

VLT® AQUA Drive

Mains Supply (L1, L2, L3):

Supply voltage	200 – 240 V ±10% (180 – 264 V)
	380 – 480 V ±10% (342 – 528 V)
	525 – 600 V ±10% (472 – 660 V)
	525 – 690 V ±10% (472 – 759 V)

Supply frequency50/60 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 HPmaximum 2 times/min.

L1, L2, L3 (power-ups) ≥ 15 HPmaximum 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, 240/480/600 V maximum.

Motor Output (U, V, W):

Output voltage..... 0 - 100% of supply voltage

Output frequency.....0 – 120 Hz

Switching on output Unlimited

Ramp times..... 1 – 3600 sec.

Torque Characteristics:

Starting torque

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

Starting torque..... maximum 135% up to 0.5 sec.*

Overload torque

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

**Percentage relates to the nominal torque.*

Cable Lengths and Cross Sections:

Max. motor cable length, shielded500 ft (150 m)

Max. motor cable length, unshielded..... 1000 ft (300 m)

Maximum cross section

To motor, mains, load sharing and brake*

To control terminals,

Rigid wire: 16 AWG /1.5 mm² (2 x 0.75 mm²)

Flexible cable 18 AWG/1 mm²

Cable with enclosed core 20 AWG/0.5 mm²

Minimum cross section

To control terminals.....24 AWG/0.25 mm²

**See Mains Supply table for more information.*

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the drive trips if the temperature reaches 203° F (95° C) $\pm 5^\circ$ C. An overload temperature cannot be reset until the temperature of the heatsink is below 158° F $\pm 9^\circ$ (70° C $\pm 5^\circ$) (Guideline - these temperatures may vary for different power sizes, enclosures etc.). VLT AQUA Drive has an auto derating function to avoid it's heatsink reaching 203° F (95° C).
- 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 drive is protected against earth faults on motor terminals U, V, W.

Digital Inputs:

Programmable digital inputs4 (6)

Additional digital inputs available with

MCB 101 general purpose I/O option card3

Terminal number 18, 19, 27¹⁾, 29, 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' NPN²⁾>19 VDC

Voltage level, logic '1' NPN²⁾<14 VDC

Maximum voltage on input.....28 VDC

Input resistance..... approx. 4 k Ω

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.

General Specifications

Analog Inputs:

Number of analog inputs	2
Additional analog inputs available with:	
MCB 101 general purpose I/O option card	2
MCB 109 advanced analog I/O option card.....	3
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	0 to +10 (scaleable)
Input resistance	approx. 10 k Ω
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.....	200 Hz

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

Pulse Inputs:

Programmable pulse inputs	2
Additional pulse inputs available with:	
MCB 101 general purpose I/O option card	3
Terminal number pulse/encoder	29, 33
Max. frequency at terminal 29, 33.....	110 kHz (Push-pull driven) 5 kHz (open collector)
Min. frequency at terminal 29, 33.....	4 Hz
Voltage level.....	see section on Digital input
Maximum voltage on input	28 VDC
Input resistance.....	approx. 4 k Ω
Pulse input accuracy (0.1 - 1 kHz)	Max. error: 0.1% 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.

Analog Output:

Number of programmable analog outputs	1
Additional analog outputs available with:	
MCB 101 general purpose I/O option card	1
MCB 109 advanced analog I/O option card.....	3
Terminal number	42
Current range at analog output	0/4 – 20 mA
Max. load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 0.5 % of full scale
Resolution on analog output	8 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

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
Additional digital outputs available with:	
MCB 101 general purpose I/O option card	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 k Ω
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
Max. load	200 mA

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

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Relay Outputs:

Programmable relay outputs	2
Additional relay outputs available with:	
MCB 105 relay option card	3
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, 1 A
Max. terminal load (DC-13) ¹⁾	
(Inductive load)	24 VDC, 0.1 A
Relay 02 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, 0.1 A
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, 0.2 A
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	25 mA

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

Control Characteristics:

Resolution of output frequency	
at 0 - 1000 Hz	+/- 0.003 Hz
System response time	
(terminals 18, 19, 27, 29, 32, 33)	≤2 ms
Speed control range	
Open loop	1:100 of synchronous speed
Speed accuracy	
Open loop	30 – 4000 rpm: error ±8 rpm

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

Surroundings:

Enclosure ≤10 HP	Protected Chassis/IP20, NEMA Type 12/IP55, IP66
Enclosure 15 HP – 125 HP	Protected Chassis/IP20, NEMA Type 1/IP21, NEMA Type 12/IP55, IP66
Enclosure ≥150 HP	Chassis/IP00, NEMA Type 1/IP21, NEMA Type 12/IP54
Enclosure kit available ≤125 HP	NEMA Type 1/IP21
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	122° F (50° C)
Derating for high ambient temperature, see Design Guide section on special conditions	
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 Design Guide section on Special
Conditions

EMC standards

Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
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

General Specifications

Connection example

This diagram shows a typical installation of the VLT® AQUA Drive. The numbers represent the terminals on the drive.

