

# ATV71EXC2C31N

enclosed variable speed drive ATV71 Plus -  
315 kW - 500 V - IP23



## Main

|                              |                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range of product             | Altivar 71 Plus                                                                                                                                                                                                                                          |
| Product or component type    | Variable speed drive                                                                                                                                                                                                                                     |
| Device short name            | ATV71 Plus                                                                                                                                                                                                                                               |
| Product destination          | Asynchronous motors<br>Synchronous motors                                                                                                                                                                                                                |
| Product specific application | Complex, high-power machines                                                                                                                                                                                                                             |
| Assembly style               | In floor-standing enclosure compact version                                                                                                                                                                                                              |
| Product composition          | A line choke<br>ATV71HC40Y drive on heatsink<br>An IP65 remote mounting kit for graphic display terminal<br>A switch and fast-acting semi-conductor fuses<br>A wired ready-assembled Sarel Spacial 6000 enclosure<br>Terminals/Bars for motor connection |
| EMC filter                   | Integrated                                                                                                                                                                                                                                               |
| Network number of phases     | 3 phases                                                                                                                                                                                                                                                 |
| Rated supply voltage         | (+/- 10 %)                                                                                                                                                                                                                                               |
| Supply voltage limits        | 450...578 V                                                                                                                                                                                                                                              |
| Supply frequency             | 50...60 Hz (+/- 5 %)                                                                                                                                                                                                                                     |
| Network frequency            | 47.5...63 Hz                                                                                                                                                                                                                                             |
| Motor power kW               | 315 kW for 500...525 V                                                                                                                                                                                                                                   |
| Line current                 | 439 A for 500 V / 315 kW                                                                                                                                                                                                                                 |

## Complementary

|                                    |                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apparent power                     | For 500 V / 315 kW                                                                                                                                                                                                                                                                                                                                  |
| Prospective line I <sub>sc</sub>   | 100 kA with external fuses                                                                                                                                                                                                                                                                                                                          |
| Continuous output current          | 462 A at 2.5 kHz, 500 V / 315 kW                                                                                                                                                                                                                                                                                                                    |
| Maximum transient current          | 693 A for 60 s / 315 kW                                                                                                                                                                                                                                                                                                                             |
| Speed drive output frequency       | 0...500 Hz                                                                                                                                                                                                                                                                                                                                          |
| Nominal switching frequency        | 2.5 kHz                                                                                                                                                                                                                                                                                                                                             |
| Switching frequency                | 2...4.9 kHz adjustable<br>2.5...4.9 kHz with derating factor                                                                                                                                                                                                                                                                                        |
| Speed range                        | 1...100 in open-loop mode, without speed feedback                                                                                                                                                                                                                                                                                                   |
| Speed accuracy                     | +/- 10 % of nominal slip for 0.2 T <sub>n</sub> to T <sub>n</sub> torque variation, without speed feedback<br>+/- 0.01 % of nominal speed for 0.2 T <sub>n</sub> to T <sub>n</sub> torque variation, in closed-loop mode with encoder feedback                                                                                                      |
| Torque accuracy                    | +/- 5 % in closed-loop mode with encoder feedback<br>+/- 15 % in open-loop mode, without speed feedback                                                                                                                                                                                                                                             |
| Transient overtorque               | 220 % of nominal motor torque, +/- 10 % for 2 s<br>170 % of nominal motor torque, +/- 10 % for 60 s                                                                                                                                                                                                                                                 |
| Braking torque                     | 30 % without braking resistor<br>≤ 150 % with braking or hoist resistor                                                                                                                                                                                                                                                                             |
| Asynchronous motor control profile | Voltage/Frequency ratio, 2 points<br>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, ENA (energy Adaptation) system<br>Flux vector control without sensor, 2 points<br>Flux vector control with sensor, standard |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| Synchronous motor control profile     | Vector control without sensor, standard<br>Vector control with sensor, standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Regulation loop                       | Adjustable PI regulator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Motor slip compensation               | Adjustable<br>Automatic whatever the load<br>Not available in voltage/frequency ratio (2 or 5 points)<br>Suppressable                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Overvoltage category                  | Class 3 conforming to EN 50178                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Local signalling                      | LCD display unit - operation function, status and configuration - mounted in the front door                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Output voltage                        | $\leq$ power supply voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Isolation                             | Electrical between power and control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Type of cable for external connection | IEC cable - 40 °C, copper 70 °C / PVC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Electrical connection                 | Bar M12 - 4 x 240 mm <sup>2</sup> (U/T1, V/T2, W/T3) entry from the bottom<br>Bar M12 - 4 x 300 mm <sup>2</sup> (L1/R, L2/S, L3/T) entry from the bottom<br>Terminal - 2.5 mm <sup>2</sup> / AWG 14 (AI1-/AI1+, AI2, AO1, R1A, R1B, R1C, R2A, R2B, LI1...LI6, PWR) entry from the bottom                                                                                                                                                                                                                                                           |
| Motor recommended cable cross section | 2 (3 x 150) mm <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Short circuit protection              | 630 A fuse protection type gI - power supply upstream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Supply                                | Internal supply : 24 V DC (21...27 V) - 0...100 mA<br>Internal supply for reference potentiometer : 10 V DC (10...11 V) - 0...10 mA<br>External supply : 24 V DC (19...30 V) - 1 A                                                                                                                                                                                                                                                                                                                                                                 |
| Analogue input number                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Analogue input type                   | Software-configurable current : (AI2) 0...20 mA/4...20 mA - 250 Ohm - sampling time: 1.5...2.5 ms - resolution: 11 bits<br>Bipolar differential voltage : (AI1-/AI1+) +/- 10 V DC - 24 V max - sampling time: 1.5...2.5 ms - resolution: 11 bits + sign<br>Software-configurable voltage : (AI2) 0...10 V DC - 24 V max - 30000 Ohm - sampling time: 1.5...2.5 ms - resolution: 11 bits                                                                                                                                                            |
| Analogue output number                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Analogue output type                  | Software-configurable current : (AO1) 0...20 mA/4...20 mA - 500 Ohm - sampling time: 1.5...2.5 ms - resolution: 10 bits<br>Software-configurable voltage : (AO1) 0...10 V DC - 470 Ohm - sampling time: 1.5...2.5 ms - resolution: 10 bits                                                                                                                                                                                                                                                                                                         |
| Discrete output number                | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Discrete output type                  | Configurable relay logic : (R2A, R2B) NO - 6.5...7.5 ms - 100000 cycles<br>Configurable relay logic : (R1A, R1B, R1C) NO/NC - 6.5...7.5 ms - 100000 cycles                                                                                                                                                                                                                                                                                                                                                                                         |
| Minimum switching current             | 3 mA at 24 V DC (configurable relay logic)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Maximum switching current             | 2 A at 30 V DC on inductive load - L/R = 7 ms (R1, R2)<br>2 A at 250 V AC on inductive load - cos phi = 0.4 (R1, R2)<br>5 A at 30 V DC on resistive load - L/R = 0 ms (R1, R2)<br>5 A at 250 V AC on resistive load - cos phi = 1 (R1, R2)                                                                                                                                                                                                                                                                                                         |
| Discrete input number                 | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Discrete input type                   | Safety input (PWR) 24 V DC ( $\leq$ 30 V) - 1.5 kOhm<br>Switch-configurable (LI6) 24 V DC ( $\leq$ 30 V) , with level 1 PLC - 1.5 kOhm - sampling time: 1.5...2.5 ms<br>Programmable (LI1...LI5) 24 V DC ( $\leq$ 30 V) , with level 1 PLC - 3.5 kOhm - sampling time: 1.5...2.5 ms                                                                                                                                                                                                                                                                |
| Discrete input logic                  | Positive logic (source) (PWR) , 0...2 V (state 0), 17...30 V (state 1)<br>Negative logic (sink) (LI1...LI6) , 16...30 V (state 0), 0...10 V (state 1)<br>Positive logic (source) (LI1...LI6) , 0...5 V (state 0), 11...30 V (state 1)                                                                                                                                                                                                                                                                                                              |
| Acceleration and deceleration ramps   | Automatic adaptation of ramp if braking capacity exceeded, by using resistor<br>Linear adjustable separately from 0.01 to 9000 s<br>S, U or customized                                                                                                                                                                                                                                                                                                                                                                                             |
| Braking to standstill                 | By DC injection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Protection type                       | Thermal protection for motor<br>Power removal for motor<br>Input phase breaks for motor<br>Thermal protection for drive<br>Short-circuit between motor phases for drive<br>Overvoltages on the DC bus for drive<br>Overheating protection for drive<br>Overcurrent between output phases and earth for drive<br>Line supply undervoltage for drive<br>Line supply overvoltage for drive<br>Input phase breaks for drive<br>Break on the control circuit for drive<br>Against input phase loss for drive<br>Against exceeding limit speed for drive |

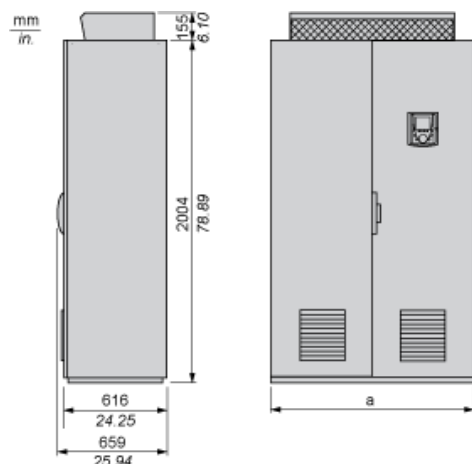
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| Dielectric strength                 | 5345 V DC between control and power terminals<br>3110 V DC between earth and power terminals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Insulation resistance               | > 1 mOhm at 500 V DC for 1 minute to earth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Frequency resolution                | 0.1 Hz for display unit<br>0.024/50 Hz for analog input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Communication port protocol         | CANopen<br>Modbus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Type of connector                   | Male SUB-D 9 on RJ45 for CANopen<br>1 RJ45 for Modbus on terminal<br>1 RJ45 for Modbus on front face                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Physical interface                  | 2-wire RS 485 for Modbus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Transmission frame                  | RTU for Modbus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Transmission rate                   | 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 1 Mbps for CANopen<br>9600 bps, 19200 bps for Modbus on front face<br>4800 bps, 9600 bps, 19200 bps, 38.4 Kbps for Modbus on terminal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Data format                         | 8 bits, odd even or no configurable parity for Modbus on terminal<br>8 bits, 1 stop, even parity for Modbus on front face                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Type of polarization                | No impedance for Modbus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Method of access                    | Slave for CANopen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Option card                         | Encoder interface cards<br>Extended I/O extension card<br>Basic I/O extension card<br>Controller inside programmable card<br>Communication card for Modbus TCP/IP<br>Communication card for Profibus DP V1<br>Communication card for Profibus DP<br>Communication card for Modbus/Uni-Telway<br>Communication card for Modbus Plus<br>Communication card for Interbus-S<br>Communication card for Fipio<br>Communication card for Ethernet/IP<br>Communication card for DeviceNet<br>Communication card for CC-Link                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Options for enclosure configuration | Isolated amplifier for control circuit<br>Relay output C/O for control circuit<br>Adaptor for 115 V logic inputs for control circuit<br>Control terminals for control circuit<br>Door handle for circuit breaker for power circuit<br>Braking unit for power circuit<br>Enclosure plinth for power circuit<br>Cable entry via the top for power circuit<br>Motor choke for power circuit<br>Enclosure heating for power circuit<br>Ammeter for power circuit<br>Line contactor for power circuit<br>Circuit breaker for power circuit<br>Door handle for main switch for power circuit<br>Voltmeter for power circuit<br>External motor fan for power circuit<br>Motor heating for power circuit<br>Key switch (local/remote) for power circuit<br>Enclosure lighting for power circuit<br>External 24 V DC supply terminals for power circuit<br>Buffer voltage 24 V DC power supply for power circuit<br>External 230 V supply terminals for power circuit<br>Design for IT networks for power circuit<br>Insulation monitoring for power circuit<br>Pt100 relay for power circuit<br>PTC relay for power circuit<br>Safe standstill for power circuit |
| Operating position                  | Vertical +/- 10 degree                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Colour of enclosure                 | Light grey RAL 7035                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Height                              | 2162 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Width                               | 1200 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Depth                               | 642 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Product weight                      | 825 kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Environment

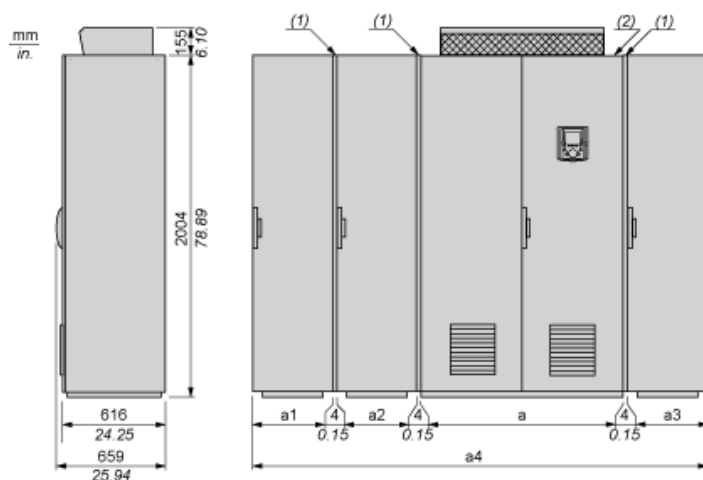
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| Electromagnetic compatibility         | Voltage dips and interruptions immunity test conforming to IEC 61000-4-11<br>Radiated radio-frequency electromagnetic field immunity test level 3 conforming to IEC 61000-4-3<br>Electrostatic discharge immunity test level 3 conforming to IEC 61000-4-2<br>Electrical fast transient/burst immunity test level 4 conforming to IEC 61000-4-4<br>Conducted radio-frequency immunity test level 3 conforming to IEC 61000-4-6<br>1.2/50 $\mu$ s - 8/20 $\mu$ s surge immunity test level 3 conforming to IEC 61000-4-5 |
| Pollution degree                      | 2 conforming to EN/IEC 61800-5-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| IP degree of protection               | IP23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Vibration resistance                  | 3M3 conforming to EN/IEC 60721-3-3<br>1.5 mm (f = 3...10 Hz) conforming to EN/IEC 60068-2-6<br>0.6 gn (f = 10...200 Hz) conforming to EN/IEC 60068-2-6                                                                                                                                                                                                                                                                                                                                                                  |
| Shock resistance                      | 3M2 EN/IEC 60721-3-3<br>4 gn 11 ms EN/IEC 60068-2-27                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Noise level                           | 69 dB conforming to 86/188/EEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Environmental characteristic          | 3S2 without condensation conforming to IEC 60721-3-3<br>3K3 without condensation conforming to IEC 60721-3-3<br>3C2 without condensation conforming to IEC 60721-3-3                                                                                                                                                                                                                                                                                                                                                    |
| Relative humidity                     | $\leq 95\%$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Ambient air temperature for operation | 40...50 °C with current derating of 0.6 % per °C<br>0...40 °C without derating                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Ambient air temperature for storage   | -25...70 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Volume of cooling air                 | 2400 m <sup>3</sup> /h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Operating altitude                    | 1000...3000 m with current derating 1 % per 100 m<br>$\leq 1000$ m without derating                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Standards                             | EN 55011 class A group 2<br>EN 61800-3 environments 1 category C3<br>EN 61800-3 environments 2 category C3<br>EN/IEC 61800-3<br>EN/IEC 61800-5-1                                                                                                                                                                                                                                                                                                                                                                        |
| Product certifications                | ATEX<br>GOST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Marking                               | CE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## IP 23 Floor-Standing Enclosure Compact Version

### Standard Compact Floor-Standing Enclosure



### Standard Compact Floor-Standing Enclosure + Additional Floor-Standing Enclosures, According to the Configuration



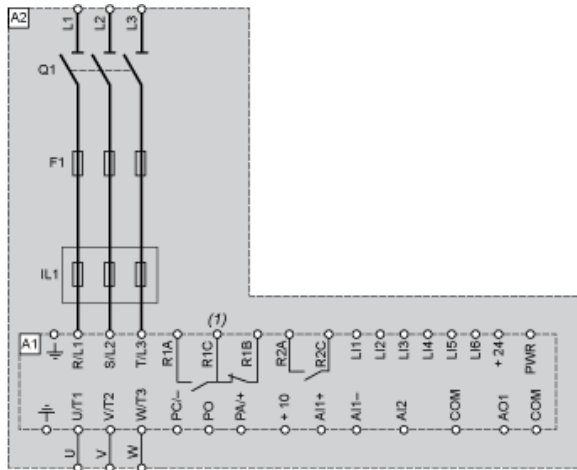
- (1) Seal. For each floor-standing enclosure added, allow a 4 mm/0.15 in. space for the seal.  
(2) Standard IP 23 compact version floor-standing enclosure.

NOTE: The position of the enclosures must be complied with during installation. The number of additional enclosures can vary according to the chosen configuration.

| Options                                                                                                                                                    | a                | a1            | a2              | a3            | a4               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|-----------------|---------------|------------------|
| With or without common options or options dependent on the drive rating                                                                                    | 1216 mm/47.8 in. | –             | –               | –             | 1216 mm/47.8 in. |
| Cable entry via the top option                                                                                                                             | 1200 mm/47.2 in. | –             | 408 mm/16 in.   | 408 mm/16 in. | 2024 mm/79.6 in. |
| Braking unit option                                                                                                                                        | 1208 mm/47.5 in. | –             | 408 mm/16 in.   | –             | 1620 mm/63.7 in. |
| Braking unit + cable entry via the top options                                                                                                             | 1200 mm/47.2 in. | 408 mm/16 in. | 400 mm/15.7 in. | 408 mm/16 in. | 2428 mm/95.5 in. |
| Motor choke option                                                                                                                                         | 1208 mm/47.5 in. | –             | –               | 408 mm/16 in. | 1620 mm/63.7 in. |
| (3) Except sinus filter option, which requires an additional enclosure. The sinus filter option is not compatible with the cable entry via the top option. |                  |               |                 |               |                  |
| (4) The cable entry via the top option is not compatible with the sinus filter option.                                                                     |                  |               |                 |               |                  |

## Floor-Standing Enclosure Compact Version

### Wiring Diagram



- A1 Drive
- A2 Enclosure
- F1 Fast-acting semi-conductor fuse
- IL1 Line choke
- Q1 Switch
- (1) Fault relay contacts. For remote signalling of drive status.

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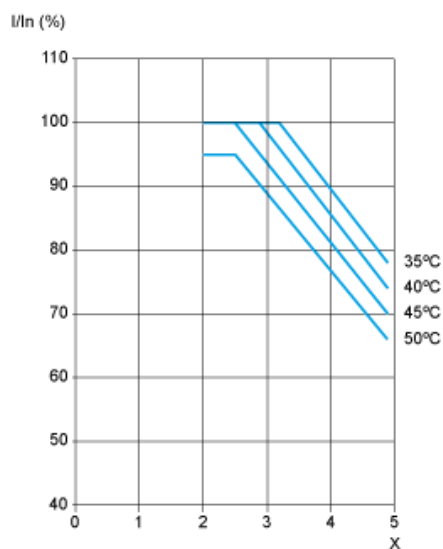
Floor-Standing Enclosure Compact Version

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Derating Curves

The derating curves for the drive nominal current ( $I_n$ ) are dependent on the temperature and switching frequency. For intermediate temperatures, interpolate between 2 curves.

NOTE: The drive will reduce the switching frequency automatically in the event of excessive temperature rise.



X Switching frequency (kHz)

NOTE: The temperatures shown correspond to the temperature of the air entering the enclosure.