

# ATV71EXS5C16Y

enclosed variable speed drive ATV71 Plus -  
160 kW - 690V - IP54 SA



## 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 with separate air flows                                                                                                                                                                                                                                             |
| Product composition          | A plinth<br>ATV71HC16Y drive on heatsink<br>An IP65 remote mounting kit for graphic display terminal<br>A line choke in an additional enclosure<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        | 621...759 V                                                                                                                                                                                                                                                                                     |
| Supply frequency             | 50...60 Hz (+/- 5 %)                                                                                                                                                                                                                                                                            |
| Network frequency            | 47.5...63 Hz                                                                                                                                                                                                                                                                                    |
| Motor power kW               | 160 kW for 690 V                                                                                                                                                                                                                                                                                |
| Line current                 | 163 A for 690 V / 160 kW                                                                                                                                                                                                                                                                        |

## Complementary

|                                  |                                                                                                                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apparent power                   | 195 kVA for 690 V / 160 kW                                                                                                                                                                                                                     |
| Prospective line I <sub>sc</sub> | 50 kA with external fuses                                                                                                                                                                                                                      |
| Continuous output current        | 180 A at 2.5 kHz, 690 V / 160 kW                                                                                                                                                                                                               |
| Maximum transient current        | 270 A for 60 s / 160 kW                                                                                                                                                                                                                        |
| Speed drive output frequency     | 0.1...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...50 synchronous motor in open-loop mode, without speed feedback<br>1...1000 asynchronous motor in closed-loop mode with encoder feedback<br>1...100 asynchronous motor 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 for 2 s<br>170 % of nominal motor torque 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                           |
| 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                        | $\leq$ rated supply voltage                                                                                                                                                                                                                                                                                                                                                   |
| Isolation                             | Electrical between power and control                                                                                                                                                                                                                                                                                                                                          |
| Type of cable for external connection | IEC cable - 40 °C, copper 70 °C / PVC                                                                                                                                                                                                                                                                                                                                         |
| Electrical connection                 | Terminal M12 - 2 x 185 mm <sup>2</sup> (L1/R, L2/S, L3/T) bottom entry<br>Terminal - 2.5 mm <sup>2</sup> / AWG 14 (AI1-/AI1+, AI2, AO1, R1A, R1B, R1C, R2A, R2B, LI1...LI6, PWR) bottom entry<br>Terminal M10 - 2 x 150 mm <sup>2</sup> (U/T1, V/T2, W/T3) bottom entry                                                                                                       |
| Motor recommended cable cross section | 3 x 95 mm <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                        |
| Short circuit protection              | 250 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 - 24 V max - 250 Ohm - sampling time: 1.5...2.5 ms - resolution: 11 bits<br>Software-configurable voltage : (AI2) 0...10 V DC - 30000 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 |
| Analogue output number                | 1                                                                                                                                                                                                                                                                                                                                                                             |
| Analogue output type                  | Software-configurable current : (AO1) 0...20 mA/4...20 mA - 470 Ohm - sampling time: 1.5...2.5 ms - resolution: 10 bits<br>Software-configurable voltage : (AO1) 0...10 V DC - 500 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   | 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>Motor phase break 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 |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Number of addresses         | 1...247 addresses for Modbus<br>1...127 addresses for CANopen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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                               |

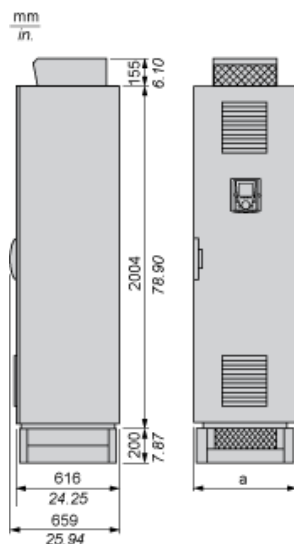
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|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 reactor for power circuit<br>12-pulse supply 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Colour of base of enclosure         | Dark grey RAL 7022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Height                              | 2362 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Width                               | 1000 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Depth                               | 642 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Product weight                      | 485 kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Environment

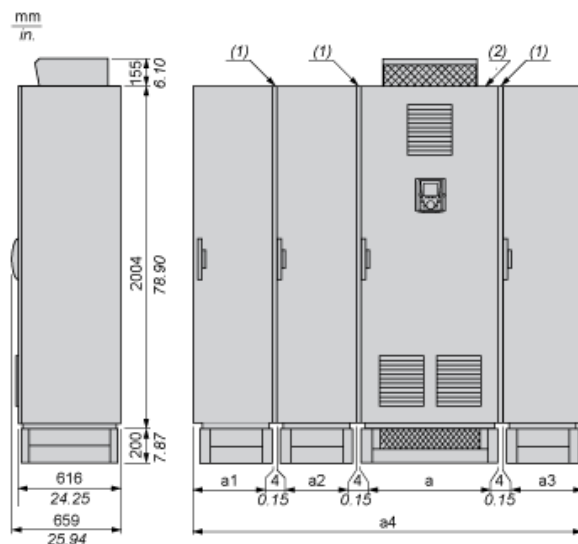
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|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 µs - 8/20 µs surge immunity test level 3 conforming to IEC 61000-4-5 |
| Pollution degree                      | 2 conforming to EN/IEC 61800-5-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Vibration resistance                  | 3M3 conforming to EN/IEC 60721-3-3<br>1.5 mm peak to peak (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 conforming to EN/IEC 60721-3-3<br>4 gn for 11 ms conforming to EN/IEC 60068-2-27                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Noise level                           | 64 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                     | <= 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                 | 600 m3/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operating altitude                    | 1000...3000 m with current derating 1 % per 100 m<br><= 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 54 Floor-Standing Enclosure with Separate Air Flows

### Standard Floor-Standing Enclosure



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



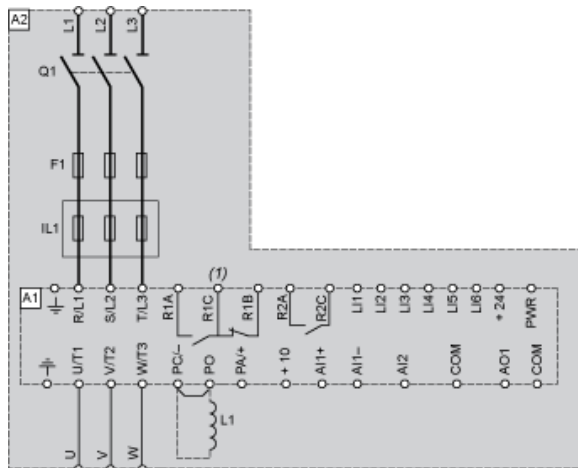
- (1) Seal. For each floor-standing enclosure added, allow a 4 mm/0.15 in. space for the seal.  
(2) Standard version floor-standing enclosure.

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                                                                                    | 608 mm/23.9 in. | —  | —             | 408 mm/16 in. | 1020 mm/40.1 in. |
| Cable entry via the top option                                                                                                                             | 608 mm/23.9 in. | —  | —             | 408 mm/16 in. | 1020 mm/40.1 in. |
| Cable entry via the top + motor choke option                                                                                                               | 600 mm/23.6 in. | —  | 408 mm/16 in. | 408 mm/16 in. | 1424 mm/56 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.                                                                     |                 |    |               |               |                  |

## IP 54 Floor-Standing Enclosure with Separate Air Flows

### Wiring Diagram



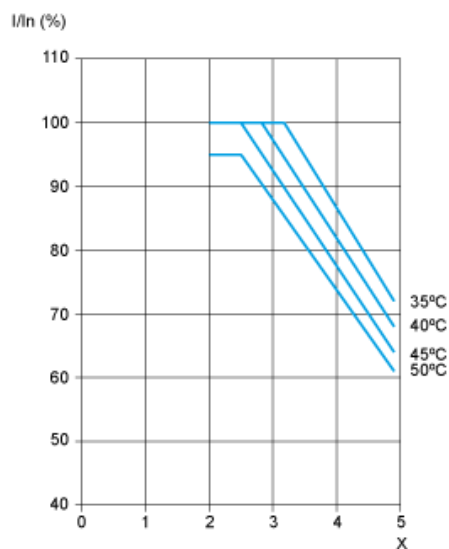
- A1 Drive
- A2 Enclosure
- F1 Fast-acting semi-conductor fuse
- IL1 Line choke
- L1 DC choke
- Q1 Switch
- (1) Fault relay contacts. For remote signalling of drive status.

## Floor-Standing Enclosure Compact Version

### 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.