Commander SK

The "High Value" AC drive

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CONTROL TECHNIQUES

Commander SK
Simplicity with Functionality

THE BENCHMARK *in simple drives*

OVERVIEW

Commander SK has been designed as a simple, compact, cost effective AC motor speed controller that delivers performance with simplicity and ease of use. With all the parameters you need for 90% of applications printed on the front of the drive, Commander SK ensures installation and commissioning are straight forward.

However, for more demanding applications, Commander SK can deliver benchmark functionality at no added cost to the base drive itself. Plug-in options, dynamic performance, PLC functionality and other benchmark features ensure that in more complex applications Commander SK can deliver more than the average general purpose drive - giving you lower cost solutions and better productivity in your motor control applications.

- • **0.3 to 3hp (.25 to 2.2kW), 1Ø 200-240VAC**
- • **1.5 to 3hp (1.1 to 2.2kW), 3Ø 200-240VAC**
- • **0.5 to 5hp (0.37 to 4kW), 3Ø 380-480VAC**
- • **Easy to set-up – all the parameters you need (90% of typical applications) are printed on the front**
- • **Easy installation – choose between simple panel mounting and DIN-rail mounting (up to 2hp)**
- • **Simple connections – easy access terminals with clear marking**
- • **Simple start-up – easy push button set-up - no need for complex programming**
- • **Communications – modbus RTU standard, available fieldbus options are Profibus-DP, INTERBUS, DeviceNet, CANopen, Ethernet**
- • **PLC Functionality– LogicStick and IEC61131-3 ladder and function block programming**
- • **Wide range of I/O – extra I/O options available including Real Time Clock**
- • **Performance – inherits the torque linearity and speed torque performance from the high performance Unidrive SP**
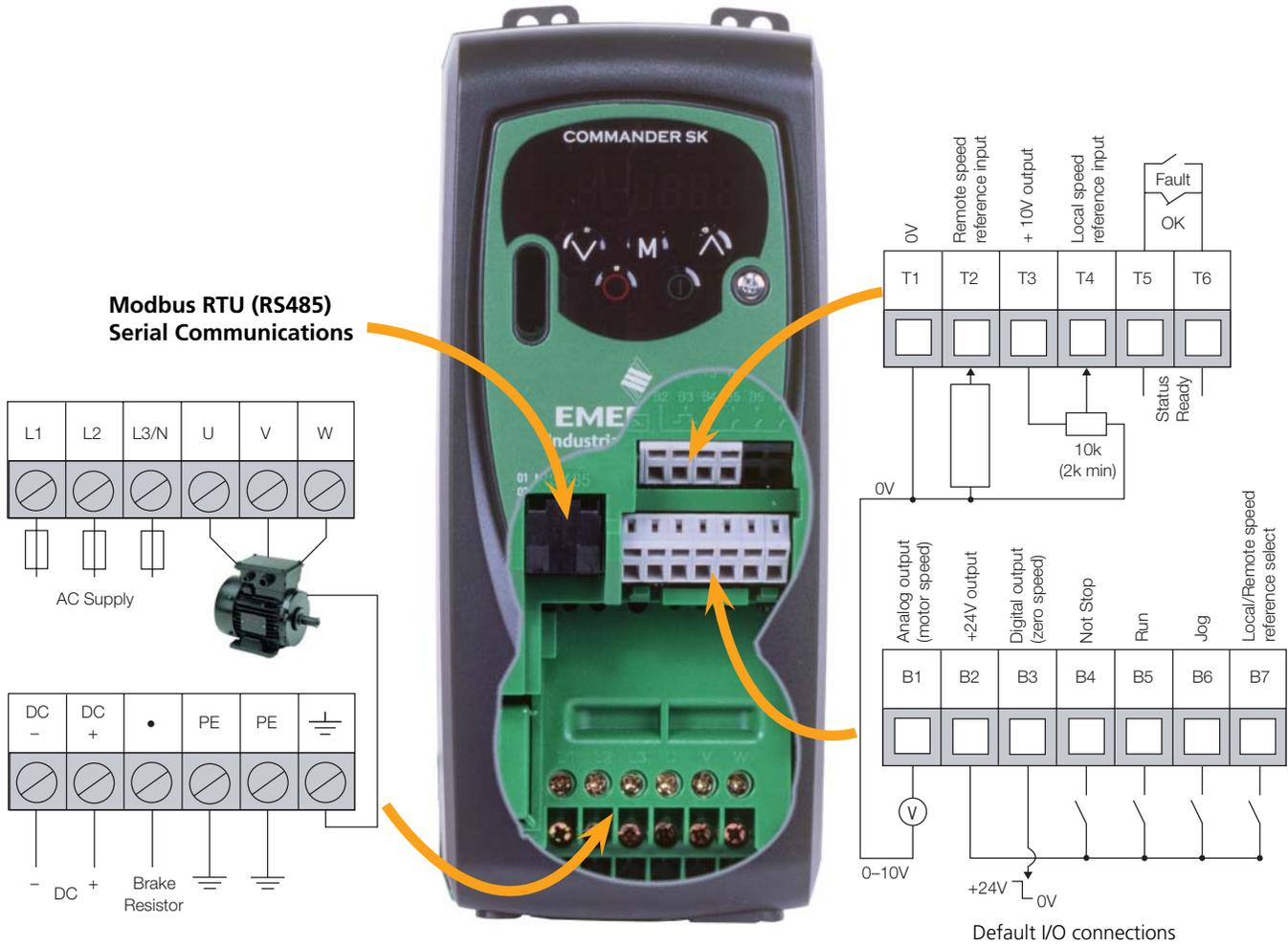
TYPICAL APPLICATIONS

Pump
Accurate Control

Material Payoff
Performance

Fan
Energy Saving

Multiple Motor
Open Loop V/Hz

Extruder
Reliability

Conveyor
Smooth Acceleration

Mixer
Simple and Easy

c(UL)us LISTED

ISO 14001 APPROVAL

ISO 9001:2000 APPROVAL

CE

N1652

2 YEAR Digital Drive Warranty

FEATURE

Performance Advantage

Open loop vector control with true space vector modulation

Precise control algorithm provides full torque down to 1 Hz for exceptional performance

Access to multiple parameter levels

Customises the drive to meet each user's needs: simple (level 1), flexible (level 2) and advanced (level 3)

SmartStick cloning module

Provides fast and cost-effective drive-to-drive parameter transfer and storage with no PC required

Terminal connection drawings and Level 1 parameters (10) listed on the drive's front cover

On-the-spot easy reference for drive set-up and maintenance

Static auto-tune

Allows fast motor / drive optimization without motor shaft rotation

Two sets of motor map parameters saved in the drive's memory

Allows sequenced switching between two motors with different operating characteristics

Configurable analog and digital I/O

Customizes drive to the specific application

S-ramp accel / decel profiling

Provides smooth speed transitions, minimizing machine "jerk"

Built-in independent PID control

Eliminates the need for an external PID controller while providing "outer loop" control of a process variable

Real Time Clock option

For scheduling and timing operations

Wide range of industry standard fieldbuses

Modbus RTU (Standard), Profibus-DP, INTERBUS, DeviceNet, CANopen, Ethernet

Replace nano and micro PLCs by using LogicStick and IEC61131-3 ladder and function block programming

200 to 240V ± 10% 48 to 62Hz					
Motor HP [1] kW	Input Phase	Continuous Output Current (A)	Overload Current [2] (A)	Frame Size	Order Code
0.33 0.25	1	1.7	2.6	A	SKA1200025
0.5 0.37	1	2.2	3.3	A	SKA1200037
0.75 0.55	1	3.0	4.5	A	SKA1200055
1.0 0.75	1	4.0	6.0	A	SKA1200075
1.5 1.1	1 or 3	5.2	7.8	B	SKBD200110
2.0 1.5	1 or 3	7.0	10.5	B	SKBD200150
3.0 2.2	1 or 3	9.6	14.4	C	SKCD200220

380 to 480V ± 10% 48 to 62Hz					
Motor HP [1] kW	Input Phase	Continuous Output Current (A)	Overload Current [2] (A)	Frame Size	Order Code
0.5 .37	3	1.3	2.0	B	SKB3400037
0.75 0.55	3	1.7	2.6	B	SKB3400055
1.0 0.75	3	2.1	3.2	B	SKB3400075
1.5 1.1	3	2.8	4.2	B	SKB3400110
2.0 1.5	3	3.8	5.7	B	SKB3400150
3.0 2.2	3	5.1	7.7	C	SKC3400220
4.0 3.0	3	7.2	10.8	C	SKC3400300
5.0 4.0	3	9.0	13.5	C	SKC3400400

[1] Motor horsepower based on typical 230 / 460 VAC four-pole motor ratings. Select model based on actual motor current rating.

[2] Overload: 150% for one minute

For higher horsepower see Commander SE or Unidrive SP

Order String

```
SK  X  X  X X  X X X X
                        Drive Kilowatt Rating

              Drive Voltage Rating: 20 = 200-240 VAC
                                    40 = 380-480 VAC
              Input Phase: 1 = 1ph, D = 1ph & 3ph, 3 = 3ph

        Size: A,B,C

    Commander SK Product Family Name
```

![CONTROL TECHNIQUES]

TERMINAL DIAGRAM

Modbus RTU (RS485) Serial Communications

T1	T2	T3	T4	T5	T6

0V — Remote speed reference input — + 10V output — Local speed reference input — Fault / OK — Status Ready

10k (2k min)

B1	B2	B3	B4	B5	B6	B7

Analog output (motor speed) — +24V output — Digital output (zero speed) — Not Stop — Run — Jog — Local/Remote speed reference select

0–10V +24V 0V

Default I/O connections

L1	L2	L3/N	U	V	W

AC Supply

DC −	DC +	•	PE	PE	⏚

− DC +   Brake Resistor

TERMINAL DESCRIPTION

Pin	Type/Description	Default Function	Notes
T1	0V Common	Common for External Analog Signals	
T2 ①	Analog Input 1 (A1) either voltage or current	Remote speed reference input 4-20mA	
T3	+10VDC	Reference Supply	5 mA max Short Circuit Protected
T4	Analog Input 2 (A2) or Digital Input	Local Speed reference input 0-10V	0 to +10 VDC (AI) 0 to +24 VDC (DI) Sample Times 6ms
T5 T6	Status Relay (Normally open)	Drive Healthy	240 VAC 30 VDC 2A/6A resistance
B1	Analog Output 1 single ended Unipolar	Motor speed	0 to +10 VDC @ 5 mA max Update Time 6ms
B2	+24 VDC Output	User Supply	100 mA max
B3	Digital Input/Output Pulse Output	Zero speed	0 to 24 VDC, 6.8k Ohms input Update Time 1.5ms Pulse output to 10 kHz

Pin	Type/Description	Default Function	Notes
B4	Digital Input	Not-stop	0 to 24 VDC, 6.8k Ohms Update Time 1.5ms
B5	Digital Input	Run	0 to 24 VDC, 6.8k Ohms Update Time 1.5ms
B6	Digital Input	Jog	0 to 24 VDC, 6.8k Ohms Update Time 1.5ms
B7	Digital Input / Pulse Input	Local/Remote Speed Reference Select A1/A2	0 to 24 VDC, 6.8k Ohms Update Time 1.5ms Pulse input to 50 kHz

■ Programmable Analog
All Analog I/O is scalable

■ Programmable Digital

① 4-20, 20-4, 20-0mA are also available. See Commander SK Getting Started Guide.

SPECIFICATION

Environment
IP20

UL TYPE 1or NEMA 1rating with optional cover + conduit entry kit

Ambient temperature -10°C to +40°C @ 3kHz switching

Humidity 95% maximum (non-condensing)

Electromagnetic Immunity complies with EN61800-3 and EN61000-6-3 and 4

Electromagnetic Emissions complies with EN61800-3 (second environment) as standard. Complies with EN61000-6-3 (residential) and EN61000-6-4 (industrial) generic standards with optional footprint EMC filter

Control
Open loop vector control, V/Hz

Speed or torque control

Reference input: 0-10V, 0-20mA, 4-20mA, Presets, Pulse, PWM (-10 to +10V SM-I/O Lite option)

Digital I/O - All configurable
    4 inputs, not stop, run, jog, local/remote (default)
    1 I/O zero speed (default)
    1 relay drive health (default)

Switching frequency: 3kHz (default)
    230V: 6,12,18kHz
    460V: 6,12kHz

Output frequency 0 to 1500Hz

Accel and Decel ramps (linear and S type)

Positive logic control

Serial communication
    Modbus RTU RS485 via R J45 connector
    Baud rate 4800, 9600, 19200 or 38400 bits per second

DC injection braking as standard

Dynamic braking transistor as standard

Dynamic motor flux V/Hz for energy saving

Quadratic motor flux V/Hz for fan and pump optimization

Protection
Undervoltage, Supply and DC Link overvoltage, Phase loss, Drive overload, Instantaneous overcurrent, Short circuit, Ground fault, Drive thermal, Watchdog, Motor thermal

General Characteristics
Maximum overload 150% of rated current for 60 sec

Intelligent Thermal Management (ITM) optimizes switching frequency

8 preset speeds

Flying start

Mains dip ride through

Automatic no-spin autotune for fast performance optimization

Keypad access to all parameters for more demanding applications

Approvals & Listings
UL, cUL	UL File Listed 8D14
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Low Voltage Directive
UL	UL type 1 with kit
ISO 9001:2000	Certified Manufacturing Facility
ISO 14001	Certified Manufacturing Facility

DIMENSIONS

Drive Size	w		h		d	
	in	mm	in	mm	in	mm
A	2.95	75	5.5	140	5.71	145
B	3.35	85	7.48	190	6.14	156
C	3.93	100	9.45	240	6.81	173

Commander SK
Options

OVERVIEW

Commander SK has been designed to offer simplicity, but with the impressive selection of benchmark options and standard features it also offers functionality that enables users to get more productivity from their machines.

Users that scratch the surface of this simple drive will reveal a list of dynamic yet functional options that owe a lot to the ground breaking Solution Platform products such as Unidrive SP, that are in the Control Techniques product portfolio.

OPTIONS AT-A-GLANCE

Option	Description	Order Code
Drive Configuration & Programming	Configuration Tool	CTSoft
	RS232/485 Cable	CT Comms Cable
	Cloning and parameter storage	SmartStick
Operator Interfaces	Remote LED display	SK-Keypad Remote
	Remote LED display	SM-Keypad Plus
	HMI Operator Interfaces	See Accessories Section
Power Accessories	Internal EMC Filter	Standard
	External EMC Filter	To fit drive
	Braking Resistor	To fit drive
Enviornmental Protection and Cable Management Options	Top cover and conduit entry	SK NEMA KIT A, B, or C
	Top cover provides IP4X protection	SK Top cover A, B, or C
	Universal cable management	SK-Bracket
Input/Output	Extended I/O	SM-I/O Lite
	Extended I/O plus Real Time Clock	SM-I/O Timer
	Double Insulated Extended I/O	SM-PELV
	120V Extended I/O	SM-I/O 120V
Communications	Modbus RTU	Standard
	PROFIBUS-DP	SM-PROFIBUS-DP
	DeviceNet	SM-DeviceNet
	CANopen	SM-CANopen
	INTERBUS	SM-INTERBUS
	Ethernet	SM-Ethernet
Application Programming Software (IEC61131-3)	Ladder and function block programming	SyPTLite
	Memory for SyPTLite program	LogicStick

Drive Configuration and Programming

DRIVE CONFIGURATION TOOL

CTSoft software is a free PC or laptop Windows based drive configuration tool designed to enable the complete control and display of all parameters within a Commander SK. Functions within CTSoft allow data to be uploaded, viewed, and saved, or retrieved from disk, modified and printed. It can be used off-line in the office or on-line in the factory. CTSoft communicates with the Commander SK via the computer's serial port to the drive's RS485 port using a communications cable (CT Comms Cable).

Some of CTSoft's capabilities include:
• Remote Upload/Download
• Parameter Saving
• Monitor Screens
• Multiple Window Display
• Block Diagram Animation
• Project Storage

FREE Software *CTSoft IS SUPPLIED WITH THE DRIVE OR YOU CAN DOWNLOAD FROM www.emersonct.com*
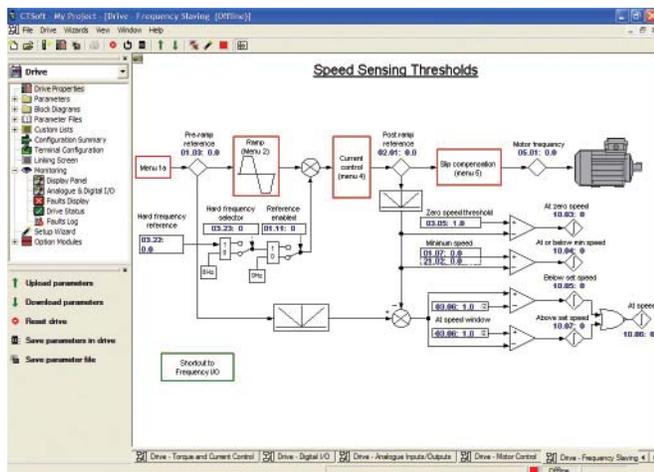
COMMUNICATION CABLE

Using an isolated serial to RS485 converter you can connect the PC/laptop to the RJ45 serial port on the front of the drive. The CT Comms Cable is available from Control Techniques for this purpose – this same cable is also used with other Control Techniques products that use a RJ45 RS485 connector such as the Commander SE and the Unidrive SP.

Description	Order Code
PC-to-drive Comms Cable	CT Comms Cable

SMARTSTICK

This option enables the simple set up of parameters in a variety of ways. The SmartStick can:
• 'Clone' a complete set of parameters from the first drive to multiple drives (perfect for serial production)
• Download parameter settings to the drive to easily set up your application
• Automatically save the user parameter set up for storage and maintenance purposes
• Load complete motor map parameters

The drive only communicates with the SmartStick when commanded to read or write, meaning that it may be "hot swapped".

Description	Order Code
PC-to-drive Comms Cable	CT Comms Cable
Cloning and Parameter storage	SmartStick

CONTROL TECHNIQUES

Operator Interfaces

KEYPAD OPTIONS

The Commander SK can operate and be set up using the standard fixed keypad, or with either the SK-Keypad Remote or SM-Keypad Plus. The SK-Keypad Remote is a full-function, 7-digit LED data display. The SM-Keypad Plus is a back-lit LCD display option that can be remote mounted, has 5 languages, plus custom text database, on-line help, and HMI features. Both keypads are "hot-pluggable," enabling them to be moved from one drive to another without powering down.

SK-Keypad Remote

SM-Keypad Plus

Description	Order Code
Remote panel mounting LED SK-Keypad Remote display with additional function key, IP65	SK-Keypad Remote
Remote panel mounting LCD multilingual text keypad display with additional help key, IP54	SM-Keypad Plus
Keypad to Drive Communication Cable	SP-LCD-485-XXX

HUMAN MACHINE INTERFACE (HMI)

These operator interface units complement the CT product line by offering an impressive way of accessing parameters and adding more programming power to your application. The following features make these screens a simple and impressive solution for you... and your customers:
- Graphical full color and 4-tone monochrome touchscreen
- Menus, submenus, alarms, fault conditions,
- Realtime trends and graphs
- Scheduling and background programs
- Modbus RTU and Modbus TCP/IP
- Import pictures and graphics
- Advanced Recipe capabilities

For more information, refer to the Accessories Section.

VT155W

VT525W

Power Accessories

DYNAMIC BRAKING RESISTORS

Dynamic braking resistors provide a means of rapidly decelerating or stopping the motor and load. The mechanical energy stored in the spinning mass is converted into electrical energy by the drive and then quickly dissipated into the resistor. (See Power Accessories section for braking resistor ratings and model numbers)

INTERNAL EMC FILTER

An internal EMC filter is provided as standard with the Commander SK which is adequate for most industrial applications. The drive and filter conforms to EN61800-3 (second environment). For installations where it is deemed necessary, Control Techniques provide a range of addition external EMC filters. The internal filter can be easily removed if the drive is to be used on IT supplies or with low earth leakage external EMC Footprint filters.
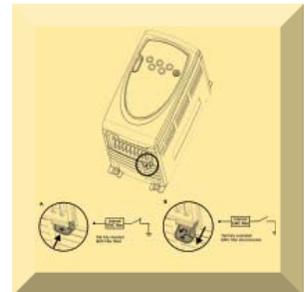
EXTERNAL EMC FILTERS

EMC filters are used to minimize high frequency power supply line disturbances caused by PWM AC drives that may interfere with proper operation of sensitive electronic equipment. These specific filters have been assessed for conformance with the EMC directive by testing with the appropriate Control Techniques drives.

TWO MOUNTING STYLES IN ONE

The Commander SK EMC filters are designed such that they can be mounted in either of two orientations.

- Bookend: filter mounts next to the drive with the smallest dimension being the width of the filter
- Footprint: filter mounts between the drive heatsink and the panel or enclosure

EMC Filter Description	Voltage	Order Code
SK-EMC Filter Size A 1 Phase	200 to 240V +/- 10% 1ph	4200-6122
SK-EMC Filter Size B 1 Phase	200 to 240V +/- 10% 1ph	4200-6212
SK-EMC Filter Size B 3 Phase	380 to 480V +/- 10% 3ph	4200-6213
SK-EMC Filter Size C 1 Phase	200 to 240V +/- 10% 1ph	4200-6310
SK-EMC Filter Size C 3 Phase	380 to 480V +/- 10% 3ph	4200-6311

EMC Filters for low earth leaking applications	Voltage	Order Code
SK-EMC Low Leakage Size A	200 to 240V +/- 10% 1ph	4200-6122
SK-EMC Low Leakage Size B	200 to 240V +/- 10% 1ph	4200-6212
SK-EMC Low Leakage Size C	380 to 480V +/- 10% 3ph	4200-6213

Environmental Protection and Cable Management

TOP COVER OPTIONS

A plastic top cover can be fitted to the Commander SK. This cover simply clips onto the top of the drive for protection from falling particles. The top cover provides protection to IP4X per IEC specification.

NEMA 1 KIT

The NEMA 1 Kit includes a Top Cover, Side Covers, and a Conduit Enrty Box providing a UL Type 1 rating. With this option Commander SK drives can be mounted into air handling ducts.

SK-BRACKET

The Sk-Bracket is mounted below the drive providing a cable strain relief and convenient method of grounding cable shields. Fits SK frame size A,B and C.

Description	Order Code
Plastic Top Covers	SK COVER A, SK COVER B, SK COVER C
UL Type 1 Rating Kit	SK NEMA1 KIT A, SK NEMA1 KIT B, SK NEMA1 KIT C
Cable Management Bracket	SK-BRACKET

Input/Output

SM-I/O LITE

Additional I/O
• 1 Analog Input - 0.1% Resolution
   (+/- 10V, 4-20mA
   or 0-20mA)
• 1 Analog Output - 0.4% Resolution
   (0-10V, 4-20mA
   or 0-20mA)
• 3 Digital Inputs
   (if the encoder reference port is used there are only 2 digital inputs available)
• 1Encoder Reference Port (55kHz Quadrature or 110kHz F/D) *
• 1 Relay Contact
• 24 Volt I/O supply
• 5 Volt Encoder supply

SM-I/O TIMER

Additional I/O with Real Time Clock
• I/O specification as per SM-I/O Lite Module
• Real Time Clock / Calendar with the following format:
   Year-Month / Date - Date of Week / Hours (24)
   Minute / Second
• Day Light Savings Mode
• Battery Back Up
• User Adjustable Time

SM-I/O PELV

Chemical industry conformance to NAMUR NE37 gives security in demanding application enviornment.

This module provides PELV (Protective Extra Low Voltage) double insulated digital and analog I/O to meet IEC 61131-2, Clause 3.3.1 Type as well as NAMUR NE37 specifications for chemical industry applications.
• 2 Analog Input (4-20mA or 0-20mA)
• 1 Analog Output (4-20mA or 0-20mA)
• 1 Digital Input
• 4 Digital Input/Output
• 2 Relay Contact (2A @ 50VAC, 4A @ 30VDC)

Input/Output (continued)

SM-I/O 120V

This module provides digital I/O rated for 120 or 240VAC for the Unidrive SP. These I/O conform to IEC 61131-2 120VAC standard.
- 6 Digital Input (120VAC or 3 Digital Inputs @ 240VAC)
- 2 Relay Contacts (2A @ 240VAC, 4A @ 30VDC)

I/O ORDERING CODE

Description	Order Code
I/O Expansion	SM-I/O Lite
I/O Expansion	SM-I/O Timer
Double Insulated I/O Expansion	SM-I/O PELV
120 Volt AC I/O Expansion	SM-I/O 120V

Communication

FIELDBUS OPTIONS

The most popular fieldbus protocols are available in the SM range of options. One option slot in sizes B and C allows a SM Fieldbus option and/or an extended I/O SM option module to be fitted.

SM-DeviceNet   SM-PROFIBUS-DP

SM-CANopen   SM-INTERBUS   SM-Ethernet

FIELDBUS MODULE ORDERING CODE

Communications Protocol	Order Code
Modbus RTU	Standard
PROFIBUS-DP	SM-PROFIBUS-DP
INTERBUS	SM-INTERBUS
DeviceNet	SM-DeviceNet
CANopen	SM-CANopen
Ethernet	SM-Ethernet

See Connectivity Section for fieldbus details.

# Programming Software

SyPTLite WITH LOGICSTICK

Commander SK is Control Techniques' simple and easy-to-use general-purpose drive. However, Commander SK contains features and functions that you may not expect to find on a low-cost drive, such as the flexibility to program PLC applications onboard the drive. By inserting a LogicStick into the front of the drive, you quickly add memory for program storage that allows you to write a PLC ladder program using SyPTLite. The drive is prioritized to execute all motor control related functions first and will use any remaining processing time to execute the SyPTLite ladder program as a background activity.

Commander SK may also be fitted with the SM-I/O Timer option that incorporates a real-time clock, allowing the drive to be used as a low-cost stand alone solution in a wide range of applications such as dosing, lubricating, heating and ventilation.

SyPTLite IEC 61131-3
LADDER PROGRAMMING SOFTWARE

SyPTLite is a ladder diagram editor that allows you to develop programs that can be executed onboard Commander SK with a LogicStick.

SyPTLite is designed to meet the needs of the majority of automation users wishing to extend the functionality of the drive control and sequencing. The software has been developed with a definite focus on intuitive ease of use allowing you to quickly access all of the drive's parameters and to monitor and debug your ladder program online.

Description	Order Code
The LogicStick plugs into the front of the drive and enables you to program PLC functions within the drive. Typically 30-50 rungs of logic.	LogicStick
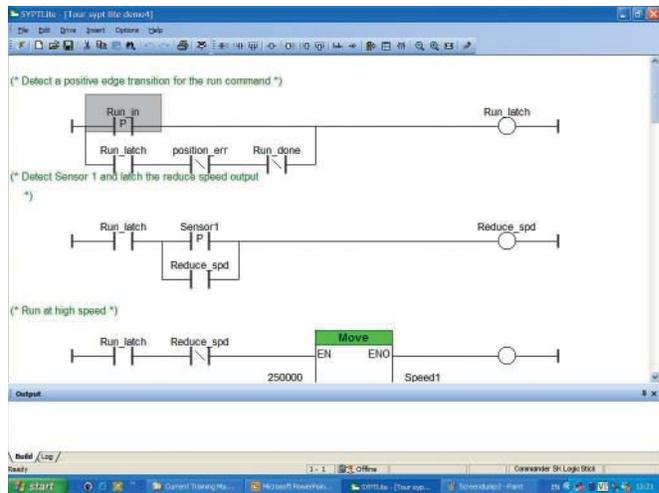
SyPTLite contains a comprehensive library of functions that is based on a subset of those available in the SyPTPro programming tool. These include:

- Arithmetic Blocks
- Timers
- Multiplexers
- Bit Manipulation
- Comparison Blocks
- Counters
- Latches