

Mains Supply (L1, L2, L3):

Supply voltage FC 301/FC 302: 200 – 240 V ±10%
 FC 301: 380 – 480 V; FC 302: 380 – 500 V ±10%
 FC 302: 525 – 600 V ±10%
 FC 302: 525 – 690 V ±10%

Supply frequency 50/60 Hz

Max. imbalance temporary
 between mains phases 3.0% of rated supply voltage

True Power Factor (λ) ≥ 0.9 nominal at rated load

Displacement Power Factor ($\cos\phi$) near unity (>0.98)

Switching on input supply

L1, L2, L3 (power-ups) ≤ 10 HP maximum 2 times/min.

L1, L2, L3 (power-ups) ≥ 15 HP maximum 1 time/min.

Environment according to

EN60664-1 overvoltage category III/pollution degree 2.

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 240/500/600/690 V maximum.

Motor Output (U, V, W):

Output voltage 0 – 100% of supply voltage

Output frequency (0.33 – 100 HP) FC 301: 0.2 – 1000 Hz
 FC 302: 0 – 1000 Hz

Output frequency (125 – 500 HP) 0 – 100 Hz

Output frequency in Flux Mode (FC 302 only) 0 – 300 Hz

Switching on output Unlimited

Ramp times 0.01 – 3600 sec.

Torque Characteristics:

Starting torque

(Constant torque) maximum 160% for 60 sec.*

Starting torque maximum 180% up to 0.5 sec.*

Overload torque

(Constant torque) maximum 160% for 60 sec.*

Starting torque

(Variable torque) maximum 110% for 60 sec.*

Overload torque

(Variable torque) maximum 110% for 60 sec.

**Percentage relates to the nominal torque.*

Cable Lengths and Cross Sections:

Max. motor cable length, screened FC 301: 165 ft (50 m)

FC 301 (A1-encl.): 80 ft (25 m)

FC 302: 500 ft (150 m)

Max. motor cable length, unscreened.. FC 301: 250 ft (75 m)

FC 301 (A1-encl.): 165 ft (50 m)

FC 302: 1000 ft (300 m)

Max. cross section to motor, mains, load sharing and brake:

0.33 – 10 HP 4 mm² / 10 AWG

15 – 20 HP 16 mm² / 6 AWG

25 – 30 HP 35 mm² / 2 AWG

Maximum cross section to control terminals,

flexible/ rigid wire:

Without cable end sleeves 1.5 mm²/16 AWG

With cable end sleeves 1 mm²/18 AWG

With cable end sleeves with collar 0.5 mm²/20 AWG

Minimum cross section to

control terminals 0.25 mm² / 24 AWG

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the drive trips if the temperature reaches a predefined level. An overload temperature cannot be reset until the temperature of the heatsink is below the values stated in the tables on the following pages (Guideline - these temperatures may vary for different power sizes, enclosures, etc.).
- The drive is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the drive trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the drive trips if the intermediate circuit voltage is too low or too high.
- The VFD constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the drive can adjust the switching frequency and/ or change the switching pattern in order to ensure the performance of the drive.

General Specifications

Digital Inputs:

Programmable digital inputs	FC 301: 4 (5) / FC 302: 4 (6)
Terminal number	18, 19, 27 ¹⁾ , 29 ⁴⁾ , 32, 33,
Logic	PNP or NPN
Voltage level	0 – 24 VDC
Voltage level, logic '0' PNP	<5 VDC
Voltage level, logic '1' PNP	>10 VDC
Voltage level, logic '0' NPN ²⁾	>19 VDC
Voltage level, logic '1' NPN ²⁾	<14 VDC
Maximum voltage on input	28 VDC
Pulse frequency range	0 – 110 kHz
(Duty cycle) Min. pulse width	4.5 ms
Input resistance	approx. 4 kΩ

Safe Stop Terminal 37³⁾ (Terminal 37 is fixed PNP logic):

Voltage level	0 – 24 VDC
Voltage level, logic '0' PNP	<4 VDC
Voltage level, logic '1' PNP	>20 VDC
Nominal input current at 24 V	50 mA rms
Nominal input current at 20 V	60 mA rms
Input capacitance	400 nF

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

2) Except safe stop input Terminal 37.

3) Terminal 37 is only available in FC 302 and FC 301 A1 with Safe Stop. It can only be used as safe stop input. Terminal 37 is suitable for category 3 installations according to EN 954-1 (safe stop according to category 0 EN 60204-1) as required by the EU Machinery Directive 98/37/EC. Terminal 37 and the Safe Stop function are designed in conformance with EN 60204-1, EN 50178, EN 61800-2, EN 61800-3, and EN 954-1. For correct and safe use of the Safe Stop function follow the related information and instructions in the Design Guide.

4) FC 302 only.

Analog Inputs:

Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	FC 301: 0 to +10/ FC 302: -10 to +10 V (scaleable)
Input resistance	approx. 10 kΩ
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	FC 301: 20 Hz/ FC 302: 100 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Pulse/Encoder Inputs:

Programmable pulse/encoder inputs	2/1
Terminal number pulse/encoder	29 ¹⁾ , 33 ²⁾ / 32 ³⁾ , 33 ³⁾
Max. frequency at terminal 29, 32, 33	110 kHz (Push-pull driven) 5 kHz (open collector)
Min. frequency at terminal 29, 32, 33	4 Hz
Voltage level	see section on Digital input
Maximum voltage on input	28 VDC
Input resistance	approx. 4 kΩ
Pulse input accuracy (0.1 - 1 kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1 - 110 kHz)	Max. error: 0.05 % of full scale

The pulse and encoder inputs (terminals 29, 32, 33) are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) FC 302 only

2) Pulse inputs are 29 and 33

3) Encoder inputs: 32 = A, and 33 = B

Analog Output:

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 – 20 mA
Max. load GND – analog output	500 Ω
Accuracy on analog output	Max. error: 0.5 % of full scale
Resolution on analog output	12 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high voltage terminals.

Control Card, RS 485 Serial Communication:

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number	61 Common for terminals 68 and 69
Standard protocol	FC protocol, Modbus RTU

The RS 485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Digital Output:

Programmable digital/pulse outputs	2
Terminal number	27, 29 ¹⁾
Voltage level at digital/frequency output	0 – 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 kΩ
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

1) Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control Card, 24 VDC Output:

Terminal number	12, 13
Output voltage	24 V +1, -3 V
Max. load	FC 301: 130 mA/ FC 302: 200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Relay Outputs:

Programmable relay outputs	FC 301 ≤10 HP: 1 FC 302 all HP: 2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1) ¹⁾ on 1-3 (NC), 1-2 (NO) (Resistive load)	240 VAC, 2 A
Max. terminal load (AC-15) ¹⁾ (Inductive load @ cosφ 0.4)	240 VAC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 1-2 (NO), 1-3 (NC) (Resistive load)	60 VDC, 1A
Max. terminal load (DC-13) ¹⁾ (Inductive load)	24 VDC, 0.1A
Relay 02 (FC 302 only)	
Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1) ¹⁾ on 4-5 (NO) (Resistive load)	400 VAC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-5 (NO) (Inductive load @ cosφ 0.4)	240 VAC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 4-5 (NO) (Resistive load)	80 VDC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-5 (NO) (Inductive load)	24 VDC, 0.1A
Max. terminal load (AC-1) ¹⁾ on 4-6 (NC) (Resistive load)	240 VAC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-6 (NC) (Inductive load @ cosφ 0.4)	240 VAC, 0.2A
Max. terminal load (DC-1) ¹⁾ on 4-6 (NC) (Resistive load)	50 VDC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-6 (NC) (Inductive load)	24 VDC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24 VDC 10 mA, 24 VAC 20 mA
Environment according to EN 60664-1 ... overvoltage category III/pollution degree 2	

1) IEC 60947 part 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

Control Card, 10 VDC Output:

Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	15 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

General Specifications

Control Characteristics:

Resolution of output frequency at 0 - 1000 Hz	+/- 0.003 Hz
Repeat accuracy of Precise start/stop (terminals 18, 19)	≤± 0.1 msec
System response time (terminals 18, 19, 27, 29, 32, 33)	≤2 ms
Speed control range	
Open loop	1:100 of synchronous speed
Closed loop	1:1000 of synchronous speed
Speed accuracy	
Open loop	30 – 4000 rpm: error ±8 rpm
Closed loop, depending on resolution of feedback device	0 – 6000 rpm: error ±0.15 rpm

All control characteristics are based on a 4-pole asynchronous motor

Control Card Performance:

Scan interval	FC 301: 5 ms / FC 302: 1 ms
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Surroundings:

Enclosure ≤ 10 HP	IP20, IP55
Enclosure ≥ 15 HP	IP21, IP55
Enclosure kit available ≤ 10 HP	IP21/TYPE 1 top
Vibration test	1.0 g RMS
Max. relative humidity	5% - 95% (IEC 60 721-3-3; Class 3K3 (non-condensing) during operation)
Aggressive environment (IEC 721-3-3), uncoated ...	class 3C2
Aggressive environment (IEC 721-3-3), coated	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	Max. 122° F (50° C) (24-hour average maximum 113° F (45° C))

See design guide for derating for high ambient temperature.

Minimum ambient temperature	
During full-scale operation	32° F (0° C)
At reduced performance	14° F (-10° C)
Temperature during storage/transport	-13° F (-25° C) to 149/158° F (65/70° C)
Maximum altitude above sea level	1000 m

Derating for high altitude, see section on special conditions

EMC standards

Emission	EN 61800-3, EN 61000-6-3/4, EN 55011
Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

See Design Guide section on Special Conditions

Control Card, USB Serial Communication:

USB standard	1.1
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

The USB ground connection is not galvanically isolated from protection earth. Use only an isolated laptop as PC connection to the USB connector on the drive.

Connection example

This diagram shows a typical installation of the VLT[®] AutomationDrive. The numbers represent the terminals on the drive.

