Specification





Altivar 61 drive 350hp 400/480 3ph

ATV61HC22N4

- ! Discontinued on: 31 Dec 2020
- ! To be end-of-service on: 31 Dec 2028

① To be discontinued

Price: 508,278.84 ZAR

Main

Range Of Product	Altivar 61
Product Or Component Type	Variable speed drive
Product Specific Application	Pumping and ventilation machine
Component Name	ATV61
Motor Power Kw	200 kW, 3 phases at 380480 V 220 kW, 3 phases at 380480 V
Motor Power Hp	300 hp, 3 phases at 380480 V 350 hp, 3 phases at 380480 V
Power Supply Voltage	380480 V - 1510 %
Supply Number Of Phases	3 phases
Line Current	331 A for 480 V 3 phases 200 kW / 300 hp 357 A for 380 V 3 phases 200 kW / 300 hp 383 A for 480 V 3 phases 220 kW / 350 hp 396 A for 380 V 3 phases 220 kW / 350 hp
Emc Filter	Level 3 EMC filter
Assembly Style	With heat sink
Apparent Power	235 kVA at 380 V 3 phases 200 kW / 300 hp 260.6 kVA at 380 V 3 phases 220 kW / 350 hp
Maximum Prospective Line Isc	50 kA for 3 phases
Maximum Transient Current	512.4 A for 60 s, 3 phases
Nominal Switching Frequency	2.5 kHz
Switching Frequency	28 kHz adjustable 2.58 kHz with derating factor
Asynchronous Motor Control	Voltage/frequency ratio, 2 points Flux vector control without sensor, standard Voltage/frequency ratio - Energy Saving, quadratic U/f Voltage/frequency ratio, 5 points
Synchronous Motor Control Profile	Vector control without sensor, standard
Communication Port Protocol	CANopen Modbus
Type Of Polarization	No impedance for Modbus

Excluding VAT and subject to change. Please check with your local distributor through "Where to buy"

Option Card	Communication card for APOGEE FLN
	Communication card for BACnet
	Communication card for CC-Link
	Controller inside programmable card
	Communication card for DeviceNet
	Communication card for EtherNet/IP
	Communication card for Fipio
	I/O extension card
	Communication card for Interbus-S
	Communication card for LonWorks
	Communication card for METASYS N2
	Communication card for Modbus Plus
	Communication card for Modbus TCP
	Communication card for Modbus/Uni-Telway
	Multi-pump card
	Communication card for Profibus DP
	Communication card for Profibus DP V1

Complementary

Product Destination	Asynchronous motors Synchronous motors				
Power Supply Voltage Limits	323528 V				
Power Supply Frequency	5060 Hz - 55 %				
Power Supply Frequency Limits	47.563 Hz				
Continuous Output Current	427 A at 2.5 kHz, 380 V - 3 phases 427 A at 2.5 kHz, 460 V - 3 phases				
Output Frequency	0.1500 Hz				
Speed Range	1100 in open-loop mode, without speed feedback				
Speed Accuracy	+/- 10 % of nominal slip 0.2 Tn to Tn without speed feedback				
Torque Accuracy	+/- 15 % in open-loop mode, without speed feedback				
Transient Overtorque	130 % of nominal motor torque +/- 10 % for 60 s				
Braking Torque	<= 125 % with braking resistor 30 % without braking resistor				
Regulation Loop	Frequency PI regulator				
Motor Slip Compensation	Automatic whatever the load Can be suppressed Not available in voltage/frequency ratio (2 or 5 points) Adjustable				
Diagnostic	1 LED (red) for drive voltage				
Output Voltage	<= power supply voltage				
Electrical Isolation	Between power and control terminals				
Type Of Cable For Mounting In An Enclosure	With an IP21 or an IP31 kit: 3 wire(s)IEC cable at 40 °C, copper 70 °C / PVC With UL Type 1 kit: 3 wire(s)UL 508 cable at 40 °C, copper 75 °C / PVC Without mounting kit: 1 wire(s)IEC cable at 45 °C, copper 70 °C / PVC Without mounting kit: 1 wire(s)IEC cable at 45 °C, copper 90 °C / XLPE/EPR				
Electrical Connection	Terminal 2.5 mm² / AWG 14 (Al1-/Al1+, Al2, AO1, R1A, R1B, R1C, R2A, R2B, Ll1Ll6, PWR) Terminal 120 mm² / 250 kcmil (PA, PB) Terminal 2 x 150 mm² / 2 x 350 kcmil (L1/R, L2/S, L3/T, U/T1, V/T2, W/T3) Terminal 2 x 150 mm² / 2 x 350 kcmil (PC/-, PO, PA/+)				
Tightening Torque	0.6 N.m (Al1-/Al1+, Al2, AO1, R1A, R1B, R1C, R2A, R2B, Ll1Ll6, PWR) 41 N.m, 360 lb.in (PC/-, PO, PA/+) 24 N.m, 212 lb.in (PA, PB) 41 N.m, 360 lb.in (L1/R, L2/S, L3/T, U/T1, V/T2, W/T3)				
Supply	Internal supply for reference potentiometer (1 to 10 kOhm): 10.5 V DC, +/- 5 %, <10 mA with overload and short-circuit protection Internal supply: 24 V DC (2127 V), <200 mA with overload and short-circuit protection External supply: 24 V DC (1930 V)				

Analogue Input Number	2					
Analogue Input Type	Al1-/Al1+ bipolar differential voltage: +/- 10 V DC 24 V max, resolution 11 bits + sign Al2 software-configurable current: 020 mA, impedance: 242 Ohm, resolution 11 bits Al2 software-configurable voltage: 010 V DC 24 V max, impedance: 30000 Ohm, resolution 11 bits					
Sampling Time	2 ms +/- 0.5 ms (Al1-/Al1+) - analog input 2 ms +/- 0.5 ms (Al2) - analog input 2 ms +/- 0.5 ms (AO1) - analog output 2 ms +/- 0.5 ms (Ll1Ll5) - discrete input 2 ms +/- 0.5 ms (Ll6)if configured as logic input - discrete input					
Absolute Accuracy Precision	+/- 0.6 % (Al1-/Al1+) for a temperature variation 60 °C +/- 0.6 % (Al2) for a temperature variation 60 °C +/- 1 % (AO1) for a temperature variation 60 °C					
Linearity Error	+/- 0.15 % of maximum value (AI1-/AI1+) +/- 0.15 % of maximum value (AI2) +/- 0.2 % (AO1)					
Analogue Output Number	1					
Analogue Output Type	AO1 software-configurable current, analogue output range 020 mA, impedance: 500 Ohm, resolution 10 bits AO1 software-configurable voltage, analogue output range 010 V DC, impedance: 470 Ohm, resolution 10 bits AO1 software-configurable logic output 10 V, 20 mA					
Discrete Output Number	2					
Discrete Output Type	Configurable relay logic: (R1A, R1B, R1C) NO/NC - 100000 cycles Configurable relay logic: (R2A, R2B) NO - 100000 cycles					
Maximum Response Time	<= 100 ms in STO (Safe Torque Off) R1A, R1B, R1C <= 7 ms, tolerance +/- 0.5 ms R2A, R2B <= 7 ms, tolerance +/- 0.5 ms					
Minimum Switching Current	3 mA at 24 V DC for configurable relay logic					
Maximum Switching Current	R1, R2: 2 A at 250 V AC inductive load, cos phi = 0.4 and L/R = 7 ms R1, R2: 2 A at 30 V DC inductive load, cos phi = 0.4 and L/R = 7 ms R1, R2: 5 A at 250 V AC resistive load, cos phi = 1 and L/R = 0 ms R1, R2: 5 A at 30 V DC resistive load, cos phi = 1 and L/R = 0 ms					
Discrete Input Number	7					
Discrete Input Type	Programmable (LI1LI5)24 V DC (<= 30 V), with level 1 PLC - 3500 Ohm Switch-configurable (LI6)24 V DC (<= 30 V), with level 1 PLC - 3500 Ohm Switch-configurable PTC probe (LI6)06 probes - 1500 Ohm Safety input (PWR)24 V DC (<= 30 V) - 1500 Ohm					
Discrete Input Logic	Negative logic (sink) (LI1LI5), > 16 V (state 0), < 10 V (state 1) Positive logic (source) (LI1LI5), < 5 V (state 0), > 11 V (state 1) Negative logic (sink) (LI6)if configured as logic input, > 16 V (state 0), < 10 V (state 1) Positive logic (source) (LI6)if configured as logic input, < 5 V (state 0), > 11 V (state 1)					
Acceleration And Deceleration Ramps	Automatic adaptation of ramp if braking capacity exceeded, by using resistor S, U or customized Linear adjustable separately from 0.01 to 9000 s					
Braking To Standstill	By DC injection					
Protection Type	Against exceeding limit speed: drive Against input phase loss: drive Break on the control circuit: drive Input phase breaks: drive Line supply overvoltage: drive Line supply undervoltage: drive Overcurrent between output phases and earth: drive Overheating protection: drive Overvoltages on the DC bus: drive Power removal: drive Short-circuit between motor phases: drive Thermal protection: drive Motor phase break: motor Power removal: motor Thermal protection: motor					

Insulation Resistance	> 1 mOhm 500 V DC for 1 minute to earth				
Frequency Resolution	Analog input: 0.024/50 Hz Display unit: 0.1 Hz				
Connector Type	1 RJ45 (on front face) for Modbus 1 RJ45 (on terminal) for Modbus Male SUB-D 9 on RJ45 for CANopen				
Physical Interface 2-wire RS 485 for Modbus					
Transmission Frame	RTU for Modbus				
Transmission Rate	4800 bps, 9600 bps, 19200 bps, 38.4 Kbps for Modbus on terminal 9600 bps, 19200 bps for Modbus on front face 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 1 Mbps for CANopen				
Data Format	8 bits, 1 stop, even parity for Modbus on front face 8 bits, odd even or no configurable parity for Modbus on terminal				
Number Of Addresses	1127 for CANopen 1247 for Modbus				
Method Of Access	Slave CANopen				
Marking	CE				
Operating Position	Vertical +/- 10 degree				
Net Weight	110 kg				
Width	440 mm				
Height	1190 mm				
Depth	377 mm				

Environment

Noise Level	66 dB conforming to 86/188/EEC					
Dielectric Strength	3535 V DC between earth and power terminals 5092 V DC between control and power terminals					
Electromagnetic Compatibility	Conducted radio-frequency immunity test level 3 conforming to IEC 61000-4-6 Electrical fast transient/burst immunity test level 4 conforming to IEC 61000-4-4 Electrostatic discharge immunity test level 3 conforming to IEC 61000-4-2 Radiated radio-frequency electromagnetic field immunity test level 3 conforming to IEC 61000-4-3 Voltage dips and interruptions immunity test conforming to IEC 61000-4-11					
Standards	EN/IEC 61800-3 IEC 60721-3-3 class 3C2 EN 61800-3 environments 2 category C3 EN 55011 class A group 2 EN 61800-3 environments 1 category C3 UL Type 1 EN/IEC 61800-5-1					
Product Certifications	GOST CSA UL NOM 117 C-Tick DNV					
Pollution Degree	3 conforming to EN/IEC 61800-5-1 3 conforming to UL 840					
Degree Of Proctection	IP41 on upper part conforming to EN/IEC 60529 IP41 on upper part conforming to EN/IEC 61800-5-1 IP54 on lower part conforming to EN/IEC 60529 IP54 on lower part conforming to EN/IEC 61800-5-1 IP00 conforming to EN/IEC 60529 IP00 conforming to EN/IEC 61800-5-1 IP30 on side parts conforming to EN/IEC 60529 IP30 on side parts conforming to EN/IEC 61800-5-1 IP30 on the front panel conforming to EN/IEC 60529 IP30 on the front panel conforming to EN/IEC 60529 IP30 on the front panel conforming to EN/IEC 61800-5-1					

Vibration Resistance	0.6 gn (f= 10200 Hz) conforming to EN/IEC 60068-2-6 1.5 mm peak to peak (f= 310 Hz) conforming to EN/IEC 60068-2-6
Shock Resistance	4 gn for 11 ms conforming to EN/IEC 60068-2-27
Relative Humidity	595 % without condensation conforming to IEC 60068-2-3 595 % without dripping water conforming to IEC 60068-2-3
Ambient Air Temperature For Operation	-1045 °C (without derating) 4560 °C (with derating factor)
Ambient Air Temperature For Storage	-2570 °C
Operating Altitude	<= 1000 m without derating 10003000 m with current derating 1 % per 100 m

Packing Units

Unit Type Of Package 1	PCE
Number Of Units In Package 1	1
Package 1 Height	38.5 cm
Package 1 Width	128.5 cm
Package 1 Length	47.6 cm
Package 1 Weight	154.0 kg
Unit Type Of Package 2	PAL
Number Of Units In Package 2	1
Package 2 Height	53.5 cm
Package 2 Width	128.5 cm
Package 2 Length	47.6 cm
Package 2 Weight	179.0 kg

Contractual warranty

Warranty 18 months



Green PremiumTM **label** is Schneider Electric's commitment to delivering products with best-inclass environmental performance. Green Premium promises compliance with the latest regulations, transparency on environmental impacts, as well as circular and low-CO₂ products.

Guide to assessing product sustainability is a white paper that clarifies global eco-label standards and how to interpret environmental declarations.

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Guide to assess a product's sustainability >



RoHS/REACh

Well-being performance



Mercury Free



Rohs Exemption Information

Yes

Certifications & Standards

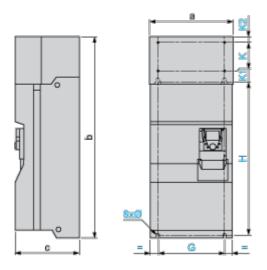
Eu Rohs Directive	Pro-active compliance (Product out of EU RoHS legal scope)		
	EU RoHS Declaration		
China Rohs Regulation	China RoHS declaration		
Weee	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins		

ATV61HC22N4

Dimensions Drawings

UL Type 1/IP 20 Drives

Dimensions with or without 1 Option Card (1)



Dimensions in mm

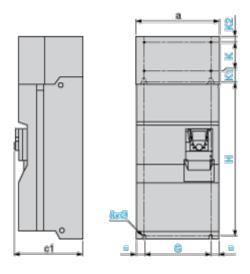
а	b	С	G	Н	K	K1	K2	Ø	
440	1190	377	350	920	150	75	30	11.5	

Dimensions in in.

а	b	С	G	Н	K	K1	K2	Ø
17.32	46.85	14.84	13.78	36.22	5.90	2.95	1.18	0.45

 $(1) \ Option \ cards: I/O \ extension \ cards, \ communication \ cards \ or \ "Controller \ Inside" \ programmable \ card.$

Dimensions with 2 Option Cards (1)



Dimensions in mm

а	c1	G	Н	K	K1	K2	Ø
440	392	350	920	150	75	30	11.5

Dimensions in in.

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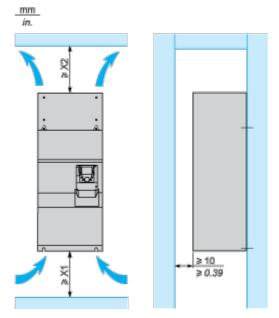
а	c1	G	Н	K	K1	K2	Ø
17.32	15.43	13.78	36.22	5.90	2.95	1.18	0.45

(1) Option cards: I/O extension cards, communication cards or "Controller Inside" programmable card.

Mounting and Clearance

Mounting Recommendations

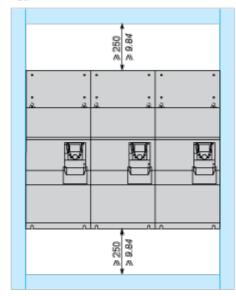
Clearance

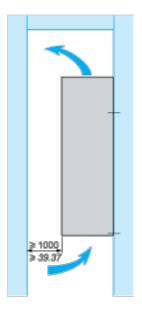


X1 in mm	X2 in mm	X1 in in.	X2 in in.	
150	150	5.91	5.91	

These drives can be mounted side by side, observing the following mounting recommendations:







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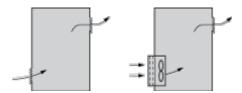
Specific Recommendations for Mounting the Drive in an Enclosure

Ventilation

10

To ensure proper air circulation in the drive:

- . Fit ventilation grilles.
- Ensure that there is sufficient ventilation. If there is not, install a forced ventilation unit with a filter. The openings and/or fans must provide a flow rate at least equal to that of the drive fans (refer to the product characteristics).



- Use special filters with IP 54 protection.
- Remove the blanking cover from the top of the drive.

Dust and Damp Proof Metal Enclosure (IP 54)

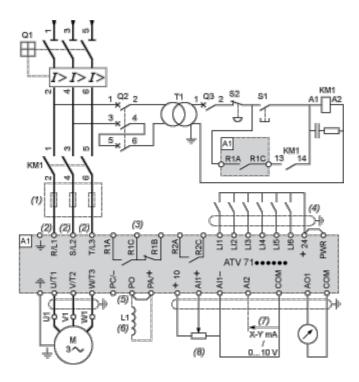
The drive must be mounted in a dust and damp proof enclosure in certain environmental conditions: dust, corrosive gases, high humidity with risk of condensation and dripping water, splashing liquid, etc.

This enables the drive to be used in an enclosure where the maximum internal temperature reaches 50°C.

Connections and Schema

Wiring Diagram Conforming to Standards EN 954-1 Category 1, IEC/EN 61508 Capacity SIL1, in Stopping Category 0 According to IEC/EN 60204-1

Three-Phase Power Supply with Upstream Breaking via Contactor



A1 ATV61 drive

KM1 Contactor

L1 DC choke

Q1 Circuit-breaker

Q2 GV2 L rated at twice the nominal primary current of T1

Q3 GB2CB05

S1, S2 XB4 B or XB5 A pushbuttons

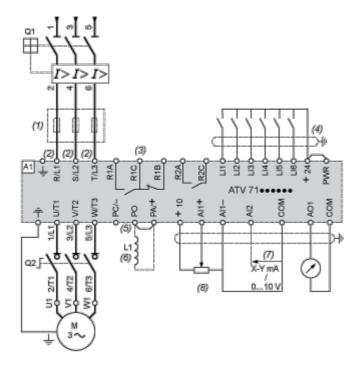
T1 100 VA transformer 220 V secondary

- (1) Line choke (three-phase); mandatory for ATV61HC11Y...HC80Y drives (except when a special transformer is used (12-pulse)).
- (2) For ATV61HC50N4, ATV61HC63N4 and ATV61HC50Y...HC80Y drives, refer to the power terminal connections diagram.
- (3) Fault relay contacts. Used for remote signalling of the drive status.
- (4) Connection of the common for the logic inputs depends on the positioning of the SW1 switch. The above diagram shows the internal power supply switched to the "source" position (for other connection types, refer to the user guide).
- (5) There is no PO terminal on ATV61HC11Y...HC80Y drives.
- (6) Optional DC choke for ATV61H•••M3, ATV61HD11M3X...HD45M3X and ATV61H075N4...HD75N4 drives. Connected in place of the strap between the PO and PA/+ terminals. For ATV61HD55M3X...HD90M3X, ATV61HD90N4...HC63N4 drives, the choke is supplied with the drive; the customer is responsible for connecting it. For ATV61W•••N4 and ATV61W•••N4C drives, the DC choke is integrated.
- (7) Software-configurable current (0...20 mA) or voltage (0...10 V) analog input.
- (8) Reference potentiometer.

Product datasheet ATV61HC22N4

Wiring Diagram Conforming to Standards EN 954-1 Category 1, IEC/EN 61508 Capacity SIL1, in Stopping Category 0 According to IEC/EN 60204-1

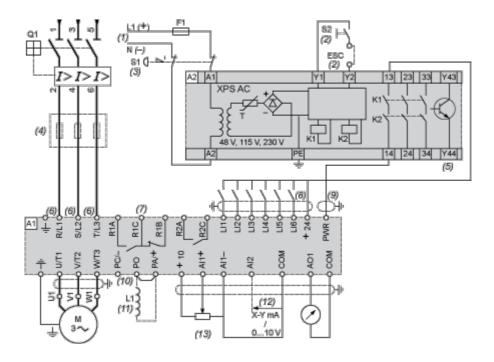
Three-Phase Power Supply with Downstream Breaking via Switch Disconnector



- A1 ATV61 drive
- L1 DC choke
- Q1 Circuit-breaker
- Q2 Switch disconnector (Vario)
- (1) Line choke (three-phase), mandatory for ATV61HC11Y...HC80Y drives (except when a special transformer is used (12-pulse)).
- (2) For ATV61HC50N4, ATV61HC63N4 and ATV61HC50Y...HC80Y drives, refer to the power terminal connections diagram.
- (3) Fault relay contacts. Used for remote signalling of the drive status.
- (4) Connection of the common for the logic inputs depends on the positioning of the SW1 switch. The above diagram shows the internal power supply switched to the "source" position (for other connection types, refer to the user quide).
- (5) There is no PO terminal on ATV61HC11Y...HC80Y drives.
- (6) Optional DC choke for ATV61H•••M3, ATV61HD11M3X...HD45M3X and ATV61H075N4...HD75N4 drives. Connected in place of the strap between the PO and PA/+ terminals. For ATV61HD55M3X...HD90M3X, ATV61HD90N4...HC63N4 drives, the choke is supplied with the drive; the customer is responsible for connecting it. For ATV61W•••N4 and ATV61W•••N4C drives, the DC choke is integrated.
- (7) Software-configurable current (0...20 mA) or voltage (0...10 V) analog input.
- (8) Reference potentiometer.

Wiring Diagram Conforming to Standards EN 954-1 Category 3, IEC/EN 61508 Capacity SIL2, in Stopping Category 0 According to IEC/EN 60204-1

Three-Phase Power Supply, Low Inertia Machine, Vertical Movement



A1 ATV61 drive

A2 Preventa XPS AC safety module for monitoring emergency stops and switches. One safety module can manage the "Power Removal" function for several drives on the same machine. In this case, each drive must connect its PWR terminal to its + 24 V via the safety contacts on the XPS AC module. These contacts are independent for each drive.

- F1 Fuse
- L1 DC choke
- Q1 Circuit-breaker
- S1 Emergency stop button with 2 contacts
- S2 XB4 B or XB5 A pushbutton
- (1) Power supply: 24 Vdc or Vac, 115 Vac, 230 Vac.
- (2) S2: resets XPS AC module on power-up or after an emergency stop. ESC can be used to set external starting conditions.
- (3) Requests freewheel stopping of the movement and activates the "Power Removal" safety function.
- (4) Line choke (three-phase), mandatory for and ATV61HC11Y...HC80Y drives (except when a special transformer is used (12-pulse)).
- (5) The logic output can be used to signal that the machine is in a safe stop state.
- (6) For ATV61HC50N4, ATV61HC63N4 and ATV61HC50Y...HC80Y drives, refer to the power terminal connections diagram.
- (7) Fault relay contacts. Used for remote signalling of the drive status.
- (8) Connection of the common for the logic inputs depends on the positioning of the SW1 switch. The above diagram shows the internal power supply switched to the "source" position (for other connection types, refer to the user guide).
- (9) Standardized coaxial cable, type RG174/U according to MIL-C17 or KX3B according to NF C 93-550, external diameter 2.54 mm /0.09 in., maximum length 15 m / 49.21 ft. The cable shielding must be earthed.
- (10) There is no PO terminal on ATV61HC11Y...HC80Y drives.
- (11) Optional DC choke for ATV61H••••M3, ATV61HD11M3X...HD45M3X and ATV61H075N4...HD75N4 drives. Connected in place of the strap between the PO and PA/+ terminals. For ATV61HD55M3X...HD90M3X,

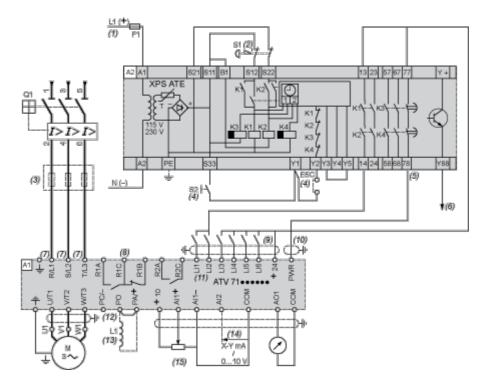
ATV61HC22N4

ATV61HD90N4...HC63N4 drives, the choke is supplied with the drive; the customer is responsible for connecting it. For ATV61W•••N4 and ATV61W•••N4C drives, the DC choke is integrated.

- (12) Software-configurable current (0...20 mA) or voltage (0...10 V) analog input.
- (13) Reference potentiometer.

Wiring Diagram Conforming to Standards EN 954-1 Category 3, IEC/EN 61508 Capacity SIL2, in Stopping Category 1 According to IEC/EN 60204-1

Three-Phase Power Supply, High Inertia Machine



A1 ATV61 drive

A2 (5) Preventa XPS ATE safety module for monitoring emergency stops and switches. One safety module can manage the "Power Removal" safety function for several drives on the same machine. In this case the time delay must be adjusted on the drive controlling the motor that requires the longest stopping time. In addition, each drive must connect its PWR terminal to its + 24 V via the safety contacts on the XPS ATE module. These contacts are independent for each drive.

- F1 Fuse
- L1 DC choke
- Q1 Circuit-breaker
- S1 Emergency stop button with 2 contacts
- S2 XB4 B or XB5 A pushbutton
- (1) Power supply: 24 Vdc or Vac, 115 Vac, 230 Vac.
- (2) Requests controlled stopping of the movement and activates the "Power Removal" safety function.
- (3) Line choke (three-phase), mandatory for ATV61HC11Y...HC80Y drives (except when a special transformer is used (12-pulse)).
- (4) S2: resets XPS ATE module on power-up or after an emergency stop. ESC can be used to set external starting conditions.
- (5) The logic output can be used to signal that the machine is in a safe state.
- (6) For stopping times requiring more than 30 seconds in category 1, use a Preventa XPS AV safety module which can provide a maximum time delay of 300 seconds.
- (7) For ATV61HC50N4, ATV61HC63N4 and ATV61HC50Y...HC80Y drives, refer to the power terminal connections diagram.
- (8) Fault relay contacts. Used for remote signalling of the drive status.

ATV61HC22N4

- (9) Connection of the common for the logic inputs depends on the positioning of the SW1 switch. The above diagram shows the internal power supply switched to the "source" position (for other connection types, refer to the user guide).
- (10) Standardized coaxial cable, type RG174/U according to MIL-C17 or KX3B according to NF C 93-550, external diameter 2.54 mm/0.09 in., maximum length 15 m/49.21 ft. The cable shielding must be earthed.
- (11) Logic inputs LI1 and LI2 must be assigned to the direction of rotation: LI1 in the forward direction and LI2 in the reverse direction.
- (12) There is no PO terminal on ATV61HC11Y...HC80Y drives.
- (13) Optional DC choke for ATV61H•••M3, ATV61HD11M3X...HD45M3X and ATV61H075N4...HD75N4 drives. Connected in place of the strap between the PO and PA/+ terminals. For ATV61HD55M3X...HD90M3X, ATV61HD90N4...HC63N4 drives, the choke is supplied with the drive; the customer is responsible for connecting it. For ATV61W•••N4 and ATV61W•••N4C drives, the DC choke is integrated.
- (14) Software-configurable current (0...20 mA) or voltage (0...10 V) analog input.
- (15) Reference potentiometer.

ATV61HC22N4

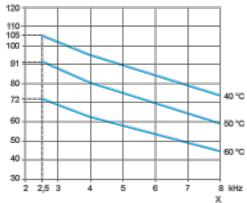
Performance Curves

Derating Curves

The derating curves for the drive nominal current (In) depend on the temperature and the switching frequency. For intermediate temperatures (e.g. 55°C), interpolate between 2 curves.

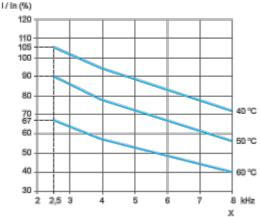
Drive combined with a 200 kW motor

17 In (%)



X Switching frequency

Drive combined with a 220 kW motor



X Switching frequency