

# ATV650D45N4E

variable speed drive ATV650 - 45kW/60HP -  
380...480V - IP55 - disconnect switch



Price\* : 4,704.00 GBP



## Main

|                              |                                                                                                                                 |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Range of product             | Altivar Process ATV600                                                                                                          |
| Product or component type    | Variable speed drive                                                                                                            |
| Product specific application | Process and utilities                                                                                                           |
| Device short name            | ATV650                                                                                                                          |
| Variant                      | With disconnect switch                                                                                                          |
| Product destination          | Synchronous motors<br>Asynchronous motors                                                                                       |
| Mounting mode                | Wall mount                                                                                                                      |
| EMC filter                   | Integrated with 50 m conforming to EN/IEC 61800-3 category C2<br>Integrated with 150 m conforming to EN/IEC 61800-3 category C3 |
| IP degree of protection      | IP55 conforming to IEC 61800-5-1<br>IP55 conforming to IEC 60529                                                                |
| Type of cooling              | Forced convection                                                                                                               |
| Supply frequency             | 50...60 Hz - 5...5 %                                                                                                            |
| Network number of phases     | 3 phases                                                                                                                        |
| [Us] rated supply voltage    | 380...480 V - 15...10 %                                                                                                         |
| Motor power kW               | 45 kW (normal duty)<br>37 kW (heavy duty)                                                                                       |
| Motor power hp               | 60 hp normal duty<br>50 hp heavy duty                                                                                           |
| Line current                 | 79.8 A at 380 V (normal duty)<br>69.1 A at 480 V (normal duty)<br>67.1 A at 380 V (heavy duty)<br>59 A at 480 V (heavy duty)    |
| Prospective line Isc         | 50 kA                                                                                                                           |
| Apparent power               | 57.4 kVA at 480 V (normal duty)<br>49.1 kVA at 480 V (heavy duty)                                                               |
| Continuous output current    | 87 A at 4 kHz for normal duty<br>72 A at 4 kHz for heavy duty                                                                   |
| Maximum transient current    | 96.8 A during 60 s (normal duty)                                                                                                |

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | 111.8 A during 60 s (heavy duty)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Asynchronous motor control profile | Optimized torque mode<br>Variable torque standard<br>Constant torque standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Synchronous motor control profile  | Permanent magnet motor<br>Synchronous reluctance motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Output frequency                   | 0.0001...0.5 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Speed drive output frequency       | 0.1...599 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Nominal switching frequency        | 4 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Switching frequency                | 2...12 kHz adjustable<br>4...12 kHz with derating factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Safety function                    | STO (safe torque off) SIL 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Discrete input logic               | 16 preset speeds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Communication port protocol        | Modbus TCP<br>Ethernet<br>Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Option card                        | Slot A: communication module, Profibus DP V1<br>Slot A: communication module, Profinet<br>Slot A: communication module, DeviceNet<br>Slot A: communication module, Modbus TCP/EtherNet/IP<br>Slot A: communication module, CANopen daisy chain RJ45<br>Slot A: communication module, CANopen SUB-D 9<br>Slot A: communication module, CANopen screw terminals<br>Slot A/slot B: digital and analog I/O extension module<br>Slot A/slot B: output relay extension module<br>Slot A: communication module, Ethernet IP/Modbus TCP/MD-Link<br>Communication module, BACnet MS/TP<br>Communication module, Ethernet Powerlink |

## Complementary

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output voltage                      | $\leq$ power supply voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Permissible temporary current boost | 1.1 x $I_n$ during 60 s (normal duty)<br>1.5 x $I_n$ during 60 s (heavy duty)                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Motor slip compensation             | Not available in permanent magnet motor law<br>Automatic whatever the load<br>Adjustable<br>Can be suppressed                                                                                                                                                                                                                                                                                                                                                                                                                |
| Acceleration and deceleration ramps | Linear adjustable separately from 0.01...9999 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Braking to standstill               | By DC injection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Protection type                     | Thermal protection: motor<br>Safe torque off: motor<br>Motor phase break: motor<br>Thermal protection: drive<br>Safe torque off: drive<br>Overheating: drive<br>Overcurrent between output phases and earth: drive<br>Overload of output voltage: drive<br>Short-circuit protection: drive<br>Motor phase break: drive<br>Overvoltages on the DC bus: drive<br>Line supply overvoltage: drive<br>Line supply undervoltage: drive<br>Line supply phase loss: drive<br>Overspeed: drive<br>Break on the control circuit: drive |
| Frequency resolution                | Display unit: 0.1 Hz<br>Analog input: 0.012/50 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Electrical connection               | Control: removable screw terminals 0.5...1.5 mm <sup>2</sup><br>Line side: screw terminal 35...50 mm <sup>2</sup><br>Motor: screw terminal 35...50 mm <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                           |
| Connector type                      | RJ45 (on the remote graphic terminal) for Ethernet/Modbus TCP<br>RJ45 (on the remote graphic terminal) for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                     |
| Physical interface                  | 2-wire RS 485 for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transmission frame                  | RTU for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Transmission rate                   | 10/100 Mbit/s for Ethernet IP/Modbus TCP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | 4.8, 9.6, 19.2, 38.4 kbit/s for Modbus serial                                                                                                                                                                                                                                                                                                                                                                  |
| Exchange mode             | Half duplex, full duplex, autonegotiation Ethernet/Modbus TCP                                                                                                                                                                                                                                                                                                                                                  |
| Data format               | 8 bits, configurable odd, even or no parity for Modbus serial                                                                                                                                                                                                                                                                                                                                                  |
| Type of polarization      | No impedance for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                 |
| Number of addresses       | 1...247 for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                      |
| Method of access          | Slave Modbus TCP                                                                                                                                                                                                                                                                                                                                                                                               |
| Supply                    | External supply for digital inputs: 24 V DC (19...30 V), <1.25 mA, protection type: overload and short-circuit protection<br>Internal supply for reference potentiometer (1 to 10 kOhm): 10.5 V DC +/- 5 %, <10 mA, protection type: overload and short-circuit protection<br>Internal supply for digital inputs and STO: 24 V DC (21...27 V), <200 mA, protection type: overload and short-circuit protection |
| Local signalling          | 3 LEDslocal diagnostic:<br>3 LEDs (dual colour)embedded communication status:<br>4 LEDs (dual colour)communication module status:<br>1 LED (red)presence of voltage:                                                                                                                                                                                                                                           |
| Width                     | 290 mm                                                                                                                                                                                                                                                                                                                                                                                                         |
| Height                    | 910 mm                                                                                                                                                                                                                                                                                                                                                                                                         |
| Depth                     | 401 mm                                                                                                                                                                                                                                                                                                                                                                                                         |
| Product weight            | 110.2 kg                                                                                                                                                                                                                                                                                                                                                                                                       |
| Analogue input number     | 3                                                                                                                                                                                                                                                                                                                                                                                                              |
| Analogue input type       | AI1, AI2, AI3 software-configurable voltage: 0...10 V DC, impedance: 30 kOhm, resolution 12 bits<br>AI1, AI2, AI3 software-configurable current: 0...20 mA/4...20 mA, impedance: 250 Ohm, resolution 12 bits                                                                                                                                                                                                   |
| Discrete input number     | 8                                                                                                                                                                                                                                                                                                                                                                                                              |
| Discrete input type       | DI1...DI6 programmable, 24 V DC (<= 30 V), impedance: 3.5 kOhm<br>DI5, DI6 programmable as pulse input: 0...30 kHz, 24 V DC (<= 30 V)<br>STOA, STOB safe torque off, 24 V DC (<= 30 V), impedance: > 2.2 kOhm                                                                                                                                                                                                  |
| Input compatibility       | DI1...DI6: discrete input level 1 PLC conforming to EN/IEC 61131-2<br>DI5, DI6: discrete input level 1 PLC conforming to IEC 65A-68<br>STOA, STOB: discrete input level 1 PLC conforming to EN/IEC 61131-2                                                                                                                                                                                                     |
| Discrete input logic      | Positive logic (source) (DI1...DI6), < 5 V (state 0), > 11 V (state 1)<br>Negative logic (sink) (DI1...DI6), > 16 V (state 0), < 10 V (state 1)<br>Positive logic (source) (DI5, DI6), < 0.6 V (state 0), > 2.5 V (state 1)<br>Positive logic (source) (STOA, STOB), < 5 V (state 0), > 11 V (state 1)                                                                                                         |
| Analogue output number    | 2                                                                                                                                                                                                                                                                                                                                                                                                              |
| Analogue output type      | Software-configurable voltage AO1, AO2: 0...10 V DC impedance 470 Ohm, resolution 10 bits<br>Software-configurable current AO1, AO2: 0...20 mA, resolution 10 bits                                                                                                                                                                                                                                             |
| Sampling duration         | 2 ms +/- 0.5 ms (DI1...DI4) - discrete input<br>5 ms +/- 1 ms (DI5, DI6) - discrete input<br>5 ms +/- 0.1 ms (AI1, AI2, AI3) - analog input<br>10 ms +/- 1 ms (AO1) - analog output                                                                                                                                                                                                                            |
| Accuracy                  | +/- 0.6 % AI1, AI2, AI3 for a temperature variation 60 °C analog input<br>+/- 1 % AO1, AO2 for a temperature variation 60 °C analog output                                                                                                                                                                                                                                                                     |
| Linearity error           | AI1, AI2, AI3: +/- 0.15 % of maximum value for analog input<br>AO1, AO2: +/- 0.2 % for analog output                                                                                                                                                                                                                                                                                                           |
| Relay output number       | 3                                                                                                                                                                                                                                                                                                                                                                                                              |
| Relay output type         | Configurable relay logic R1: fault relay NO/NC electrical durability 100000 cycles<br>Configurable relay logic R2: sequence relay NO electrical durability 100000 cycles<br>Configurable relay logic R3: sequence relay NO electrical durability 100000 cycles                                                                                                                                                 |
| Refresh time              | Relay output (R1, R2, R3): 5 ms (+/- 0.5 ms)                                                                                                                                                                                                                                                                                                                                                                   |
| Minimum switching current | Relay output R1, R2, R3: 5 mA at 24 V DC                                                                                                                                                                                                                                                                                                                                                                       |
| Maximum switching current | Relay output R1, R2, R3 on resistive load, cos phi = 1: 3 A at 250 V AC<br>Relay output R1, R2, R3 on resistive load, cos phi = 1: 3 A at 30 V DC<br>Relay output R1, R2, R3 on inductive load, cos phi = 0.4 and L/R = 7 ms: 2 A at 250 V AC<br>Relay output R1, R2, R3 on inductive load, cos phi = 0.4 and L/R = 7 ms: 2 A at 30 V DC                                                                       |
| Isolation                 | Between power and control terminals                                                                                                                                                                                                                                                                                                                                                                            |

## Environment

|                       |                                         |
|-----------------------|-----------------------------------------|
| Insulation resistance | > 1 MOhm 500 V DC for 1 minute to earth |
| Noise level           | 69.7 dB conforming to 86/188/EEC        |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating position                    | Vertical +/- 10 degree                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Maximum THDI                          | <48 % from 80...100 % of load conforming to IEC 61000-3-12                                                                                                                                                                                                                                                                                                                                                                                 |
| Electromagnetic compatibility         | Electrostatic discharge immunity test level 3 conforming to IEC 61000-4-2<br>Radiated radio-frequency electromagnetic field immunity test level 3 conforming to IEC 61000-4-3<br>Electrical fast transient/burst immunity test level 4 conforming to IEC 61000-4-4<br>1.2/50 $\mu$ s - 8/20 $\mu$ s surge immunity test level 3 conforming to IEC 61000-4-5<br>Conducted radio-frequency immunity test level 3 conforming to IEC 61000-4-6 |
| Pollution degree                      | 2 conforming to EN/IEC 61800-5-1                                                                                                                                                                                                                                                                                                                                                                                                           |
| Vibration resistance                  | 1.5 mm peak to peak (f= 2...13 Hz) conforming to IEC 60068-2-6<br>1 gn (f= 13...200 Hz) conforming to IEC 60068-2-6                                                                                                                                                                                                                                                                                                                        |
| Shock resistance                      | 15 gn for 11 ms conforming to IEC 60068-2-27                                                                                                                                                                                                                                                                                                                                                                                               |
| Relative humidity                     | 5...95 % without condensation conforming to IEC 60068-2-3                                                                                                                                                                                                                                                                                                                                                                                  |
| Ambient air temperature for operation | -15...40 °C (without)<br>40...50 °C (with derating factor)                                                                                                                                                                                                                                                                                                                                                                                 |
| Ambient air temperature for storage   | -40...70 °C                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Operating altitude                    | <= 1000 m without<br>1000...4800 m with current derating 1 % per 100 m                                                                                                                                                                                                                                                                                                                                                                     |
| Environmental characteristic          | Chemical pollution resistance class 3C3 conforming to EN/IEC 60721-3-3<br>Dust pollution resistance class 3S3 conforming to EN/IEC 60721-3-3                                                                                                                                                                                                                                                                                               |
| Standards                             | EN/IEC 61800-3<br>Environment 1 category C2 EN/IEC 61800-3<br>Environment 2 category C3 EN/IEC 61800-3<br>EN/IEC 61800-5-1<br>IEC 61000-3-12<br>IEC 60721-3<br>IEC 61508<br>IEC 13849-1                                                                                                                                                                                                                                                    |
| Product certifications                | REACH<br>ATEX INERIS<br>ATEX zone 2/22<br>CSA<br>UL<br>TÜV<br>DNV-GL                                                                                                                                                                                                                                                                                                                                                                       |
| Marking                               | CE                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### Offer Sustainability

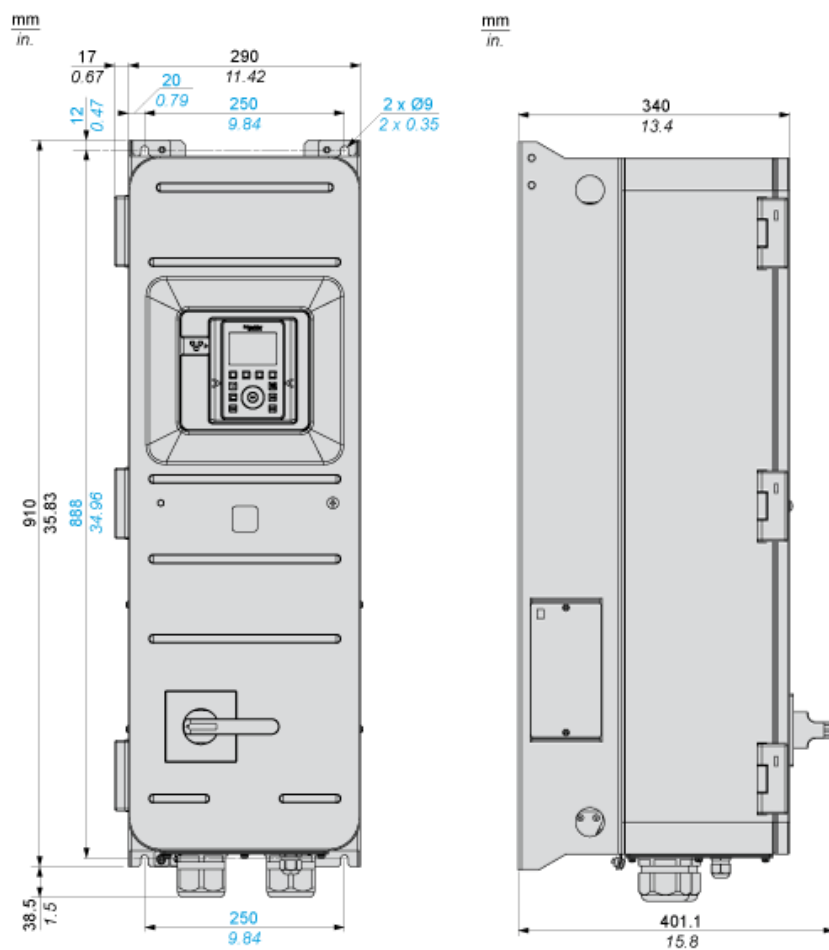
|                            |                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Sustainable offer status   | Green Premium product                                                                                                       |
| REACH Regulation           | <a href="#">REACH Declaration</a>                                                                                           |
| EU RoHS Directive          | Pro-active compliance (Product out of EU RoHS legal scope)<br><a href="#">EU RoHS Declaration</a>                           |
| Mercury free               | Yes                                                                                                                         |
| RoHS exemption information | <a href="#">Yes</a>                                                                                                         |
| China RoHS Regulation      | <a href="#">China RoHS declaration</a>                                                                                      |
| Environmental Disclosure   | <a href="#">Product Environmental Profile</a>                                                                               |
| Circularity Profile        | <a href="#">End of Life Information</a>                                                                                     |
| WEEE                       | The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins |

### Contractual warranty

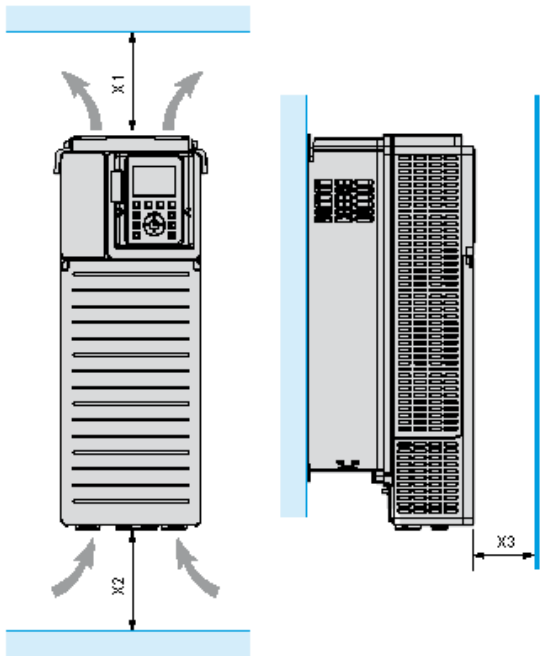
|          |           |
|----------|-----------|
| Warranty | 18 months |
|----------|-----------|

## Dimensions

### Front and Left Views



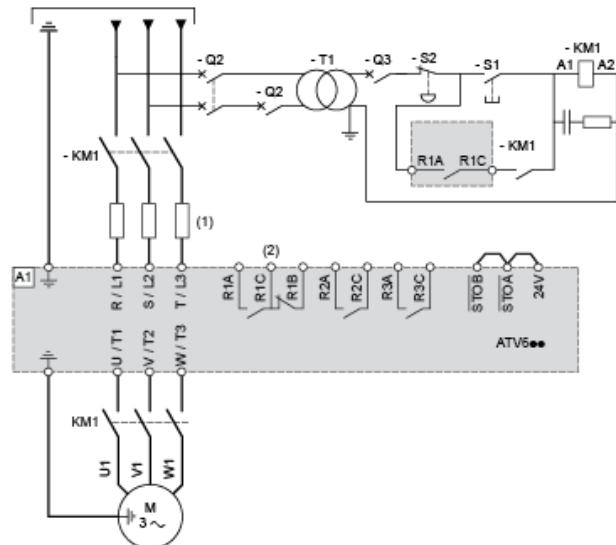
Clearances



| X1                  | X2                  | X3                 |
|---------------------|---------------------|--------------------|
| ≥ 100 mm (3.94 in.) | ≥ 100 mm (3.94 in.) | ≥ 10 mm (0.39 in.) |

## Three-Phase Power Supply with Upstream Breaking via Line Contactor

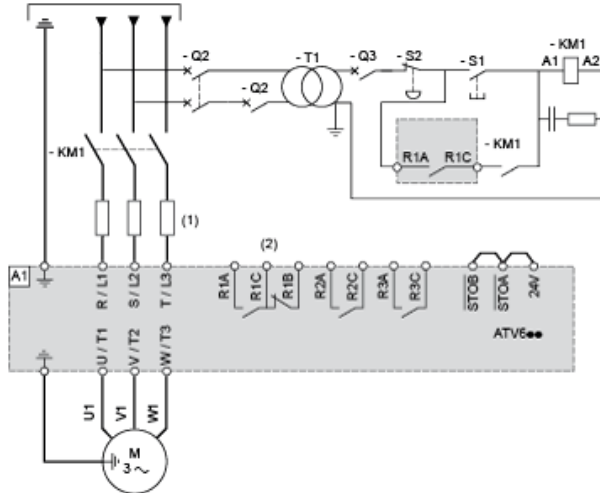
Connection diagrams conforming to standards EN 954-1 category 1 and IEC/EN 61508 capacity SIL1, stopping category 0 in accordance with standard IEC/EN 60204-1



- (1) Line choke if used
- (2) Use relay R1 set to operating state Fault to switch Off the product once an error is detected.
- A1 : Drive
- KM1 : Line Contactor
- Q2, Q3 : Circuit breakers
- S1, S2 : Pushbuttons
- T1 : Transformer for control part

## Three-Phase Power Supply with Downstream Breaking via Contactor

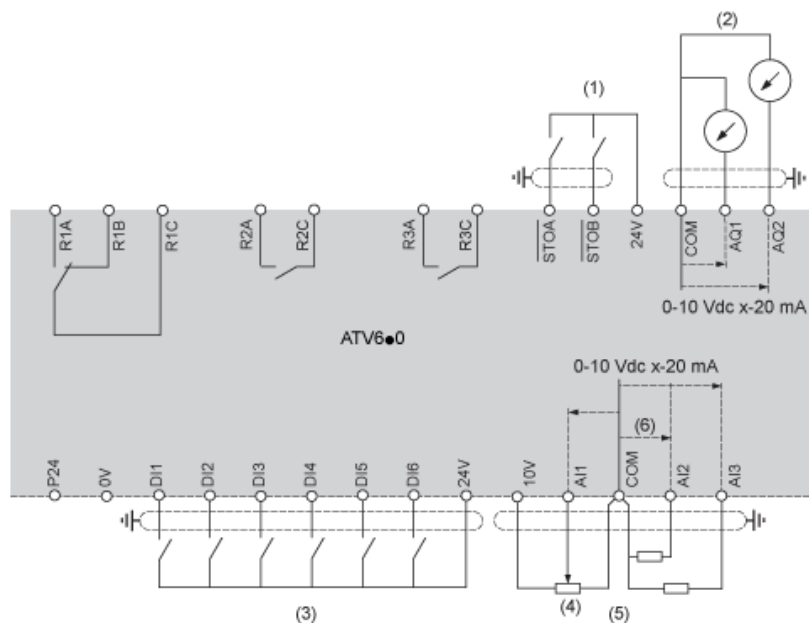
Connection diagrams conforming to standards EN 954-1 category 1 and IEC/EN 61508 capacity SIL1, stopping category 0 in accordance with standard IEC/EN 60204-1



- (1) Line choke if used
- (2) Use relay R1 set to operating state Fault to switch Off the product once an error is detected.
- A1 : Drive
- KM1 : Contactor



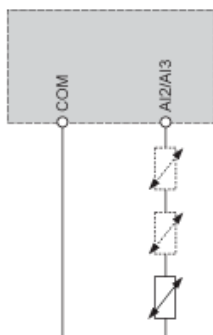
## Control Block Wiring Diagram



- (1) Safe Torque Off
- (2) Analog Output
- (3) Digital Input
- (4) Reference potentiometer
- (5) Analog Input
- R1A, R1B, R1C Relay
- R2A, R2C Sequence relay
- R3A, R3C Sequence relay

## Sensor Connection

It is possible to connect either 1 or 3 sensors on terminals AI2 or AI3.

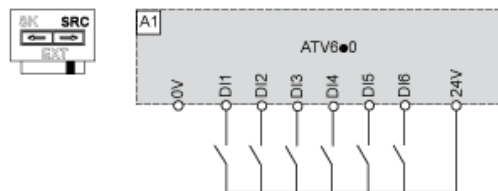


## Sink / Source Switch Configuration

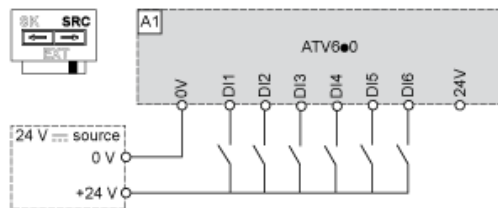
The switch is used to adapt the operation of the logic inputs to the technology of the programmable controller outputs.

- Set the switch to Source (factory setting) if using PLC outputs with PNP transistors.
- Set the switch to Ext if using PLC outputs with NPN transistors.

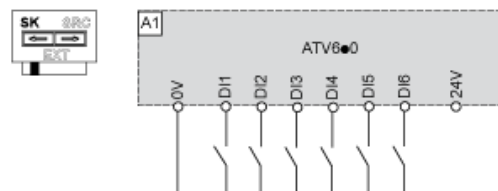
### Switch Set to SRC (Source) Position Using the Output Power Supply for the Digital Inputs



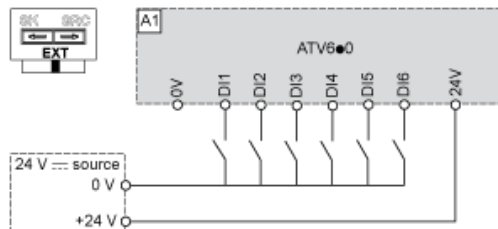
### Switch Set to SRC (Source) Position and Use of an External Power Supply for the DIs



### Switch Set to SK (Sink) Position Using the Output Power Supply for the Digital Inputs



### Switch Set to EXT Position Using an External Power Supply for the DIs



### Derating Curves

