VS-616G5
AC drive for optimal efficiency and productivity
Control & Automation from L & T

*L&T* offers system solutions for control, regulation and monitoring. It plans and implements drive controls and automation projects from concept to commissioning.

The spectrum includes system analysis, project planning, hardware selection, application engineering, application software, manufacture, procurement, testing, integration, commissioning, training, spares and after-sales service.

Applications

Iron and Steel *

- Sponge iron plants
- Blast furnaces/arc furnaces
- Continuous casting plants
- Wire rod mills
- Annealing furnaces
- Cold rolling mills
- Process and finishing lines . . .

Cement *

Plant-wide drives, control and instrumentation from crusher to packing.

SPRS for ID, FD fans, classifier fans . . .

Paper *

- Sectional paper machines
- Super calenders
- Slitters
- Rewinders . . .

Material Handling *

- Port-based long conveyor
- Stacker reclaimers
- Bagging plants . . .

* Exhaustive reference lists are available.
Chemical *
- LPG/gas sweetening
- Distillation column control
- Naphtha cracker and aromatic plants
- Lactum and anone plants . . . .

Power *
- Boiler interlocks, burner management
- Water treatment
- Coal & ash handling . . . .

Range of Equipment

Drive Systems
based on
- Fully digital DC drives - ACEDRIVE
- High performance, vector control AC drives with powerpack from YASKAWA ELECTRIC, Japan
- Slip Power Recovery Systems (SPRS)
- Transformers, motors, control desks, sensors and other electrics

Automation Systems
based on
- High-end 'Quantum' process controllers and accessories from SCHNEIDER AUTOMATION, U.S.A.
- Mid-size 'GL' process controllers and accessories from YASKAWA ELECTRIC, Japan

Both with a full range of 1000/1600 I/O modules and panels.
- Windows® 95/NT based 'Panorama' supervisory colour graphic operator stations. Network hardware and integration
- Programming packages, sensors, instruments, consoles and other accessories

* Exhaustive reference lists are available.
The VS-616G5 is a full-scale flux vector control (or Adaptive Vector Control, AVC™) AC drive.

The VS-616G5 directly controls the direct current that results in the motor torque.

The VS-616G5 integrates four control functions in one drive.

User-friendly built-in programmable parameters (more than 200) make most of the control system tasks as easy as 1-2-3.

The VS-616G5 is the ultimate drive for a wide range of applications. With its extensive features it is ideal for use as a stand-alone drive or as part of a system and offers smooth start up from low speeds.

Overview

Interactive digital operator

The user-friendly interactive digital operator allows:

- Customized programming of AC drive based on applications
- Extensive monitoring of AC drive operating conditions
VS-616G5 allows smooth operation from 1/100th of rated speed to high starting torque. Overcomes tough starts even without a PG*. When an additional PG is installed, it enables full torque operation even at zero speed.

High starting torque at low speeds without PG  
[Speed control range 100:1 (1000:1 with PG)]

Accurate Torque Control

The VS-616G5 offers excellent output torque response of 150Hz with a torque accuracy of ±5%.

Online switching from torque to speed control is possible!

* PG = Pulse Generator (speed sensor)
The VS-616G5 comes with four integrated control functions.

- **Speed-sensorless V/f control**
- **V/f control with speed sensor**
- **Speed-sensorless vector control**
- **Vector control with speed sensor**

The control functions can be applied to a wide range of applications starting from stand-alone drive to multi-drive systems by a simple switching of parameters through a digital operator.

### Overview

<table>
<thead>
<tr>
<th>Control method</th>
<th>Speed-sensorless V/f control</th>
<th>V/f control with speed sensor</th>
<th>Speed-sensorless vector control</th>
<th>Vector control with speed sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic control</td>
<td>Voltage/frequency control (open loop)</td>
<td>Voltage/frequency control with speed compensation</td>
<td>Current vector control without PG</td>
<td>Current vector control with PG</td>
</tr>
<tr>
<td>Speed sensor</td>
<td>Necessary</td>
<td>Necessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed control range</td>
<td>1:40</td>
<td>1:40</td>
<td>1:100</td>
<td>1:1000</td>
</tr>
<tr>
<td>Starting torque</td>
<td>150% at 3Hz</td>
<td>150% at 3Hz</td>
<td>150% at 1Hz</td>
<td>150% at 0 rpm</td>
</tr>
<tr>
<td>Speed control accuracy</td>
<td>± 2 to ± 3%</td>
<td>± 0.03%</td>
<td>±0.2%</td>
<td>±0.01%</td>
</tr>
<tr>
<td>Torque limit</td>
<td>Disabled</td>
<td>Disabled</td>
<td>Enabled</td>
<td>Enabled</td>
</tr>
<tr>
<td>Torque control</td>
<td>Disabled</td>
<td>Disabled</td>
<td>Disabled</td>
<td>Enabled</td>
</tr>
<tr>
<td>Applications</td>
<td>• Simple replacement of conventional product</td>
<td>• Applications in which accuracy of the speed in the steady state has to be improved</td>
<td>• Variable speed control in general</td>
<td>• Simplified servo drive</td>
</tr>
<tr>
<td></td>
<td>• Simple speed variation</td>
<td>• Cases where the resolution of the speed sensor is low</td>
<td></td>
<td>• High accuracy speed control</td>
</tr>
<tr>
<td></td>
<td>• Multiple motor drive</td>
<td>• Cases where there is backlash between the motor shaft and the speed sensor</td>
<td></td>
<td>• Torque control</td>
</tr>
</tbody>
</table>

L&T AUTOMATION
Automation systems for optimal efficiency and productivity
The VS-616G5 offers an excellent speed holding accuracy of ± 0.01% even under fluctuating load conditions.

Outstanding Servo Response

The unique high-speed flux vector control allows fast response (better than 30Hz) to changes in the speed reference.

Quick response to any reference changes
(Speed reference step response)

Quick response to rapid changes in load
(Speed recovery characteristics upon impact load)
Ultra Modern Hardware

- The 32-bit RISC (Reduced Instruction Set Computer) type MPU and advanced LSI based control elements enable real time processing of information and complex calculations [40000 calculations per second] accurately to get DC drive like performance.

- Flash memory enables editing of the application programmes with personal computer.

- Low noise, low loss and compact IGBT (Insulated Gate Bi-polar Transistor) for reliable power processing.

- Network compatible* through Modbus Plus™ protocol (Modbus Plus™ - High speed, peer-to-peer de-facto industry standard plantwide network protocol)

* Onboard option
Specification

**Power conditions/capacity**

Capacity 1.4 to 460 kVA  
Rated current 1.8 to 600A  
Input supply voltage 380/400/415/440/460V, +10%, -15%  
Input supply frequency 50/60Hz ± 5%  
Deration of current rating 1.25% /°C above 45°C

**Control characteristics**

Control method High carrier frequency (low noise) sine wave PWM technique  
Speed control range 1:1000 with PG (1:100 without PG)  
Speed control accuracy ±0.01% with PG (±0.2% without PG)  
Speed response 30Hz with PG (5Hz without PG)  
Starting torque 150% at zero mechanical speed with PG (150% at 1Hz without PG)  
Torque accuracy ± 5%  
Torque response 150Hz or better with PG (20Hz or better without PG)  
Frequency control range 0.1 to 400Hz (standard)  
1000Hz available as option  
Frequency control accuracy  
Digital command ±0.01% [-10°C to 40°C]  
Analog command ±0.1% [25°C ±10°C]  
Frequency setting signal -10 to +10V, 0 to +10V, 4 to 20mA  
Frequency setting resolution  
Digital command 0.01Hz/100Hz  
Analog command 0.03Hz/60Hz  
Braking torque Approximately 20% (upto 150% with braking resistor)  
Accel./Decel. time 0.01 to 6000 seconds (available in 4 independent steps)

**Protections**

Motor overload, instantaneous overcurrent, power-loss ride through, ground fault, FIN overheat, O/P short-circuit protection, stall prevention, I/P & O/P overvoltage and undervoltage, I/P & O/P open-circuit protection, etc.
Application Software Functions

The VS-61G5 has more than 200 powerful system application software functions inbuilt. Given beneath an overview of selected functions:

**Highlights**

- For constant flow control: PID control
- For maximum efficiency in fans & pumps: Patented energy-saving feature based on optimum system efficiency calculation in real time
- For versatile operation: Four independent settings for acceleration/deceleration
- For master-slave operation: Droop control

**Overview**

<table>
<thead>
<tr>
<th>Function</th>
<th>Application</th>
<th>Description of Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy saving operation</td>
<td><strong>Pumps, fans, blowers.</strong></td>
<td>• Energy saving</td>
</tr>
<tr>
<td>Droop control</td>
<td><strong>Calender drives</strong>, press section drives, bridle roll drives, stacker reclaimer drives.</td>
<td>• Multi-motor drives</td>
</tr>
<tr>
<td>2-motor changeover</td>
<td><strong>Spindle drives</strong>, main/aux. hoist drives.</td>
<td>2 motors with difference in capacity and characteristics are driven alternatively by single AC drive</td>
</tr>
<tr>
<td>Torque limit</td>
<td><strong>Agitator drives</strong>, pay-off reel drives.</td>
<td>• Protection of machine • Improvement of continuous operation reliability • Torque limit</td>
</tr>
<tr>
<td>Torque control</td>
<td><strong>Coiler/uncoiler drives</strong>, unwinder drives.</td>
<td>• Constant tension control</td>
</tr>
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<td>Application</td>
<td>Description of Function</td>
</tr>
<tr>
<td>----------------------------------</td>
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<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Excess torque signal</td>
<td><strong>Machine tool applications</strong></td>
<td>Works when ‘over torque setting operation’ is accomplished. Can be used as a torque limiter.</td>
</tr>
<tr>
<td>Quick stop without braking</td>
<td><strong>High-speed routers, fans, blowers</strong></td>
<td>Prevents overrun at stop. Used for starting the coasting motor without tripping. Generates better than 70% of the braking torque.</td>
</tr>
<tr>
<td>resistor (DC injection braking stop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency hold operation</td>
<td><strong>Conveyors, elevators, cranes</strong></td>
<td>Temporarily holds frequencies during accel/decel.</td>
</tr>
<tr>
<td>Multi-step speed operation</td>
<td><strong>Yarn twisting, draw twisting, carding drives</strong></td>
<td>Setting the contact combinations can set multi-stop operation, so the connection with process controller becomes very easy. When combined with jog speed, it allows simple positioning.</td>
</tr>
<tr>
<td>Accel/decel. time changeover</td>
<td>General</td>
<td>The accel/decel. times are set by an external contact signal. Necessary for switching operation of 2 machines with different functions by a single drive.</td>
</tr>
<tr>
<td>Operating site selection</td>
<td>General</td>
<td>Operation and settings can be selected while the AC drive is online (gain, frequency set point, etc.)</td>
</tr>
<tr>
<td>Speed search operation</td>
<td><strong>Centrifugal load drives, ID, FD drives</strong></td>
<td>Synchronize with the coasting motor. Starts the AC drive at the specified frequency, automatically detects the synchronization point, and performs at the operation frequency. No speed detector is required.</td>
</tr>
</tbody>
</table>