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## 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                | Asynchronous motors<br>Synchronous motors                                                                                      |
| EMC filter                         | Integrated with 150 m conforming to EN/IEC 61800-3 category C3                                                                 |
| IP degree of protection            | IP55 conforming to IEC 60529<br>IP55 conforming to IEC 61800-5-1                                                               |
| 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 (heavy duty)<br>55 kW (normal duty)                                                                                      |
| Motor power hp                     | 60 Hp heavy duty<br>75 hp normal duty                                                                                          |
| Line current                       | 84.2 A at 480 V (normal duty)<br>81.4 A at 380 V (heavy duty)<br>71.8 A at 480 V (heavy duty)<br>97.2 A at 380 V (normal duty) |
| Prospective line I <sub>sc</sub>   | 50 kA                                                                                                                          |
| Apparent power                     | 59.7 KVA at 480 V (heavy duty)<br>70 kVA at 480 V (normal duty)                                                                |
| Continuous output current          | 87 A for heavy duty<br>106 A at 2.5 kHz for normal duty                                                                        |
| Maximum transient current          | 132 A during 60 s (heavy duty)<br>116.6 A during 60 s (normal duty)                                                            |
| Asynchronous motor control profile | Variable torque standard<br>Constant torque standard<br>Constant torque standard                                               |
| Synchronous motor control profile  | Synchronous reluctance motor<br>Permanent magnet motor                                                                         |
| Output frequency                   | 0.0001...0.5 kHz                                                                                                               |
| Speed drive output frequency       | 0.1...599 Hz                                                                                                                   |
| Nominal switching frequency        | 2.5 kHz                                                                                                                        |
| Switching frequency                | 2...8 kHz adjustable<br>2.5...8 kHz with derating factor                                                                       |
| Safety function                    | STO (safe torque off) SIL 3                                                                                                    |
| Discrete input logic               | 16 preset speeds                                                                                                               |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communication port protocol | Ethernet<br>Modbus TCP<br>Modbus TCP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Option card                 | Slot A: communication module, Profinet<br>Slot A: communication module, DeviceNet<br>Slot A: communication module, Modbus TCP/<br>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<br>Slot A: communication module, Profibus DP V1 |

## Complementary

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output voltage                      | $\leq$ power supply voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Permissible temporary current boost | 1.5 x $I_n$ during 60 s (heavy duty)<br>1.1 x $I_n$ during 60 s (normal duty)                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Motor slip compensation             | Automatic whatever the load<br>Not available in permanent magnet motor law<br>Can be suppressed<br>Adjustable                                                                                                                                                                                                                                                                                                                                                                                                                |
| Acceleration and deceleration ramps | Linear adjustable separately from 0.01...9999 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Braking to standstill               | By DC injection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Protection type                     | 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<br>Thermal protection: motor |
| Frequency resolution                | Analog input: 0.012/50 Hz<br>Display unit: 0.1 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Electrical connection               | Motor: screw terminal 70...120 mm <sup>2</sup> /AWG 1/0...250 kcmil<br>Line side: screw terminal 50...120 mm <sup>2</sup> /AWG 1...250 kcmil<br>Control: removable screw terminals 0.5...1.5 mm <sup>2</sup>                                                                                                                                                                                                                                                                                                                 |
| Connector type                      | RJ45 (on the remote graphic terminal) for Modbus serial<br>RJ45 (on the remote graphic terminal) for Ethernet/Modbus TCP                                                                                                                                                                                                                                                                                                                                                                                                     |
| Physical interface                  | 2-wire RS 485 for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transmission frame                  | RTU for Modbus serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Transmission rate                   | 4.8, 9.6, 19.2, 38.4 kbit/s for Modbus serial<br>10/100 Mbit/s for Ethernet IP/Modbus TCP                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 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                              | 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<br>External supply for digital inputs: 24 V DC (19...30 V), <1.25 mA, protection type: overload and short-circuit protection                                                                                                               |

|                           |                                                                                                                                                                                                                                                                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local signalling          | 3 LEDs (dual colour) for embedded communication status<br>4 LEDs (dual colour) for communication module status<br>1 LED (red) for presence of voltage<br>3 LEDs for local diagnostic                                                                                                                                                     |
| Width                     | 345 mm                                                                                                                                                                                                                                                                                                                                   |
| Height                    | 1250 mm                                                                                                                                                                                                                                                                                                                                  |
| Depth                     | 436 mm                                                                                                                                                                                                                                                                                                                                   |
| Net weight                | 89.3 kg                                                                                                                                                                                                                                                                                                                                  |
| Analogue input number     | 3                                                                                                                                                                                                                                                                                                                                        |
| Analogue input type       | AI1, AI2, AI3 software-configurable current: 0...20 mA/4...20 mA, impedance: 250 Ohm, resolution 12 bits<br>AI1, AI2, AI3 software-configurable voltage: 0...10 V DC, impedance: 30 kOhm, resolution 12 bits                                                                                                                             |
| Discrete input number     | 8                                                                                                                                                                                                                                                                                                                                        |
| Discrete input type       | 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<br>DI1...DI6 programmable, 24 V DC (<= 30 V), impedance: 3.5 kOhm                                                                                                                            |
| Input compatibility       | 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<br>DI1...DI6: discrete input level 1 PLC conforming to EN/IEC 61131-2                                                                                                                               |
| Discrete input logic      | 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)<br>Positive logic (source) (DI1...DI6), < 5 V (state 0), > 11 V (state 1)                                   |
| Analogue output number    | 2                                                                                                                                                                                                                                                                                                                                        |
| Analogue output type      | Software-configurable current AO1, AO2: 0...20 mA, resolution 10 bits<br>Software-configurable voltage AO1, AO2: 0...10 V DC impedance 470 Ohm, resolution 10 bits                                                                                                                                                                       |
| Sampling duration         | 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<br>2 ms +/- 0.5 ms (DI1...DI4) - discrete input                                                                                                                                                      |
| Accuracy                  | +/- 1 % AO1, AO2 for a temperature variation 60 °C analog output<br>+/- 0.6 % AI1, AI2, AI3 for a temperature variation 60 °C analog input                                                                                                                                                                                               |
| Linearity error           | AO1, AO2: +/- 0.2 % for analog output<br>AI1, AI2, AI3: +/- 0.15 % of maximum value for analog input                                                                                                                                                                                                                                     |
| Relay output number       | 3                                                                                                                                                                                                                                                                                                                                        |
| Relay output type         | Configurable relay logic R2: sequence relay NO electrical durability 100000 cycles<br>Configurable relay logic R3: sequence relay NO electrical durability 100000 cycles<br>Configurable relay logic R1: fault relay NO/NC 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 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<br>Relay output R1, R2, R3 on resistive load, cos phi = 1: 3 A at 250 V AC |
| Isolation                 | Between power and control terminals                                                                                                                                                                                                                                                                                                      |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variable speed drive application selection | Other application Food and beverage processing<br>Fan Mining mineral and metal<br>Pump Mining mineral and metal<br>Fan Oil and gas<br>Other application Water and waste water<br>Screw compressor Building - HVAC<br>Pump Food and beverage processing<br>Fan Food and beverage processing<br>Atomization Food and beverage processing<br>Electro submersible pump (ESP) Oil and gas<br>Water injection pump Oil and gas<br>Jet fuel pump Oil and gas<br>Compressor for refinery Oil and gas<br>Centrifuge pump Water and waste water<br>Positive displacement pump Water and waste water<br>Electro submersible pump (ESP) Water and waste water<br>Screw pump Water and waste water<br>Lobe compressor Water and waste water<br>Screw compressor Water and waste water<br>Compressor centrifugal Water and waste water<br>Fan Water and waste water<br>Conveyor Water and waste water<br>Mixer Water and waste water |
| Motor power range AC-3                     | 55...100 kW at 480...500 V 3 phases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Mounting mode                              | Wall mount                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## Environment

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insulation resistance                 | > 1 MOhm 500 V DC for 1 minute to earth                                                                                                                                                                                                                                                                                                                                                                                          |
| Noise level                           | 69.9 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         | 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 µs - 8/20 µs 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<br>Electrostatic discharge immunity test level 3 conforming to IEC 61000-4-2 |
| Pollution degree                      | 2 conforming to EN/IEC 61800-5-1                                                                                                                                                                                                                                                                                                                                                                                                 |
| Vibration resistance                  | 1 gn (f= 13...200 Hz) conforming to IEC 60068-2-6<br>1.5 mm peak to peak (f= 2...13 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 | 40...50 °C (with derating factor)<br>-15...40 °C (without derating)                                                                                                                                                                                                                                                                                                                                                              |
| Ambient air temperature for storage   | -40...70 °C                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operating altitude                    | 1000...4800 m with current derating 1 % per 100 m<br><= 1000 m without derating                                                                                                                                                                                                                                                                                                                                                  |
| Environmental characteristic          | Dust pollution resistance class 3S3 conforming to EN/IEC 60721-3-3<br>Chemical pollution resistance class 3C3 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                | UL<br>CSA<br>REACH<br>ATEX zone 2/22<br>TÜV<br>DNV-GL<br>REACH                                                                                                                                                                                                                                                                                                                                                                   |
| Marking                               | CE                                                                                                                                                                                                                                                                                                                                                                                                                               |

## Packing Units

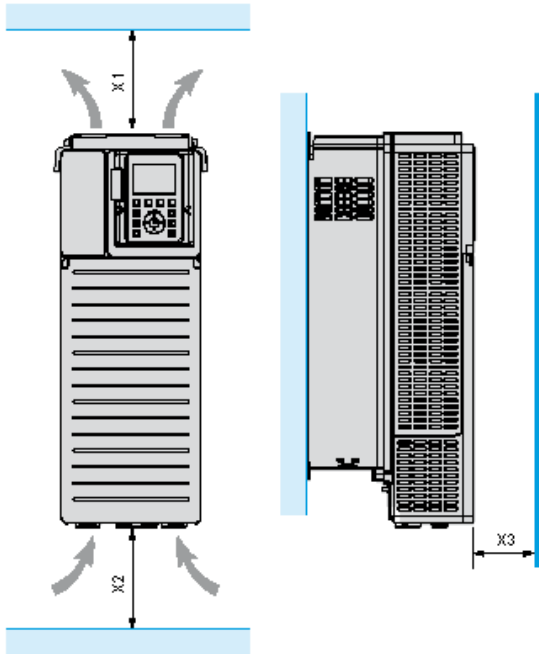
|                  |           |
|------------------|-----------|
| Package 1 Weight | 81.000 kg |
| Package 1 Height | 6.300 dm  |
| Package 1 width  | 4.300 dm  |
| Package 1 Length | 14.000 dm |

## 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) <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 |
| Upgradeability             | <a href="#">Upgraded Components Available</a>                                                                               |



Clearances

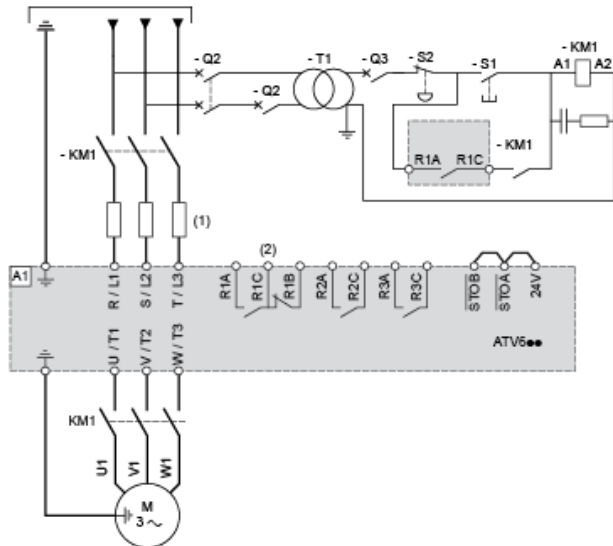


| X1                  | X2                  | X3                 |
|---------------------|---------------------|--------------------|
| ≥ 100 mm (3.94 in.) | ≥ 100 mm (3.94 in.) | ≥ 10 mm (0.39 in.) |



Three-Phase Power Supply with Upstream Breaking via Line Contactor

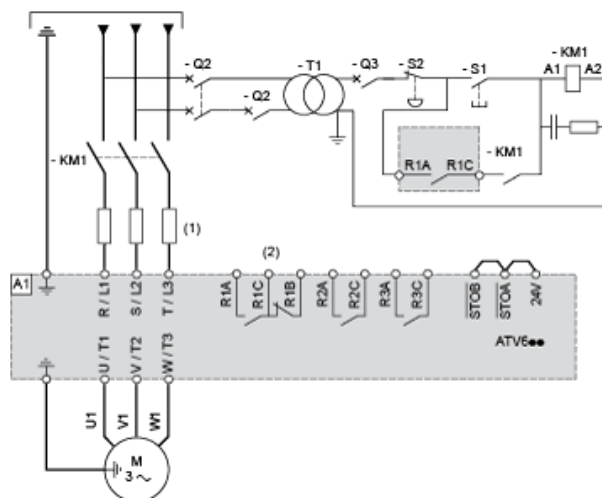
Connection diagrams conforming to standards EN 954-1 category 1 and IEC/EN 61508 capacity SIL1, stopping category 0 in accordance with standard IEC/EN 60204-1



- (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, Circuit breakers
- Q3 :
- S1, Pushbuttons
- S2 :
- T1 : Transformer for control part

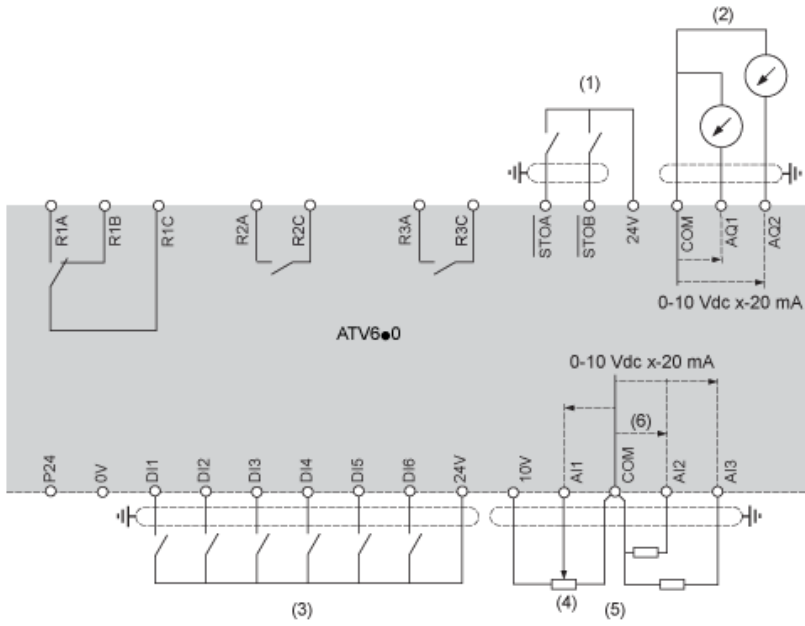
Three-Phase Power Supply with Downstream Breaking via Contactor

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

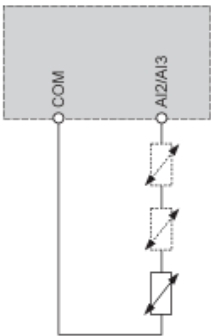
## Control Block Wiring Diagram



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

## Sensor Connection

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

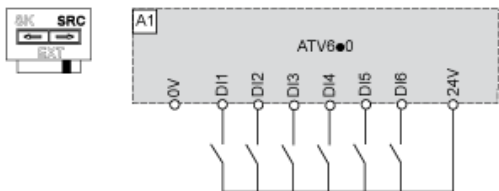


## Sink / Source Switch Configuration

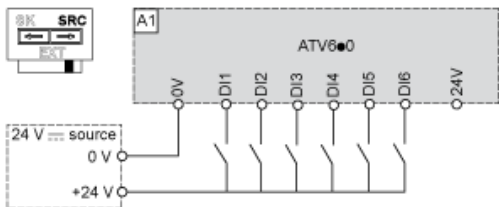
The switch is used to adapt the operation of the logic inputs to the technology of the programmable controller outputs.

- 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.

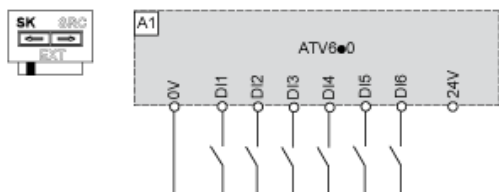
Switch Set to SRC (Source) Position Using the Output Power Supply for the Digital Inputs



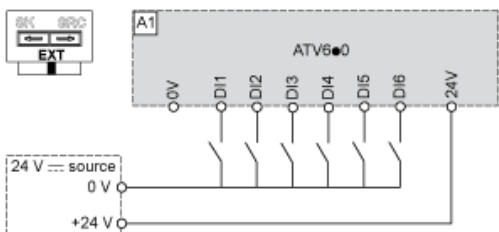
Switch Set to SRC (Source) Position and Use of an External Power Supply for the DIs



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

