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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                            | Standard version  |
| Product destination                | Asynchronous motors<br>Synchronous motors   |
| 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            | IP54 conforming to IEC 60529<br>IP55 conforming to IEC 61800-5-1  |
| [Us] rated supply voltage          | 380...480 V   |
| Type of cooling                    | Forced convection   |
| Supply frequency                   | 50...60 Hz - 5...5 %  |
| [Us] rated supply voltage          | 380...480 V - 15...10 %   |
| Motor power kW                     | 7.5 kW (heavy duty)<br>11.0 kW (normal duty)  |
| Motor power hp                     | 10 Hp heavy duty<br>15 hp normal duty   |
| Line current                       | 19.8 A at 380 V (normal duty)<br>17 A at 480 V (normal duty)<br>14.1 A at 380 V (heavy duty)<br>12.5 A at 480 V (heavy duty)    |
| Prospective line Isc               | 50 kA   |
| Apparent power                     | 10.4 kVA at 480 V (heavy duty)<br>14.1 kVA at 480 V (normal duty)   |
| Continuous output current          | 16.5 A at 2.5 kHz for heavy duty<br>23.5 A at 4 kHz for normal duty   |
| Maximum transient current          | 24.8 A during 60 s (heavy duty)<br>25.9 A during 60 s (normal duty)   |
| Asynchronous motor control profile | Constant torque standard<br>Optimized torque mode<br>Optimized torque mode  |
| Synchronous motor control profile  | Synchronous reluctance motor<br>Permanent magnet motor  |
| Speed drive output frequency       | 0.1...500 Hz  |
| Nominal switching frequency        | 4 kHz   |
| Switching frequency                | 2...8 kHz adjustable<br>2...12 kHz adjustable   |
| Safety function                    | STO (safe torque off) SIL 3   |
| Discrete input logic               | 16 preset speeds  |

|                             |   |
|-----------------------------|---|
| Communication port protocol | Modbus TCP<br>Ethernet<br>Ethernet  |
| 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<br>chain RJ45<br>Slot A: communication module, CANopen SUB-D 9<br>Slot A: communication module, CANopen screw<br>terminals<br>Slot A/slot B: digital and analog I/O extension<br>module<br>Slot A/slot B: output relay extension module<br>Slot A: communication module, Ethernet IP/Modbus<br>TCP/MD-Link<br>Communication module, BACnet MS/TP<br>Communication module, Ethernet Powerlink<br>Slot A: communication module, Profibus DP V1 |

## Complementary

|                                     |  |
|-------------------------------------|--|
| Mounting mode                       | Wall mount   |
| Network number of phases            | 3 phases   |
| Discrete output number              | 0  |
| Discrete output type                | Relay outputs R1A, R1B, R1C 250 V AC 3000 mA<br>Relay outputs R1A, R1B, R1C 30 V DC 3000 mA<br>Relay outputs R2A, R2C 250 V AC 5000 mA<br>Relay outputs R2A, R2C 30 V DC 5000 mA<br>Relay outputs R3A, R3C 250 V AC 5000 mA<br>Relay outputs R3A, R3C 30 V DC 5000 mA  |
| 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             | Not available in permanent magnet motor law<br>Can be suppressed<br>Automatic whatever the load<br>Can be suppressed   |
| Acceleration and deceleration ramps | Linear adjustable separately from 0.01...9999 s  |
| Physical interface                  | Ethernet<br>2-wire RS 485  |
| 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 |
| Transmission rate                   | 10, 100 Mbits<br>4800 bps, 9600 bps, 19200 bps, 38.4 Kbps  |
| Frequency resolution                | Analog input: 0.012/50 Hz<br>Display unit: 0.1 Hz  |
| Transmission frame                  | RTU  |

|                        |   |
|------------------------|---|
| Electrical connection  | Line side: M12 bar - 3 cables 3 x 185 mm <sup>2</sup> maximum per phase (normal duty)<br>Line side: M12 bar - 4 cables 3 x 120 mm <sup>2</sup> maximum per phase (normal duty)<br>Motor: M12 bar - 3 cables 3 x 185 mm <sup>2</sup> maximum per phase (normal duty)<br>Motor: M12 bar - 4 cables 3 x 120 mm <sup>2</sup> maximum per phase (normal duty)<br>Line side: M12 bar - 3 cables 3 x 185 mm <sup>2</sup> maximum per phase (heavy duty)<br>Line side: M12 bar - 4 cables 3 x 120 mm <sup>2</sup> maximum per phase (heavy duty)<br>Motor: M12 bar - 3 cables 3 x 185 mm <sup>2</sup> maximum per phase (heavy duty)<br>Motor: M12 bar - 4 cables 3 x 120 mm <sup>2</sup> maximum per phase (heavy duty)<br>Line side: M12 bar - 3 cables 3 x 150 mm <sup>2</sup> minimum per phase (normal duty)<br>Line side: M12 bar - 4 cables 3 x 95 mm <sup>2</sup> minimum per phase (normal duty)<br>Motor: M12 bar - 2 cables 3 x 185 mm <sup>2</sup> minimum per phase (normal duty)<br>Motor: M12 bar - 3 cables 3 x 120 mm <sup>2</sup> minimum per phase (normal duty)<br>Line side: M12 bar - 2 cables 3 x 185 mm <sup>2</sup> minimum per phase (heavy duty)<br>Line side: M12 bar - 3 cables 3 x 95 mm <sup>2</sup> minimum per phase (heavy duty)<br>Motor: M12 bar - 2 cables 3 x 185 mm <sup>2</sup> minimum per phase (heavy duty)<br>Motor: M12 bar - 3 cables 3 x 120 mm <sup>2</sup> minimum per phase (heavy duty)<br>Control: removable screw terminals 0.5...1.5 mm <sup>2</sup> /AWG 20...AWG 16 |
| Connector type         | RJ45 (on the remote graphic terminal) for Modbus serial<br>RJ45 (on the remote graphic terminal) for Ethernet/Modbus TCP  |
| Data format            | 8 bits, configurable odd, even or no parity   |
| Type of polarization   | No impedance  |
| Exchange mode          | Half duplex, full duplex, autonegotiation Ethernet/Modbus TCP   |
| 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                  | 264 mm  |
| Height                 | 678 mm  |
| Depth                  | 299 mm  |
| Net weight             | 13.7 kg   |
| Analogue input number  | 3   |
| Analogue input type    | AI1, AI2, AI3 software-configurable voltage: 0...10 V DC, impedance: 31.5 kOhm, resolution 12 bits<br>AI1, AI2, AI3 software-configurable current: 0...20 mA, impedance: 250 Ohm, resolution 12 bits<br>AI2 voltage analog input: - 10...10 V DC, impedance: 31.5 kOhm, resolution 12 bits  |
| Discrete input number  | 8   |
| Discrete input type    | DI7, DI8 programmable as pulse input: 0...30 kHz, 24 V DC (<= 30 V)   |
| 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   | Positive logic (source) (DI1...DI8), < 5 V (state 0), > 11 V (state 1)<br>Negative logic (sink) (DI1...DI8), > 16 V (state 0), < 10 V (state 1)   |
| Analogue output number | 2   |
| Analogue output type   | Software-configurable voltage AQ1, AQ2: 0...10 V DC impedance 470 Ohm, resolution 10 bits<br>Software-configurable current AQ1, AQ2: 0...20 mA, resolution 10 bits<br>Software-configurable current DQ-, DQ+: 30 V DC<br>Software-configurable current DQ-, DQ+: 100 mA   |
| 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  |
| Maximum output frequency                   | 500 kHz  |
| Maximum input current                      | 19.8 A   |
| 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<br>Compressor centrifugal Building - HVAC |
| Motor power range AC-3                     | 250...500 kW at 480...500 V 3 phases<br>7...11 kW at 380...440 V 3 phases  |
| Quantity per set                           | 1  |
| Enclosure mounting                         | Wall mounted   |

## Environment







|                                       |  |
|---------------------------------------|--|
| Insulation resistance                 | > 1 MOhm 500 V DC for 1 minute to earth  |
| Noise level                           | 52 dB conforming to 86/188/EEC   |
| Power dissipation in W                | 5700 W, switching frequency 2.5 kHz (heavy duty)   |
| 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  |

|                        |  |
|------------------------|--|
| Standards              | 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<br>UL 508C |
| Product certifications | ATEX zone 2/22<br>CSA<br>ATEX INERIS<br>TÜV  |
| Marking                | CE   |
| Standards              | EN/IEC 61800-3<br>EN/IEC 61800-3 environment 2 category C3<br>EN/IEC 61800-5-1<br>IEC 61000-3-12<br>IEC 60721-3<br>IEC 61508<br>IEC 13849-1<br>UL 508C |
| Overvoltage category   | III  |
| Regulation loop        | Adjustable PID regulator   |
| Noise level            | 52 dB  |
| Pollution degree       | 3  |

### Packing Units

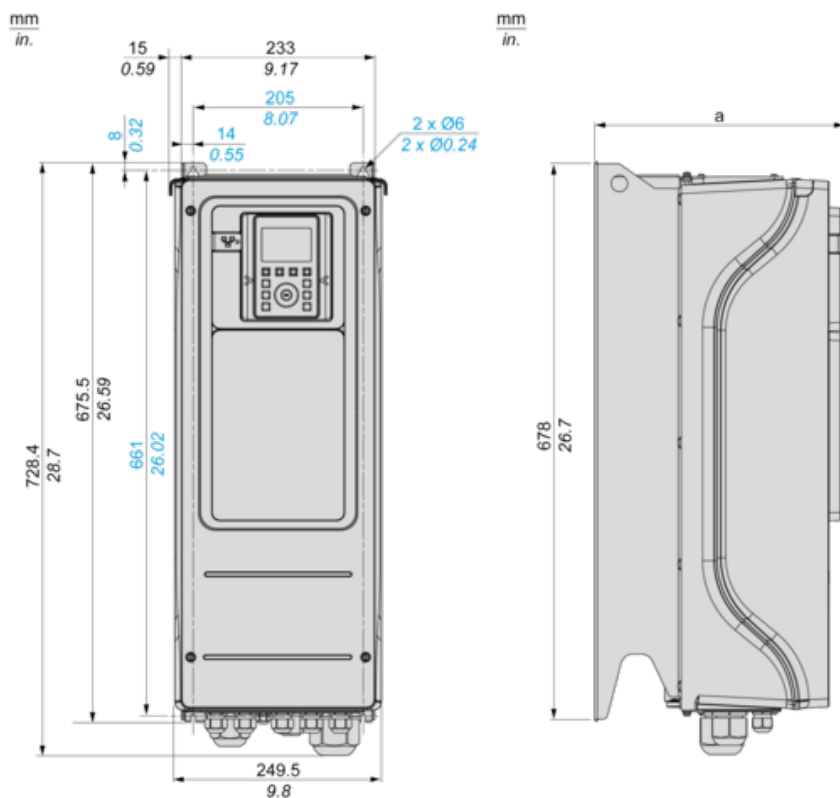
|                              |         |
|------------------------------|---------|
| Unit Type of Package 1       | PCE     |
| Number of Units in Package 1 | 1       |
| Package 1 Height             | 75.0 cm |
| Package 1 Width              | 60.0 cm |
| Package 1 Length             | 80.0 cm |
| Package 1 Weight             | 29.5 kg |
| Unit Type of Package 2       | P06     |
| Number of Units in Package 2 | 1       |
| Package 2 Height             | 75.0 cm |
| Package 2 Width              | 60.0 cm |
| Package 2 Length             | 80.0 cm |
| Package 2 Weight             | 29.5 kg |

### 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  |
| China RoHS Regulation      |  <a href="#">China RoHS Declaration</a>   |
| RoHS exemption information |  <a href="#">Yes</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             | Upgraded components available  |

Dimensions

Front and Left Views



(a) = 299 mm (11.8 in.)

Clearances

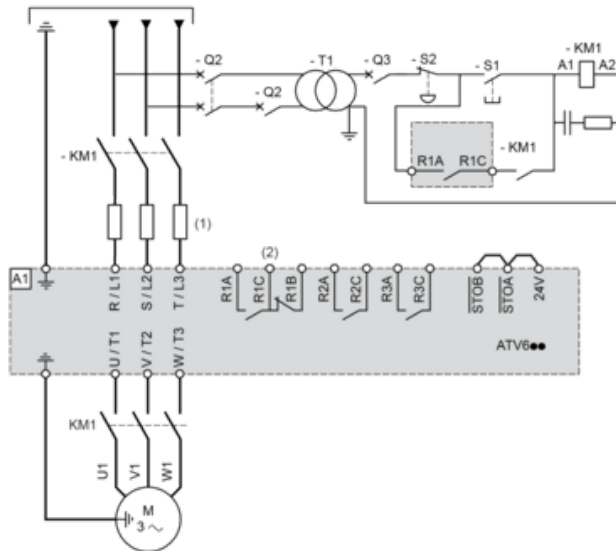


| X1                  | X2                  | X3                 |
|---------------------|---------------------|--------------------|
| ≥ 100 mm (3.94 in.) | ≥ 100 mm (3.94 in.) | ≥ 10 mm (0.39 in.) |



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

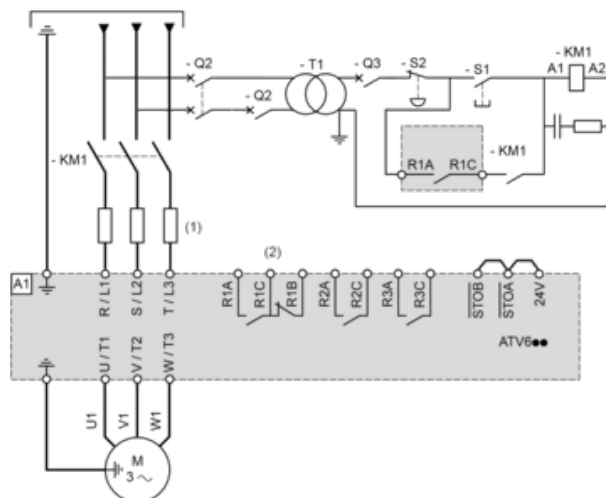
Q2, Q3 : Circuit breakers

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



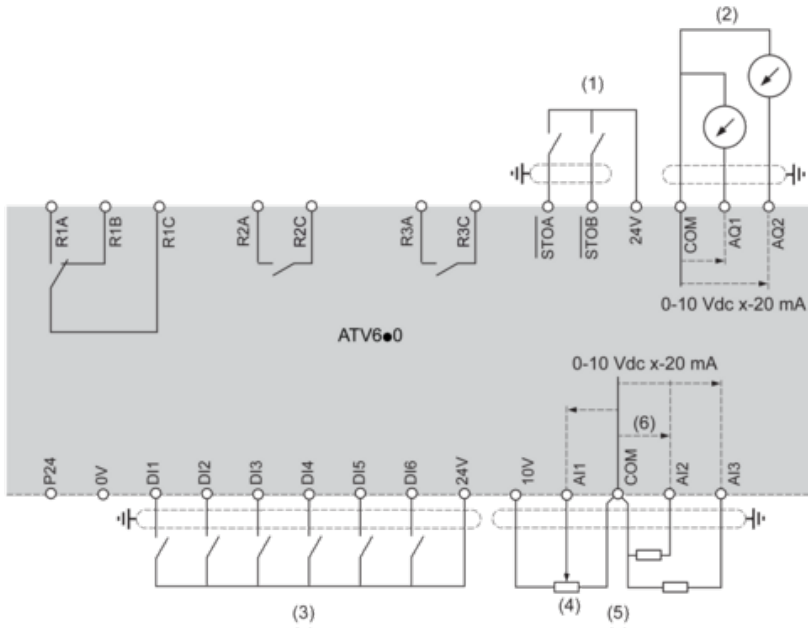
(1) Line choke if used

(2) Use relay R1 set to operating state Fault to switch Off the product once an error is detected.

A1 : Drive

KM1 : Contactor

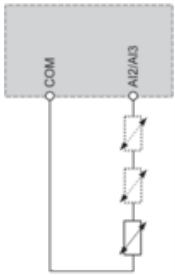
## Control Block Wiring Diagram



- (1) Safe Torque Off
  - (2) Analog Output
  - (3) Digital Input
  - (4) Reference potentiometer
  - (5) Analog Input
- R1A, R1B, R1C : Fault 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.

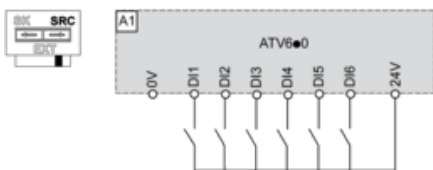


## Sink / Source Switch Configuration

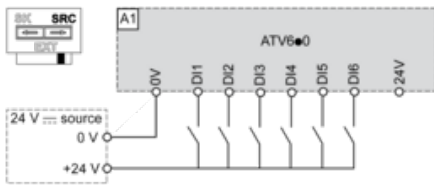
The switch is used to adapt the operation of the logic inputs to the technology of the programmable controller outputs.

- 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.

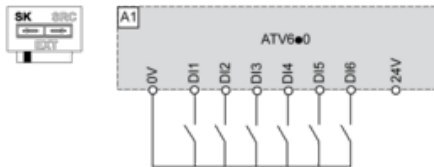
## Switch Set to SRC (Source) Position Using the Output Power Supply for the Digital Inputs



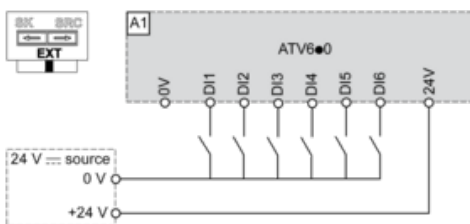
### Switch Set to SRC (Source) Position and Use of an External Power Supply for the DIs



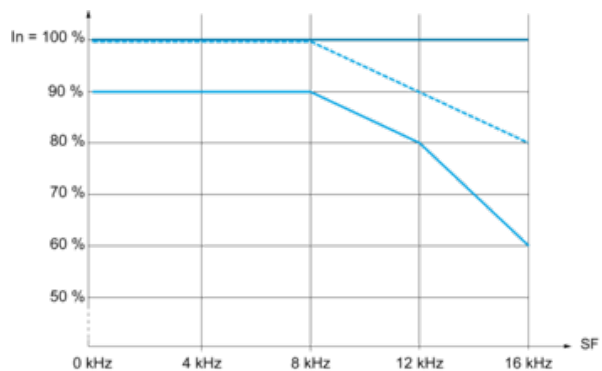
### Switch Set to SK (Sink) Position Using the Output Power Supply for the Digital Inputs



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



Derating Curves



- 40 °C (104 °F)
- 45 °C (113 °F)
- 50 °C (122 °F)

In : Nominal Drive Current  
SF : Switching Frequency