Unidrive SP: Servo

Servo Drive Solutions

0.5 hp - 100 hp Heavy Duty (0.37 kW - 75 kW)
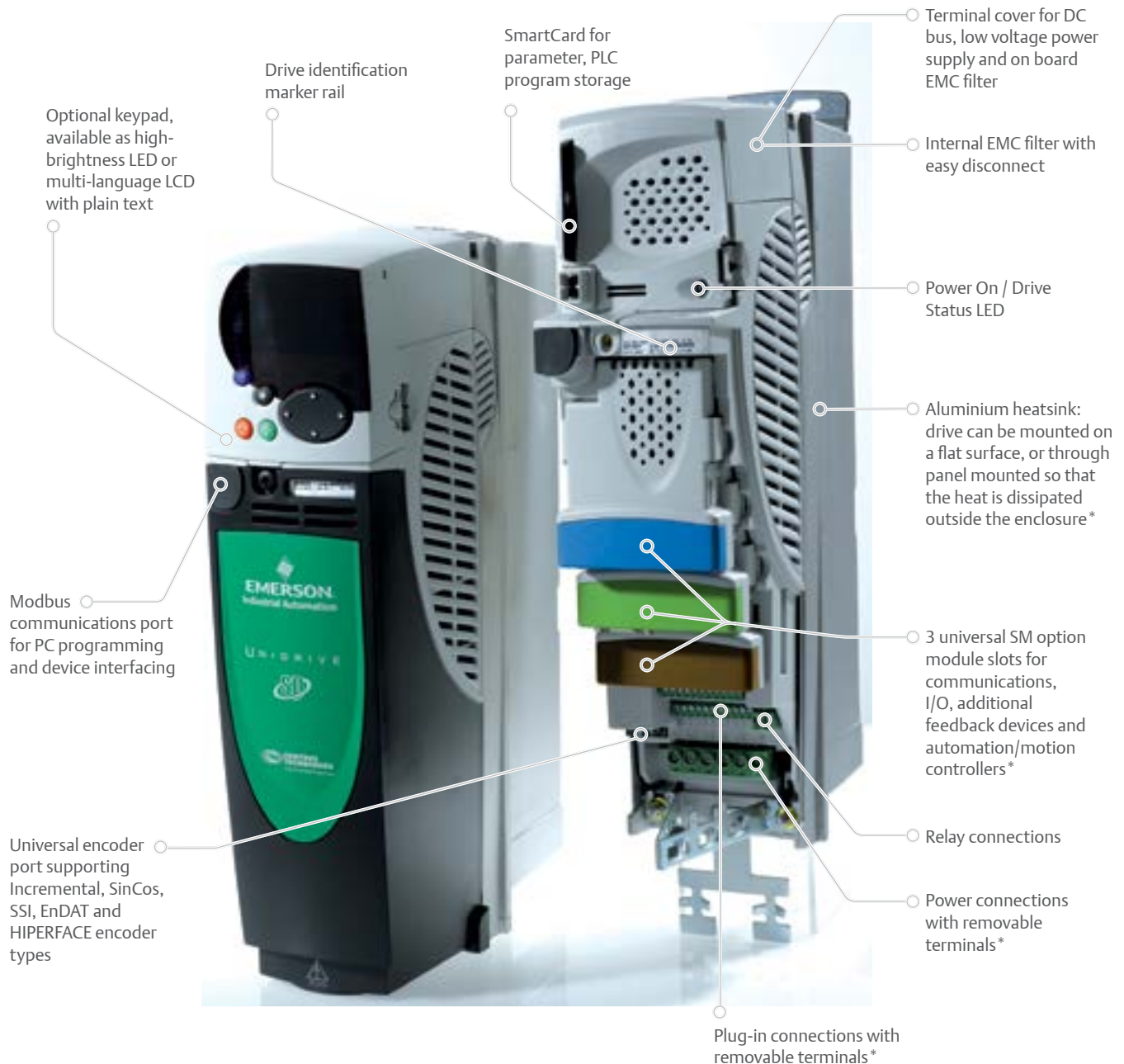230 V | 460 V

Control Techniques™

EMERSON™
Industrial Automation

Unidrive SP – Advanced Solutions Platform for Servo Motor Control

Control Techniques' Unidrive SP delivers dynamic performance to operate a wide array of servo motor types and power ratings. Snap-in SM option modules allow the addition of programming platforms, distributed or centralized control architecture, I/O, communications and feedback to tailor the solution to specific application needs.

SmartCard for parameter, PLC program storage

Drive identification marker rail

Optional keypad, available as high-brightness LED or multi-language LCD with plain text

Terminal cover for DC bus, low voltage power supply and on board EMC filter

Internal EMC filter with easy disconnect

Power On / Drive Status LED

Aluminium heatsink: drive can be mounted on a flat surface, or through panel mounted so that the heat is dissipated outside the enclosure*

Modbus communications port for PC programming and device interfacing

3 universal SM option module slots for communications, I/O, additional feedback devices and automation/motion controllers*

Relay connections

Universal encoder port supporting Incremental, SinCos, SSI, EnDAT and HIPERFACE encoder types

Power connections with removable terminals*

Plug-in connections with removable terminals*

* Features and their locations vary on some drive sizes

CE   cULus E171230   N1652   BSI REGISTERED Certificate No. EMS 54446 ISO 14001   UKAS ENVIROMENTAL MANAGEMENT 003   BSI REGISTERED Certificate No. Q 05176 ISO 9001   UKAS QUALITY MANAGEMENT 003   5 YEAR Digital Drive Warranty   2 YEAR Digital Drive Warranty

One Drive, Any Power, Any Motor

The Unidrive SP is a universal AC and Servo drive with ratings from 0.5 to 2,900hp. This field-proven drive features dynamic servo performance with a wide array of power, motor types and snap-in SM option modules including programming/automation platforms, distributed or centralized control, I/O, communications and feedback to tailor the solution to your exact needs. (For full details on the wide range of available option modules, please see the Control Techniques *SM Option Modules* brochure.)

Panel Mount – Standard Drives

0.5 hp to 100 hp (0.37 kW to 75 kW)

Unidrive SP Panel Mount drives are standard AC input, AC output sizes for installation within a control panel. Optional conduit boxes are available for wall mounting.

Ratings

Input Voltage

Horsepower Range
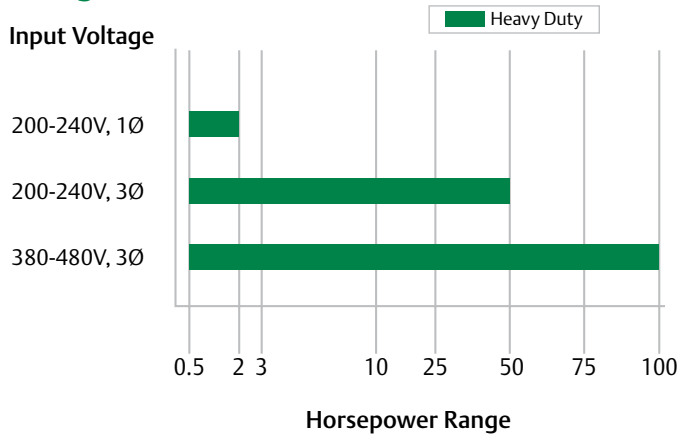
Performance Advantage

Servo Motor Control
Closed-loop servo motor control and power regeneration control features in one drive

Induction Motor Control
Closed-loop motor control for motion control applications

24Vdc Auxiliary Power Supply Input
Maintains control, network communications and position loop on input AC power loss, minimizing system recovery time

Comprehensive Auto-Tune
Inertia monitoring and static auto-tune reduce startup time

Universal Feedback Interface
Supports 14 different types of feedback devices, including several absolute encoders; multiple encoders can be connected to a single drive with SM option modules

High-Resolution Analog Input
16-bit, 250μsec interface for high-performance applications; two additional 10-bit analog inputs for lower level controls

Extensive Fieldbus Connectivity
ModbusRTU (Standard), Profibus-DP, EtherNet/IP, Modbus TCP/IP, DeviceNet, CAN, CANOpen, EtherCAT, SERCOS, Interbus-S and CTNet/CTSync optional via zero-space option modules; up to four fieldbus devices can connect to a single drive, eliminating the need for expensive gateways

Universal SM Option Module Slots
Unidrive SP size 0 has two slots; Unidrive SP sizes 1 and up have three option module slots; SM-Fieldbus, I/O and Application modules fit in any of the open module slots

Safe Torque Off Function
Conforms to IEC61800-5-1, SIL 3 and EN954-1 Category 3 for machine safety and system cost reduction

SmartCard for Simple Set-up and Cloning
Easy-to-use card stores drive configuration for simple startup and parameter cloning — supplied free with every Unidrive SP

Keypad Options
Choose no keypad, LED keypad or LCD keypad based on the system design and operating environment

Drive-Mounted Brake Resistors
Unidrive SP sizes 0, 1 and 2 feature a drive-mounted brake resistor option to reduce panel space requirements

Automation Solutions

Unidrive SP programmable drives provide compact, higher-performance and lower-cost solutions in machinery automation applications. Over the past 30 years, Control Techniques has pioneered the embedding of programmable automation, motion control and communications features within its drive products.

Featured SM Option Modules

To provide the best possible dynamic motor performance, the following Control Techniques SM option modules contain a high-performance microprocessor that allows the base drive to be dedicated to motion control as well as machine control.

SM-EZMotion

The SM-EZMotion option module and Control Techniques' FREE PowerTools Pro software provide a user-friendly environment for easy "out-of-the-box" configuration and motion programming. The EZMotion approach is ideal for rapid development of motion application solutions. The module has four digital inputs and two digital outputs for high-speed I/O operations.

SM-Applications Plus

SM-Applications Plus offers all of the features of the SM-Applications Lite V2 module plus Control Techniques' CTNet network interface (see below), RS485 serial port and high-speed I/O. The SM-Applications Plus option module is programmed using SyPTPro (System Programming Tool).

- Drive-to-drive communications: SM-Applications Plus option modules include a high-speed, drive-to-drive network called CTNet. This network is optimized for intelligent drive systems offering flexible peer-to-peer communications. CTNet has the capability to connect to remote I/O, operator panels, Mentor MP DC drives and PCs providing the ability to perform true parallel multi-tasking.

- Control Techniques' CTSync is also standard on the SM-Applications Plus module, providing drive-to-drive synchronization with <4μsec jitter.

- Inputs/Outputs: This module has two digital inputs and two digital outputs for high-speed I/O operations such as position capture and actuator firing.

SM-Applications Lite V2

The SM-Applications Lite V2 option module provides programmable control for standalone drive applications or when the drive is connected to a centralized controller via I/O or fieldbus. SM-Applications Lite V2 may be programmed using Ladder Logic with SyPTLite or can use the full automation and motion control capabilities contained within SyPTPro, IEC 61131-3 software (see page 8 for more information).

- Real-time control: The SM-Applications Lite V2 module provides real-time access to all of the drive's parameters plus access to data from I/O and other drives. The module uses a high-speed multi-tasking operating system with task update times as low as 250μs. Tasks are synchronized to the drive's own control loops to give you the best possible performance for drive control and motion.

SM-Register

The SM-Register option module is designed to provide a flexible, high-performance solution for programmable motion requiring high-speed registration features – ideal for applications such as printing, packaging and cutting machinery.

Features include:

- Motion programming using PLCopen or Control Techniques' Advanced Position Controller (APC)
- Two fully independent registrations capture channels
- Storage for 256 events per channel, microseconds apart
- Pattern recognition
- Speed capacity in excess of 3000ft/min
- Ability to filter unwanted marks (i.e. splashes, dirt, text, etc.)
    - Minimum and/or maximum pulse width
    - Distance from previous edge
- Compensation for registration sensor throughput delay
- CTNet and CTSync functionality

"Made-to-Order" Drive Configurations

Feature-rich Unidrive SP drives are optimized for servo applications requiring high peak torque, dynamic response, ease of use and versatile integration features. Several core configurations are listed below to which feedback, communications and I/O option modules can be added for custom solutions. All in all, there are over 10,000 possible Unidrive SP configurations allowing you to match your specific application and development requirements. The following combination examples also offer the option of adding two additional option modules.

Unidrive SP "Base." With up to 14 different motor feedback options, the base Unidrive SP can be easily controlled with single- and multi-axis controllers, PLC's and host controllers for medium- to high-power applications. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The drive can be controlled over a SERCOS or EtherCAT network with the addition of an SM-SERCOS or SM-EtherCAT option module.

Drive set-up parameters can be easily stored on a credit card-sized SmartCard. Simple sequencing logic can be accomplished using the onboard Ladder editor. Configuration and diagnostics is performed using the FREE CTSoft software tool.

Unidrive SP "EZ" (Base drive + SM-EZMotion module). With out-of-the-box motion control in minutes, the Unidrive SP is the ultimate servo drive in terms of ease of use and motion performance. Utilizing a familiar Windows® interface, machine builders can use PowerTools Pro software to quickly set up and program the Unidrive SP "EZ" to perform almost any motion profile. Applications requiring camming, indexing, electronic gearing, velocity and torque modes can be accomplished through simple drag-and-drop, fill-in-the-blank set-up. Real-time programs with "Basic-like" command structured text can be used to program the machine sequencing. The programming interface guides the user through the drive, I/O and motion configurations. The drive offers a standalone solution for many common indexing and synchronized motion applications.

Product Styles

Unidrive SP Configuration	"Base"	"EZ"	"Plus"
Control Hierarchy			
Centralized Control System	✓		
Decentralized Control System		✓	✓
Hybrid		✓	✓
Standalone Applications		✓	✓
Motion Control Functionality			
Velocity, Torque Mode	✓	✓	✓
Position-Indexing		✓	✓
Synchronization, Electronic Gearing		✓	✓
CAMS		✓	✓
Programming Environment			
Drag-and-Drop, Fill-in-the-Blank		✓	
Text Programming		✓	✓
PLC Open			✓
IEC 61131 Programming			✓
FREE Application Software			
PowerTools Pro		✓	
SyPTPro			✓
SyPTLite	✓		
CTSoft	✓		✓
CTScope	✓	✓	✓
CTOPCServer	✓	✓	✓

Unidrive SP "Apps" (Base drive + SM-Applications Plus module). This full-functionality machine control set-up is optimized for high-performance machine cells requiring drive-to-drive networking and precision motion control synchronization. SyPT Pro is an IEC61131-3 compliant software development environment used to provide effective machine control, motion and network communications. Ethernet and I/O connectivity enable interfacing with other automation components and intellectual property protection ensures your valuable knowledge remains secure.

Motion Made Easy™ Solutions

"Motion Made Easy™"

Each step is configured using simple check boxes, drop-down selections and drag-and-drop functionality. A straightforward programming language allows users to develop more complex applications and advanced sequencing by simply dragging functions onto the work area and dropping them in place.

PowerTools Pro Software for Unidrive SP EZMotion

PowerTools Pro software provides advanced motion control programming for Control Techniques drives with internal motion controller. This FREE software enables users to fully realize the power of our EZMotion motion controller. A familiar Microsoft® Windows® interface provides operators and machine builders with the tools needed to access everything they need for complete servo control — PLS, Queueing, High-Speed Capture, Electronic Gearing, Event Assignments and more.

Developing motion applications with PowerTools Pro is a simple "five-step, top-down" process. The five steps are displayed in a familiar "explorer" bar (insert, left) for easier navigation:

- Hardware configuration
- Drive setup
- I/O setup
- Motion
- Programs

Assignments – Use "virtual wiring" to create programs right out of the box without writing a single line of code. For example, the assignment screen (below) allows you to drag-and-drop the desired machine function onto the digital inputs and outputs.

Indexes – Indexes are easily set up by filling in the screen's blanks to create an index profile. Select from Incremental, Absolute, Registration or Rotary Plus and Minus types. "Position Tracker™" synchronization is easily achieved using menu selections. Choose the time base of the index by selecting either real-time or synchronization with a master.
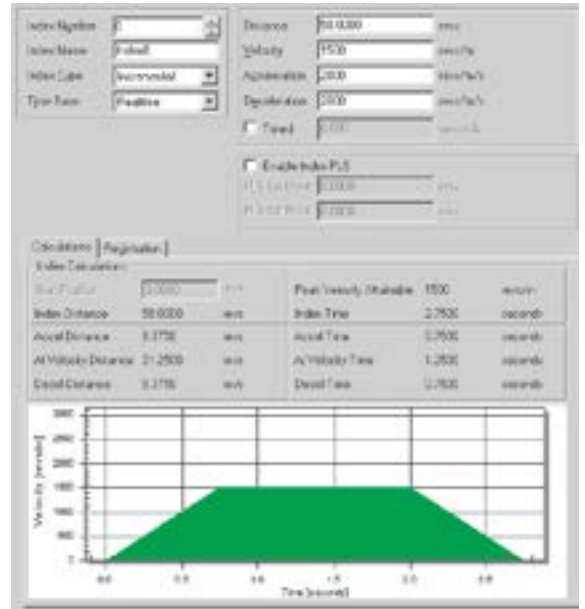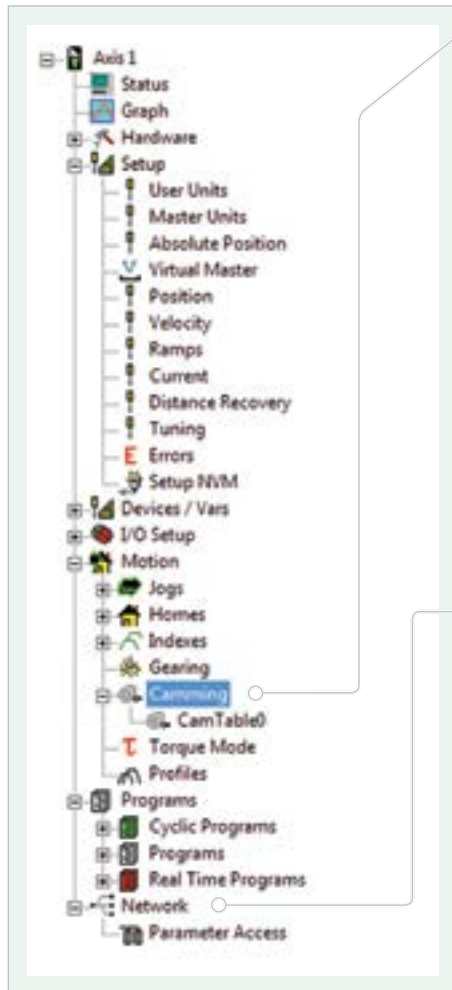

Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and other countries.

Software Matched to Your Application Requirements

PowerTools Pro continued

Camming – Cams make set-up and programming of complex motion profiles easy. The use of real-time programs provides smooth transitions when switching between cam profiles on the fly. Cam data is easily imported within PowerTools Pro and the cam graphing tool features multiple interpolation types.
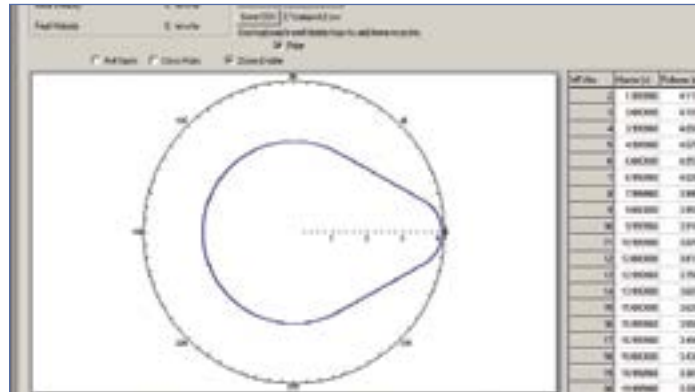

Sophisticated motion routines such as camming, gearing or multiple profile summation are easily implemented with PowerTools Pro and Unidrive SP.
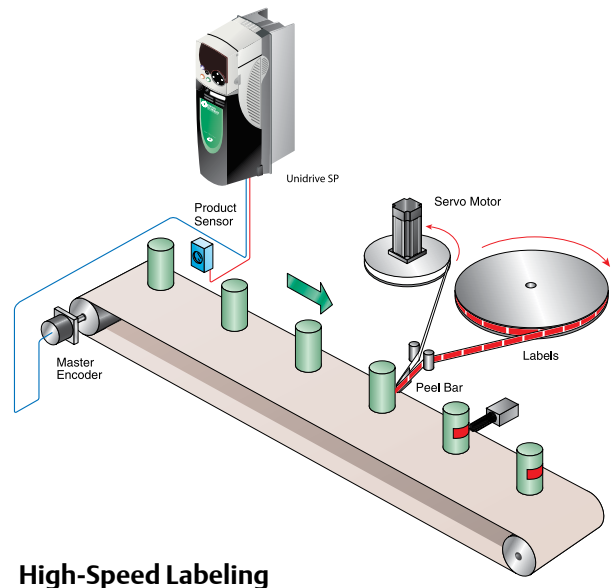
Network – Regardless of the fieldbus being used, setting up network communications is quick and easy. Fill-in-the-blank, drag-and-drop procedures are used to set up communication. PowerTools Pro's diagnostics allow you to monitor the data being sent and received.

Typical Applications
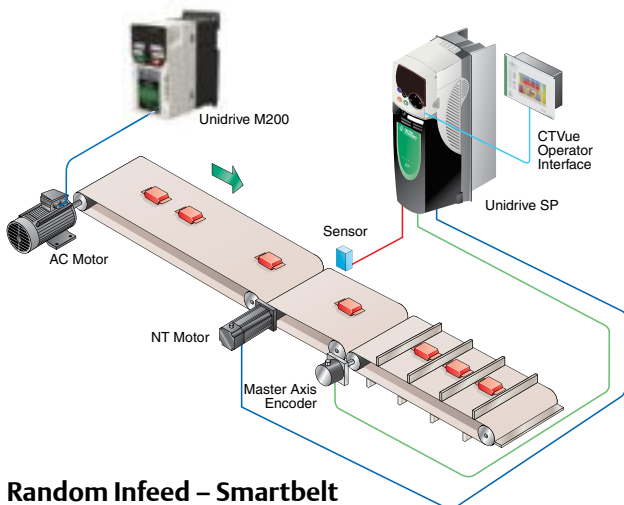
Random Infeed – Smartbelt

High-Speed Labeling

Flexible Automation Software

SyPTPro (Systems Programming Toolkit)

SyPTPro is a full-featured automation development environment that can be used for developing tailored solutions for single- or multiple-drive applications. The programming environment fully supports three IEC 61131 languages: Function Block, Ladder Logic and Structured Text. Motion control is configured using PLCopen motion language, supporting multiple axes.

CTNet, a high-speed, deterministic drive-to-drive network links the drives, SCADA and I/O together to form a networked system, with SyPTPro managing both the application programs and network communications.

Programming Flexibility

SyPTPro can be used with three programming languages — Function Block diagram, Ladder Logic and Drive Programming Language (DPL). The software offers a multi-tasking environment in which tasks are scheduled according to the required speed of execution or triggered by events.

Function Block
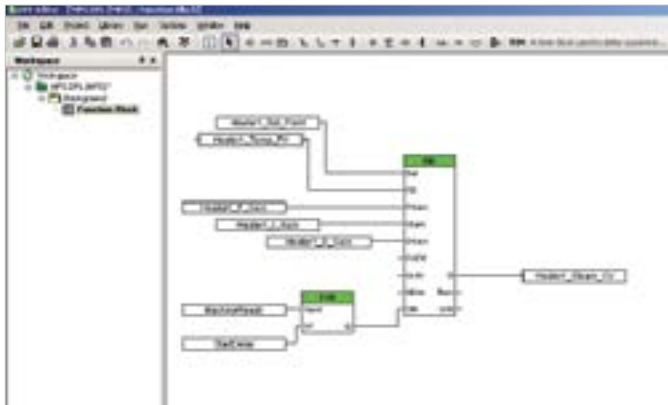
SyPTPro includes a library of more than 380 Function Blocks for both simple and complex functions. In addition to the defined Function Blocks, users can create User Defined Function Blocks (UDFB). This feature allows users to create special functions. It is also possible to use pre-defined Function Blocks inside the UDFB. Intellectual property can be protected by creating a UDFB that allows access only to authorized source code users.

Ladder Logic
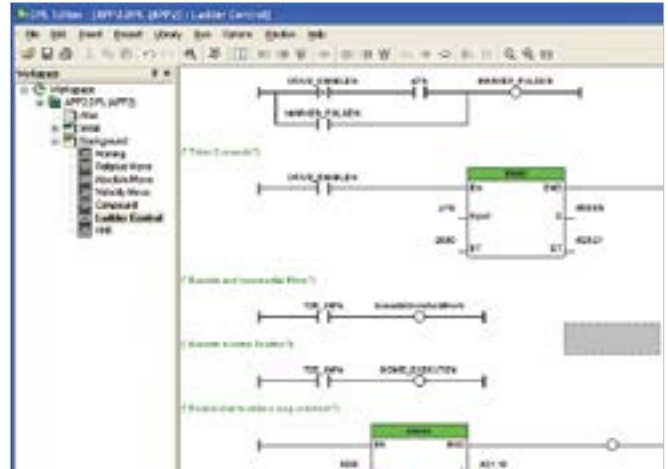
SyPTPro is the ideal format for sequencing and I/O control familiar to all PLC programmers. Using an SM-Applications Plus module, over 5,000 rungs of logic may be stored and executed. All normal Ladder Logic functions are available plus high-level blocks for communications, word manipulation, math operands and much more.

Drive Programming Language (DPL)

DPL is a structured text language as easy to use as BASIC, incorporating many standard constructs such as IF-THEN-ELSE and FOR-NEXT loops. DPL is ideal for initializing, configuration and general programming of Control Techniques drives. DPL may be mixed throughout the program with the other graphical editors such as Ladder Logic.

PLCopen (Open Motion Programming)

PLCopen-style programming for motion control uses industry-standard Function Blocks for motion control resulting in reduced development time.

Additional Software

CTOPC Server

OPC is the industry standard for connecting industrial automation components to higher-level information systems such as SCADA, MRP, ERP and others. Control Techniques' CTOPC server is an OPC-compliant server that allows PCs to communicate with Control Techniques drives via Ethernet, CTNet, RS485 and USB. The OPC standard allows OPC clients to browse data from an OPC server thus eliminating the need for gateway data concentrators or proprietary drivers and gateways. CTOPC server "serves" data to the various OPC clients then polls data from all Control Techniques components connected via Modbus RTU, Modbus TCP/IP or CTNet.

SERVOSoft

SERVOsoft CTA is a standalone software tool designed to help you select the optimum servo drive and motor combination for your machine in 8 easy steps using the EasySize Wizard tool:

1. Select the number of axes and electrical configuration
2. Name the axes to match your machine
3. Select the load type for each axis
4. Define the motion profile for each axis
5. Enter the mechanical characteristics
6. Add any mechanical transmission elements
7. Select drives and motors products from the database
8. Run a system check to ensure the products selected meet all of the desired operating conditions

CTScope
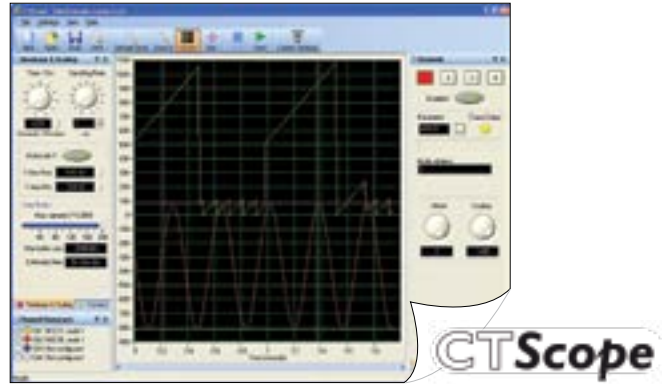
This Windows®-based software utility is designed to trend/trace parameter values on Control Techniques drives and option modules. CTScope has the look and feel of a traditional hardware oscilloscope and can plot up to four channels of data simultaneously. All channel data appears in single-scope view for easy comparison and CTScope files can be saved for future use.

CTSoft
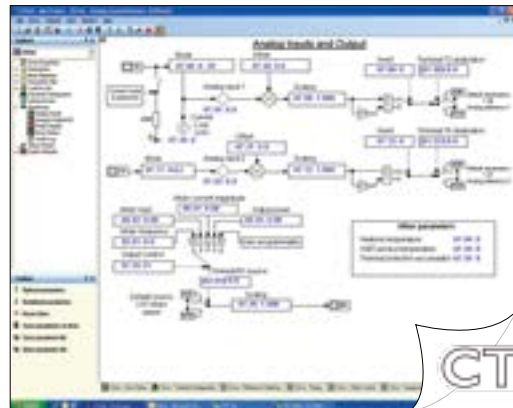
Control Techniques' free drive configuration tool can be used to commission, optimize and monitor Unidrive SP "Base" drives. CTSoft uses wizards to simplify commissioning, manages data stored on the SmartCard and features robust and graphical tools for monitoring and troubleshooting. The status of the program can be monitored and the speed of the motion reduced for commissioning and testing purposes.

Applications with PLC or Motion Functionality
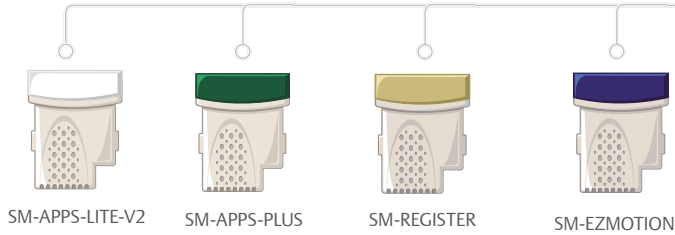
SM-APPS-LITE-V2   SM-APPS-PLUS   SM-REGISTER   SM-EZMOTION

CTNET   CTSYNC

SyPTLite   SyPTPro   PowerTools Pro

*See the Software brochure
for relevence to each module and order codes*

FREE Software

External Control

Windows 98, NT 4.0, 2000, XP, Vista 32 or 7-compatible PC

PLC   **Multi-Axis Controller**

USB Port-to-Drive Serial Interface Cable
CT-USB-CABLE

Operator Interface Options

SmartCard

Memory device to store and copy drive parameters

SMARTCARD

Software

CTSoft
CTScope
CTOPCserver

HMI Operator Interface

See the Options & Accessories brochure for order codes

LCD Keypad

Remote panel or drive-mount LCD multilingual text keypad display to IP54 (NEMA 12)

SM-KEYPAD-PLUS

Interconnect Cable
See Options & Accessories brochure for order codes

LED Keypad

Drive mount LED display to IP65 (NEMA 12) Size 1 and up.

SM-KEYPAD

LED Keypad

Drive mount LED display to IP65 (NEMA 12) Size Zero.

KEYPAD-SP0

Communications

Standard   Options

Modbus RTU

SM-CAN
SM-CANOPEN
SM-DEVICENET
SM-ETHERCAT

SM Option Modules
SM-ETHERNET:
 EtherNet/IP, Modbus TCP/IP, email, web server, simple network time Protocol

SM-INTERBUS
SM-PROFIBUS-DP
SM-PROFINET
SM-SERCOS

CANopen   DeviceNet   PROFIBUS   Modbus RTU   Modbus TCP/IP   EtherCAT   EtherNet/IP

Input / Output

Standard   Options

5 Analog input/outputs
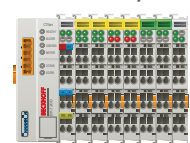7 Digital input/outputs
1 Safe Torque Off

SM Option Modules
SM-I/O-32 (32 digital I/O)
SM-I/O-24V (protected)
SM-I/O-LITE
SM-I/O-PELV
SM-I/O-TIMER (Real-Time Clock)
SM-I/O-120V (120Vac I/O)
SM-I/O-PLUS

Remote I/O

See the Options & Accessories brochure for order codes

Dynamic Braking Options

Filters

Standard | Options

Internal EMC Filter

External EMC Filter

See the Options & Accessories brochure for order codes

Internal Zero-Space Braking Resistor

Frame sizes 0 to 2.

See the Options & Accessories brochure for order codes

Dynamic Brake Resistors E-Stop or Cyclic Duty

See the Options & Accessories brochure for order codes

Feedback

Standard | Options

Sincos Quadrature
Frequency/Direction
Clockwise/Counter Clockwise

EnDat   HIPERFACE®   SSI

SM Option Modules

SM-UNI-ENCODER*
SM-ENCODER-OUT**
SM-ENCODER-PLUS**
SM-RESOLVER

* Accepts and replicates incremental and absolute feedback types. Recommended for Servo and positioning applications

** For use with Induction motors and incremental feedback devices.

Installation Accessories

DC Back-up Power Supply

24Vdc Control

48-96Vdc Power

Conduit Boxes

Available on sizes 1 to 6 for wall-mount applications

See Options & Accessories brochure for order codes

Motor Control Modes

AC Induction Open-loop Vector Control

AC Induction Closed-loop Vector Control

Servo Motor

Linear Motor

Regenerative Active Front End

Motors to Match Your Application Needs

The Unidrive SP supports 14 feedback devices as standard for flawless operation with nearly any Servo motor or actuator to fit a wide range of motion control needs. Control Techniques manufactures several matched motor solutions for Unidrive SP Servo drives and supplies a wide range of gear reducers, actuators and other motion products through Control Techniques' One Source program (see page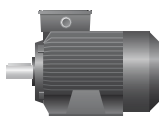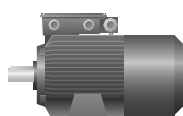 16). Control Techniques drive-and-motor combinations provide an optimized system in terms of ratings, performance, cost and ease of use. Some motors fitted with high-resolution SinCos or absolute encoders are pre-loaded with the motor "electronic nameplate" data during the manufacturing process. This data can be read by Control Techniques Servo drives and used to automatically optimize the drive settings. This feature simplifies commissioning and maintenance, ensures consistent performance and saves time.

Servo Motor Product Matrix

Motor Family	Unimotor fm	Unimotor hd	NT Series	XV Series
Drive Voltage	230 V / 460 V	230 V / 460 V	230 V	230 V
Continuous Stall Torque	Up to 1204 lb-in (136 Nm)	Up to 752 lb-in (85.0 Nm)	Up to 56 lb-in (6.3 Nm)	Up to 101 lb-in (11.4 Nm)
Flange	IEC (NEMA option)	IEC	IEC, NEMA	Metric
Frame	75, 95, 115, 142, 190, 250 mm	55, 67, 89, 115, 142, 190 mm	2, 3 in	40, 60, 80, 130 mm
Inertia	Med. (high inertia option)	Low	Low	Low, medium
Peak Torque	Up to 3611 lb-in (408 Nm)	Up to 2257 lb-in (255 Nm)	Up to 144 lb-in (16.2 Nm)	Up to 301 lb-in (34 Nm)
Base Speeds	Up to 6000 rpm	Up to 6000 rpm	Up to 5000 rpm	Up to 5000 rpm
Brake Options	24 Vdc Holding Brake			
Connector Options	Circular style frame-mounted 90° and rotatable; optional 90° fixed, vertical, or mixed	Circular style frame mounted 90° and rotatable	MS or circular style frame mounted, MS style on 40-in lead, flying leads, drive connector terminated leads (20 ft max.)	AMP Mat-n-Loc on 1-ft. lead (40 to 80 mm); MS style frame-mounted (130 mm)
Feedback Options	Incremental encoders, SinCos single- and multi-turn, SinCos single and multi-turn, resolver, HIPERFACE® and EnDat	Incremental encoders, SinCos single- and multi-turn, SinCos single and multi-turn, resolver, HIPERFACE® and EnDat	Incremental 2048 line count	Incremental 2048 line count
Ingress Protection	IP65	IP65	IP65, IP67, IP68	IP55, IP65
Approvals	CE, UL, RoHS	CE, UL, RoHS	UL, RoHS	CE, UL, RoHS
Shaft Seals	✓	✓	✓	

Assembled in the U.S.A.   Assembled in the U.S.A.   Assembled in the U.S.A.

Selecting the Right Motor for the Right Drive

Control Techniques drive-and-motor combinations provide an optimized system in terms of ratings, performance, cost and ease of use. Use SERVOSoft software to select system components or manually select the system using the following steps.

1. Determine the application's continuous and peak torque requirements at various motor shaft speeds, then refer to motor data tables and the visual-reference overview on the facing page to help determine which motor family will be most appropriate for the application.

2. Once the motor family is selected, refer to the Control Techniques *Servo Motors* brochure to select a specific motor that delivers the required torque and speed. Make note of the continuous and peak current (Amps) requirements of the selected motor.

3. Check the ratings tables on page 19 of this brochure to select the drive model that delivers adequate continuous and peak current for the selected motor.

4. Go to the Control Techniques *Servo Motors* brochure to select motor power and feedback cables for the selected drive/motor combination.

Check that the rotor inertia of the selected motor has a ratio of <10 when calculated with the load inertia using the following equation:

Load inertia / rotor inertia

Note: A gear reducer will reduce the load inertia based on the following equation:

*Reflected load inertia = load inertia / (gear ratio)^2*

When specifying a motor system, be sure to consider such factors as user-interface (HMI) options, braking resistors and other options and accessories that will enhance the system's performance and value (see *Options & Accessories* brochure for information and order codes).

Electronic Nameplates
Some motors fitted with high-resolution SinCos or absolute encoders are pre-loaded with the motor "electronic nameplate" data during the manufacturing process. This data can be read by Control Techniques' Servo drives and used to automatically optimize the drive settings. This feature simplifies commissioning and maintenance, ensures consistent performance and saves time.

Example (using Control Techniques' NT Motor family and Unidrive SP Servo drive family)**:**

Step 1: The application requires 10 lb-in continuous torque. The input voltage available is 230Vac.
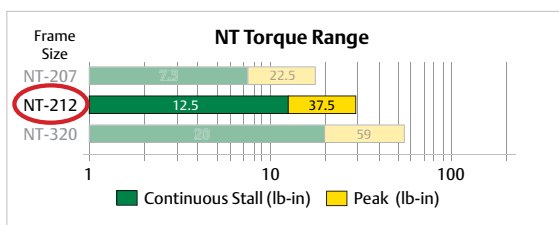
Step 3: Select the Unidrive SP drive with adequate current rating.

Frame Size	200-240Vac +/- 10% 3Ø (kW@220V, hp@230V) Order Code	Normal Duty			Heavy Duty		
		Max Continuous Current (A)	Motor Power (hp)	Typical Output (kW)	Max Continuous Current (A)	Motor Power (hp)	Typical Output (kW)
0	SP0201	2.2	0.5	0.37	2.2	0.5	0.37
	SP0202	3.1	0.75	0.55	3.1	0.75	0.55
	SP0203	4	1	0.75	4	1	0.75
	SP0204	5.7	1.5	1.1	5.7	1.5	1.1

Step 2: The Control Techniques *Servo Motors* brochure lists the NT-212 motor with 2.7A continuous torque and 6A peak.

Step 4: Select the appropriate power and feedback cables.

NT Motor Specifications

Motor Model	Rated Torque lb-in (Nm)	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed rpm	Inertia lb-in-sec² (kgm²)	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms (Nm/Arms)	Motor Weight lb (kg)
NT-207	7.5 (.85)	1.7	3.6	11.1	39.1	5000	0.000094 (.106)	35	5.12 (.58)	3 (1.36)
NT-212	12.5 (1.4)	2.7	6	4.56	18.9	5000	0.000164 (.000018)	35	5.12 (.58)	4 (1.82)
NT-320	20 (2.2)	5.4	16.2	1.5	16.0	4000	0.000528 (.537)	29	3.50 (.40)	6 (2.72)

Standard Features

SmartCard

The SmartCard is a memory device that is supplied with every Unidrive SP and can be used to back-up parameter sets and PLC programs and copy them from one drive to another.

- Parameter and program storage
- Simplify drive maintenance and commissioning
- Quick set-up for sequential build of machines
- Machine upgrades can be stored on a SmartCard and sent to the customer for installation

SMARTCARD>

Internal Dynamic Braking Resistors

During deceleration, the kinetic energy stored in the spinning mass of the motor/load combination is converted to electrical energy which recharges the drive's DC bus. Dynamic braking resistors provide a means of rapidly dissipating that energy so that the drive does not fault from the DC bus over voltage trip. The Ohmic value and power rating of the braking resistor is a function of the drive type, size and duty cycle of the application.

A zero-space braking resistor is available for heatsink mounting on Unidrive SP frame sizes 0 to 2. These resistors are designed for low-inertia loads commonly used in servo type applications. For higher inertia loads, the heatsink-mounted resistor may not have enough braking capacity and a larger external resistor may be required. No additional thermal protection device is required with these heatsink-mounted resistor packages.

Frame Size	DC Resistance	Power Rating	Order Code
0	70Ω	50W	SM-HEATSINK-DBR0
1	75Ω	50W	SM-HEATSINK-DBR1
2	37.5Ω	100W	SM-HEATSINK-DBR2

(Drives larger than Size 2 do not have this option.)

Unidrive SP-Compatible Encoders

Encoder Type
Quadrature incremental encoders with or without marker pulse
Quadrature incremental encoders with UVW commutation signals for permanent magnet motors with or without marker pulse
Forward / reverse incremental encoders with or without marker pulse
Forward / reverse incremental encoders with UVW commutation signals for permanent magnet motors with or without marker pulse
Frequency and direction incremental encoders with or without marker pulse
Frequency and direction incremental encoders with UVW commutation signals for permanent magnet motors with or without marker pulse
SinCos incremental encoders
Heidenhain sin/cos encoders with Endat comms for absolute position
Stegmann sin/cos encoders with Hiperface comms for absolute position
SinCos encoders with SSI comms for absolute position
SSI encoders (gray code or binary)
Endat comms only encoders
UVW commutation only encoders*

This feedback device provides very low resolution feedback and should not be used for applications requiring a high level of performance

Options

The Unidrive SP provides application and system designers with an incredibly flexible drive platform which is easily modified by an extensive range of sophisticated snap-in SM option modules for economical, space saving solutions. SM option modules install easily into any of the three option slots on the Unidrive SP with no tools required. The I/O, feedback, motion control, communication and application modules enable the Unidrive SP to provide an optimized solution to meet your specific application requirements.

Option	Description	Order Code
Base Drive Configuration and Programming	Cloning and parameter storage card	SMARTCARD[1]
	Configuration software	CTSOFT
	USB 485 communications cable	CT-USB-CABLE
	Keypad to drive cable, 5ft	SP-LCD-485-005
	Keypad to drive cable, 10ft	SP-LCD-485-010
	Keypad to drive cable, 15ft	SP-LCD-485-015
	Keypad to drive cable, 25ft	SP-LCD-485-025
	Keypad to drive cable, 50ft	SP-LCD-485-050
	Keypad to drive cable, xxx is cable length in 5ft increments (max length 100ft)	SP-LCD-485-xxx
Operator Interface	No keypad option	Standard
	LED keypad (SP size 1 to 6)	SM-KEYPAD[2]
	LED keypad (SP size 0 only)	KEYPAD-SP0[2]
	LCD keypad	SM-KEYPAD-PLUS[2]
	Programmable HMI panels	*See the Options & Accessories brochure*
Power Accessories	Zero-space brake resistor	Based on Drive
	E-Stop duty braking resistor	*See page 13*
	Cyclic-duty braking resistor	*See the Options & Accessories brochure*
	Zero-space EMC filter	Standard
	External EMC filters	*See the Options & Accessories brochure*
Applications Programming Software	Ladder Logic and Function Blocks	SYPT-LITE
	IEC 61131-3 (Ladder Logic, Function Block, and text-based)	SYPTPRO
	Motion Made Easy™ programming	POWERTOOLSPRO
Programmable SM Option Modules	Systems programming (distributed control) SM-Applications Plus	SM-APPS-PLUS
	Systems programming (centralized control) SM-Applications Lite V2	SM-APPS-LITE-V2
	System programming and registration	SM-REGISTER
	Dedicated motion control	SM-EZMOTION[4]

Option	Description	Order Code
Communications SM Option Modules	Modbus RTU follower	Standard
	Modbus RTU master	SM-APPS-PLUS[3]
	Modbus RTU master	SM-REGISTER[3]
	DeviceNet	SM-DEVICENET
	PROFIBUS DP	SM-PROFIBUS-DP
	PROFINET	SM-PROFINET
	Ethernet (Modbus TCP/IP, EtherNet IP)	SM-ETHERNET
	INTERBUS-S	SM-INTERBUS
	CANopen	SM-CANOPEN
	CAN Interface	SM-CAN[5]
	Ethernet (EtherCAT)	SM-ETHERCAT
	SERCOS	SM-SERCOS
	CTNet, CTSync	SM-APPS-PLUS
	CTNet, CTSync	SM-REGISTER
Feedback SM Option Modules	Universal encoder feedback SM-Universal Encoder Plus	SM-UNI-ENCODER
	Incremental encoder input SM-Encoder Plus	SM-ENCODER-PLUS
	Incremental encoder input and output SM-Encoder Output Plus	SM-ENCODER-OUT
	Resolver feedback	SM-RESOLVER
	Screw terminal connector	SM-ETC
I/O SM Option Modules	Extended analog and digital I/O	SM-I/O-PLUS
	Extra analog and digital I/O	SM-I/O-LITE
	Extended I/O	SM-I/O-32
	Extra I/O with Real-Time Clock/Calendar	SM-I/O-TIMER
	120/240 Vac I/O	SM-I/O-120V
	Double insulated extended I/O	SM-I/O-PELV
	Remote network I/O	*See the Options & Accessories brochure*
	+24 Vdc protected I/O	SM-I/O-24V
Safety	Safe Torque Off (STO)	Standard
	High-speed IEC 61800-5-2 functions	SM-SAFETY
Miscellaneous	Conduit entry plates	*See the Options & Accessories brochure*
	IP54 or IP55 cooling fans	(Based on drive)

1 Can be ordered separately, but comes standard with Unidrive SP
2 Must be ordered separately
3 Provides an additional Modbus RTU port (in addition to one on drive)
4 Only one of these modules can be used in a Unidrive SP at a time
5 Requires an SM-Application module

Unidrive SP Additional Functionality

Unidrive SP Regenerative Mode

Unidrive SP can be configured to provide full four-quadrant control of the power or drive system. In regenerative mode, the Unidrive SP is capable of either supplying power to the DC bus of the Unidrive controlling the motor or removing power from the DC bus of the Unidrive SP controlling the motor and returning it back to the supply.

- Unity or controllable input power factor
- Sinusoidal input current (low harmonic content)

Control Techniques engineers are experts at building four-quadrant regenerative systems for use in many applications where clean sinusoidal power can be put back to the AC supply.

Unidrive SP Regenerative Solutions
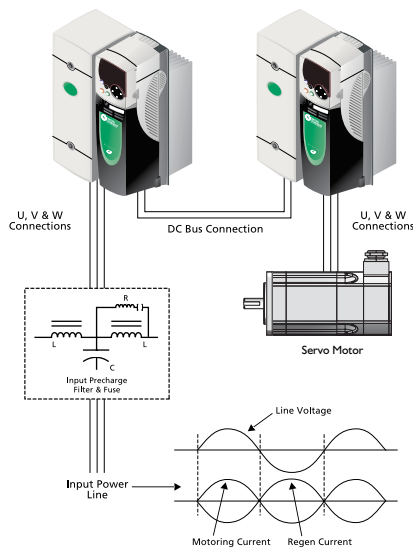
Control Techniques has the solution for any application requiring pure sinusoidal regenerative output such as winder-to-winder or tensioner machines.

Positioning Using Closed-Loop Vector Motors

Unidrive SP motion programming platforms support closed-loop vector motor positioning applications using "Motion Made Easy," PowerTools Pro software with the SM-EZMotion option module, or using SyPTPro with the SM-Applications option module. Many applications today can benefit from the advanced control capabilities, energy savings, cleanliness, noise reduction and advanced communications that AC vector motor positioning and the Unidrive SP can provide. Through its One Source program, Control Techniques offers a wide selection of closed-loop vector motors which feature an economical incremental encoder and matched cabling. This combination provides users with "plug-and-play" solutions for hundreds of applications that can now be solved using the latest AC motor and control technology to increase performance while lowering overall costs.

Benefits

- Overcomes high-load inertia mismatches with use of larger AC motors without the expense of large servo motors and/or gear reducers
- Provides precise high-speed positioning when rapid accel/decel rates are not required
- Eliminates environmental and maintenance issues associated with hydraulic and pneumatic systems
- Plug-and-play fieldbus integration into full-featured control systems
- Integrated, scalable PLC functionality reduces panel space and wiring costs
- Simplified programming, quick startup and advanced diagnostics
- High-performance 2000-to-1 speed range
- Encoder-ready with cables

Control Techniques One Source Program

One Source provides access to key peripheral equipment from world class suppliers. All products provided under this program are only available with Emerson drive or soft starter product/solutions.

For more information on Control Techniques' One Source program, visit:
OneSource.cta@emerson.com

Terminal Diagram

RS485

Pin #	Function
1	120Ω Termination resistor
2	RX TX
3	Isolated 0V
4	+24V (100mA)
5	Isolated 0V
6	TX enable
7	RX\ TX\
8	RX\ TX\ (if termination resistors are required, link to pin1)
Shell	Isolated 0V

Control Terminals - Bottom Row

Pin #	Function	Description
21	0V Common	Common for external digital inputs
22	+24Vdc Output	200mA max user supply
23	0V Common	Common for external digital inputs
24	Digital I/O 1	0 to 24Vdc input, or 1 to 24Vdc, 240mA max output digital I/O
25	Digital I/O 2	0 to 24Vdc input, or 1 to 24Vdc, 240mA max output digital I/O
26	Digital I/O 3	0 to 24Vdc input, or 1 to 24Vdc, 240mA max output digital I/O
27	Digital Input 4	0 to 24Vdc, 6kΩ digital input
28	Digital Input 5	0 to 24Vdc, 6kΩ digital input
29	Digital Input 6	0 to 24Vdc, 6kΩ digital input
30	0V Common	Common for external digital inputs
31	Safe Torque Off	0 to 24Vdc, 8μsec typical/20μsec max sample digital input
41	Status Relay	240Vac, 2A resistive normally open
42	Status Relay	240Vac, 2A resistive normally open

Power - Line/Motor

Pin #	Function
PE	Ground Connection
L1	Line In
L2	Line In
L3	Line In
U	Motor Connection
V	Motor Connection
W	Motor Connection
GND	Motor Ground

Connection shown for Size 1 unit

Bottom view

Power - DC Connections

Pin #	Function
48V	48Vdc
-DC	- DC Bus
+DC	+ DC Bus
BR	Brake Resistor
GND	Ground

Connection shown for size 1 unit
Terminal locations may vary based on unit size

Control Terminals - Top Row

Pin #	Function	Description
1	0V Common	Common for backup power supply
2	+24Vdc External Input	60W, 24Vdc - Backup power supply for control
3	0V Common	Common for external analog signals
4	10Vdc source	10mA max reference supply
5	Analog Input 1+	±10Vdc 100kΩ - differential analog input, non-inverting input, 16 bit
6	Analog Input 1-	±10Vdc 100kΩ - differential analog input, inverting input, 16 bit
7	Analog Input 2	±10Vdc, 100kΩ or 0-20/4-20mA, 200Ω single-ended analog input 10 bit
8	Analog Input 3	±10Vdc, 100kΩ or 0-20/4-20mA, 200Ω single-ended analog input 10 bit, motor thermistor input
9	Analog Output 1	±10Vdc or 0-20 / 4-20mA single-ended analog output, bi-polar, 10 bit
10	Analog Output 2	±10Vdc or 0-20 / 4-20mA single-ended analog output, bi-polar, 10 bit
11	0V Common	Common for external analog signals

Encoder

Pin #	Signal Quadrature	ABS	Pulse
1	A	Cos	F
2	A/	Cosref	F/
3	B	Sin	D, R
4	B/	Sinref	D/, R/
5	Z	Data	Z
6	Z/	Data/	Z/
7	U	n/c	U
8	U/	n/c	U/
9	V	n/c	V
10	V/	n/c	V/
11	W	Clock	W
12	W/	Clock/	W/
13	+V	+V	+V
14	0V Common	0V Common	0V Common
15	Thermistor	Thermistor	Thermistor

Specifications and Dimensions

Specifications

Environment

Ambient Operating Temperature	32 to 104 °F (0 to 40 °C) 32 to 122 °F (0 to 50 °C) with derating
Cooling method	Forced convection
Humidity	95% maximum non-condensing at 104 °F (40 °C)
Storage Temperature	-40 to 122 °F (-40 to 50 °C)
Altitude	0 to 9,900ft (0 to 3000m). Derate 1% per 328ft (100m) between 3280ft (1000m) and 9,900ft (3000m)
Vibration	Tested in accordance with IEC 60068-2-6, 2-29, 2-64
Mechanical Shock	In accordance with IEC 60068-2-27
Enclosure	NEMA 1 (IP 20), NEMA 12 (IP 54) through-panel mounting
Electromagnetic Immunity	In compliance with EN 61800-3 and EN 61000-6-2, and complies with EN61800-3 2nd environment with built-in filter
Electromagnetic Emissions	In compliance with EN61000-6-4 when the recommended RFI filter is used and EMC installation guidelines are followed

AC Supply Requirements

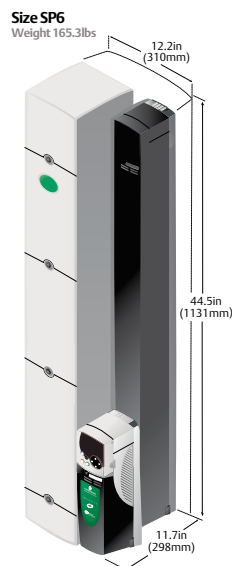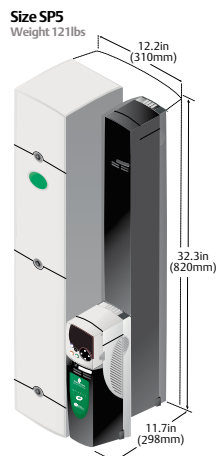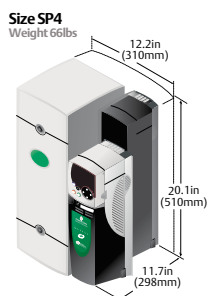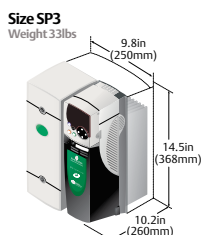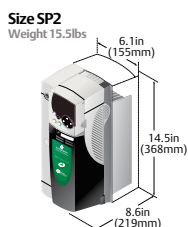|	
Voltage	200 to 240Vac ±10% 380 to 480Vac ±10% 500 to 575Vac ±10% 500 to 690Vac ±10%
Phase	3Ø (SP size Zero: 200 to 240V 1Ø or 3Ø)
Phase Imbalance	2% negative phase sequence (equivalent to 3% voltage imbalance between phases)
Frequency	48 to 65Hz
Input Power Factor	Displacement 0.97

Control

Carrier Frequency	3, 4, 6, 8, 12,16kHz - Panel Mount drives 3, 4, 6kHz - Free Standing and SPM drives
Output Frequency	0 to 3000Hz (Open-loop)
Output Speed	0 to 40,000rpm (Closed-loop)
Frequency Accuracy	±0.01% of full scale
Frequency Resolution	0.001Hz
Analog Input	10 bit + sign (Qty 2); 16 bit + sign (Qty 1) resolution
Serial Communications	2-wire RS485 4-wire RS232 or RS485 with SM-APPS module Protocol is ANSI x 3.28-2.5-A4, or Modbus RTU Baud rate 300 to 115,200
Braking	DC injection braking (stopping and holding) and dynamic braking transistor standard.
Control Power Ride Through	Up to 1 second depending on inertia and decel time

Protection

DC Bus Undervoltage Trip	175 / 330 / 435Vdc (approximately 124 / 233 / 307Vac line voltage)
DC Bus Overvoltage Trip	415 / 830 / 990Vdc (approximately 293 / 587 / 700Vac line voltage)
MOV Voltage Transient Protection	120 Joules, 1500Vdc clamping (line-to-line); 140 Joules, 1815Vdc clamping (line-to-ground)
Drive Overload Trip	Current overload value is exceeded
	Programmable for Normal Duty or Heavy Duty, open-loop or closed-loop operation
Instantaneous Overcurrent Trip	225% of drive rated current
Phase Loss Trip	DC bus ripple threshold exceeded
Overtemperature Trips	Drive heatsink, control board, and option module(s) monitoring
Short Circuit Trip	Protects against output phase to phase fault
Ground Fault Trip	Protects against output phase to ground fault
Motor Thermal Trip	Electronically protects the motor from overheating due to loading conditions

Dimensions

Size SP0 Weight 4.6lbs
8.9in (226mm)
9.8in (249.7mm)
12.7in (322mm)
2.4in (62mm)

Size SP1 Weight 11lbs
3.9in (100mm)
14.5in (368mm)
8.6in (219mm)

Size SP2 Weight 15.5lbs
6.1in (155mm)
14.5in (368mm)
8.6in (219mm)

Size SP3 Weight 33lbs
9.8in (250mm)
14.5in (368mm)
10.2in (260mm)

Size SP4 Weight 66lbs
12.2in (310mm)
20.1in (510mm)
11.7in (298mm)

Size SP5 Weight 121lbs
12.2in (310mm)
32.3in (820mm)
11.7in (298mm)

Size SP6 Weight 165.3lbs
12.2in (310mm)
44.5in (1131mm)
11.7in (298mm)

Ratings

200-240Vac, 1Ø Input, 3Ø Output

Frame Size	Order Code	Max. Continuous Current (A)	Max. Peak Current (A)	Typical hp	Typical kW
0*	SP0201	2.2	3.3	0.5	0.37
	SP0202	3.1	4.6	0.75	0.55
	SP0203	4	6	1	0.75
	SP0204	5.7	8.5	1.5	1.1
	SP0205	7.5	11.2	2	1.5

200-240Vac, 3Ø Input and Output

Frame Size	Order Code	Max. Continuous Current (A)	Max. Peak Current (A)	Typical hp	Typical kW
0*	SP0201	2.2	3.8	0.5	0.37
	SP0202	3.1	5.4	0.75	0.55
	SP0203	4	7	1	0.75
	SP0204	5.7	10	1.5	1.1
	SP0205	7.5	13.1	2	1.5
1	SP1201	4.3	7.5	1	0.75
	SP1202	5.8	10.1	1.5	1.1
	SP1203	7.5	13.1	2	1.5
	SP1204	10.6	18.5	3	2.2
2	SP2201	12.6	22	3	2.2
	SP2202	17	29.7	5	3.7
	SP2203	24.2	43.7	7.5	5.5
3	SP3201	31	54.2	10	7.5
	SP3202	42	73.5	15	11
4	SP4201	56	98	20	15
	SP4202	68	119	25	18.5
	SP4203	80	140	30	22
5	SP5201	105	184	40	30
	SP5202	121.7	227	50	37

380-480Vac, 3ø Input and Output

Frame Size	Order Code	Max. Continuous Current (A)	Max. Peak Current (A)	Typical hp	Typical kW
0*	SP0401	1.3	2.2	0.5	0.37
	SP0402	1.7	2.9	0.75	0.55
	SP0403	2.1	3.6	1	0.75
	SP0404	3	5.2	1.5	1.1
	SP0405	4.2	7.3	2	1.5
1	SP1401	2.1	3.6	1	0.75
	SP1402	3	5.2	1.5	1.1
	SP1403	4.2	7.3	2	1.5
	SP1404	5.8	10.1	3	2.2
	SP1405	7.6	13.3	5	3.7
	SP1406	9.2	16.6	7.5	5.5
2	SP2401	13	22.7	7.5	5.5
	SP2402	14.9	28.8	10	7.5
	SP2403	19.9	40.2	15	11
	SP2404	20.5	50.7	15	11
3	SP3401	30.3	56	20	15
	SP3402	33.8	70	25	18.5
	SP3403	33.8	80.5	25	18.5
4	SP4401	51.9	105	40	30
	SP4402	51.9	129.5	40	30
	SP4403	66.6	168	50	37
5	SP4402	82.4	217	60	45
	SP5402	109	273	75	55
6**	SP4402	134.5	269	100	75
	SP6402	127.7	315	100	75

Notes:

All ratings based on 104° F (40° C) ambient temperature and 6 kHz switching frequency.

Refer to the Unidrive SP User Guide for ratings for alternative operating conditions.

* Frame 0 drives can accept quantity 2 SM option modules, all other frames can accept quantity 3.

** Frame 6 drives require an external 24 Vdc power supply for cooling fans.

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