Variable speed drives for asynchronous motors
Altivar 38

Applications
The Altivar 38 is a frequency inverter for three-phase asynchronous motors powered by a three-phase supply 380 V – 10% to 460 V + 10% or 480 V + 5% in the power range 0.75 kW to 315 kW.
The Altivar 38 has been designed for state-of-the-art applications in heating, ventilation and air conditioning (HVAC) in industrial and commercial buildings:
- ventilation
- air conditioning
- pumping
The Altivar 38 can reduce operating costs in buildings by optimizing energy consumption whilst improving user comfort.
Its numerous integrated options enable it to be adapted to and incorporated into electrical installations and sophisticated control systems.
The need for electromagnetic compatibility was taken into account at the outset of designing the drive. Depending on the drive rating, filters and chokes are either built-in or available as optional accessories.

Functions
The Altivar 38 ( ) is supplied ready for use in pumping and ventilation applications.
It comprises a terminal ( ) which can be used to modify programming, adjustment, control or monitoring functions in order to adapt and customize the application to meet individual customer requirements.
- Specific functions for pumping/ventilation:
  - Energy saving
  - Automatic catching a spinning load with speed detection (catch on the fly)
  - Adaptation of current limiting according to speed
  - Faster/slower, preset speeds
  - Integrated PI control, with preset PI references
  - Electricity and service hours meter
  - Motor noise reduction
- Protection functions:
  - Motor and fan thermal protection via PTC thermal probe
  - Protection against overloads and overcurrents in continuous operation
  - Machine mechanical protection via jump frequency function
  - Protection via multiple fault management and configurable alarms
- Easy to integrate into control systems:
  - 4 logic inputs, 2 relay outputs, 2 analogue inputs and 1 analogue output
  - Plug in I/O connectors
  - Display of electrical variables and operating indicators
  - An RS 485 multidrop serial link with Modbus protocol as standard in the drive. This serial link can be used to connect PLCs ( ), a PC, communication gateways or one of the available programming tools.

Options
- PowerSuite advanced dialogue solutions:
  3 solutions are available, with plain text display in 5 languages (English, French, German, Spanish, Italian) and configuration memory:
  - Pocket PC for PowerSuite ( )
  - PowerSuite software workshop for PC ( )
  - Magelis display unit ( )
- Customizing the application:
  - I/O extension cards ( )
  - Application cards ( ):
    - pump switching, multi-motor function, multiple parameter settings and cycles
    - Communication cards for bus or network ( ):
      - METASYS N2, Ethernet, Fipio, Uni-Telway/Modbus, Modbus Plus, AS-Interface, Profibus DP, INTERBUS, CANopen, DeviceNet
  - Communication module for LonWorks bus ( ).

Standard versions
The Altivar 38 is available in two versions for integration into machines.
- Drive with heatsink
- Altivar 38 ENERGY ready-assembled drive with a power rating between 3 and 75 kW.
The IP 55 enclosure is equipped with a drive with a cooling system and a Vario switch disconnector. A slot is provided for an additional contactor. The drives are supplied with a built-in line choke.
This enclosure can be installed next to the motor.
Characteristics

Variable speed drives for asynchronous motors
Altivar 38

Environment characteristics

Conforming to standards
Altivar 38 drives have been developed to conform to the strictest national and international standards and the recommendations relating to electrical industrial control devices (IEC, EN, NFC, VDE), in particular:
- Low voltage EN 50178
- EMC immunity:
  - IEC 1000-4-2/EN 61000-4-2 level 3
  - IEC 1000-4-3/EN 61000-4-3 level 3
  - IEC 1000-4-4/EN 61000-4-4 level 4
  - IEC 1000-4-5/EN 61000-4-5 level 3
  - IEC 1800-3/EN 61800-3, environments 1 and 2
- EMC, radiated and conducted emissions:
  - IEC 1000-4-2/EN 61000-4-2 level 3
  - IEC 1000-4-3/EN 61000-4-3 level 3
  - IEC 1000-4-4/EN 61000-4-4 level 4
  - IEC 1000-4-5/EN 61000-4-5 level 3
  - IEC 1800-3/EN 61800-3, environments: 2 (industrial supply) and 1 (public supply), restricted distribution
- EN 55011 class A (drives with built-in radio interference filters)
- EN 55022 class B, with additional filters

CE marking
The drives have been designed to meet the requirements of the European low voltage (73/23/EEC and 93/68/EEC) and EMC (89/336/EEC) directives. Altivar 38 drives are therefore permitted to carry the CE European Union mark.

Product certifications
- DNV (up to 75 kW), UL and CSA
- EN 50178

Degree of protection
Conforming to EN 50178
ATV 38HU18N4 to HD23N4 and ATV 38HD25N4 to HD79N4 drives
IP 21 and IP 41 on upper part
ATV 38HC10N4 to HC33N4X drives
IP 00 on lower part (1), IP 20 on other sides

Vibration resistance
Conforming to IEC 60068-2-6
ATV 38HU18N4 to HD23N4 and ATV 38HD25N4 to HD79N4 drives
1.5 mm peak from 2 to 13 Hz
1 g from 13 to 200 Hz
ATV 38HC10N4 to HC33N4X drives
0.6 g from 10 to 55 Hz
1 g from 55 to 150 Hz

Shock resistance
Conforming to IEC 60068-2-27
All ratings
15 g for 11 ms

Maximum ambient pollution
Conforming to UL 508C
ATV 38HU18N4 to HD23N4 and HD25N4 to HD79N4X drives
Level 3
Conforming to IEC 664-1 and EN 50178
ATV 38HU18N4 to HD23N4 and ATV 38HC10N4X to HC33N4X drives
Level 2

Maximum relative humidity
Conforming to IEC 60068-2-3
93 % without condensation or dripping water

Ambient air temperature around the device

<table>
<thead>
<tr>
<th>Operation</th>
<th>Storage</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV 38HU18N4 to HU90N4 drives</td>
<td>-25...+65</td>
<td></td>
</tr>
</tbody>
</table>
| ATV 38HD12N4 to HD23N4 and ATV 38HC10N4 to HC33N4X drives | -10...+50 without derating
Up to +60 with current derating of 2.2 % per °C above 50 °C |
| ATV 38HD25N4 to HD79N4 and HD25N4X to HD79N4X drives | -10...+40 without derating
Up to +50 with current derating of 2.2 % per °C above 40 °C |
| ATV 38HD25N4 to HD79N4 and HD25N4X to HD79N4X drives | -10...+40 without derating
Up to +60 with ventilation kit, current derating of 2.2 % per °C above 40 °C |

Maximum operating altitude
m
1000 without derating (above this, derate the current by 1 % per additional 100 m)

Operating position
Vertical

Drive characteristics

Output frequency range
Hz
0.1...500

Configurable switching frequency
Without derating, in continuous operation
ATV 38HU18N4 to HD46N4 and HD25N4X to HD46N4X drives
kHz
0.5-1-2-4
ATV 38DS45N4 to HD79N4 and HD54N4X to HC33N4X drives
kHz
0.5-1-2

Without derating with intermittent operating cycle or with derating by one power rating in continuous operation
ATV 38HU18N4 to HD23N4 drives
kHz
8-12-16
ATV 38HD25N4 to HD46N4 and HD25N4X to HD46N4X drives
kHz
8-12
ATV 38HD54N4 to HD79N4 and HD54N4X to HD79N4X drives
kHz
4-8
ATV 38HC10N4X to HC33N4X drives
kHz
4

Speed range
1...10

Transient overtorque
110 % of the nominal motor torque (typical value at ± 10 %) for 60 s

Braking torque
30 % of the nominal motor torque without braking resistor (typical value) for low power ratings

Principle of motor control
Pulse width modulation (PWM)

(1) A protection device to prevent direct contact by personnel must be added.
### Electrical characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>a.c. voltage: hold level to 400 V or 480 V, three-phase</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Maximum voltage equal to line supply voltage</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td>Electrical isolation between power and control inputs, outputs, power supplies</td>
</tr>
<tr>
<td>Available internal supplies</td>
<td>Protected against short-circuits and overloads:</td>
</tr>
<tr>
<td></td>
<td>- 1 x + 10 V (0. 10 %) supply for the reference potentiometer (1…10 kΩ), maximum current 10 mA</td>
</tr>
<tr>
<td></td>
<td>- 1 x + 24 V (supply (min. 20 V, max. 30 V) for control inputs, maximum current 200 mA</td>
</tr>
<tr>
<td>Analogue inputs AI</td>
<td>1 analogue voltage output AI1: 0-10 V, impedance 30 kΩ</td>
</tr>
<tr>
<td></td>
<td>1 analogue current output AI2: 0-20 mA, impedance 100 Ω (reassignable to X-Y mA by programming X and Y with a precision of 0.1 mA)</td>
</tr>
<tr>
<td></td>
<td>Frequency resolution at analogue reference: 0.1 Hz for 100 Hz (10 bits), precision ± 1 %, linearity ± 0.5 % of the maximum output frequency</td>
</tr>
<tr>
<td></td>
<td>Sampling time: 4 ms max. Other analogue inputs: see option cards</td>
</tr>
<tr>
<td>Analogue output AO1</td>
<td>Assignable analogue output 0-20 mA, max. load impedance 500 kΩ (reassignable to X-Y mA by programming X and Y from 0 to 20 with a precision of 0.1 mA)</td>
</tr>
<tr>
<td></td>
<td>Resolution 0.04 mA (9 bits), linearity ± 0.1 mA, precision ± 0.2 mA</td>
</tr>
<tr>
<td></td>
<td>Max. sampling time 2 ms Other analogue inputs: see option cards</td>
</tr>
<tr>
<td>Logic inputs LI</td>
<td>4 assignable logic inputs, impedance 3.5 kΩ, compatible with PLC level 1, standard IEC 65A-68. Maximum length of shielded cable: 100 m</td>
</tr>
<tr>
<td></td>
<td>+ 24 V power supply (min. 11 V, max. 30 V), State 0 if &lt; 5 V, state 1 if ≥ 11 V</td>
</tr>
<tr>
<td></td>
<td>Sampling time: 2 ms max. Other logic inputs: see option cards</td>
</tr>
<tr>
<td>Logic outputs</td>
<td>2 relay logic outputs R1 (fault relay) and R2 (assignable)</td>
</tr>
<tr>
<td></td>
<td>1 C/O contact protected against overvoltages (relay R1)</td>
</tr>
<tr>
<td></td>
<td>1 N/O contact protected against overvoltages (relay R2)</td>
</tr>
<tr>
<td></td>
<td>Minimum switching capacity: 10 mA for:</td>
</tr>
<tr>
<td></td>
<td>- on resistive load (cos ϕ = 1): 5 A for ~ 250 V or ~ 30 V</td>
</tr>
<tr>
<td></td>
<td>- on inductive load (cos ϕ = 0.4 and L/R = 7 ms): 1.5 A for ~ 250 V or ~ 30 V</td>
</tr>
<tr>
<td></td>
<td>Other outputs: see option cards</td>
</tr>
<tr>
<td>Maximum connection capacity of I/O</td>
<td>1.5 mm² (AWG 14)</td>
</tr>
<tr>
<td>Communication</td>
<td>RS 485 multidrop serial link with Modbus protocol integrated into the drive</td>
</tr>
<tr>
<td></td>
<td>Transmission speed: 9600 or 19200 bps, no parity</td>
</tr>
<tr>
<td></td>
<td>Use:</td>
</tr>
<tr>
<td></td>
<td>- connecting a terminal (option) or</td>
</tr>
<tr>
<td></td>
<td>- connecting a microprocessor card or</td>
</tr>
<tr>
<td></td>
<td>- connecting a PC or a pocket PC (options) or</td>
</tr>
<tr>
<td></td>
<td>- connecting one or more PLCs</td>
</tr>
<tr>
<td>Acceleration and deceleration ramps</td>
<td>Ramp profiles can be selected: linear, S or U. Possibility of 2 ramp ranges which can be switched via frequency threshold or logic input.</td>
</tr>
<tr>
<td></td>
<td>Can be adjusted separately between 0.05 and 999.9 s (precision 0.1 s)</td>
</tr>
<tr>
<td></td>
<td>Automatic adaptation of deceleration ramp times if the braking capacity is exceeded (configurable option)</td>
</tr>
<tr>
<td>Braking to a standstill</td>
<td>By d.c. injection:</td>
</tr>
<tr>
<td></td>
<td>- by a signal on an assignable logic input</td>
</tr>
<tr>
<td></td>
<td>- automatically on stopping as soon as the frequency drops below 0.1 Hz, for a time which can be set between 0 and 30 s or alternately set - continuous</td>
</tr>
<tr>
<td>Main protection and safety features of the drive</td>
<td>Short-circuit protection:</td>
</tr>
<tr>
<td></td>
<td>- between output phases</td>
</tr>
<tr>
<td></td>
<td>- between output phases and earth</td>
</tr>
<tr>
<td></td>
<td>- on internal supply outputs</td>
</tr>
<tr>
<td></td>
<td>Thermal protection against excessive overheating and overcurrents</td>
</tr>
<tr>
<td></td>
<td>Mains undervoltage and overvoltage safety circuits</td>
</tr>
<tr>
<td></td>
<td>Loss of supply phase safety circuit (prevents single phase operation of 3-phase drives)</td>
</tr>
<tr>
<td>Motor protection</td>
<td>Thermal protection integrated into the drive via continuous calculation of I²t taking the speed into account:</td>
</tr>
<tr>
<td></td>
<td>- the motor thermal state is saved when the drive is powered down.</td>
</tr>
<tr>
<td></td>
<td>- the function can be modified via the terminal or by using the PowerSuite advanced dialogue solutions, depending on the type of motor (force-cooled or self-cooled).</td>
</tr>
<tr>
<td></td>
<td>Protection against motor phase breaks</td>
</tr>
<tr>
<td></td>
<td>Protection via PTC probes with option card</td>
</tr>
<tr>
<td>Insulation resistance to earth</td>
<td>Mi1 &gt; 500 (electrical isolation) at ≤ 500 V</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>V = 2830 earth/power</td>
</tr>
<tr>
<td></td>
<td>~ 2000 control/power</td>
</tr>
</tbody>
</table>