



# COMPAX



CE (EMC and LVD)

## Single- and Multi-Axis CE-Marked Digital Brushless Servo Systems

- Position, velocity & torque controller for three phase sinusoidal brushless motors
- Power ratings up to 19.5 kW continuous
- Fully protected IGBT power stage
- Three-phase power input, direct on line (no transformer required)
- Separate power module allows shared supply in multi-axis systems
- Nonvolatile memory for stored-program operation
- Completely enclosed metal casing for total protection and electromagnetic shielding
- Fully-digital current loop based on high-speed digital signal processor (100  $\mu$ s cycle time)
- Range of customized variants tailored to meet the demands of specific applications
- Automatic tuning adjustment from given load data
- Simplified servo loop optimization using only two parameters (stiffness and damping)
- Open communications structure with a choice of serial, binary and PLC interfaces as well as Profibus, CANbus and Interbus-S
- PLC-compatible input and output circuits using 24V signal levels
- High-speed data interface (HEDA) allows precise multi-axis synchronization with decentralized control

### A Choice of Power Ratings

There is a selection of continuous power ratings covering the range 2.5-19.5kW. The COMPAX is available in single axis and multi-axis configurations. The single axis version incorporates a built-in power supply which operates from three-phase AC inputs at voltages up to 460V. The multi-axis version offers two central power supply modules (both of which operate from three-phase AC inputs at voltages up to 460V). The power supplies have built-in dynamic braking circuit to dissipate regenerated power during deceleration. The multi-axis

COMPAX with distributed power supply makes for a cost effective solution for applications requiring more than two axes of control.

All configuration data required for standard motors is pre-loaded at the factory and may be recalled using a 3-digit code, minimizing the setup time for standard motors. By simply entering the maximum and minimum values for the external load inertia, the drive will automatically calculate optimum tuning values to ensure stable operation from power-up.

COMPAX drives are housed in a rugged, fully-enclosed metal casing providing a high degree of protection as well as effective electromagnetic shielding. The rear-mounted heat sink allows the higher-power units to be mounted through a cutout in the panel, minimizing the heat dissipation within the equipment cabinet.

The COMPAX incorporates the latest breakthroughs in servo controller functionality into a fully digital, user-friendly system. The COMPAX was designed in Germany, where fieldbus conductivity has long been a critical application consideration. Today, fieldbus options are being explored domestically by many progressive OEMs and end-users. This product significantly reduces application development time through the use of parameter-based programming and application-specific software modules.

### Powerful Control Functions

The COMPAX may be controlled using direct commands in real time from a host controller, or it can operate from an internally-stored control program with up to 250 command lines. In addition to the basic position control version, application-specific variants cater to a wide variety of tasks from processing material in motion to electronic gearing and cam control.

An RS-232C serial interface provides complete configuration and diagnostic facilities using an external computer or terminal. Parameter editing and storage software is provided with the controller. For diagnostic purposes, the front panel incorporates a 7-segment LED display combined with a simple three-button selection system to monitor system status.

### Preferred Motors

The COMPAX Series drives are offered with a selection of preferred brushless servo motors which provide rated shaft power ranging from 0.5kW to 9kW at their rated shaft speeds. The HDY Series motors feature continuously rotatable connector housings (up to 270 degrees) for flexibility in application design and installation. The HDY Series motors also feature connectors that conform to a worldwide standard and are compatible with the connectors of many other motor brands. The HBMR Series motors feature high power performance capabilities.

### The Technology

In most conventional servo systems, the control of the machine or overall process is separated both electrically and physically from the control of velocity, torque and position. Since these functions are closely inter-related, there are significant benefits in integrating them into a single device.

The control system in the COMPAX drive is based on two microprocessors—a host controller and a high-speed digital signal processor. The host processor handles I/O and low-speed communications, while the DSP controls the digital current loop, processes encoder and resolver data, and communicates with other axes using a high-speed data channel. The DSP has access to all relevant data, including motion profiles, external moments of inertia and instantaneous motor currents. This permits the application of advanced control concepts such as adaptive and observer control, and allows all main controller parameters to be set fully automatically.

### Benefits of the Integrated Solution

- High-accuracy tracking in coordinated motion applications, achieved with the use of velocity, acceleration and current feedforward terms.
- Outstanding smoothness at low speeds resulting from the use of observer control.
- Automatic parameter setting from external load data (load inertia, motor type, gear ratio etc.)
- Simplified optimization for specific applications using only two independent adjustments—stiffness and damping.
- Precise multi-axis synchronization achieved using a high-speed data link between drives.
- Closer co-ordination of process and motion control resulting in improved dynamic performance, better stability, higher stiffness and lower peak currents.
- The high-level process controller becomes less complex, costs less & requires fewer connections.

### Open Communications

COMPAX offers a variety of communication interfaces to suit all types of applications and host controllers.

- RS232C interface for parameter setting and motion control
  - Card slots for fast bus systems (Profibus, CAN-Bus, Interbus-S or RS485)
  - 16 binary inputs & outputs for program control & status checks
  - Universal PLC data interface using binary I/O
  - 7-segment display for status & error messages
- Where there is a requirement for fast bus communication

with the rest of the system, COMPAX can accommodate most of the popular options. However, where very rapid data transmission is not necessary, the universal data interface is particularly convenient as a means of simple data exchange with the host controller. Using only 5 binary I/O lines, it can be implemented inexpensively with all types of PLC and avoids the need to become conversant with serial bus systems.

### The Control Section

The basic COMPAX controller is designed to meet the requirements of a standard positioning axis. Its standard features accommodate applications such as point-to-point positioning in either absolute or incremental modes. In addition, there is a range of application-specific variants designed to handle tasks such as electronic gearing and cam control. These variants are described on the next page and are identified by a code within the part number. For example, the COMPAX 2570S incorporates the electronic cam control function (code 70).

Up to 250 sequentially-numbered command lines can be stored by the user in the program memory. Execution of the program can be controlled either by a data interface of the binary I/O lines. Specific addresses within the control program can also be selected.

The structure of the control program has been kept as simple as possible and closely resembles BASIC. As well as motion-related commands such as speed, position and acceleration rate, there are also comparison operators, I/O control commands and program flow commands.

Here is a sample program:

N001	ACCEL 250	Acceleration time 250ms
N002	SPEED 80	Speed 80% of rated
N003	REPEAT 10	Conditional wait loop lasting a maximum of 1 sec.
N004	IF I7=1 GOTO 9	If input 7 is at logic 1 jump to line 9, otherwise continue
N005	WAIT 100	Wait for 100ms
N006	END	End of the wait loop
N007	OUTPUT O7=1	Turn on output 7
N008	GOTO 13	Jump to end
N009	POSA 1250	Move to absolute position 1250
N010	OUTPUT O8=1	Turn on output 8
N011	WAIT 500	Wait for 500ms
N012	OUTPUT O8=0	Turn off output 8
N013	END	End of program

The commands are always executed sequentially, and the program can be interrupted by a break signal which will bring the axis to a halt. The program can then be restarted at a different program line. The ability to nominate the line at which execution will start allows the program to contain several individually-selectable motion sequences.

### Completely Digital Control Including Power Stage

The fully-digital COMPAX relies wholly on software algorithms to calculate all the manipulated variables. As a result, all settings are entirely reproducible and may be saved to disk. Since all main control parameters are set automatically, stable operation is guaranteed right from power-up. End users have no need of extensive experience with control technology since the required expertise is incorporated in software form. The optimized control structure based on powerful control algorithms results in very high performance combined with extreme flexibility in meeting the requirements of specific applications.

For More Information on CE-Marked Digital Servo Systems, Call 1-800-358-9070 Today.