

ServoStep technology



Ever
ELETRONICA

***The clever drive
since 1977***



What means "ServoStep"

- "ServoStep" in Ever Elettronica's strategy resumes seven key-points for quality and performances in motion control applications:

1 Stepping motors



2 Fast Forward Feed Full Digital Drive



3 Full Digital technology



4 Available specific motion control applications



5 Wide product range



6 Integrated motion control system



7 Fair price





What means ServoStep

1 Stepping motors





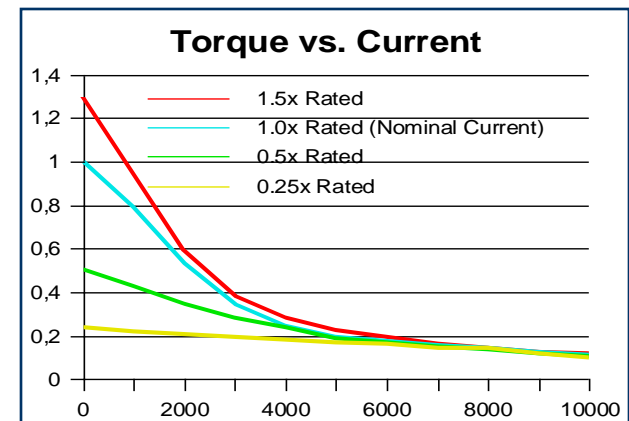
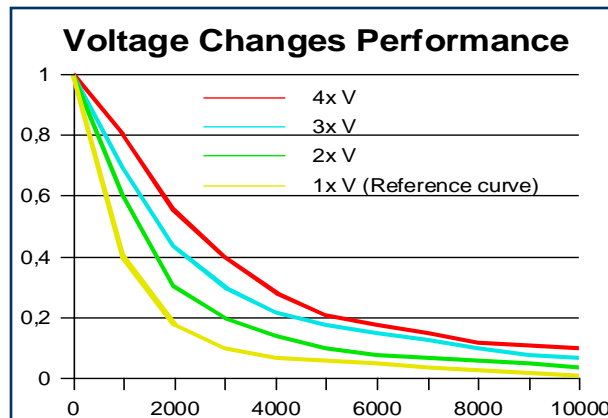
1

Stepping motors



Performances

- The graphs show the dynamic torque of the same motor driven by bipolar chopper drives with:
 - different phase currents (right)
 - different phase voltages (below)



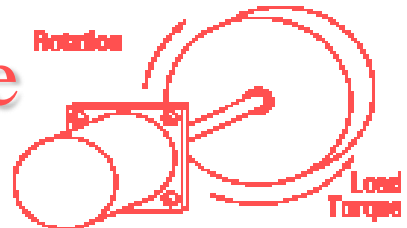
1 Stepping motors



Usage

- Stepper motors are a good match to the following mechanical solutions:

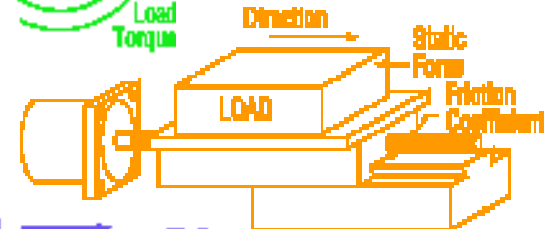
Rotary Motion-Direct Drive



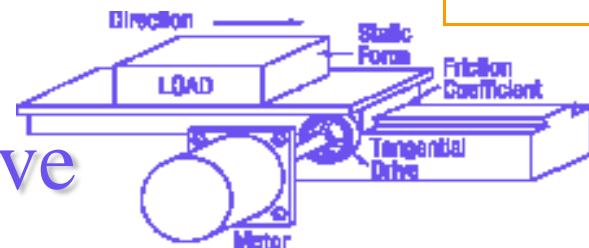
Rotary Motion-Belt Drive



Linear Leadscrew Drive



Tangential Direct Drive





Stepping motors



Direct drive benefits

- When facing an automation that requires a motor with characteristics that are offered both by an AC and a step motor, the user should choose a step motor because:
 - a) When employing AC motors, it is necessary to use several additional mechanical components (gearbox, coupling, cardan joint, etc...) in order to obtain precise positionings
 - b) Step motors don't need any support of additional mechanical parts to execute precise positioning tasks as they are very precise both in *open loop* and in *closed loop* drive thanks to their manufacturing technology and mechanical characteristics.



1

Stepping motors



Technology benefits

- Step motor's high pole count, high torque rating in small size and very precise rotor standstill positioning favour
- the elimination of mechanical reduction gear and shaft encoder feedback for normal positioning making
- stepping motor ideal in low speed direct drive applications
- through simple and money saving driver solutions

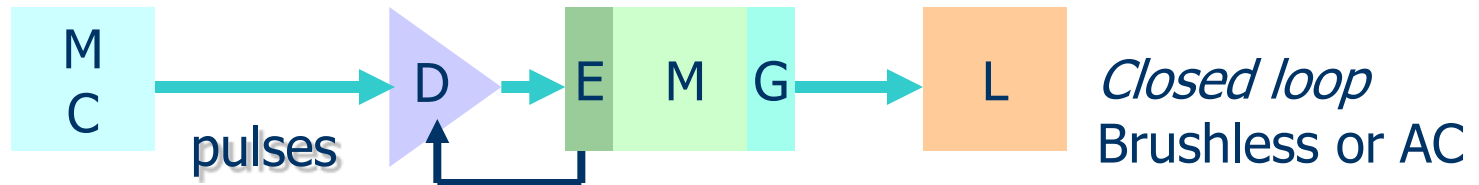


1 Stepping motors

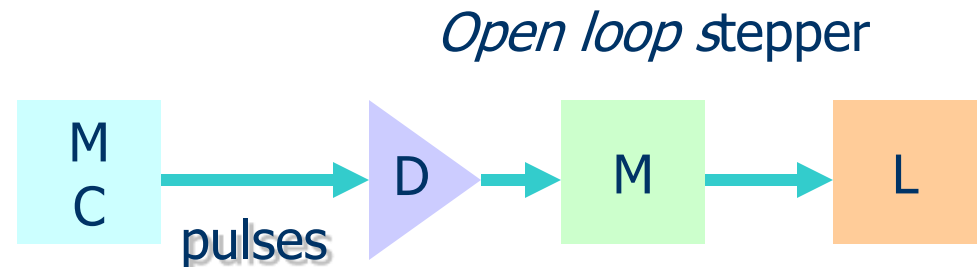


Using ways (direct drive)

- A step motor has many similarities with digital technology: the motor can run the programmed number of steps (pulses) to the wanted position without any feedback devices



MC= Master controller
D = Drive
M = Motor
G = Gear
E = Feedback encoder
L = Load





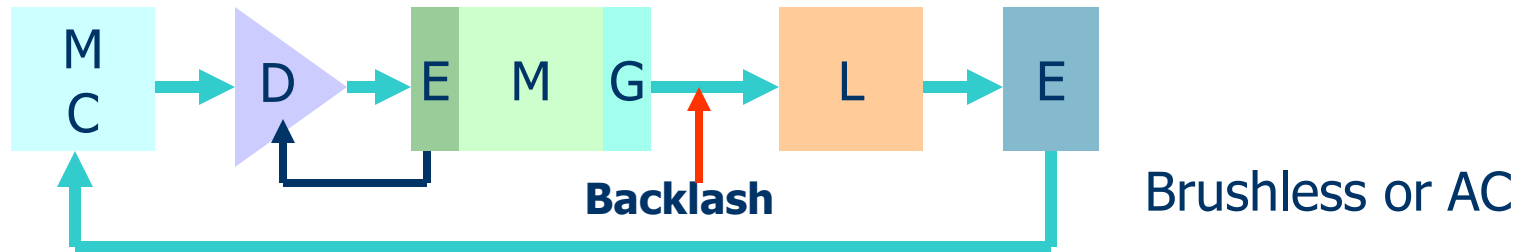
1

Stepping motors

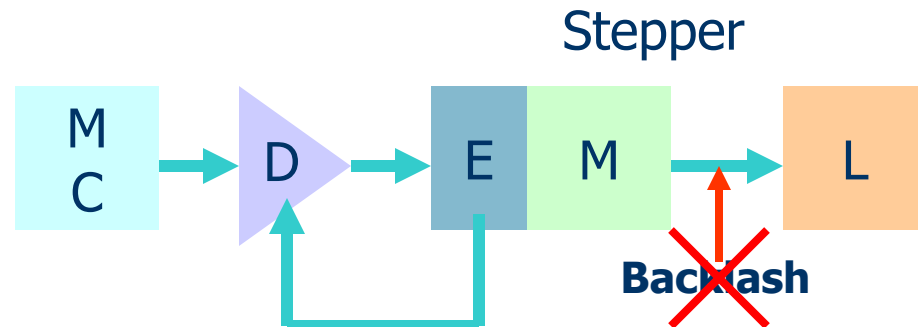


Using ways (closed loop drive)

- The step motor direct drive gives effective benefits as geared brushless motors replacement in high precision medium/low speed actuators



MC= Master controller
 D = Drive
 M = Motor
 G = Gear
 E = Feedback Encoder
 L = Load








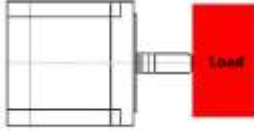
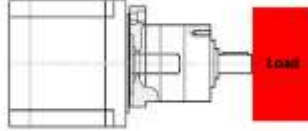
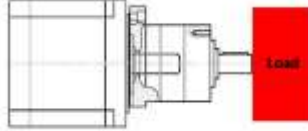
1

Stepping motors



Specific characteristics

- Synchronous brushless motors with a high number of electric poles, commonly known as stepper motors, can replace, at lower costs and in a more user-friendly way, servomotors, with a lower number of poles and a shaft fitted mechanical gear, not just in open but above all in closed loop motion control applications

Characteristics	Stepper Motor	AC Motor	Brushless Motor
Dimensions	 <p>Compact size and best torque/dimension ratio</p>	 <p>Good torque/dimension ratio</p>	 <p>Good torque/dimension ratio</p>
Assembly	 <p>Direct installation on load with high precision positioning and elimination of mechanical gear</p>	 <p>Gear is needed, expensive if with low backlash for precise positioning</p>	 <p>Gear is needed, expensive if with low backlash for precise positioning</p>



1

Stepping motors



Specific characteristics

- Synchronous brushless motors with a high number of electric poles, commonly known as stepper motors, can replace, at lower costs and in a more user-friendly way, servomotors, with a lower number of poles and a shaft fitted mechanical gear, not just in open but above all in closed loop motion control applications

Characteristics	Stepper Motor	AC Motor	Brushless Motor
Torque	<p>non- linear torque-speed characteristics</p>	<p>linear torque-speed characteristics</p>	<p>linear torque-speed characteristics</p>
Feedback	<p>No need of shaft encoder and circuitry. Good position stiffness in open loop system with microstepping</p>	<p>Requires shaft encoder and the position stiffness is dependent on encoder line-to line angle</p>	<p>Requires shaft encoder and the position stiffness is dependent on encoder line-to line angle</p>



1

Stepping motors



Specific characteristics

- Application example:

With AC motor



With AC motor



1

Stepping motors



Specific characteristics

- Application example:

With stepper motor





What means *ServoStep*

2 Fast Forward Feed Full Digital Drive





2

Fast Forward Feed Full Digital Drive



Characteristics

- The *ServoStep* technology is based on *step-less* phase current regulation and is implemented by Ever Elettronica with an innovative algorithm called **Fast Forward Feed Full Digital Drive** - f^4d^2 - owing its name to its main characteristics
- Possible thanks to Ever Elettronica DSPC *Full Digital* technology drives
- Designed with the aim to obtain a quick and robust '*space vector*' motor control
- Implemented with several application firmwares, f^4d^2 can offer a wide range of motion control solutions





2

Fast Forward Feed Full Digital Drive



Functionality

- Algorithm f^4d^2 does not change the computation coordinates in winding current regulation, as in a normal manner, the current control is implemented directly in the coordinates of the stator by modulating the amplitude and angle of the current vector according to rotor's instant position and speed and BEMF

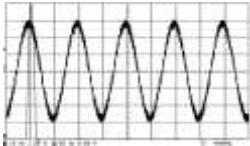


2 Fast Forward Feed Full Digital Drive



Benefits

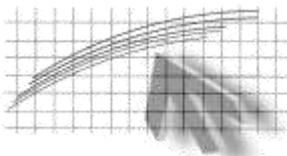
- The algorithm f^4d^2 can make calculations so quickly that it permits a high chopper frequency motor excitation featuring:



- **Sinusoidal currents without any parasitic harmonics**



- **Silent rotation without any damping or resonance**



- **Maximum torque at any speed**

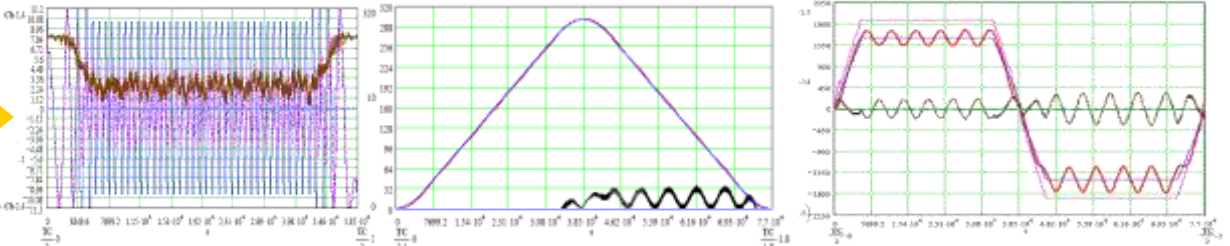
2 Fast Forward Feed Full Digital Drive



Closed loop drive's further benefits

- The high frequency (8 kHz) **closed loop** control of the rotor's **torque, speed** and **position** provided by f^4d^2 algorithm prevents motor overheating and guarantees very accurate position and speed "stepless" references tracking

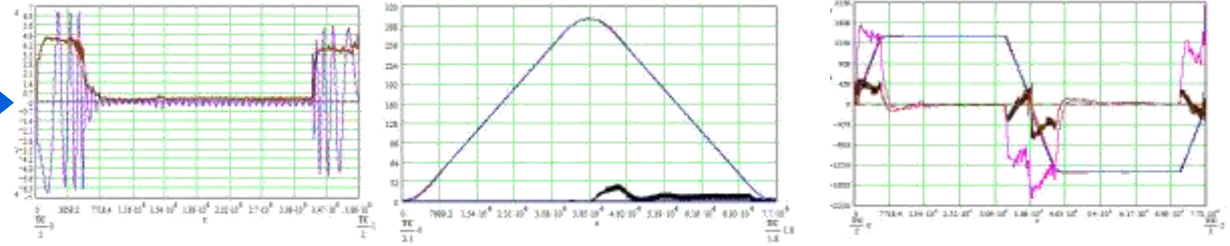
Open Loop ➔



Torque

Position

Speed



Torque

Position

Speed



What means ServoStep

3 Full Digital drives



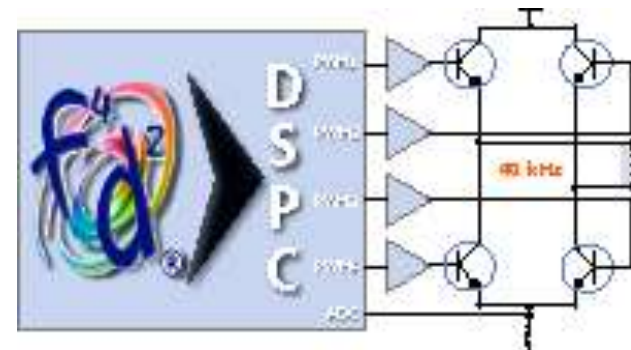


Full Digital technology



Characteristics

- Ever Elettronica has created new fully digital drives series implementing the *Fast Forward Feed Full Digital* technology.
- In these new drives the power stage, that supplies current to the motor, is controlled in PWM mode by a DSPC (Digital Signal Processor Controller) running the f^4d^2 firmware.
- The DSPC replaces the microprocessor normally used in traditional analogue-digital drives.





Full Digital technology



Best functionality

- Replacing the generic microprocessor with the DSPC controller, *'Full Digital'* drives can improve the qualitative and functional features of old D/A technology drives offering the user a wide versatility in application possibilities, easy installation and best drive handling.





Full Digital technology



Enhanced performances

- Flexible generation and regulation of current waveforms that can be optimized by software for various movement scenarios
- Silent and smooth motor rotation even at very slow speed and high motor power output at minimum overheating thanks to an accurate regulation of the winding currents through high frequency power stages chopping (40 kHz)
- A more repetitive and stable drive performance over time thanks to full digital electronics
- Minimized hardware parts count to improve drive reliability
- Extensive diagnostics functionality





What means *ServoStep*

4

Available specific motion control applications



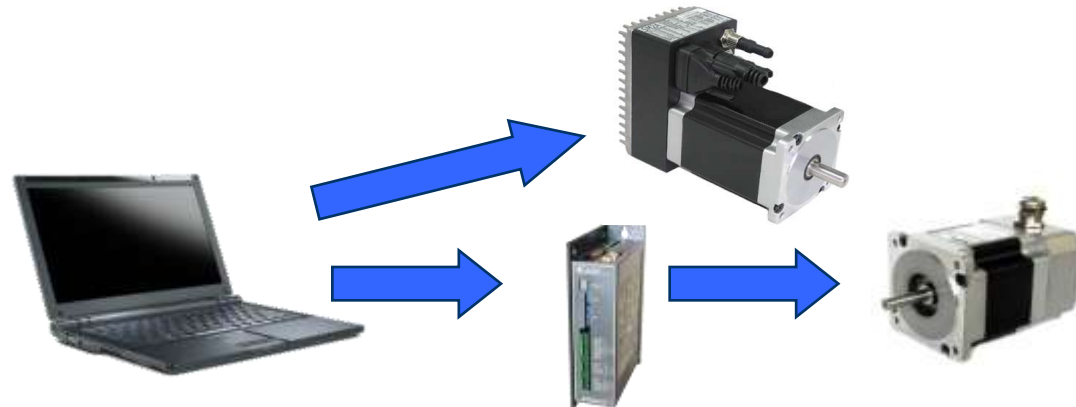
4

Specific available applications



Characteristics

- Ever Elettronica's *Full Digital* servo drives are designed to realize autonomously, in open or closed loop, specific "turn key" motion control applications
- Thanks to the f^4d^2 algorithm the DSPC takes a minimum fraction of time to control the motor, so flexible and enhanced motion applications can be realized





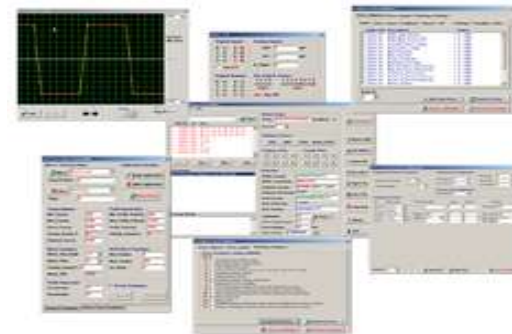
4

Specific available applications



Functionality

- To simplify the drive installation and maintenance and to update the working parameters of the various available applications, Ever Elettronica provides the user with PC software tools.
- These Windows compatible software tools provide various drive set-up and programming functions, among which:
 - **on-line and real-time diagnostics of connected devices**
 - **drive's firmware updating**
 - **complete working parameters configuration**
 - **firmware debugging for a fast application start-up**
 - **feedback parameters optimization functionalities**





What means ServoStep

5 Wide products range





Wide products range



Versatility

- A wide series of standard hardware is available to the user in terms of motors and drives, each model being specified in terms of:
 - **intelligence and programmability**
 - **housing**
 - **power supply**
 - **I/O count**
 - **communication interfaces**



What means ServoStep

6 Integrated systems





Integrated systems



Characteristics

- The integrated motor, drive and optional shaft encoder provides motion control systems designed to simplify the machine control and electrical wiring
- Ever Elettronica's integrated motor and drive devices, feature minimal heat dissipation, even working at maximum power, as well as at high mechanical and thermal strength of the internal unit's parts. They excel in reliability even in hard vibration and temperature working conditions
- Some of the benefits that can be obtained by the devices:
 - Smaller and cooler machine's panel
 - Lower machine overall dimensions
 - Reduction of wirings
 - Lower electromagnetic interference



What means *ServoStep*

7 Fair price



 **7 Fair price**

Benefits

- Ever Elettronica's fair price has been achieved through an optimized product engineering process, aimed to reducing wastes in the production of devices, and designed to minimize material costs without sacrificing performances robustness, improved use safety and reliability, in order to meet today's needs of the automation machines manufacturers

