





## Main

|                                    |                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range of product                   | Altivar Machine ATV320                                                                                                                                                                                                                                                                                                                                                                  |
| Product or component type          | Variable speed drive                                                                                                                                                                                                                                                                                                                                                                    |
| Product specific application       | Complex machines                                                                                                                                                                                                                                                                                                                                                                        |
| Device short name                  | ATV320                                                                                                                                                                                                                                                                                                                                                                                  |
| Product destination                | Synchronous motors<br>Asynchronous motors                                                                                                                                                                                                                                                                                                                                               |
| Format of the control block        | Compact                                                                                                                                                                                                                                                                                                                                                                                 |
| EMC filter                         | Class C2 EMC filter integrated                                                                                                                                                                                                                                                                                                                                                          |
| IP degree of protection            | IP20 conforming to IEC 61800-5-1<br>IP20 conforming to IEC 60529                                                                                                                                                                                                                                                                                                                        |
| Degree of protection               | UL type 1 (with conformity kit)                                                                                                                                                                                                                                                                                                                                                         |
| Type of cooling                    | Fan                                                                                                                                                                                                                                                                                                                                                                                     |
| Network number of phases           | 1 phase                                                                                                                                                                                                                                                                                                                                                                                 |
| [Us] rated supply voltage          | 200...240 V - 15...10 %                                                                                                                                                                                                                                                                                                                                                                 |
| Supply frequency                   | 50...60 Hz - 5...5 %                                                                                                                                                                                                                                                                                                                                                                    |
| Motor power kW                     | 1.5 kW for heavy duty                                                                                                                                                                                                                                                                                                                                                                   |
| Motor power hp                     | 2.0 hp for heavy duty                                                                                                                                                                                                                                                                                                                                                                   |
| Line current                       | 16.0 A at 200 V (heavy duty)<br>13.4 A at 240 V (heavy duty)                                                                                                                                                                                                                                                                                                                            |
| Prospective line I <sub>sc</sub>   | 1 kA                                                                                                                                                                                                                                                                                                                                                                                    |
| Apparent power                     | 3.2 kVA at 240 V (heavy duty)                                                                                                                                                                                                                                                                                                                                                           |
| Continuous output current          | 8.0 A at 4 kHz for heavy duty                                                                                                                                                                                                                                                                                                                                                           |
| Maximum transient current          | 12.0 A during 60 s (heavy duty)                                                                                                                                                                                                                                                                                                                                                         |
| Power range                        | 1.5...2.2 kW at 200...240 V, 1 phase (based on load duty)                                                                                                                                                                                                                                                                                                                               |
| Asynchronous motor control profile | Voltage/Frequency ratio, 5 points<br>Flux vector control without sensor, standard<br>Voltage/Frequency ratio - Energy Saving, quadratic U/f<br>Flux vector control without sensor - Energy Saving<br>Voltage/frequency ratio, 2 points                                                                                                                                                  |
| Synchronous motor control profile  | Vector control without sensor                                                                                                                                                                                                                                                                                                                                                           |
| Speed drive output frequency       | 0.1...599 Hz                                                                                                                                                                                                                                                                                                                                                                            |
| Nominal switching frequency        | 4 kHz                                                                                                                                                                                                                                                                                                                                                                                   |
| Switching frequency                | 2...16 kHz adjustable<br>4...16 kHz with derating factor                                                                                                                                                                                                                                                                                                                                |
| Safety function                    | STO (safe torque off) SIL 3<br>SLS (safe limited speed)<br>SS1 (safe stop 1)<br>SMS (safe maximum speed)<br>GDL (guard door locking)                                                                                                                                                                                                                                                    |
| Communication port protocol        | Modbus serial<br>CANopen                                                                                                                                                                                                                                                                                                                                                                |
| Optional communication modules     | Communication module, CANopen daisy chain RJ45<br>Communication module, CANopen SUB-D 9<br>Communication module, CANopen open style terminal block<br>Communication module, EtherCAT RJ45<br>Communication module, DeviceNet<br>Communication module, Ethernet/IP<br>Communication module, Profibus DP V1<br>Communication module, Profinet<br>Communication module, Ethernet Powerlink |

## Complementary

|                                     |                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variant                             | Standard version                                                                                                                                                                                                                                                                                          |
| Output voltage                      | $\leq$ power supply voltage                                                                                                                                                                                                                                                                               |
| Permissible temporary current boost | 1.5 x I <sub>n</sub> during 60 s (heavy duty)                                                                                                                                                                                                                                                             |
| Speed range                         | 1...100 for asynchronous motor in open-loop mode                                                                                                                                                                                                                                                          |
| Speed accuracy                      | +/- 10 % of nominal slip 0.2 T <sub>n</sub> to T <sub>n</sub>                                                                                                                                                                                                                                             |
| Torque accuracy                     | +/- 15 %                                                                                                                                                                                                                                                                                                  |
| Transient overtorque                | 170...200 % of nominal motor torque                                                                                                                                                                                                                                                                       |
| Braking torque                      | $\leq$ 170 % during 60 s with braking resistor                                                                                                                                                                                                                                                            |
| Regulation loop                     | Adjustable PID regulator                                                                                                                                                                                                                                                                                  |
| Motor slip compensation             | Automatic whatever the load<br>Adjustable 0...300 %<br>Not available in voltage/frequency ratio (2 or 5 points)                                                                                                                                                                                           |
| Acceleration and deceleration ramps | Linear<br>U<br>S<br>CUS<br>Ramp switching<br>Acceleration/Deceleration ramp adaptation<br>Acceleration/deceleration automatic stop with DC injection                                                                                                                                                      |
| Braking to standstill               | By DC injection                                                                                                                                                                                                                                                                                           |
| Protection type                     | Input phase breaks: drive<br>Overcurrent between output phases and earth: drive<br>Overheating protection: drive<br>Short-circuit between motor phases: drive<br>Thermal protection: drive                                                                                                                |
| Frequency resolution                | Display unit: 0.1 Hz<br>Analog input: 0.012/50 Hz                                                                                                                                                                                                                                                         |
| Electrical connection               | Screw terminal, clamping capacity: 0.5...1.5 mm <sup>2</sup> , AWG 20...AWG 16 (control)<br>Screw terminal, clamping capacity: 1.5...2.5 mm <sup>2</sup> , AWG 14...AWG 12 (motor/<br>braking resistor)<br>Screw terminal, clamping capacity: 1.5...4 mm <sup>2</sup> , AWG 14...AWG 10 (power<br>supply) |
| Connector type                      | 1 RJ45 (on terminal) for Modbus/CANopen                                                                                                                                                                                                                                                                   |
| Physical interface                  | 2-wire RS 485 for Modbus serial/CANopen                                                                                                                                                                                                                                                                   |
| Transmission frame                  | RTU for Modbus serial                                                                                                                                                                                                                                                                                     |
| Transmission rate                   | 4.8, 9.6, 19.2, 38.4 kbit/s for Modbus serial<br>50 kbps, 125 kbps, 250 kbps, 500 kbps, 1 Mbps for CANopen                                                                                                                                                                                                |
| 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...127 for CANopen<br>1...247 for Modbus serial                                                                                                                                                                                                                                                          |
| Method of access                    | Slave CANopen                                                                                                                                                                                                                                                                                             |
| Supply                              | Internal supply for reference potentiometer (1 to 10 kOhm): 10.5 V DC +/- 5 %, <10 mA, protection type: overload and short-circuit protection                                                                                                                                                             |
| Local signalling                    | 1 LED (green)CANopen run:<br>1 LED (red)CANopen error:<br>1 LED (red)drive fault:                                                                                                                                                                                                                         |
| Width                               | 105.0 mm                                                                                                                                                                                                                                                                                                  |
| Height                              | 142.0 mm                                                                                                                                                                                                                                                                                                  |
| Depth                               | 158.0 mm                                                                                                                                                                                                                                                                                                  |
| Product weight                      | 1.6 kg                                                                                                                                                                                                                                                                                                    |
| Analogue input number               | 3                                                                                                                                                                                                                                                                                                         |
| Analogue input type                 | AI1 voltage: 0...10 V DC, impedance: 30000 Ohm, resolution 10 bits<br>AI2 bipolar differential voltage: +/- 10 V DC, impedance: 30000 Ohm, resolution 10 bits<br>AI3 current: 0...20 mA (or 4-20 mA, x-20 mA, 20-x mA or other patterns by configuration), impedance: 250 Ohm, resolution 10 bits         |
| Discrete input number               | 7                                                                                                                                                                                                                                                                                                         |
| Discrete input type                 | Programmable (sink/source) (DI1...DI4)24...30 V DC, with level 1 PLC<br>Programmable as pulse input 20 kpps (DI5)24...30 V DC, with level 1 PLC<br>Switch-configurable PTC probe (DI6)24...30 V DC<br>Safe torque off (STO)24...30 V DC - 1500 Ohm                                                        |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Discrete input logic                       | Negative logic (sink) (DI1...DI6), > 19 V (state 0), < 13 V (state 1)<br>Positive logic (source) (DI1...DI6), < 5 V (state 0), > 11 V (state 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Analogue output number                     | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Analogue output type                       | AQ1 software-configurable current: 0...20 mA, impedance: 800 Ohm, resolution 10 bits<br>AQ1 software-configurable voltage: 0...10 V, impedance: 470 Ohm, resolution 10 bits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Sampling duration                          | 2 Ms (AI1, AI2, AI3) - analog input<br>2 ms (AQ1) - analog output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Accuracy                                   | +/- 0.2 % AI1, AI2, AI3 for a temperature of -10...60 °C analog input<br>+/- 0.5 % AI1, AI2, AI3 for a temperature of 25 °C analog input<br>+/- 1 % AQ1 for a temperature of 25 °C analog output<br>+/- 2 % AQ1 for a temperature of -10...60 °C analog output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Linearity error                            | AI1, AI2, AI3: +/- 0.2...0.5 % of maximum value for analog input<br>AQ1: +/- 0.3 % for analog output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Discrete output number                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Discrete output type                       | Configurable relay logic: (R1A, R1B, R1C) NO/NC - 100000 cycles<br>Configurable relay logic: (R2A, R2B) NO - 100000 cycles<br>Logic: (LO)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Refresh time                               | Logic input (DI1...DI6): 8 ms (+/- 0.7 ms)<br>Relay output (R1A, R1B, R1C): 2 ms<br>Relay output (R2A, R2C): 2 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Minimum switching current                  | Relay output R1, R2: 5 mA at 24 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Maximum switching current                  | Relay output R1 on resistive load, cos phi = 1: 3 A at 250 V AC<br>Relay output R1 on resistive load, cos phi = 1: 4 A at 30 V DC<br>Relay output R1, R2 on inductive load, cos phi = 0.4: 2 A at 250 V AC<br>Relay output R1, R2 on inductive load, cos phi = 0.4: 2 A at 30 V DC<br>Relay output R2 on resistive load, cos phi = 1: 5 A at 250 V AC<br>Relay output R2 on resistive load, cos phi = 1: 5 A at 30 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Specific application                       | Machinery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Variable speed drive application selection | Self erecting Hoisting<br>Carousel Material handling<br>Conveyor Material handling<br>Lifting platform Material handling<br>Palletizers - medium performance Material handling<br>Transfer table Material handling<br>Turn table Material handling<br>Cutting - medium accuracy Material working (wood, ceramic, stone, pvc, metal)<br>Drilling Material working (wood, ceramic, stone, pvc, metal)<br>Saw Material working (wood, ceramic, stone, pvc, metal)<br>Bagging Packaging<br>Feed conveyor low performance Packaging<br>Filling bottles - intermittent operation Packaging<br>Linear labeling Packaging<br>Other application Packaging<br>Stretching wrapping Packaging<br>Tray take Packaging<br>Knitting Textile<br>Printing machines Textile<br>Spinning Textile<br>Car Washing machines<br>Other application Washing machines<br>Standard crane - travelling or trolley Hoisting |
| Motor power range                          | 1.5...2.2 kW at 200...240 V 1 phase                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Motor starter type                         | Variable speed drive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Environment

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolation                     | Between power and control terminals                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Insulation resistance         | > 1 MOhm 500 V DC for 1 minute to earth                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Noise level                   | 48 dB conforming to 86/188/EEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Power dissipation in W        | Fan: 82.4 W at 200 V, switching frequency 4 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Volume of cooling air         | 16.0 m3/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Operating position            | Vertical +/- 10 degree                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Electromagnetic compatibility | 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>Electrical fast transient/burst immunity test level 4 conforming to IEC 61000-4-4<br>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>Voltage dips and interruptions immunity test conforming to IEC 61000-4-11 |

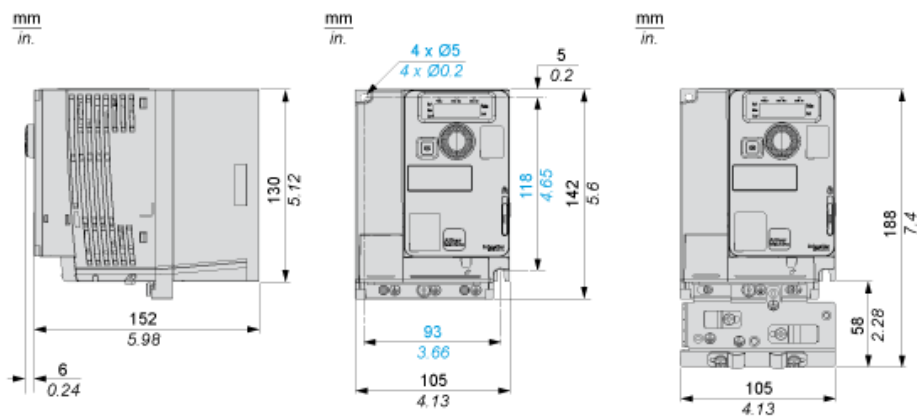
|                                       |                                                                                                                                                                                         |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pollution degree                      | 2 conforming to EN/IEC 61800-5-1<br>3 conforming to EN/IEC 61800-5-1                                                                                                                    |
| Vibration resistance                  | 1 gn (f= 13...200 Hz) conforming to EN/IEC 60068-2-6<br>1.5 mm peak to peak (f= 2...13 Hz) conforming to EN/IEC 60068-2-6                                                               |
| Shock resistance                      | 15 gn for 11 ms conforming to EN/IEC 60068-2-27                                                                                                                                         |
| Relative humidity                     | 5...95 % without condensation conforming to IEC 60068-2-3<br>5...95 % without dripping water conforming to IEC 60068-2-3                                                                |
| Ambient air temperature for operation | -10...50 °C without<br>50...60 °C with derating factor                                                                                                                                  |
| Ambient air temperature for storage   | -25...70 °C                                                                                                                                                                             |
| Operating altitude                    | <= 1000 m without<br>1000...2000 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 3S2 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                | CE<br>ATEX<br>NOM<br>EAC<br>RCM<br>KC                                                                                                                                                   |
| Marking                               | CE<br>ATEX<br>UL<br>CSA<br>EAC<br>RCM<br>KC                                                                                                                                             |

## Offer Sustainability

|                            |                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Sustainable offer status   | Green Premium product                                                                                                       |
| 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 |

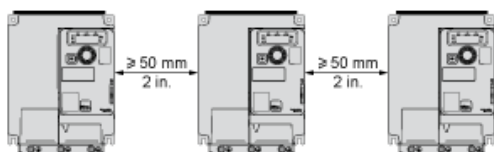
Dimensions

Right View, Front View and Front View with EMC Plate



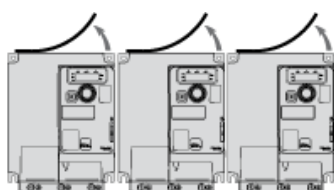
## Mounting Types

### Mounting Type A: Individual with Ventilation Cover

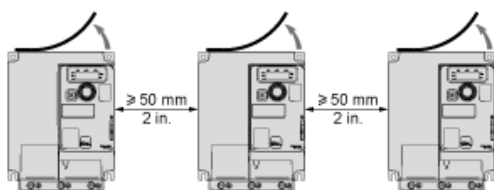


Only Possible at Ambient Temperature Less or Equal to 50 °C (122 °F)

### Mounting Type B: Side by Side, Ventilation Cover Removed



### Mounting Type C: Individual, Ventilation Cover Removed

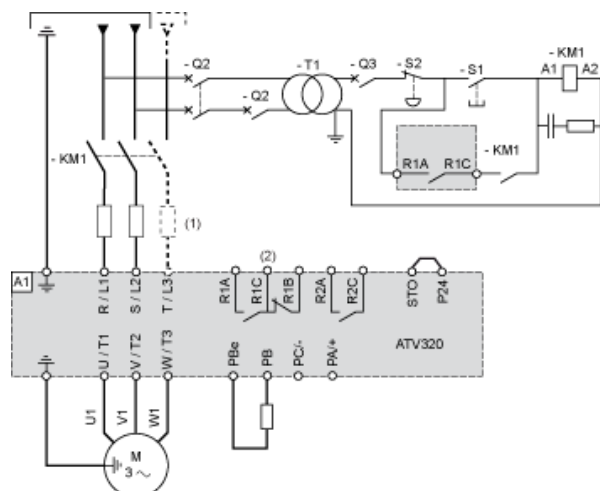


For Operation at Ambient Temperature Above 50 °C (122 °F)

## Connection Diagrams

### Diagram with Line Contactor

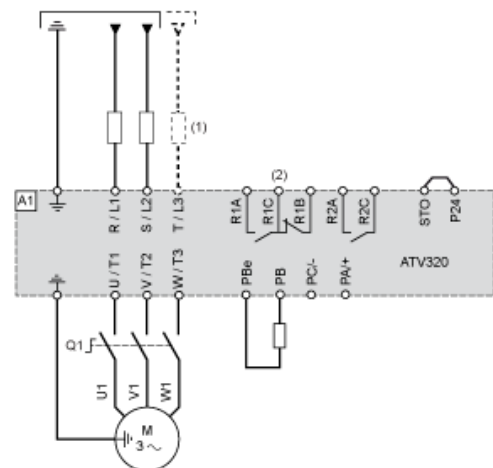
Connection diagrams conforming to standards ISO13849 category 1 and IEC/EN 61508 capacity SIL1, stopping category 0 in accordance with standard IEC/EN 60204-1.



- (1) Line choke (if used)
- (2) Fault relay contacts, for remote signaling of drive status

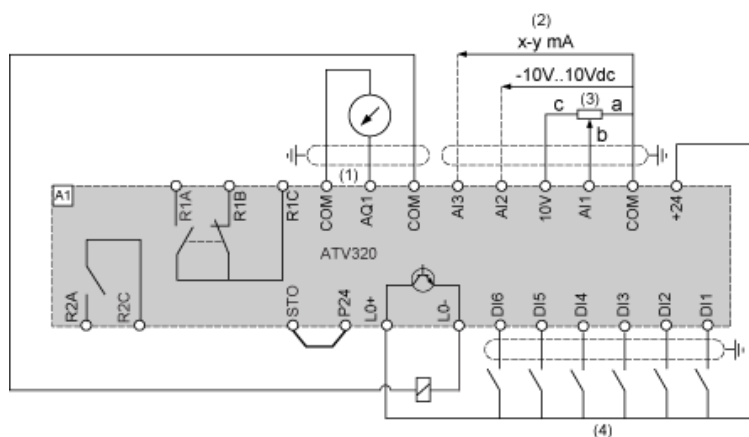
### Diagram with Switch Disconnect

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) Fault relay contacts, for remote signaling of drive status

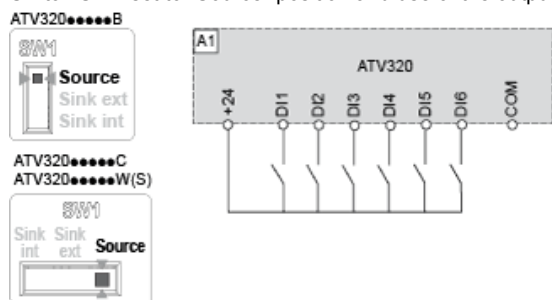
## Control Connection Diagram in Source Mode



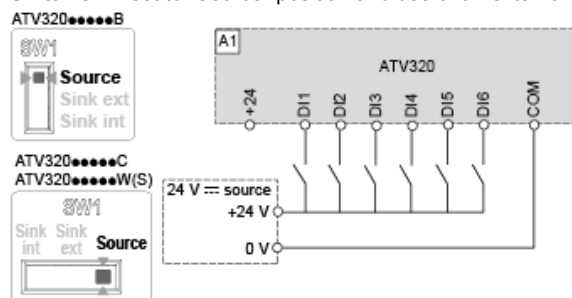
- (1) Analog output
- (2) Analog inputs
- (3) Reference potentiometer (10 kOhm maxi)
- (4) Digital inputs

## Digital Inputs Wiring

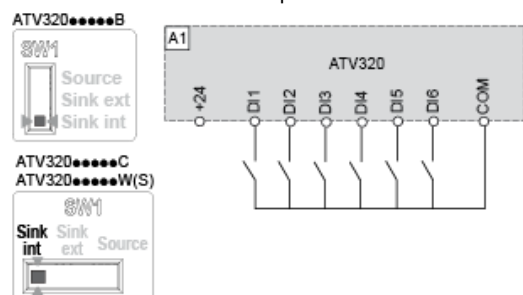
The logic input switch (SW1) is used to adapt the operation of the logic inputs to the technology of the programmable controller outputs. Switch SW1 set to “Source” position and use of the output power supply for the DIs.



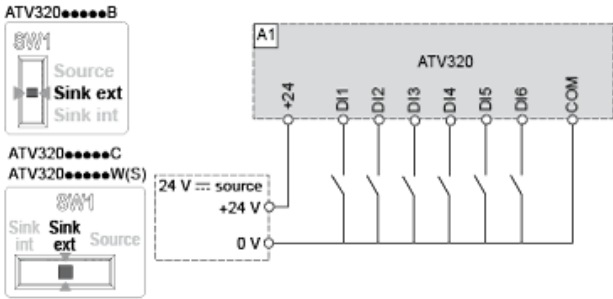
Switch SW1 set to “Source” position and use of an external power supply for the DIs.



Switch SW1 set to “Sink Int” position and use of the output power supply for the DIs.

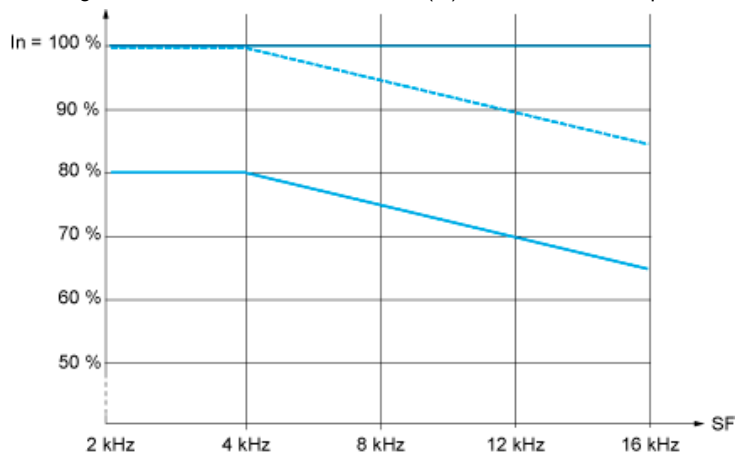


Switch SW1 set to “Sink Ext” position and use of an external power supply for the DIs.



## Derating Curves

Derating curve for the nominal drive current ( $I_n$ ) as a function of temperature and switching frequency (SF).



— 40 °C (104 °F) - Mounting type A, B and C

- - - 50 °C (122 °F) - Mounting type A, B and C

— 60 °C (140 °F) - Mounting type B and C

$I_n$  : Nominal Drive Current

SF : Switching Frequency