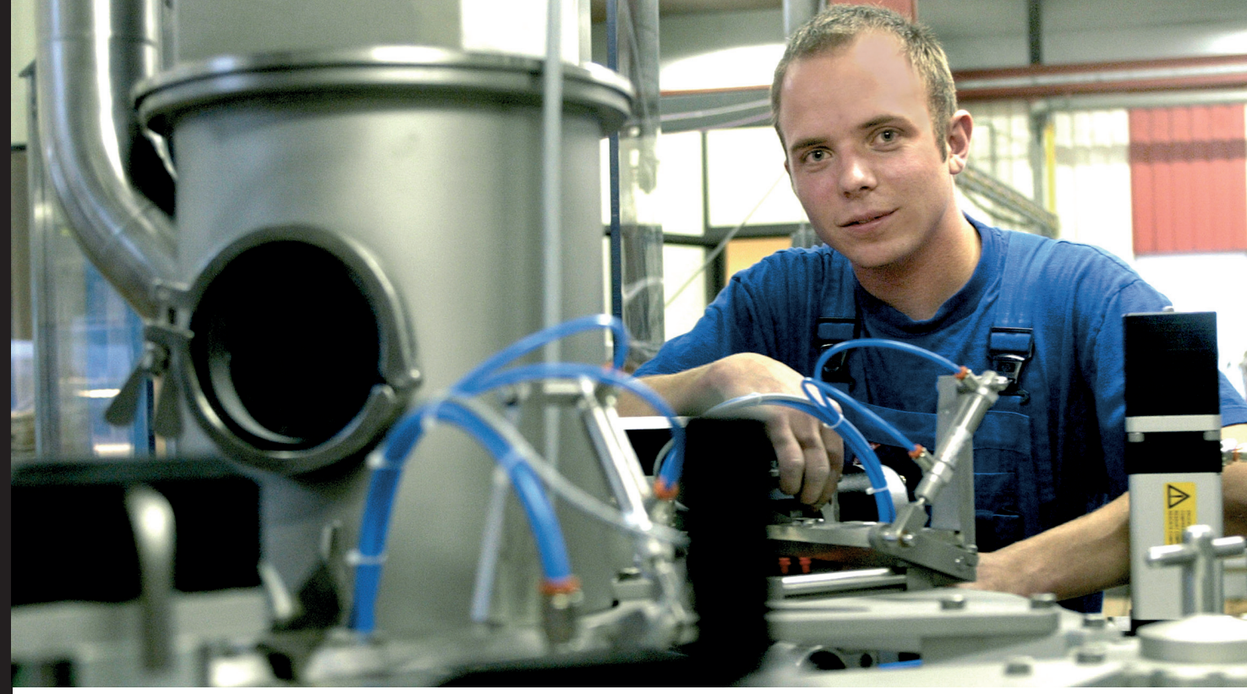
MAC motor®
– Integrated Servo Motor

A new way of saving money
All Electronics Inside

Brushless servo motors
with integrated controller



Save Money and Troubles

In the past building up a motion control system was a complicated affair involving many componets:

- PLC
- Indexer/controller
- Driver
- Motor with Encoder and Hall sensor
- A lot of cabelling to connect all these items

-and finally complicated software that had to be programmed properly

It required a lot of expertise to make the system function and the installation was very time consuming and involved many sources that could create faults. Electrical noise from the cables carrying the high motor currents added to the problems.

JVL has reduced these problems to a minimum by introducing of the Integrated MAC motor on the motion control market.

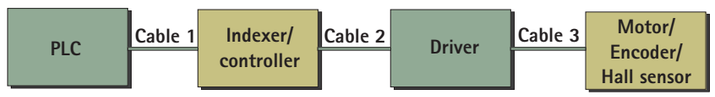
In these motors the Indexer/controller, Driver, Encoder and Hall sensor are all built-in into one compact unit.

A software package, MacTalk, makes set-up extremely easy and expansion modules mounts directly into the motorhousing to adapt the motor to almost any application.

By investing in a modern integrated MAC motor from JVL you achieve the following benefits:

- Reduced material costs.
  Because the drive and controller are in the motor, most cabling to a control panel is eliminated
- Reduced labor costs
  With cabling eliminated, assembly time is greatly reduced
- Better quality and reliability
- Fewer connections, less wiring
- Ease of serviceability
  Because all electronics are self-contained you simply change the motor
- Double supply facility to ensure that position and parameters are maintained after emergency stop
- Switching noise from the drive due to commutation is contained in the motor
- Reduced setup time
  6th order digital filter requires only one tuning parameter for load or reflected inertia
- OEM cost savings, the modular approach means you only pay for the functionality required

Previous system build-up



Modern system build-up

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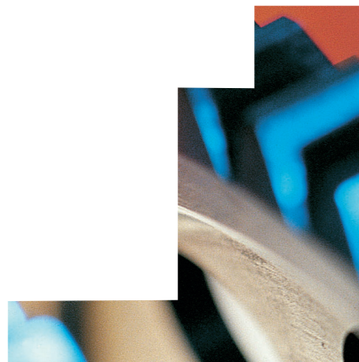


The MAC motor - 50 to 134 W - the complete motion solution for smaller powers ratings

Brushless servo motor with integrated controller everything in one unit, except power supply.

The major advantages of the MAC motors are:

- High performance
- Cost effective
- Decentral intelligence
- Quiet and maintenance free operation
- High efficiency
- Low operational cost
- Less machine space required
- Low installation cost. Shorter and faster installation
- Fewer possibilities for wiring errors
- Minimum positioning error during operation and halt
- Modular flexibility
- New users can easily set up the system

Main features
(basic MAC models)

- Ideal for high volume applications in harsh industrial environments
- Accepts position and velocity commands sent via 2 serial interfaces
- Genuine AC-servomotor with high toque at high speed
- Pulse and direction input makes it possible to replace any step motor
- Quadrature output to master controller when used as a ±10V driver
- Switching technology in motor and power supplies
- High performance serial protocol with addressing facilities
- Easy and simple Windows program available for installation/ set-up

Pulse input and outputs
±10V analogue input
In position and Error output

RS232 and RS485
interface for setup and monitoring

Wide supply range
12 to 48 VDC

Expansion module (shown MAC00-B1) for adapting to a wide range of applications

High efficiency Power
Mos-fets in motor driver

Main Control board

Standard NEMA23 flange and shaft

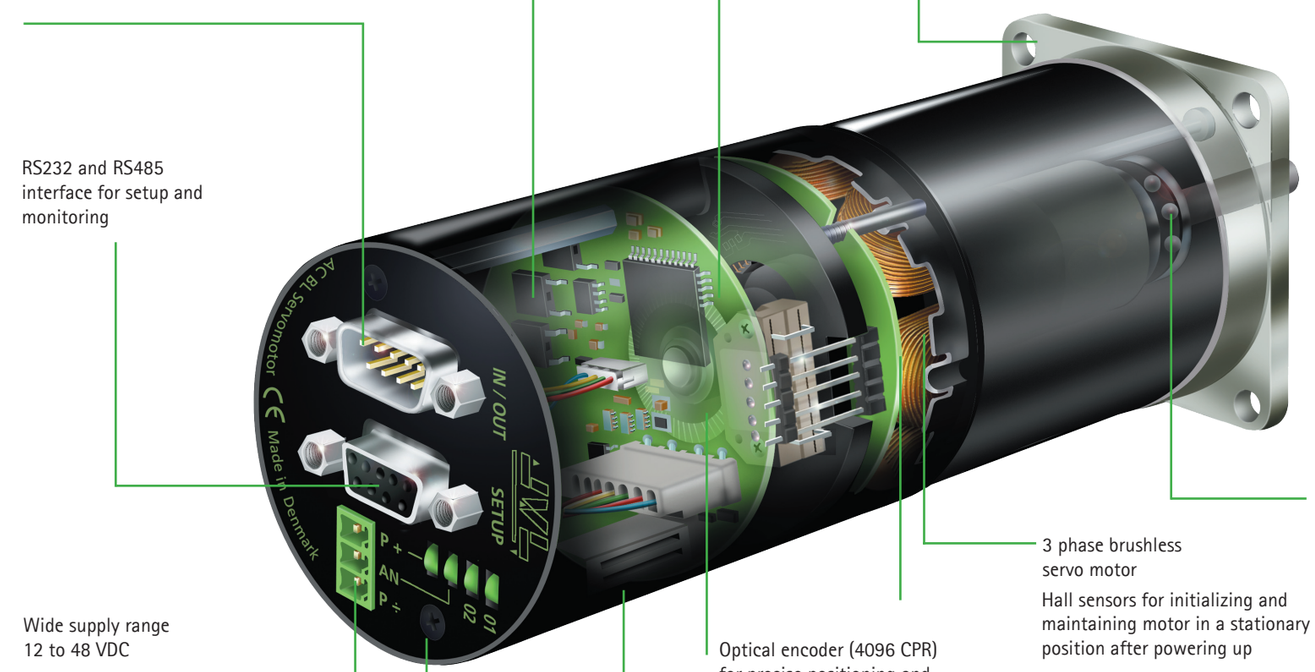
Ball bearings for mantenance free operation

3 phase brushless servo motor

Hall sensors for initializing and maintaining motor in a stationary position after powering up

Optical encoder (4096 CPR) for precise positioning and speed regulation

Solid aluminium housing which protects and shields the internal components

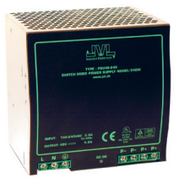


The comple range of MAC motors®
The complete range of JVL AC servo, integrated MAC motors offer you a wide selection of motor sizes adaptable to a wide range of applications

Cables
Cables for all types of set up can be delivered as required. In this way installation is fast and easy for our customers

Electronic brake
Optionally an electronic brake, type MAB23x, can be mounted on all motors with a NEMA23 flange and 6.35mm shaft. It is usefull for holding the motor shaft fixed at power off or when the motor is used in a vertical application

IP67 Protection
IP67 versions can also be delivered. They are resistant against rough chemicals and ideal for use in food processing, pharmaceutical and chemical industries. A double shaft seal and leak-proof cable entry provide watertight sealing



Power Supplies
JVL can supply a wide range of power supplies for supplying one or several MAC motors. They range from very simple do-it-yourself kits to big switch mode supplies. It should be noted that MAC800 includes a complete 115/230 VAC power supply for driver voltage. Only 24VDC for control circuit is required externally

Adapt your motor to your application

The JVL Integrated motors utilizes the unique module concept. Plug-in expansion modules adapt the motor to the application. You can choose connector type, D-Sub, cable glands or M12 connectors and you can choose freely between Profibus, DeviceNet, CANopen or nano PLC control. A High

Basic Modules

Analog · Pulse I/O · 2DO · Cable

MAC00-CS
Low cost module, with cable glands. Pulse/dir. ±10V and 5V serial

Pulse/Dir Analog

Analog · RS232 · RS485 · Pulse I/O · 2DO · DSUB

MAC00-B1,
General purpose module withSub-D connectors: Pulse/Dir, ±10V,

RS 232 485

Analog · RS232 · RS485 · Dual Supp. · 2DO · Cable

MAC00-B2
General purpose module w/Cable Glands: otherwise same as -B1

RS 232 485

Analog · RS232 · RS485 · Pulse I/O · Dual Supp. · 2DO · M12

MAC00-B4
General purpose module w/M12 connectors. Double supply

RS 232 485

Analog · RS232 · RS485 · Pulse I/O · USB · Dual Supp. · 6HI I/O · M12

MAC00-B41
Is a MAC00-B4 module with extendeed I/O functions and USB

RS 232 485

Programable Modules

Analog · RS232 · RS485 · Dual Supp. · 8DI+4DO · DSUB

MAC00-R1
Nano-PLC Module w/Sub-D connectors: Stand-alone operation with 8 DI + 4 DO

PLC NANO

Analog · RS232 · RS485 · Dual Supp. · 8DI+4DO · M12

MAC00-R4
Nano-PLC Module w/M12 connectors: otherwise same as –R1

PLC NANO

Process Control Modules

RS232 · RS485 · Dual Supp. · 2 AI · 2 AO · 2 DO · P4: M12 · P5: M12 + Harting

MAC00-P4 or P5
Process Control modul with analogue 4-20mA input

PROCESS Control

DSUB	9 or 15-pin DSUB connectors IP42
Cable	Shielded cable up to 20 m IP67
M12	M12 screw connector. Cable up to 20 m. IP67
Dual Supp.	Position and parameters can be maintained under emergency stop

Speed and wireless modules add to the possibilities. This means that you have possibilities as with no other motors on the market, and also important, you only pay for what you need. Moreover, if you do not find the feature you need please contact us and we will develop a customized module for you.

Wireless Modules

Analog · RS232 · Dual Supp. · 5DI/4DO · M12 · Wireless

MAC00-FB4 Bluetooth
MAC00-EW4 WLAN
MAC00-FZ4 IEEE802.154

Bluetooth® · ZigBee · WLAN

Field Bus Modules

Analog · RS232 · 4DI/2DO · Dual Supp. · Limit +/- · M12 · CANopen

MAC00-FC4
CAN bus Module w/
M12 connectors: Bus,
4 DI/DO and RS232

CANopen

Analog · RS232 · 4DI/2DO · Dual Supp. · Limit +/- · M12 · DeviceNet

MAC00-FD4
DeviceNet Module
w/M12 connectors:
Bus, 4 DI/DO and RS232

DeviceNet™

Analog · RS232 · Dual Supp. · 4DI/2DO · Limit +/- · M12 · Profibus

MAC00-FP4
Profibus Module
w/M12 connectors:
Bus, 4 DI/DO and RS232

PROFIBUS

Analog · RS232 · Dual Supp. · 1DI/1DO · M12 · L/A IN · L/A OUT

MAC00-EI4/EC4
EtherNET/IP / EtherCAT
Module w/M12 connec-
tors: Bus and RS232

EtherNet/IP™ · EtherCAT®

Analog · RS232 · Dual Supp. · 1DI/1DO · M12 · L/A IN · L/A OUT

MAC00-EP4 Profinet IO
MAC00-ES4 Sercos III
MAC00-EM4 Modbus TCP
MAC00-EL4 Powerlink

PROFINET · SERCOS interface · Modbus · ETHERNET POWERLINK

High Speed Multi-Axis modules

Analog · RS485 · Dual Supp. · 4DI+2DO · DSUB

MAC00-FS1
High Speed
Multi-axis Module
w/Sub-D connectors

RS 485 High-Speed

Analog · RS485 · Dual Supp. · 4DI+2DO · M12

MAC00-FS4
High Speed
Multi-axis Module
w/M12 connectors

RS 485 High-Speed

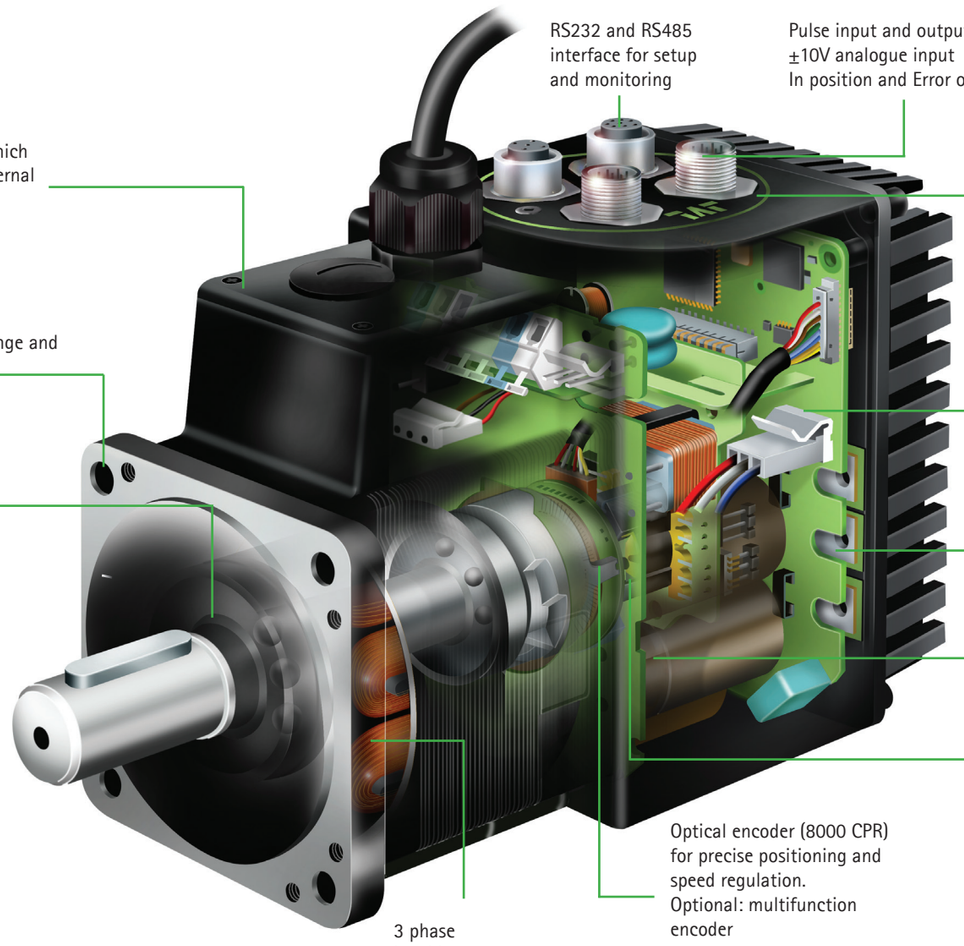
Analog ±10V for speed or torque control or 24V home switch

Pulse I/O RS422 balanced inputs for pulse/direction incremental signal or encoder output

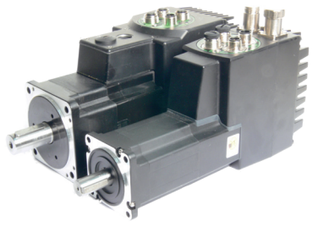
Limit +/- 2 of the inputs can be used as negative or positive limit switch inputs. ▬▮ = Optocouplers.

The MAC motor - 400 W and 750 W - the complete solution for medium and larger power ratings

Brushless servo motor with integrated controller everything in one unit including mains power supply



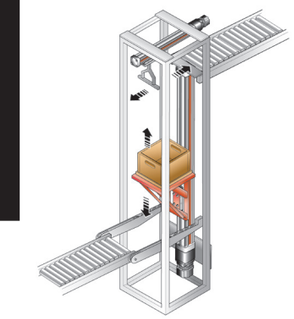
Gears
A wide range of planetary, worm and backlash free gears can be provided for the MAC motors



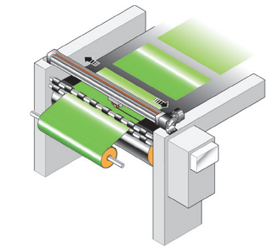
Built-in Brake
For applications in which motor position must be maintained at power-off, or for use in vertical applications, the 400 and 750W MAC motors can be supplied with a built-in brake

MAC1500 and MAC3000
Soon available. They will extend the MAC motor power range to 3000 W. Present series of expansion modules will still fit in these larger motors

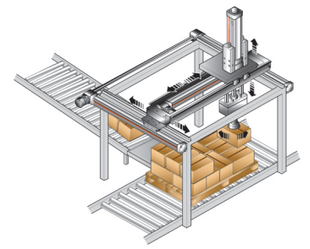
MAC400
MAC400 for medium power ratings with incremental encoder or multi-turn encoder for precise positioning and speed regulation



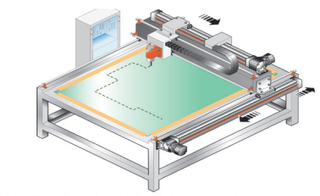
Material Handling Systems vertical and horizontal transfer movements



Slitting Machines. High speed traverse applications for slicing materials



Auto Handling. High speed pick and place movements



Profile Cutting Machines Intricate profile movements of water jets and laser cutters

Other applications

- Replacement for pneumatic solutions
- Replacement of step motors offering much faster response and speed
- Conveyor systems
- Printing machines
- 3-D and XY tables
- Replacement for frequency inverters
- ±10V speed/torque driver for external controllers
- Screw and toothed belt pick and place robots
- Labelling dispensers

Software

JVL delivers the software that you need!

MacTalk

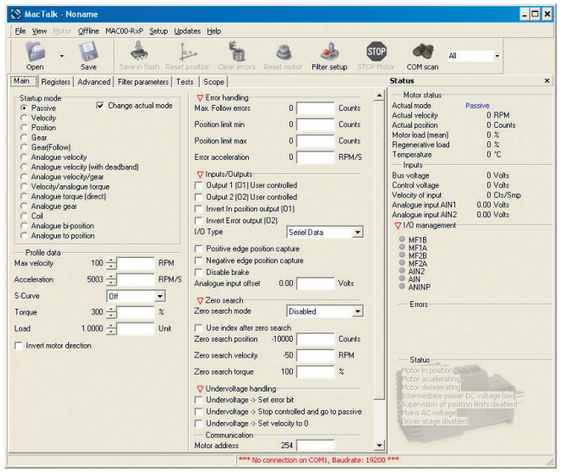
For setup, monitoring and diagnotics Mac-Talk is the preferred choice for most users.

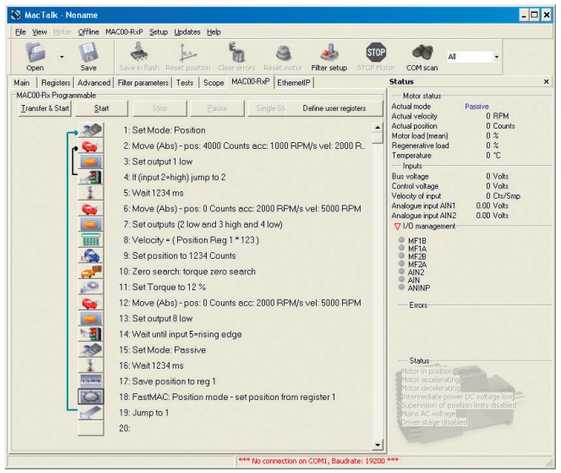
Although advanced functionality is included, all operations are very intuitive and easy to use.

MacTalk allows you to adjust all vital parameters and save them in a file- or load them from a file. It is also possible to monitor parameters and motor status in real time.

When commissioning a system MacTalk even provides a convenient way to test and adjust your system. You can easily set up a test sequence and then adjust parameters like velocity, acceleration and torque.
It is possible to select the distance moved and the delay between the moves. The more advanced 6th-order filter used in MAC motors, instead of a simple PID loop, is easily adjusted.

A nice feature is the Update function: if your PC is connected to the Internet you can update the MacTalk software itself – and even the servo system's firmware can be updated both the driver and the expansion module. Once bought, MacTalk will stay "fresh".
– always including the latest functionality.





Graphical Programming

The Nano PLC MAC00-Rx module can be programmed from MacTalk using userfriendly, icon-based commands in a graphical programming environment. With 8 inputs 4 outputs, all 5-24VDC, and one ±10V analogue input, a small PLC system can be programmed. It is register-based with different kinds of relative or absolute movements, Jump and IF commands, timer and other functions. It is possible to request input conditions and set outputs.

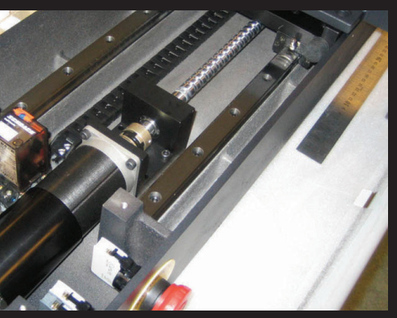
All register and parameters in the MAC motor can be accessed and changed if required.

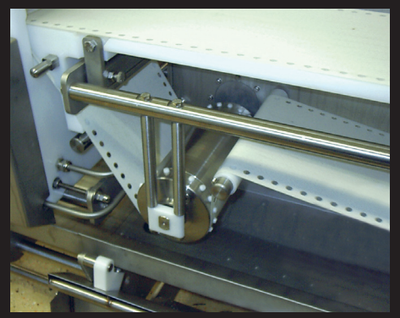
OCX software

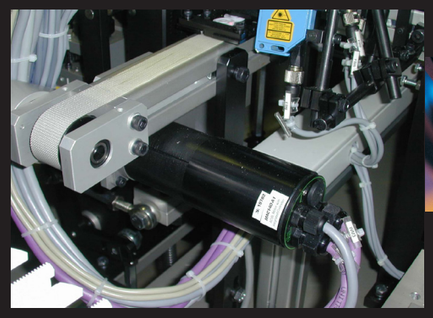
If your application is controlled by a PC you might prefer JVL's OCX software. The OCX (OLE Custom Controls – also known as ActiveX Controls) enables applications to be easily developed in for example:

- Visual Basic
- Visual C++
- Visual .Net
- Delphi
- Borland C++ Builder
- LabView
- Excel

any other environment supporting OCX controls.







Specifications

Technical specifications	MAC50	MAC95	MAC140	MAC141	MAC400-D2	MAC800-D2	MAC1500-D2	MAC3000-D2	Unit
Supply voltage	12-48VDC	12-48VDC	12-48VDC	12-48VDC	115/230VAC	115/230VAC	3x400VAC	3x400VAC	VAC
Speed range (nominal)	0-4000	0-4000	0-4000	0-2700	0-3000	0-3000	0-3000	0-3000	RPM
Rated power@4000/3000 RPM	46/0.062	92/0.124	134/0.18	134/0.18	400/0.54	746/1	1500/2	3000/4	W/hp
Cont. torque@tamb.-25°C	0.11/15,6	0.22/31.1	0.32/45.3	0.48/68	1.3/184.1	2.38/337.1	4.78/677	9.55/1352.4	Nm/oz-in.
Peak torque@tamb.-25°C	0.32/45.3	0.62/87.8	0.9/127.5	1.59/225.2	3.8/538.13	6.8/963	14.3/2025	28.6/4050.1	Nm/oz-in
Rotor inertia	0.075/0.0010	0.119/0.0017	0.17/0.0024	0.23/0.0033	0.34/0.0048	0.91/0.0129	6.26/0.0886	12.14/0.1719	$kgcm^2/oz\text{-}in\text{-}s^2$
Encoder resolution (standard)	4096	4096	4096	4096	8000/8192	8000	32767	32767	CPR
Absolute Encoder (Single / Turns)					8192/4096	8192/4096	8192/4096	8192/4096	CPR/Rev
Physical dimensions: MAC050-141 (dia x lenght) MAC400-3000 (wide x height x lenght)	Ø59x112/ 2.32x4.41	Ø59x131/ 2.32x5.16	Ø59x153/ 2.32x6.02	Ø59x172/ 2.32x6.77	60x114x191/ 2.36x4.48x7.52 with brake 60x114x224.5/ 2.36x4.48x8.84	80x115x175/ 3.15x4.53x6.89 with brake 80x115x207/ 3.15x4.53x8.15	130x200x182/ 5.12x7.87x7.16	130x200x232/ 5.12x7.87x9.13	mm/inch
Weight without exp. module	0.6/1.32	0.85/1.87	1.1/2.43	1.33/2.93	2.3/5.1	3.5/7.72	6.5/14.33	10.5/23.15	kg/lb
Protection class	IP42/IP67 optional				IP55 (IP66 on request)	IP55 (IP66 on request)	IP55 (IP66 on request)		
Flange	58.7x58.7/2.32x2.32				60x60/2.36x2.36	80x80/3.15x3.15	130x130/5.12x5.12		mm/inch
Shaft	Ø6.35/0.25 (other diameter on request)				Ø14/0.55	Ø19/0.75	Ø24/0.95		mm/inch

JVL Industri Elektronik A/S

JVL Industri Elekronik A/S is a modern company, located in Birkerød, just north of Copenhagen. The up-to-date development, research and production facilities of JVL employ only the latest technology for the development and production of electronic controls for step- and servo motors. More than 50% of the staff are engineers with a very high degree of experience and competence in the field of motion control. We can therefore offer a product programme that includes all the necessary units and components to build up a complete motor control system.
JVL is represented throughout Europe and Asia by independent agents and in USA by a sister company, JVL International ApS. In Germany we have our own offices, JVL Deutschland. All distributors are carefully selected by JVL to have the necessary knowledge and experience to help our customers in the best possible way in their choice of motion control components.

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...integration in motion

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