CONTROL TECHNIQUES

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Commander SE
Product Data

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Product Overview & Key Features

Responding to Customer Driven Priorities

Since its formation in 1973, Control Techniques has become a global specialist dedicated to the design, manufacture and supply of AC and DC drives, servos and drive systems, with over 1 million drives commissioned to date. This dedication to understanding and satisfying customers needs ensures that we produce a range of world class products all designed to meet the varying application requirements of industry. In response to customer driven priorities for a simple, easy to use, general purpose open loop inverter, Control Techniques have developed the Commander SE.

Commander SE

The Commander SE is an advanced AC drive for use with AC induction motors. Every unit can operate in either V/Hz, or sensorless vector mode.

Sizes

There are four physical sizes ranging from 0.25KW to 15KW:
0.25 to 2.2KW, single phase, 200 to 240V
0.75 to 7.5KW, three phase, 200 to 240V
0.75 to 15KW, three phase, 380 to 480V

Simple to Use

Reducing complexity and cost is what Commander SE is all about. The SE stands for Simple and Easy and it is SIMPLE to install and EASY to use. The drives first 10 parameters cover most applications easily, quickly and cost effectively.

Technology

Many of the features of Commander SE would not be possible without the use of advanced technology. The SE drive employs State of the Art microprocessor technology which controls all drive functions. The inverter ASIC (Application Specific Integrated Circuit) synthesises an adjustable carrier frequency PWM (Pulse Width Modulation) output controlling the IGBT (Insulated Gate Bipolar Transistor) inverter section. All printed circuit boards are manufactured using surface mount technology.

Product Overview & Key Features

Key Features

- Only 10 parameters needed for most applications - level 1
- Quick installation with convenient cable management
- Large easy-to-cable power terminals
- Standard size, pluggable control terminals
- Integrated braking transistor from 0.75-15 kW
- Level 2 parameters for added flexibility and functionality
- No spin rotating autotune for fast drive/motor optimisation
- Minimum motor noise with maximum drive protection via unique Intelligent Thermal Management (ITM)
- RS485 serial communications as standard on all sizes
- Complies with power drive systems standard EN 68100-3 for the second environment 'Industrial sites' without an additional EMC filter.
- Small enough to fit - big enough to use
- Plug-in communication packages that will include, Profibus-DP, DeviceNet, CAN Open, Interbus S and CT Net
- The mains dip ride-through feature gives maximum protection against expensive process stoppages and minimises product wastage, breakages and downtime
- Commander SE's level 3 parameters give the user, via serial communications, access to advanced features such as:
  PID Controller,
  kW hour meter,
  8 preset speeds,
  motorised potentiometer,
  second motor map
  and lots more
- With true space vector modulation - open loop vector control, full torque down to 1 Hz
- Commander SE up to 4 kW, fits 200mm deep cubicles even with footprint EMC filter fitted
- Rugged, industrial 50°C ambient rating for applications where operating conditions are hot and tough
- IP21/NEMA 1, rating for added protection
- Safety Extra Low Voltage (SELV) compliant - complete galvanic isolation allowing the drive to be connected to a PC without the risk of damage
- Fast, accurate drive to drive parameter transfer and storage with the new QuicKey - saves time and money

General Features

- Coast & Ramp to Stop modes
- Programmable security code

Operating Modes

Introduction

The Commander SE can be configured to operate in the following operating modes:

Open-Loop

For use with standard AC induction motors. The Drive applies power to the motor at frequencies which are varied by the user. The motor speed is a result of the output frequency of the Drive and slip due to the mechanical load.

V/Hz Mode

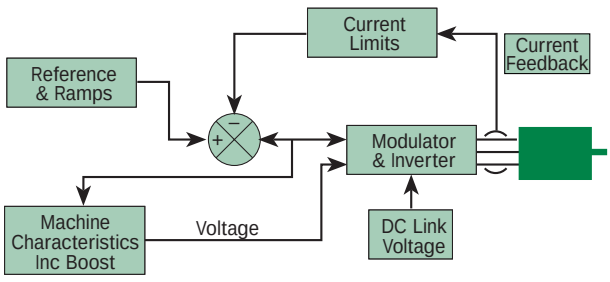
In this mode the drive can power one motor or a number of motors connected in parallel (each motor must be protected against overload; This is described in the Installation Guide).

Improved motor performance can be achieved by applying the following:

- Slip compensation
- Fixed boost

Fixed boost applies a fixed voltage boost at low frequencies.

Open Loop V/Hz Mode



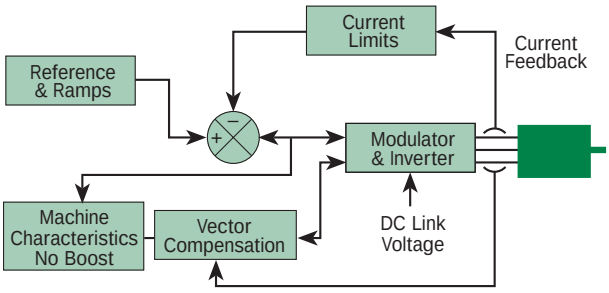
Typical examples of Applications

Conveyors, Centrfugal Loads (Fans & Pumps), Multi-Motor Control, etc

Open Loop Vector Mode

This mode of operation maintains almost constant flux by dynamically adjusting the motor voltage according to the load on the motor.

Open-loop Vector Control provides full torque down to 1Hz giving an excellent speed range to cover most general purpose applications.



Typical examples of Applications

Conveyors, Extruders, Mixers, Textile Machines, etc

Default Configurations

The Drive is supplied in either of two default configurations to suit the continent in which it is sold. The configurations are distinguished as follows:

- European voltage, 50Hz supply
- USA voltage, 60Hz supply

The drive is dispatched from the factory in the appropriate default configuration for the continent in which it is to be sold.

Europe

- Ability to select negative logic for the digital I/O (Positive logic is default).
- Ability to adjust the current loop PI Gains.

USA

- Ability to select digital control by two or three wires.
- Frequency demand indication.

Default Parameters

Listed below are the default values for Commander SE along with the relevant parameters which are for monitoring only. Parameters 01 - 10 are Level 1 parameters which are initially accessible at power up, with Parameters 11 - 47 accessible after setting P10 = L2.

Level 1

Pr	Function	Default Value
01	Minimum Speed	0Hz
02	Maximum Speed	50 (60USA) Hz
03	Acceleration Rate	5s/100Hz
04	Deceleration Rate	10s/100Hz
05	Speed Reference Select	A1.A2 (Pad USA)
06	Rated Current	(Drive Rating)
07	Rated Speed	1500 (1800 USA) rpm
08	Rated Voltage	230 Volts
09	Power Factor	0.85
10	Parameter Access	L1
11	Preset 1	0.0
12	Preset 2	0.0
13	Preset 3	0.0
14	Preset 4	0.0
15	Jog Reference	1.5
16	Current Input Mode	4-.20
17	Enable Negative Preset Speeds	Off
18	Last Trip	-(M)
19	Trip Before P18	-(M)
20	Trip Before P19	-(M)
21	Trip Before P20	-(M)
22	Load Display Units	Ld
23	Speed Display Units	Fr
24	Customer Defined Scaling	1.00
25	Security Setup	0
26	Fwd/Rev Key Enable	Off
27	Power Up Keypad Ref	0
28	Parameter Cloning	No
29	Load Defaults	No
30	Ramp Mode	1
31	Stopping Mode	1
32	Variable Torque Select	Off
33	Spinning Motor Select	Off

Pr	Function	Default Value
34	Positive Logic Select	On
35	Start/Stop Logic Select	0
36	Analogue Output Select	Fr
37	Switching Frequency	3
38	Autotune	0
39	Rated Frequency	50.0 (60.0 USA)
40	No. of Poles	Auto
41	Serial Mode	Ansi
42	Band Rate	4.8
43	Serial Address	1.1
44	Software Version	-
The following 3 parameters are hidden and only appear when P41 is set to Fbus:		
45	Fieldbus Node Address	0
46	Fieldbus Band Rate	8
47	Fieldbus Diagnostics	PP

Commander SE Options

Drive Flexibility

- Bi-polar input card

Drive Setup

- Quickey cloning module
- Easy setup of multiple drives
- Simplifies the transfer of parameters between drives
- Stores 1 full parameter set

Drive Communications

- RS 485 to 232 Converter Lead
  For easy commissioning and drive programming via PC
- Plain Text LCD Remote Keypad
- Backlit to read LCD display
- Text parameter descriptions
- Plugs directly into RJ45 connector on drive

Distributed Applications

- RS 485 to 232 Converter Lead
  For easy commissioning and drive programming via PC
- Plain Text LCD Remote Keypad
- Backlit to read LCD display
- Text parameter descriptions
- Plugs directly into RJ45 connector on drive

Specification

AC Supply Requirements

- 200V to 240V ±10%
  1 and 3 phase (dual rated)
- 380V to 480V ±10%
  3 phase
- Maximum supply imbalance: 2% negative phase sequence (equivalent to 3% voltage imbalance between phases) 48 - 62Hz

Motor Requirements

- No. of phases: 3
- Voltage:
  380V - 480V ±10%
  200V - 240V ±10%

Temperature, Humidity and Cooling Method

- Ambient temperature range: -
  10°C to + 50°C (14°F to 122°F)
- Cooling method: Natural convection (size 1)
  Fan assisted (size 2, 3 + 4)
- Maximum humidity: 95% non condensing
- Storage temperature range: -
  40°C to + 60°C (- 40°F - 122°F)
- Maximum storage time: 12 months

Altitude

- Reduce the normal full load current by 1% for every 100m (325ft) above 1000m (3250ft) to a maximum of 4000m (13000ft).

Distributed Applications

- Profibus DP module
- DeviceNet module
- CAN open module
- Interbus-S module
- CT Net module

Vibration

- Packaged and unpackaged - tested to 0.01g2/Hz from 5 - 150 Hz for 1 hour in each of 3 axes as in IEC68-2-34 and IEC68-2-36.

Ingress Protection

- IP20 NEMA.

Starts Per Hour

- By using the electronic control terminals: unlimited.
- By switching the supply: 20 starts per hour max.

Accuracy and Resolution

- Output frequency accuracy: 0.01%
- Output frequency resolution: 0.1Hz

Frequencies and Speed

- Pwm switching frequency
- 6KHz nominal (selectable up to 12KHz)
- Max output frequency: 1000Hz

Specification

Power and Current ratings

40°C (104°F) ambient	Nominal rating		Maximum permissible continuous output current				Nominal AC supply current	
Model	@380V	@460V	3kHz	6kHz	9kHz	12kHz		
SE11200025	0.25KW	0.33HP	1.5A	1.5A	1.5A	1.5A	5.6A	
SE11200037	0.37KW	0.48HP	2.3A	2.3A	2.3A	2.3A	6.5A	
SE11200055	0.55KW	0.73HP	3.1A	3.1A	3.1A	3.1A	8.8A	
SE11200075	0.75KW	1.0HP	4.3A	4.3A	4.3A	4.3A	11.4A	
							1PH	3PH
SE2D200075	0.75KW	1.0HP	4.3A	4.3A	4.3A	4.3A	11.0A	5.5A
SE2D200110	1.1KW	1.45HP	5.8A	5.8A	5.8A	5.8A	15.1A	7.9A
SE2D200150	1.5KW	2.0HP	7.5A	7.5A	7.5A	7.5A	19.3A	9.6A
SE2D200220	2.2KW	3.0HP	10.6A	10.6A	10.6A	10.6A	26.2A	13.1A
SE23200400	4.0KW	5.0HP	17.0A	17.0A	17.0A	17.0A	20.9A	
SE23400075	0.75KW	1.0HP	2.1A	2.1A	2.1A	2.1A	3.6A	
SE23400110	1.1KW	1.45HP	3.0A	3.0A	3.0A	3.0A	4.8A	
SE23400150	1.5KW	2.0HP	4.2A	4.2A	4.2A	4.2A	6.4A	
SE23400220	2.2KW	3.0HP	5.8A	5.8A	5.8A	5.8A	9.0A	
SE23400300	3.0KW	4.0HP	7.6A	7.6A	7.6A	7.6A	10.8A	
SE23400400	4.0KW	5.0HP	9.5A	9.5A	9.5A	9.5A	13.5A	
SE33200550	5.5KW	7.5HP	25.0A	25.0A	25.0A	25.0A	22.8A	
SE33200750	7.5KW	10.0HP	28.5A	28.5A	28.5A	28.5A	24.6A	
SE33400550	5.5KW	7.5HP	13.0A	13.0A	13.0A	13.0A	13.0A	
SE33400750	7.5KW	10.0HP	16.5A	16.5A	16.5A	16.5A	15.4A	
SE33401100	11KW	15HP						
SE33401500	15KW	25HP						

50°C (122°F) ambient	Nominal rating		Maximum permissible continuous output current			
Model	@380V	@460V	3kHz	6kHz	9kHz	12kHz
SE11200025	O.25KW	0.33HP	1.5A	1.5A	1.5A	1.5A
SE11200037	0.37KW	0.48HP	2.3A	2.3A	2.3A	2.3A
SE11200055	0.55KW	0.73HP	3.1A	3.1A	3.1A	3.1A
SE11200075	0.75KW	1.0HP	4.3A	4.3A	4.3A	3.7A
SE2D200075	0.75KW	1.0HP	4.3A	4.3A	4.3A	4.3A
SE2D200110	1.1KW	1.45HP	5.8A	5.8A	5.8A	5.8A
SE2D200150	1.5KW	2.0HP	7.5A	7.5A	7.5A	7.5A
SE2D200220	2.2KW	3.0HP	10.6A	10.6A	10.6A	10.6A
SE23200400	4.0KW	5.0HP	17.0A	17.0A	17.0A	17.0A
SE23400075	0.75KW	1.0HP	2.1A	2.1A	2.1A	2.1A
SE23400110	1.1KW	1.45HP	3.0A	3.0A	3.0A	3.0A
SE23400150	1.5KW	2.0HP	4.2A	4.2A	4.2A	4.2A
SE23400220	2.2KW	3.0HP	5.8A	5.8A	5.8A	5.8A
SE23400300	3.0KW	4.0HP	7.6A	7.6A	7.6A	7.6A
SE23400400	4.0KW	5.0HP	9.5A	9.5A	9.5A	9.5A
SE33200550	5.5KW	7.5HP	25.0A	25.0A	25.0A	25.0A
SE33200750	7.5KW	10.0HP	28.5A	28.5A	28.5A	28.5A
SE33400550	5.5KW	7.5HP	13.0A	13.0A	13.0A	13.0A
SE33400750	7.5KW	10.0HP	16.5A	16.5A	16.5A	16.5A

Specification

Dissipation

Model	Nominal rating		Maximum total power dissipation		
	@380V	@460V	3kHz	6kHz	12kHz
SE11200025	0.25KW	0.33HP	17W	18W	20W
SE11200037	0.37KW	0.48HP	22W	24W	27W
SE11200055	0.55KW	0.73HP	34W	37W	42W
SE11200075	0.75KW	1.0HP	50W	56W	63W

Dimension

Dimension	Model size			
	1	2	3	4
H	191mm 7 17/32 in	280mm 11 1/32 in	336mm 13 1/4 in	412mm 16 1/5 in
W	100mm 4 in	144mm 5 11/16 in	190mm 7 12/25 in	250mm 9 17/20 in
D	130mm 5 1/8 in	130 mm 5 1/8 in	155mm 6 1/10 in	185mm 7 3/10 in

Overall dimensions

H Height including mounting feet

W Width

D Projection forward of panel when surface mounted

Weights

Model size	kg	lb
1	1.25	2.75
2	3.20	7.05
3	6.80	15.0
4		

Dynamic Braking

Resistor Connections

The external braking resistor should be connected to the Commander SE terminals labelled (+) and DBR on the terminal strip on Commander SE size 2, 3 + 4. The resistor must be thermally protected in the unlikely event that the braking transistor fails. This thermal device must either disconnect the input AC power to the inverter or disconnect the resistor from the circuit. Please contact the Drive Centre for additional application information.

Customer Resistor Values

The resistor chmic value is based on the torque required to stop the motor (and connected load) in the time dictated by the application. The first equation to be solved is the torque required knowing the required stop time.

$$T = \frac{J \times N}{t_d \times 307} \text{ (Ft - Lb) or } T = \frac{2\pi J \times N}{t_d \times 60} \text{ (Nm)}$$

Where:

J = Total Inertia (Lb-Ft^2 or Kgm^2)

N = Motor Max. Speed (RPM)

t_d = Decel Time (Sec.)

T = Torque (Ft-Lb or Nm)

The torque required must be equal or less than 1.5 x motor/drive capability.

$$HP(brake) = \frac{T \times N}{5250} \quad \text{or } P_{(kW)} = \frac{T \times N}{30}$$

The ohmic value of the resistor can now be calculated using the following formula:

$$R = \frac{(V_b)^2}{HP_{(brake)} \times 746} \quad \text{or } R = \frac{(Vb)^2}{P_{(kW)}}$$

Where:

V_b = Bus voltage level when braking
= 750 VDC

Specification

Minimum Values

The calculated minimum ohmic value is limited by the braking transistor supplied in the Commander SE being used. The following is a list of the minimum values.

Minimum resistance values and peak power rating for the braking resistor at 40°C (10.4°F).

The minimum resistance allows the braking resistor to dissipate up to approximately 150% of the power rating of the Drive for up to 60 seconds.

Average Power Dissipation

The average power dissipated in the resistor for intermittent operation is then simply the number of watts dissipated per stop times the duty cycle (D).

Where:

$$D = \frac{t_d}{T_d + t_{off}}$$

In order to use this formula for average power dissipation, the brake resistor must be off long enough for the temperature of the resistor to return to ambient temperature between braking cycles. Also, the maximum on time (or decel time) should not exceed the peak capabilities of the power resistor. Typically, a power resistor has the capability of dissipating 10 times rated wattage for 5 to 10 seconds.

Peak Power Rating

The peak power handling ability of the resistor must meet or exceed the following:

PPK = (Vb)2/R

Model	Minimum Resistance	Recommended Value
SE2D200075	50Ω	100Ω
SE2D200110	50Ω	100Ω
SE2D200150	50Ω	75Ω
SE2D200220	30Ω	50Ω
SE23200400	20Ω	25Ω
SE23400075	100Ω	200Ω
SE23400110	100Ω	200Ω
SE23400150	100Ω	200Ω
SE23400220	75Ω	100Ω
SE23400300	75Ω	100Ω
SE23400400	75Ω	100Ω
SE33200550	11Ω	15Ω
SE33200750	11Ω	15Ω
SE33400550	33Ω	50Ω
SE33400750	33Ω	50Ω

I/O Specification

1 0V common	
2 Local Speed Reference Input (A1)	
Type of input	Single-ended
Voltage range	0 to +10V
Scaling	0V represents the value in parameter 01, Minimum speed+10V represents the value in parameter 02, Maximum speed
Absolute maximum voltage range	+35V to -18V with respect to 0V common
Input impedance	100kW
Resolution 0.1% (10 bit)	
Accuracy	± 2%
Sample time	6ms
3 +10V Reference Output	
Voltage accuracy	± 2%
Maximum output current	5mA
Protection tolerates continuous short circuit to 0V	
4 0V Common	
5 Remote Current Speed-Reference Input (A2)	
Default	4 - .20mA (See parameter 16)
Type of input	Single ended
Current range (programmable)	0-20mA, 20-0mA, 4-20mA, 20-4mA, 4-20mA, 20-4mA
Absolute maximum voltage range	+35V to -18V with respect to 0V common
Input impedance	200W
Resolution 0.1% (10 bit)	
Accuracy	± 2%
Sample time	6ms
6 Analog Voltage Output	
Default	Motor Speed (See parameter 36)
Absolute maximum voltage range	+ 35V to -1V with respect to 0V common
Voltage range	0 to +10V
Scaling: Motor speed output	0V represent 0Hz/0 rpm output + 10V represents the value of parameter 02, Maximum speed
% full load current output	0V represent 0% Drive rated current + 10V represents 150% Drive rated current
Maximum output current	5mA
Resolution	0.1% (10 bit)
Accuracy	± 5%
Update time	22ms
Protection	tolerates continuous short circuit to 0V
7 +24V Output	
Voltage accuracy	± 5%
Maximum output current	100mA
Protection tolerates continuous short circuit to 0V	
8 Digital Output	
Function	Zero Speed Output
Absolute maximum voltage range	+35V to -1V with respect to 0V common
Voltage range	0V to +24V
Maximum output current	50mA at +24V
Output impedance	10kW pull-down resistor in inactive state
Update time	1.5ms

Note: The total current from the +24V rail, which includes the digital output, is 100mA.
Therefore if the digital output is providing 30mA, the +24V rail will only provide 70mA.

I/O Specification

9 Digital Input - Enable / Reset †	
10 Digital Input - Run Forward (Edge Triggered) *	
11 Digital Input - Run Reverse (Edge Triggered) *	
12 Digital Input - Local/Remote Speed Ref (A1/A2)	
13 Digital Input - Jog	
Default	Positive logic (See parameter 34)
Voltage range	0V to +24V
Absolute maximum voltage range	+35V to -18V with respect to 0V common
Nominal threshold voltage	+10V
Input impedance	7.5kW
Sample time	1.5ms

† Following a Drive trip, open and close the Enable terminal to reset the Drive. If the Run Forward or Run Reverse terminal is closed, the Drive will run straight away.

* Following a Drive trip and a reset via the Stop/Reset key the Run Forward or Run Reverse terminals will need to be opened and closed to allow the Drive to run. This ensures that the Drive does not start when the Stop/Reset key is pressed.

14 +24V Output	
Voltage accuracy	± 5%
Maximum output current	100mA
Protection	tolerates continuous short circuit to 0V
15 Status Relay (Normally Open)	
16	
Function	Drive Healthy
Voltage rating	240VAC /30VDC
Current rating	2A/6A (resistive)
Contact isolation	2.5kVAC (meets IEC664-1 with over voltage category II)
Update time	6ms
Operation of contact	OPEN - AC supply removed from Drive - AC supply applied to Drive with the Drive in a tripped condition CLOSED - AC supply applied to Drive with the Drive in a 'ready to run' or 'running' condition (not tripped)

Protection (Fuses & Cables, EMC and Filters)

DC Bus Undervoltage Trip
200V units = 180V DC
400V units = 400V DC

DC Bus Overvoltage Trip
200V units = 420V DC
400V units = 830V DC

Drive Overload Trip
Current overload value is exceeded. Programmable to allow up to 150% of drive current for 1 minute

Instantaneous Overcurrent Trip
215% of drive rated current

Phase Loss Trip
DC bus ripple threshold exceeded

Overtemperature Trip
Drive heatsink temperature exceeds 95°C

Short Circuit Trip
Protects against output 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

Protection (Fuses & Cables, EMC and Filters)

Cable & Fuse Recommendations

FUSES and CABLES										
	AC Supply Cables				Motor Cables				Fuse Ratings	
Model	mm2		AWG		mm2		AWG		Amps	
SE11200025	1.0	18	1.0	18	6					
SE11200037	1.0		18		1.0		18		10	
SE11200055	1.0		18		1.0		18		16	
SE11200075	1.5		14		1.0		18			16
	1PH	3PH	1PH	3PH	1PH	3PH	1PH	3PH	1PH	3PH
SE2D200075	1.5	1.0	16	18	1.0	1.0	18	18	16	16
SE2D200110	2.5	1.5	14	16	1.0	1.0	18	18	20	16
SE2D200150	2.5	1.5	14	16	1.0	1.0	18	18	32	20
SE2D200220	4.0	2.5	10	14	1.0	1.0	18	18	40	32
SE23200400	4.0		10		2.5		14		32	
SE23400075	1.0		18		1.0		18		6	
SE23400110	1.0		18		1.0		18		10	
SE23400150	1.0		18		1.0		18		10	
SE23400220	1.0		18		1.0		18		10	
SE23400300	1.5		16		1.0		18		16	
SE23400400	2.5		14		1.0		18		20	
SE33200550	4.0		10		4.0		10		30	
SE33200750	4.0		10		4.0		10		30	
SE33400550	1.5		16		1.5		16		16	
SE33400750	2.5		14		2.5		14		20	

EMC:

- EN50082-2 and EN61800-3 for immunity
- EN61800-3 second environment, without RFI filter
- *EN50081-1, EN50081-2 and EN61800-3 first environment with optional RFI filter.

See sections 3.3 and 4.5.

* Size 1 units only.

RFI Filter

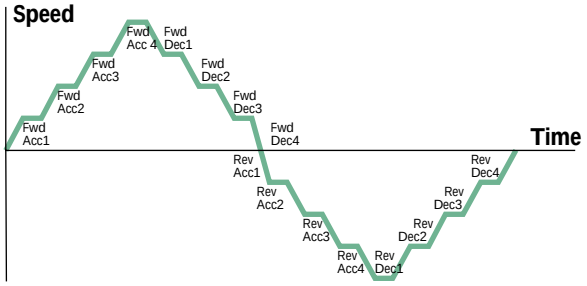
Commander SE Size 1

- RFI filters are available as optional extra parts where required. Note that for compliance with EN61800-3 in the second environment, no filter is required.
- Three alternative filters are available:
- Standard footprint/side-mounting filter, part number: 4200-6102.
  For general use, mounted behind or next the Drive.
- Low earth leakage filter, part number: 4200-6103.
  For applications where earth leakage currents must be restricted. This filter can only be used with motor cables up to 15m long.
- Low cost filter, part number: 4200-6101.
  An economical side-mounting filter. This filter can only be used with motor cables up to 20m long.

Additional Configurable Functions

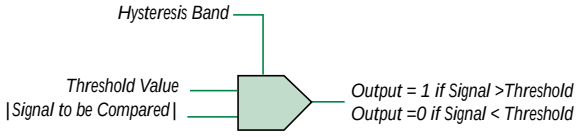
Acceleration and Deceleration Ramp Selection

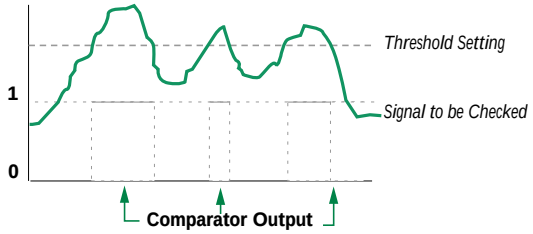
There are eight acceleration rates and eight deceleration rates which are selectable by logic inputs. The rates are operational in the forward and reverse directions. However, they can be split such that four of the rates operate in forward and four operate in reverse.



Programmable Threshold

The drive software supports one software controllable 'numerical comparators'. This comparator can be used to detect when an internal or external signal exceeds a user set point threshold. This threshold comparator provides a hysteresis band to prevent erratic operation at or near the threshold point.



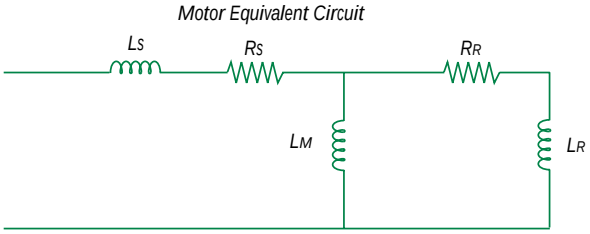


Applications:

- Release External Brake when Torque > 50%
- Turn on Motor Fan when Speed < 20%

Autotune

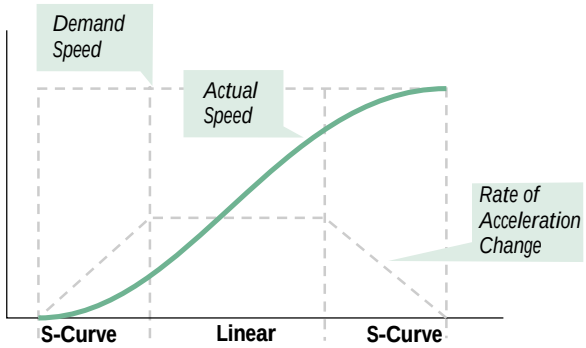
The Commander SE is capable of measuring the motor's stator resistance (Rs) and magnetising inductance (Lm). These values allow the drive to establish a mathematical model of the motor's electrical circuit for use in open loop vector control. The magnetising inductance is measured upon command through a bit parameter, and is only performed when instructed to. The Commander SE may be configured to measure the stator resistance automatically every time the drive is enabled or powered up. Automatic measurement can also be disabled.



Additional Configurable Functions

S-Ramp

The acceleration and deceleration ramps can be configured as S-ramps. This function provides smoother starting and stopping for sensitive loads. The user can adjust the maximum rate of change of acceleration (time squared), which in effect defines the curvature of the S-ramp.



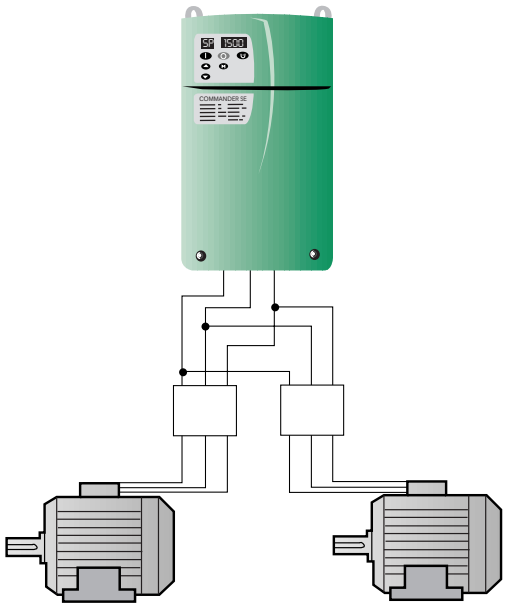
Preset Speed

The Commander SE has eight preset speeds which can be selected by terminal inputs.

Logic Input			
A	B	C	Selected Preset
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

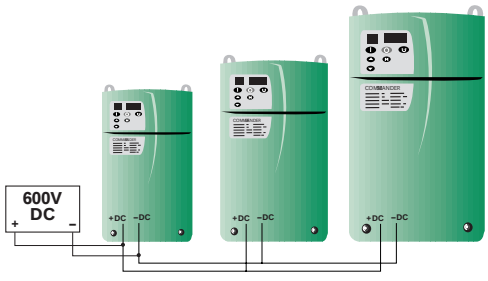
Dual Motor Setup

Commander SE has 2 separate motor maps allowing individual control of 2 motors with differing nameplate characteristics from one drive.



DC Bus Paralleling

Commander SE sizes 2, 3 and 4 can be DC bus paralleled and supplied from a DC source. Simply connect using the +DC -DC terminals on the drive. Please note, the drives to be connected on a parallel DC bus must be of the same voltage rating.



Additional Configurable Functions

Analogue Input Modes

There are multiple analogue signal input possibilities. Commander SE has 2 analogue inputs. Analogue input 1 is a unipolar voltage input having a ramp of 0 to +10V. Analogue input 2 is a unipolar current input. There are several choices for signal type and several choices for how the drive handles a signal loss.

Analogue Mode	Signal Type	Action Upon Signal Loss
0	0-20mA	N/A
1	20-0mA	N/A
2	4-20mA	Trip on Loss
3	20-4mA	Trip on Loss
4	4-.20mA	Min (or low) Speed on Loss
5	20-.4mA	Min (or low) Speed on Loss

Power Cost and Consumption Calculator

Commander SE can calculate the instantaneous cost per hour to operate the drive based on the current power consumption rate and the electricity cost per kwatt hour. The electricity cost can be scaled to any currency so that the cost is calculated according to that currency. Additionally, there is a power meter which measures consumed power in MwHrs and KwHrs.

Parameter	Units	Range
6.26	Currency/Hour	0.00-32000
6.25	KwHrs	0.00-99.99
6.24	MwHrs	0.00-999.9

Run Time Log: Years, Days, Hours, Minutes

Commander SE keeps a running log of it's total operating time. This data is useful for maintenance purposes and allows the user to easily identify run time down to the minute.

- Y2K Compliant.

Parameter	Units	Range
6.22	Years/Days	0-9.365
6.23	Hours/Minutes	0-23.59

Assignable I/O

Commander SE has inputs and outputs which are user assignable, the user defines which I/O points operate with which functions. For example, digital input 1 could be defined as a preset speed or a drive reset. This capability provides optimum usage and maximum flexibility of Commander SE's I/O and it applies to analogue as well as digital I/O.

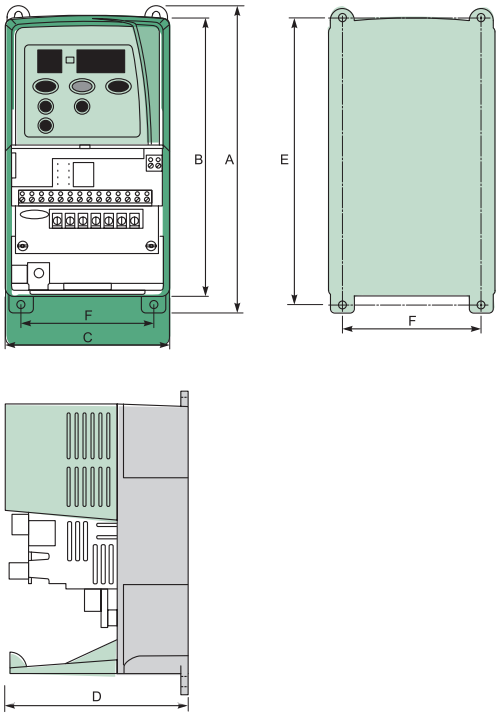
I/O Type	Quantity	Function
Analogue In	2	Assignable
Analogue Out	1	Assignable
Digital In	5	Assignable
Digital In or Out	1	Assignable

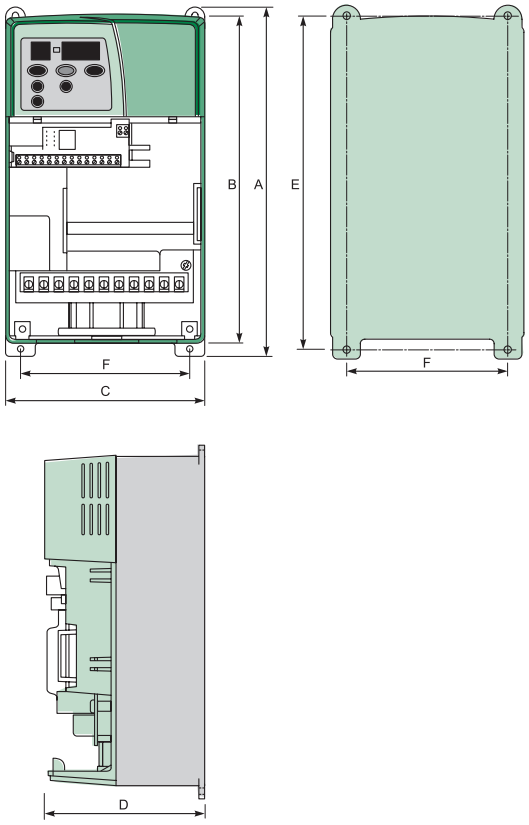
Sequence Logic Control Modes

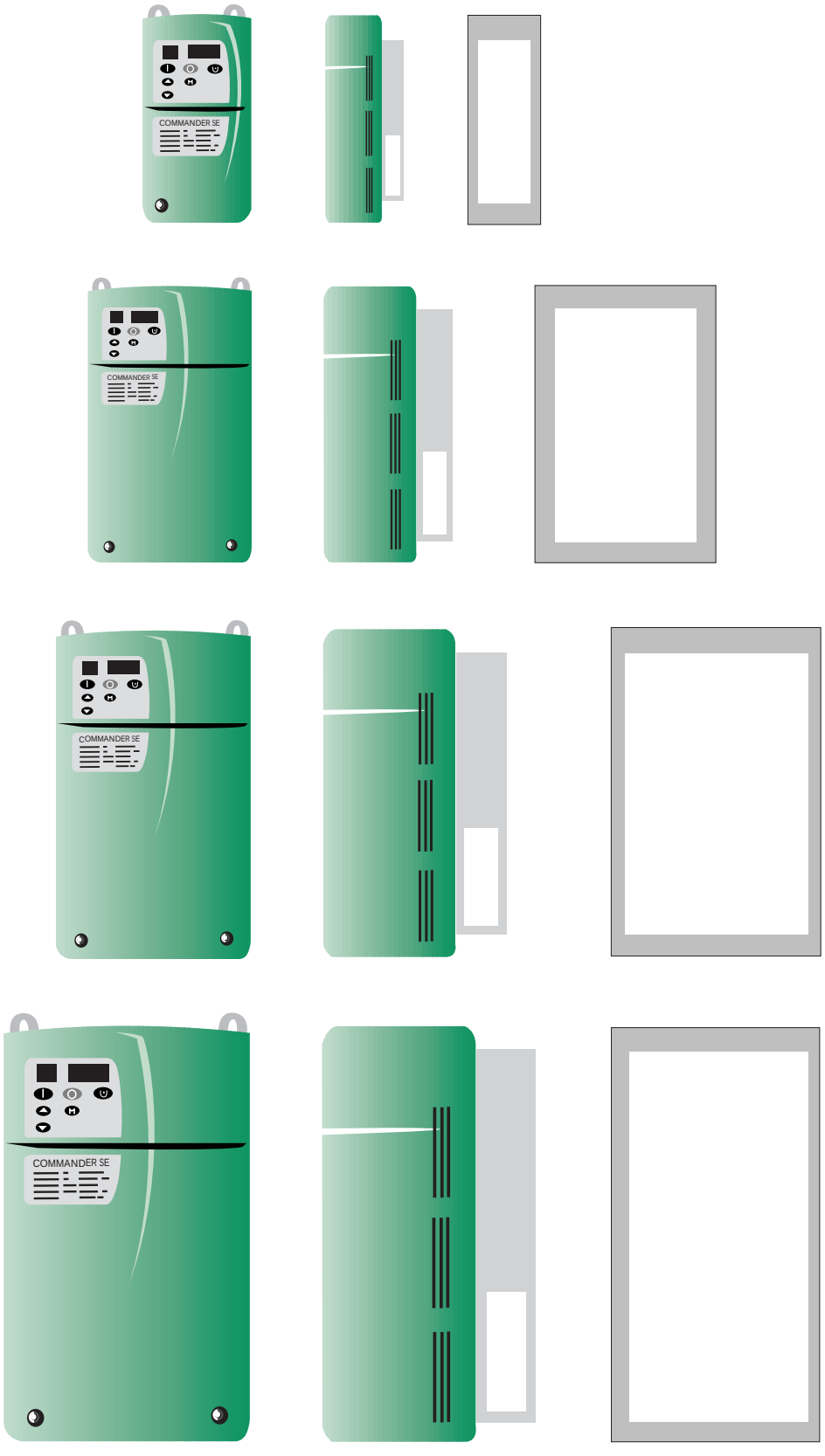
There are 5 logic control modes available run sequencing. Two of the modes are used with momentary run inputs (the drive provides latching software). Two of the modes are used with maintained run inputs (non latching), and one mode can be used to assign the terminals as the user prefers.

#6.04 Start/ Stop Logic	Run Signal Contact Type
0	Non Latching
1	Latching
2	Non Latching
3	Latching
4	User Definable

Pre-Installation






COMMANDER SE
COMMANDER SE
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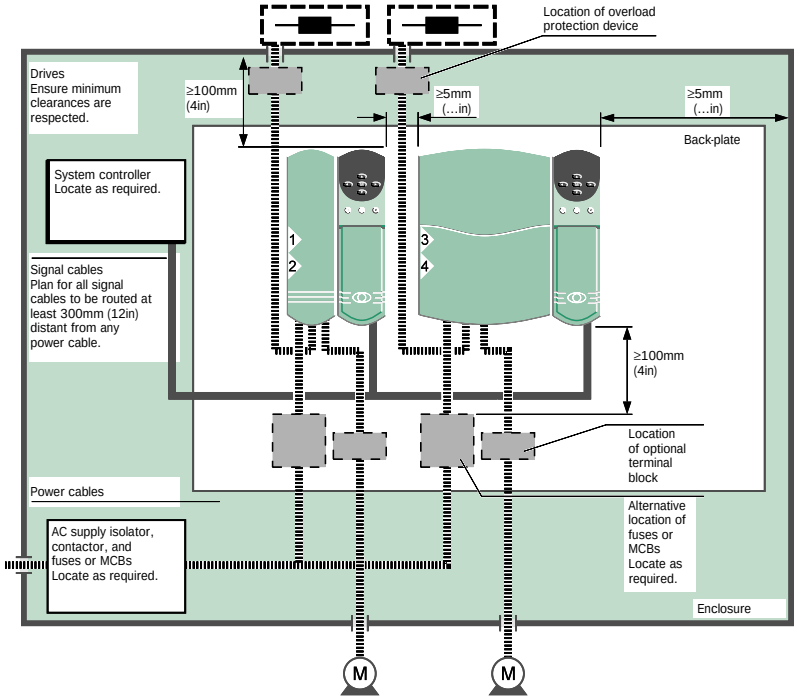
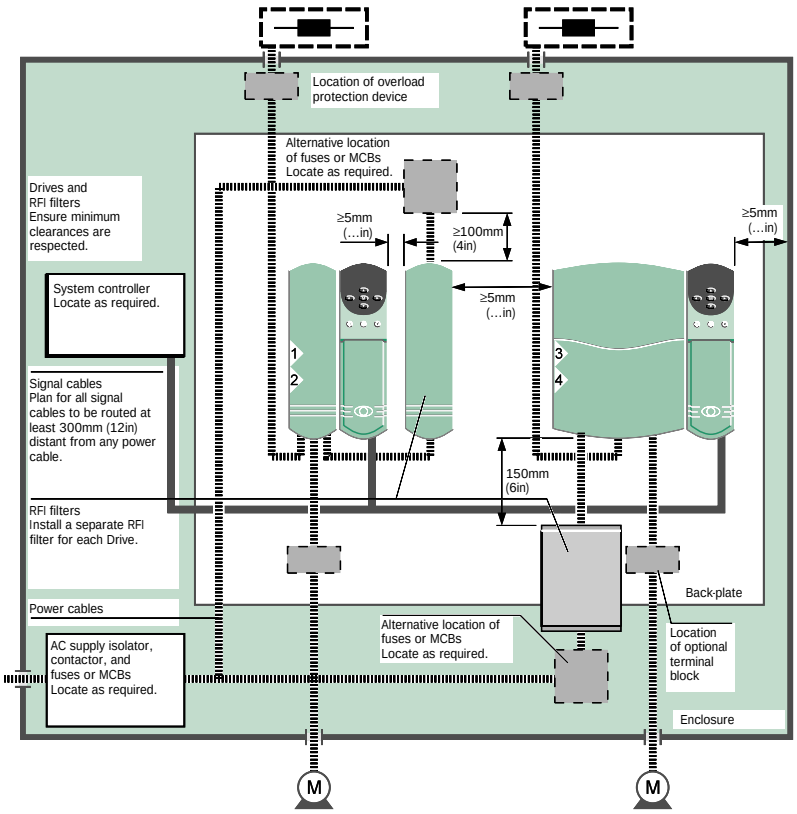
COMMANDER SE

Optional braking resistors as required for the Drives
External: Mount on top surface of enclosure.
Internal: Mount in top part of enclosure.



Optional braking resistors as required for the Drives
External: Mount on top surface of enclosure.
Internal: Mount in top part of enclosure.



Enclosure Guidelines

Heat Dissipation in a sealed enclosure

If possible, locate heat-generating equipment in the lower part of the enclosure to encourage internal convection. Otherwise, use a taller enclosure or install stirrer fans.

The enclosure must be of adequate size to maintain sufficient cooling of the drive when it is installed inside a sealed enclosure. Heat generated by all the equipment in the enclosure must be taken into account. To calculate the minimum acceptable size of an enclosure, use the following procedure:

Calculate the minimum required surface area Ae for the enclosure from:

$$A_e = \frac{P}{K(T_i - T_{amb})}$$

Where:

T_{amb}	*Maximum ambient temperature in °C external to the enclosure.*
A_e	*Unobstructed heat-conducting are in mm2.*
K	*Heat transmission coefficient of the enclosure material.*
T_i	*Maximum permissible operating temperature in °C.*
P	*Power in watts dissipated by all heat sources in the enclosure.*

Example:

To calculate the size of an enclosure for model GPD 1403 (1.5kW, 2HP).

The following conditions are assumed:

The Drive is surface-mounted inside the enclosure.
Only the top, front, and two sides of the enclosure are free to dissipate heat.
The enclosure is made from painted 2mm (.079in) sheet steel.
Maximum external air temperature: 30°C (86°F).

Insert the following values:

T_i =	40°C
T_{amb} =	30°C
K =	5.5 (typical for painted 2mm .079in sheet steel)
P =	100 at 3kHz (see pages 18 & 19)

Note:

It is essential to include any other heat sources in the value of P.

The minimum required heat conducting area is then:

$$A_e = \frac{100}{5.5(40 - 30)} = 1.81m^2$$

Estimate two of the enclosure dimensions - the height (H) and depth (D), for instance. Calculate the width (W) from:

$$W = \frac{A_e - 2HD}{H + D}$$

Inserting H = D = 0.5m, obtain the minimum width:

$$W = \frac{1.81 - (2 \times 0.5 \times 0.5)}{0.5 + 0.5} = 0.81m$$

Heat Dissipation in a ventilated enclosure

If a high ingress protection rating is not required, the enclosure may be smaller. A ventilating fan can be used to exchange air between the inside and outside of the enclosure.

To calculate the volume of ventilating air, use the following equation:

$$V = \frac{3.1P}{T_i - T_{amb}}$$

Where V = Air-flow in m^3 per hour.

Example:

P =	100
T_i =	40°C
T_{amb} =	30°C

Then:

$$V = \frac{3.1 \times 73}{40 - 30} = 31m^3 / hr$$

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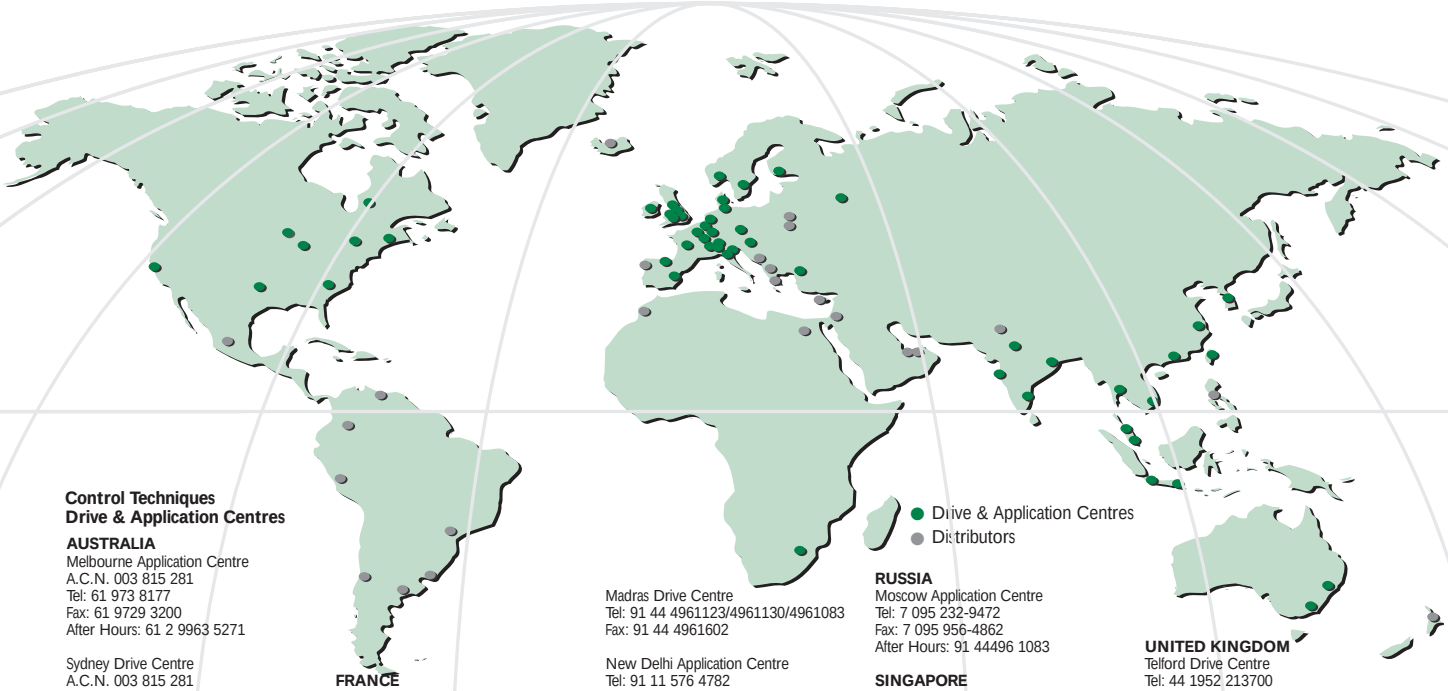

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