connection Capacity		Tightening Torque in N•m (lb-in)
	AWG	mm^2	
HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X	6	16	2.2 (19.47)
HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X	3	25	4 (35.40)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

Table 5: Power Terminal Functions

Terminal	Function	On ATV31 Drive Controllers
⏚	Ground terminal	All ratings
R/L1 S/L2	Power supply	ATV31••••M2 [1]
R/L1 S/L2 T/L3		ATV31••••M3X [1] ATV31••••N4 [1] ATV31••••S6X [1]
PO	DC bus + polarity	All ratings
PA/+	Output to braking resistor (+ polarity)	All ratings
PB	Output to braking resistor	All ratings
PC/-	DC bus - polarity	All ratings
U/T1 V/T2 W/T3	Outputs to the motor	All ratings

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

NOTE: Never remove the common link between PO and PA/+.

Control Terminals

Table 6: Control Terminal Characteristics

Terminal	Function	Electrical characteristics
R1A R1B R1C	R1A is a N.O. contact. R1B is a N.C. contact. R1C is common. R1 is a programmable relay, factory set as a fault relay. As a fault relay, R1A is closed and R1B is open when the controller is powered with no fault.	• Min. switching capacity: 10 mA for 5 V c • Max. switching capacity on a resistive load (power factor = 1 and L/R time constant = 0 ms): 5 A for 250 V a and 30 V c • Max. switching capacity on an inductive load (power factor = 0.4 and L/R time constant = 7 ms): 1.5 A for 250 V a and 30 V c • Sampling time: 8 ms • Service life: 100,000 operations at max. switching power 1,000,000 operations at min. switching power
R2A R2C	N.O. contact of programmable relay R2	
COM	Analog I/O common	0 V
AI1	Analog voltage input	Analog input 0 to +10 V (max. safe voltage is 30 V) • Impedance: 30 kΩ • Resolution: 0.01 V, 10-bit converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms • Operation with a shielded cable: 100 m max.
10 V	Power supply for setpoint potentiometer 1 to 10 kΩ	+10 V (+ 8%, - 0%), 10 mA max, protected against short circuits and overloads
AI2	Analog voltage input	Bipolar analog input 0 to ±10 V (max. safe voltage is ±30 V) **The + or - polarity of the voltage on AI2 affects the direction of the setpoint and therefore the direction of operation.** • Impedance: 30 kΩ • Resolution: 0.01 V, 10-bit + sign converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms • Operation with shielded cable: 100 m max.

Table 6: Control Terminal Characteristics (Continued)

Terminal	Function	Electrical characteristics
AI3	Analog current input	Analog input X to Y mA; X and Y are programmable from 0–20 mA • Impedance: 250 Ω • Resolution: 0.02 mA, 10-bit converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms
COM	Analog I/O common	0 V
AOV AOC	Analog voltage output AOV or Analog current output AOC or Logic voltage output on AOC Either AOV or AOC can be assigned, but not both.	Analog output 0 to 10 V with a min. load impedance of 470 Ω or Analog output X to Y mA, with X and Y programmable from 0 –20 mA and with a max. load impedance of 800 Ω: • Resolution: 8 bits [1] • Precision: ± 1% [1] • Linearity: ± 0.2% [1] • Sampling time: 8 ms or AOC can be configured as a 24 V logic output with a min. load impedance of 1.2 kΩ.
24 V	Logic input power supply	+ 24 V protected against short circuits and overloads, min. 19 V, max. 30 V Max. available current is 100 mA.
LI1 LI2 LI3 LI4 LI5 LI6	Logic inputs	Programmable logic inputs • + 24 V power supply (max. 30 V) • Impedance: 3.5 kΩ • State 0 if the voltage difference between LI and CLI is < 5 V, State 1 if the voltage difference between LI and CLI is > 11 V • Sampling time: 4 ms
CLI	Logic input common	Refer to the *ATV31 Installation Manual* for the logic input switch.

[1] Characteristics of the digital/analog converter.

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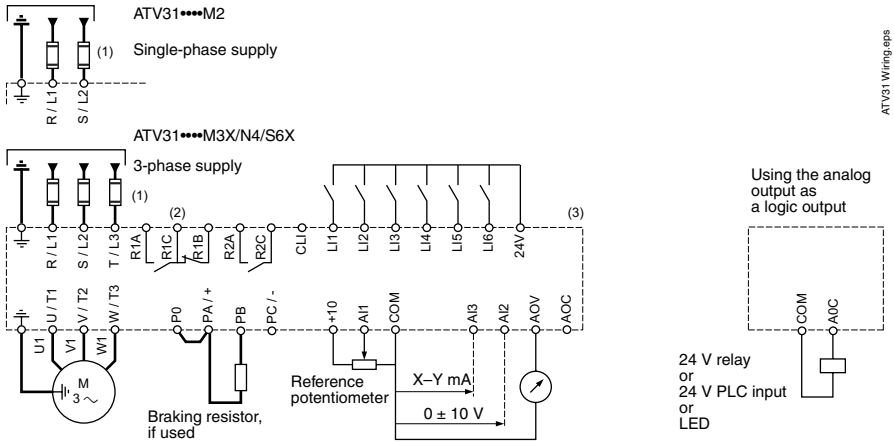
Wiring Diagram for Factory Settings



NOTE: The line supply terminals are shown at the top and the motor terminals are shown at the bottom. Connect the power terminals before connecting the control terminals. Install surge suppressors on all inductive circuits located near the drive controller or coupled to the same circuit.

(1) Refer to the drive controller nameplate for recommended fuses. Fast acting or time delay Class J fuses can be used.
(2) Fault relay contacts for remote indication of drive controller status.
(3) Internal +24 V. If an external source is used (30 V max.), connect the 0 V of the source to the COM terminal, and do not use the +24 V terminal on the drive controller.

Logic Input Switch

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The logic input switch is factory set for source logic. Do not change the position of the logic input switch without consulting the *ATV31 Installation Manual*.

Failure to follow this instruction can result in injury or equipment damage.

This switch assigns the logic input common link to 0 V, 24 V, or floating. Refer to the *ATV31 Installation Manual*, VVDED303041US, for more information.

ENGLISH

PROGRAMMING

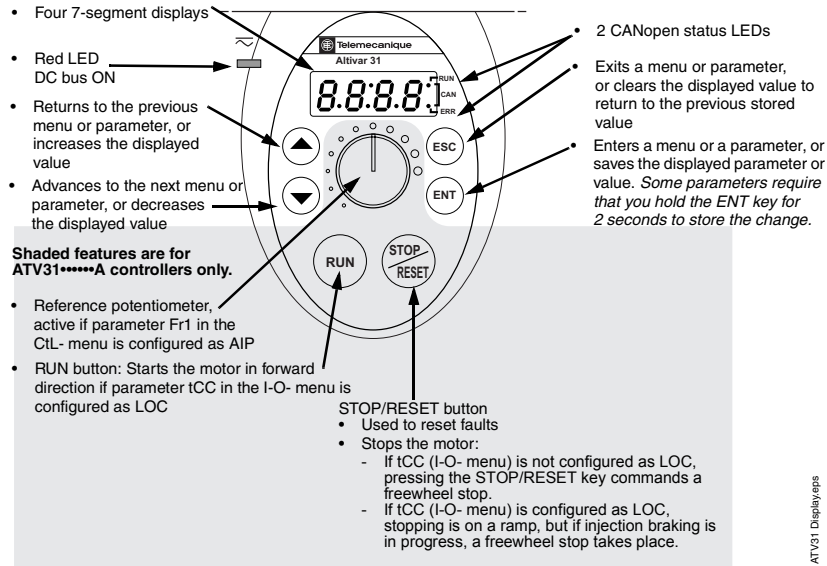
⚠DANGER

UNQUALIFIED USER

- This equipment must be installed, programmed, and serviced only by qualified personnel.
- Qualified personnel performing diagnostics or troubleshooting that requires electrical conductors to be energized must comply with NFPA 70 E - Standard for Electrical Safety Requirements for Employee Workplaces and OSHA Standards - 29 CFR Part 1910 Subpart S Electrical.

Failure to follow these instructions will result in death or serious injury.

Display Functions



- Press and hold down (longer than 2 seconds) the ▲ or ▼ keys to scroll through the data quickly.
- Pressing ▲ or ▼ does not store the selection.
- To store the selection, press the ENT key.The display flashes when a value is stored.

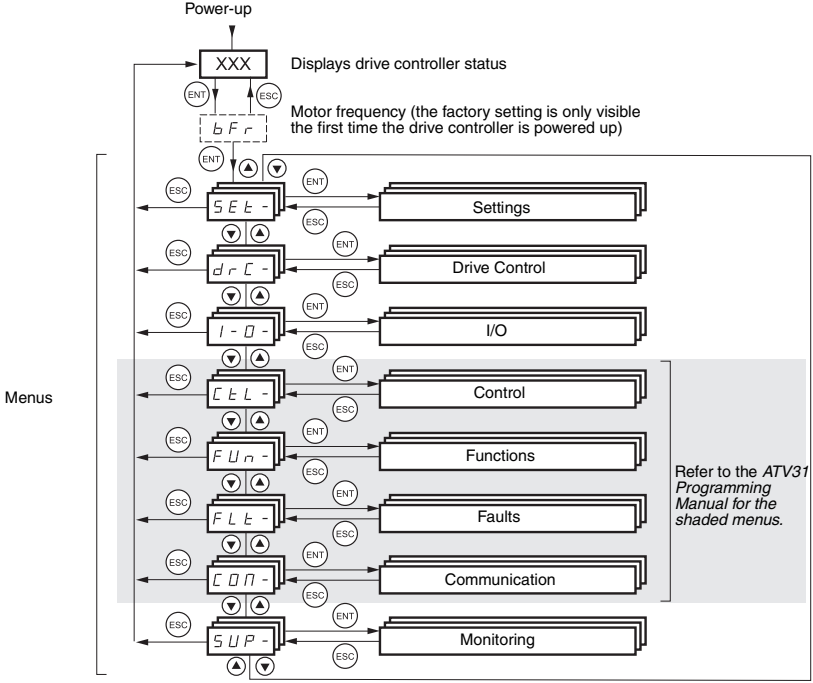
A normal display with no fault present and no run command shows:

- The value of one of the monitoring parameters (see page 41). The default display is motor frequency, for example 43.0. In current limiting mode, the display flashes.
- init: Initialization sequence
- rdY: Drive ready
- dcb: DC injection braking in progress
- nSt: Freewheel stop
- FSt: Fast stop
- tUn: Auto-tuning in progress

If a fault is present, the display flashes.

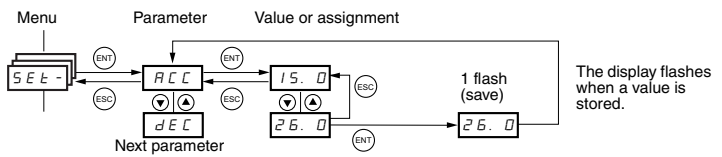
ENGLISH

Access to Menus



A dash appears after menu codes to differentiate them from parameter codes. For example, SEt- is a menu, but ACC is a parameter.

- To store the selection, press the ENT key.



bFr Parameter

Code	Description	Adjustment Range	Factory Setting
bFr	Motor frequency	50 or 60 Hz	50 Hz
	This is the first parameter displayed when the drive controller is powered up or after a factory reset. bFr can be modified at any time in the drC- menu. This parameter modifies the preset values of the following parameters: HSP (page 32), Ftd (page 34), FrS (page 35), and tFr (page 37).		

Settings Menu SEt-

⚠DANGER

UNINTENDED EQUIPMENT OPERATION

- Ensure that changes to the current operating settings do not present any danger.
- It is recommended that changes be made with the drive controller stopped.

Failure to follow these instructions will result in death or serious injury.

CAUTION

MOTOR OVERHEATING

- This drive controller does not provide direct thermal protection for the motor.
- Use of a thermal sensor in the motor may be required for protection at all speeds or loading conditions.
- Consult the motor manufacturer for the thermal capability of the motor when operated over the desired speed range.

Failure to follow these instructions can result in equipment damage.

ENGLISH

Settings Menu SEt-

Code	Assignment	Adjustment Range	Factory Setting
ACC dEC	Acceleration ramp time for the motor to go from 0 Hz to FrS (nominal frequency, see page 35). Deceleration ramp time for the motor to go from FrS to 0 Hz. Ensure that dEC is not set too low for the load.	0.0 to 999.9 s 0.0 to 999.9 s	3 s 3 s
LSP	Low speed (minimum reference)	0 to HSP	0 Hz
HSP	High speed (maximum reference). Ensure that this setting is appropriate for the motor and the application.	LSP to tFr	bFr
ItH	Current used for motor thermal protection. Set ItH to the nominal current indicated on the motor nameplate. To disable thermal protection, refer to the *ATV31 Programming Guide*.	0 to 1.15 In [1]	According to the controller rating
UFr	IR compensation/voltage boost Used to optimize torque at low speeds. Increase UFr if the torque is insufficient. To avoid operating instability, ensure that the value of UFr is not too high for a warm motor. *NOTE: Modifying UFt (page 36) will cause UFr to return to the factory setting (20%).*	0 to 100%	20%
FLG	Frequency loop gain Used only in n and nLd ratios (see page 36). This parameter adjusts the speed ramp based on the inertia of the driven load. If the value is too low, the response time is longer. If the value is too high, overspeed or operating instability can result.	0 to 100%	20%
StA	Frequency loop stability Used only in n and nLd ratios (see page 36). If the value is too low, overspeed or operating instability can result. If the value is too high, the response time is longer.	1 to 100%	20%

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Settings Menu SEt- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
SLP	Slip compensation Used only in n and nLd ratios (see page 36). Adjusts slip compensation for fine tuning of speed regulation. If slip setting < actual slip, the motor is not rotating at the correct speed in steady state. If the slip setting > actual slip, the motor is overcompensated and the speed is unstable.	0 to 150%	100
tdC	Automatic DC injection time	0.1 to 30 s	0.5 s
SdC	Level of automatic DC injection current **⚠ WARNING** **NO HOLDING TORQUE** • DC injection braking does not provide holding torque at zero speed. • DC injection braking does not function during a loss of power or during a drive controller fault. • When required, use a separate brake for holding torque. **EXCESSIVE DC INJECTION BRAKING** • Application of DC injection braking for long periods of time can cause motor overheating and damage. • Protect the motor from extended periods of DC injection braking. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**	0 to 1.2 In [1]	0.7 In [1]
tdC2	Second automatic DC injection time Refer to the *ATV31 Programming Manual* for more information.	0 to 30 s	0 s
SdC2	Second level of DC injection current Refer to the *ATV31 Programming Manual* for more information.	0 to 1.2 In [1]	0.5 In [1]
JPF	Skip frequency Skip frequency prevents prolonged operation at a frequency range of ± 1 Hz around JPF. This function avoids a critical speed which leads to resonance. Setting the function to 0 renders it inactive.	0 to 500 Hz	0 Hz

[1] In is the nominal drive controller current shown on the drive controller nameplate.

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Settings Menu SEt- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
JF2	Second skip frequency Prevents prolonged operation at a frequency range of ± 1 Hz around JF2. This function avoids a critical speed which leads to resonance. Setting the function to 0 renders it inactive.	0 to 500 Hz	0 Hz
SP2	Second preset speed	0 to 500 Hz	10 Hz
SP3	Third preset speed	0 to 500 Hz	15 Hz
SP4	Fourth preset speed	0 to 500 Hz	20 Hz
CLI	Current limiting	0.25 to 1.5 In [1]	1.5 In [1]
tLS	Low speed operating time This parameter defines a period for operation at LSP (see page 32). After the programmed time has elapsed, the motor is stopped automatically. When the frequency reference is greater than LSP and a run command is still present, the motor will restart. Setting the function to 0 renders it inactive.	0 to 999.9 s	0 (no limit)
Ftd	Refer to the *ATV31 Programming Manual*.		
ttd	Refer to the *ATV31 Programming Manual*.		
Ctd	Refer to the *ATV31 Programming Manual*.		
SdS	Refer to the *ATV31 Programming Manual*.		
SFr	Switching frequency This parameter can also be accessed in the drC- menu. See page 37.	2.0 to 16 kHz	4 kHz

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC-

With the exception of tUn, which can power up the motor, drive control parameters can only be modified when the drive controller is stopped and no run command is present. Drive controller performance can be optimized by:

- Setting the drive control parameters to the values on the motor nameplate
- Performing an auto-tune operation (on a standard asynchronous motor)

Drive Control Menu drC-

Code	Assignment	Adjustment Range	Factory Setting
bFr	Motor frequency This parameter modifies the presets of the following parameters: HSP (page 32), Ftd (page 34), FrS (page 35), and tFr (page 37)	50 or 60 Hz	50 Hz
UnS	Nominal motor voltage indicated on the nameplate	According to the drive controller rating	According to the drive controller rating
FrS	Nominal motor frequency indicated on the nameplate. The factory setting is 50 Hz, or 60 Hz if bFr is set to 60 Hz.	10 to 500 Hz	50 Hz
nCr	Nominal motor current indicated on the nameplate	0.25 to 1.5 In [1]	According to the drive controller rating
nSP	Nominal motor speed indicated on the nameplate. 0 to 9999 rpm, then 10.00 to 32.76 krpm. If nominal speed is not listed on the nameplate, refer to the *ATV31 Programming Manual*.	0 to 32760 rpm	According to the drive controller rating
COS	Motor power factor indicated on the nameplate	0.5 to 1	According to the drive controller rating

[1] In is the nominal drive controller current shown on the drive controller nameplate.

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Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
tUn	Auto-tuning Before performing an auto-tune, ensure that all of the drive control parameters (UnS, FrS, nCr, nSP, COS) are configured correctly. nO: auto-tune not performed YES: Auto-tuning is performed as soon as possible, then the parameter automatically switches to dOnE or, in the event of a fault, to nO. The tnF fault is displayed. dOnE: Auto-tuning is completed and the measured stator resistance will be used to control the motor. rUn: Auto-tuning is performed each time a run command is sent. POn: Auto-tuning is performed each time the controller is powered up. LI1 to LI5: Auto-tuning is performed when the logic input assigned to this function transitions from 0 to 1. *Note: Auto-tuning will only be performed if no run or braking command has been activated. Auto-tuning may last for 1 to 2 seconds.* ***Do not interrupt the auto-tune! Wait for the display to change to dOnE or nO.*** *During auto-tune, the motor operates at nominal current.*		nO
tUS	Auto-tuning status tAb: The default stator resistance value is used to control the motor. PEnd: Auto-tuning has been requested, but not yet performed. PrOG: Auto-tuning in progress. FAIL: Auto-tuning has failed. dOnE: The stator resistance measured by the auto-tuning function will be used to control the motor.		tAb
UFt	Selection of the voltage/frequency ratio L: Constant torque (for motors connected in parallel or special motors) P: Variable torque (pump and fan applications) n: Sensorless flux vector control (for constant torque applications) nLd: Energy savings (for variable torque applications not requiring high dynamics. This behaves in a way similar to the P ratio at no-load and the n ratio with load.) Modifying UFt will cause UFr to return to the factory setting of 20%.		n

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
nrd	Random switching frequency This function randomly modulates the switching frequency to reduce motor noise. YES: Function active nO: Function inactive		YES
SFr	Switching frequency Adjust the setting to reduce audible motor noise. If the switching frequency is set to a value higher than 4 kHz, in the event of excessive temperature rise the drive controller will automatically reduce the switching frequency. It will increase it again when the temperature returns to normal. Refer to page 17 for derating curves. SFr can also be accessed in the SEt- menu. See page 34.	2 to 16 kHz	4.0 kHz
tFr	Maximum output frequency The factory setting is 60 Hz, or 72 Hz if bFr is set to 60 Hz.	10 to 500 Hz	60 Hz
SSL	Suppression of the speed loop filter nO: The speed loop filter is active (prevents the reference from being exceeded). YES: The speed loop filter is suppressed (in position control applications, this reduces the response time but the reference may be exceeded.)		nO
SCS	Saving the parameter configurations nO: Function inactive Str1: Saves the current configuration (but not the result of auto-tuning) to EEPROM. SCS automatically switches to nO as soon as the save has been performed. Use this function to keep a backup configuration in addition to the current configuration. The drive controller ships with both the current configuration and the backup configuration initialized to the factory settings.		nO

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
FCS	Return to factory settings/Restore the configuration nO: Function inactive rECI: Replaces the current configuration with the backup configuration previously saved by SCS. rECI is visible only if the backup has been carried out. FCS automatically switches to nO as soon as this action has been performed. InI: Replaces the current configuration with the factory settings. FCS automatically switches to nO as soon as this action has been performed. *Note: For rECI and InI to be taken into account, the ENT key must be held down for 2 seconds.*		nO

[1] In is the nominal drive controller current shown on the drive controller nameplate.

I/O Menu I-O-

These parameters can only be modified when the drive controller is stopped and no run command is present.

I/O Menu I-O-

Code	Assignment	Factory Setting
tCC	Configuration of terminal block control: 2C: 2-wire control 3C: 3-wire control LOC: Local control 2-wire control (maintained contact): The state of the input (open or closed) controls running or stopping. 3-wire control (momentary contact): A forward or reverse pulse is needed to control start-up. A stop pulse is sufficient to control stopping. See the *ATV31 Programming Manual* for more information. On ATV31••••••A controllers, reconfiguring tCC to 2C reassigns the LI1 (forward) and LI2 (reverse) inputs. Although this renders the RUN button on the drive controller inactive, the potentiometer still provides the speed reference. The potentiometer can be deactivated and the speed reference assigned to analog input AI1 by configuring parameter Fr1 to AI1 in the CTL- menu. Refer to the *ATV31 Programming Manual* for more information. *Note: To change the assignment of tCC, press the ENT key for 2 seconds. This causes rrS, tCt, and all functions affecting logic inputs to return to their factory setting.*	2C ATV31••••••A: LOC
tCt	Type of 2-wire control (parameter only accessible if tCC is set to 2C) LEL: If the forward or reverse input is high when the drive controller is powered up, the drive controller will start the motor. If both inputs are high on power up, the controller will run forward. trn: The forward or reverse input must transition from low to high before the drive controller will start the motor. If the forward or reverse input is high when the drive controller is powered up, the input must be cycled before the drive controller will start the motor. PFO: Same as LEL, but the forward input has priority over the reverse input. If forward is activated while the controller is running in reverse, the controller will run forward.	trn

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I/O Menu I-O- (Continued)

Code	Assignment	Factory Setting
rrS	Reverse operation via logic input nO: Not assigned to a logic input. Reverse operation may still be commanded by another means, such as negative voltage on AI2 or a serial link command. LI2: Logic input LI2 can be accessed if tCC is set to 2C LI3: Logic input LI3 LI4: Logic input LI4 LI5: Logic input LI5 LI6: Logic input LI6	
CrL3 CrH3 AOt dO r1 r2	Refer to the *ATV31 Programming Manual.*	
SCS FCS	Identical to the drC- menu, see pages 37 and 38.	

Display Menu SUP-

Display parameters can be accessed with the drive controller running or stopped. Some functions have numerous associated parameters. To clarify programming and keep parameter lists short, these functions have been grouped together in sub-menus. Like menus, sub-menus are identified by a dash after their code, for example LIF-.

When the drive controller is running, the value of one of the monitoring parameters is displayed. The factory setting is output frequency (rFr).

To change the parameter displayed, scroll to the desired monitoring parameter and press the ENT key. To retain your selection as the new default, press and hold the ENT key again for 2 seconds. The value of this parameter will be displayed during operation, even after power to the drive controller has been cycled. If the new choice is not confirmed by pressing the ENT key a second time, the drive controller will return to the previous parameter after power is cycled.

Display Menu SUP-

Code	Description	Range
	Shaded parameters only appear if the function has been enabled.	
LFr	Frequency reference for control via integrated terminal or remote terminal.	0 to 500 Hz
rPI	Internal PI reference	0 to 100%
FrH	Frequency reference (absolute value)	0 to 500 Hz
rFr	Output frequency applied to the motor	- 500 Hz to + 500 Hz
SPd	Output value in customer units Refer to the *ATV31 Programming Manual.*	
LCr	Motor current (A)	
OPr	Motor power 100% = Nominal motor power	
ULn	Line voltage calculated from the measured voltage on the DC bus (Vac).	

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Display Menu SUP- (Continued)

Code	Description	Range
tHr	Motor thermal state 100% = Nominal thermal state 118% = OLF threshold (motor overload, see page 45)	
tHd	Drive thermal state 100% = Nominal thermal state 118% = OHF threshold (drive overload, see page 45)	
LFt	Last fault See “Troubleshooting” on page 43	
Otr	Motor torque 100% = Nominal motor torque	
rtH	Operating time Total time the motor has been powered up: 0 to 9999 (hours), then 10.00 to 65.53 (khours). Can be reset to zero by the rPr parameter in the FLt- menu (refer to the *ATV31 Programming Manual*.)	0 to 65530 hours
COd	Terminal locking code Please refer to the *ATV31 Programming Manual*.	
tUS	Auto-tuning status (refer to page 36 for auto-tuning parameters.) tAb: The default stator resistance value is used to control the motor. PEnd: Auto-tuning has been requested but not yet performed. PrOG: Auto-tuning in progress. FAIL: Auto-tuning has failed. dOnE: The stator resistance measured by the auto-tuning function will be used to control the motor.	
UdP	Indicates the ATV31 software version For example, 1102 = V 1.1IE02	
LIF-	Logic input functions Refer to the *ATV31 Programming Manual*.	
AIF-	Analog input functions Refer to the *ATV31 Programming Manual*.	

TROUBLESHOOTING

Fault Display

If a problem occurs during setup or operation, ensure that all ambient environment, mounting, and connection recommendations have been followed.

The first fault detected is stored and displayed, flashing, on the screen. The drive controller locks and the fault relay (R1A-R1C or R2A-R2C) contact opens.

Drive Controller Does Not Start, No Display

If the drive controller will not start and there is no display indication, check the power supply to the drive controller. Refer to the *ATV31 Programming Manual* for more troubleshooting information.

Faults Which Cannot be Automatically Reset

Faults which cannot be automatically reset are listed in the table beginning on page 44. To clear these faults:

1. Remove power from the drive controller.
2. Wait for the display to go off completely.
3. Determine the cause of the fault and correct it.
4. Reapply power.

CrF, SOF, tnF, bLF, and OPF can also be reset remotely via a logic input (rSF parameter in the FLt- menu, see the *ATV31 Programming Manual*).

Faults Which Cannot be Automatically Reset

Fault	Probable Cause	Remedy
bLF Brake sequence	Brake release current not reached	• Check the drive controller and motor connections. • Check the motor windings. • Check the Ibr setting in the FUn-menu. Refer to the *ATV31 Programming Manual*.
CrF Precharge circuit fault	Precharge circuit damaged	• Reset the drive controller. • Replace the drive controller.
InF Internal fault	• Internal fault • Internal connection fault	• Remove sources of electromagnetic interference. • Replace the drive controller.
OCF Overcurrent	• Incorrect parameter settings in the SEt- and drC- menus • Acceleration too rapid • Drive controller and/or motor undersized for load • Mechanical blockage	• Check the SEt- and drC- parameters. • Ensure that the size of the motor and drive controller is sufficient for the load. • Clear the mechanical blockage.
SCF Motor short circuit	• Short circuit or grounding at the drive controller output • Significant ground leakage current at the drive controller output if several motors are connected in parallel	• Check the cables connecting the drive controller to the motor, and check the motor insulation. • Reduce the switching frequency. • Connect output filters in series with the motor.
SOF Overspeed	• Instability • Overhauling load	• Check the motor, gain, and stability parameters. • Add a braking resistor. • Check the size of the motor, drive controller, and load.
tnF Auto-tuning fault	• Motor or motor power not suitable for the drive controller • Motor not connected to the drive controller	• Use the L or the P ratio (see UFt on page 36). • Check the presence of the motor during auto-tuning. • If a downstream contactor is being used, close it during auto-tuning.

Faults Which Can be Reset With the Automatic Restart Function

After the cause of the fault has been removed, the following faults can be reset:

- With the automatic restart function (Atr parameter in the FLt- menu, see the *ATV31 Programming Manual*),
- Via a logic input (rSF parameter in the FLt- menu, see the *ATV31 Programming Manual*),
- By cycling power to the drive controller.

Faults Which Can be Reset With Automatic Restart

Fault	Probable Cause	Remedy
CnF Serial link failure CANopen	Loss of communication between drive controller and communication device or remote keypad.	• Check the communication bus. • Refer to the product-specific documentation.
EPF External fault	User defined	User defined
LFF Loss of 4-20 mA follower	Loss of the 4-20 mA reference on input AI3	Check the connection on input AI3.
ObF Overvoltage during deceleration	• Braking too rapidly • Overhauling load	• Increase the deceleration time. • Install a braking resistor if necessary. • Activate the brA function if it is compatible with the application. Refer to the *ATV31 Programming Manual*.
OHF Drive overload	• Drive controller or ambient temperature are too high. • Continuous motor current load is too high.	Check the motor load, the drive controller ventilation, and the environment. Wait for the drive controller to cool before restarting.
OLF Motor overload	• Thermal trip due to prolonged motor overload • Motor power rating too low for the application	Check the ItH setting (motor thermal protection, page 32), check the motor load. Allow the motor to cool before restarting.

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Faults Which Can be Reset With Automatic Restart (Continued)

Fault	Probable Cause	Remedy
OPF Motor phase failure	• Loss of phase at drive controller output • Downstream contactor open • Motor not connected • Instability in the motor current • Drive controller oversized for motor	• Check the connections from the drive controller to the motor. • If a downstream contactor is being used, set OPL to OAC. Refer to the *ATV31 Programming Manual*, FLt- menu. • Test the drive controller on a low power motor or without a motor: set OPL to nO. Refer to the *ATV31 Programming Manual*, FLt- menu. • Check and optimize the UFr (page 32), UnS (page 35), and nCr (page 35) parameters and perform auto-tuning (page 36).
OSF Overvoltage during steady state operation or during acceleration	• Line voltage too high • Line supply transients	• Check the line voltage. Compare with the drive controller nameplate rating. • Reset the drive controller.
PHF Input phase failure	• Input phase loss, blown fuse • 3-phase drive controller used on a single phase line supply • Input phase imbalance • Transient phase fault *Note: This protection only operates with the drive controller running under load.*	• Check the connections and the fuses. • Disable the fault by setting IPL to nO. Refer to the *ATV31 Programming Manual*. • Verify that the input power is correct. • Supply 3-phase power if needed.
SLF Serial link failure Modbus	Loss of connection between drive controller and communication device or remote keypad.	• Check the communication connection. • Refer to the product-specific documentation.

Faults That Will Be Reset As Soon As the Fault is Cleared

Fault	Probable Cause	Remedy
CFF Configuration fault	The parameter configurations are not suited to the application.	Restore the factory settings or load the backup configuration, if it is valid. See parameter FCS in the drC- menu, page 38.
CFI Configuration fault via serial link	The parameter configurations loaded in the drive controller via the serial link are not suited to the application.	• Check the configuration loaded previously. • Load a compatible configuration.
USF Undervoltage	• Line supply too low • Transient voltage dip • Damaged precharge resistor	• Check the line voltage. • Check the setting of the UNS parameter (see page 35). • Replace the drive controller.