New MAC Motors, 400 and 750W

The AC servo motor with built-in driver/controller is the same size as a traditional servo motor

JVL, which is the European leader in the development of new servo- and step motor technology, has again developed a new, unique product in the field of integrated motor control. JVL's new additions to the fold comprise two complete, recently developed, high-capacity MAC Servo Motors with ratings of 400W and 750W. These new products were first revealed at the Danish *Herning Tech* trade fair last year. The MAC motor consists of a complete servo system, including a high-dynamic AC servo motor, hall-sensor, encoder, power supply, driver and positioning controller, as well as facilities for incorporating various modules such as Profibus, CANopen, Nano PLC, etc.

A new type of motor

The MAC motor sets completely new standards for the performance and appearance of servo controls. With a length of only 175mm for a 2.4Nm/750W motor, the MAC motor matches the size of traditional servo motors that have no built-in driver/controller. This has only been possible through the use of an extremely compact motor and the development of electronics and mechanics that utilise the latest technologies and manufacturing methods. At no point has quality been compromised and the motor and electronic components have been specifically selected to withstand the rigorous demands on quality and lifetime required by industrial use.

Everything is integrated

These large and powerful motors are based on the same concept as JVL's previously introduced MAC motors, which have ratings from 50 to 140W. For applications involving vertical movement or robotic solutions, the larger models can be supplied with built-in electro-mechanical braking. The specific control characteristics of a particular motor are determined by the module mounted in the motor housing. These modules are termed "expansion modules" and are similar to those used in the smaller models of the MAC motor.

Advantages

This method of construction is unique, because you only buy what you require for a specific application and thus gain specific functionality at an extremely low price. Space is saved in the control cabinet, noise induced through the use of long motor cables is avoided, and errors due to cabling and components are reduced considerably. With significantly reduced cabling and 30% of the normal number of components, you can be sure of reducing the number of errors, and save on installation costs. In addition, service is much simpler, since the motor and controller can be replaced as a single integrated unit.

The motor itself is a very powerful, compact, 3-phase AC servo motor that can yield up to 3.9 and 6.8 Nm peak torque. The motor construction is extremely compact, measuring only 175x115x80mm (750W model), which

Expansion modules adapt the motor to the specific application

corresponds to a normal servo motor without built-in driver. The flange is a standard servo flange, similar to Yaskawa and Omron flanges.

The basic motor offers the following standard features:

- Operating commands from PC/PLC via RS232/422/485
- Pulse/Direction or quadrature inputs for electronic gearing
- A+B encoder output
- Velocity and torque control, either controlled digitally or via ±12bit, ±10V inputs
- Positioning via digital interface
- Software-controlled end-of-travel stops
- Selection of acceleration, maximum velocity, torque, etc.
- 6th-order servo filter
- Sine commutation with 2000 PPR encoder. (8000 pulses/revolution.)
- Alarm and "in position" outputs
- 3 inputs and 3 outputs for High Speed start/stop and capture applications
- Internal Power Dump

Via the use of expansion modules, the following additional features are offered:

- Profibus DP module, enabling connection to 12Mbit Profibus.
- CANbus/CANOpen module with 6 in/ 2 out for sensors and PLC
- Nano PLC, containing a single controller that can position on the basis of 8 optically isolated inputs. This module can accomplish 80% of positioning applications.
- High-speed serial RS485 interface that enables multi-axis operation so that robotic movements and advanced XYZ operation is possible at high speed. Can additionally interface directly to IEC61131-3 softPLC.
- Expansion modules are available for IP42 (SUB-D) or IP67 (cable glands or M12 connector).
- Other modules are under development, e.g. for DeviceNet and Ethernet, and USB modules both as Bluetooth and WLAN modules for wireless data transmission.
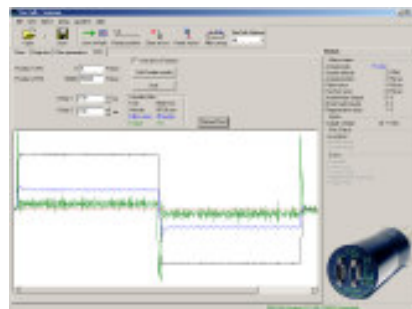
Software
To ease the set up of the motor, it is delivered with the Windows software MacTalk. Internet upgrades are an integrated part of the MAC concept. If an update of MacTalk or the motor's firmware is required, the user simply selects "Update MacTalk" or "Update Firmware" and MacTalk will automatically download the latest version from JVL´s Internet server. It cannot be easier.

Control and electronic gearing
The MAC motor can be controlled via ±10V in velocity or torque mode, with encoder feedback to the overall motion controller (PC or PLC). In addition, the MAC motor can replace any step- or servo system that is based on pulse/ direction signals, without changing the PLC/PC controller software. The built-in electronic gear enables the MAC motor to simulate any conceivable step resolution.


Software MacTalk makes it easy to set up the motor.

Power supply
Powering the MAC motors is simple and only requires connection of a mains voltage of either 115 or 230VAC. To ensure correct and effective emergency-stop procedures, the encoder and microprocessor circuitry must be powered using 24VDC.
Switching technology is used to ensure large energy savings and thus reduction of heat generation when the voltage is regulated to the internal control circuits.

Regulation filter with 6th-order
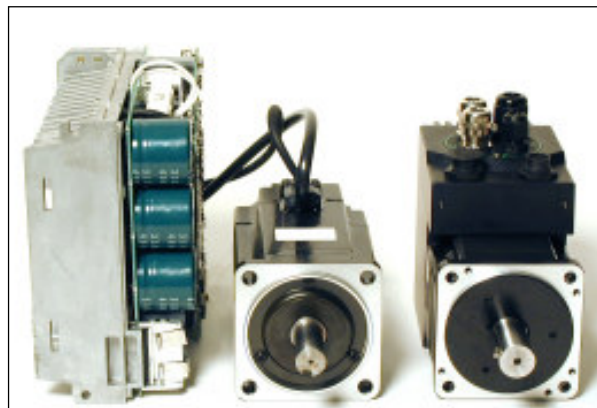
The motor with controller is no larger than an ordinary 750W servo motor

regulator
Normally a PID regulator, which is a 1st-order regulator, is used for each of the three control loops (torque, velocity and position).
JVL however has opted to use a significantly better 6th-order filter, which is a mathematically modelled perfect regulator that is far better than a PID filter at handling non-linear and undamped systems.

A 6th-order regulator offers the following advantages:

- Reduced installation and commissioning times
- A stiffer system with shorter positioning times
- Inexperienced users can set-up the servo system
- Oscillations due to non-linear mechanical systems are avoided
- Minimum positioning error during operation and stop

Adjust one parameter – it can't be easier
A common feature of JVL´s regulators is that the user need only adjust a single parameter. This parameter is called the "Load factor", since it only depends on the inertia of the system. The greater the load on the motor, the greater the load factor. Expert users can continue to fine-tune very complex, undamped systems using the MacTalk software to select the "Filter Selector" window and change the speed response and hardness. In addition, it is possible to optimise compensation for follow errors.