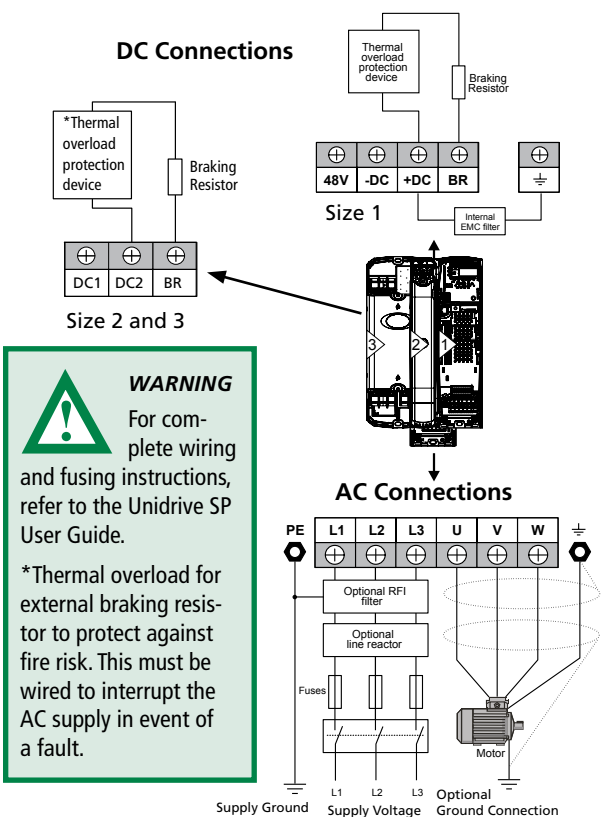


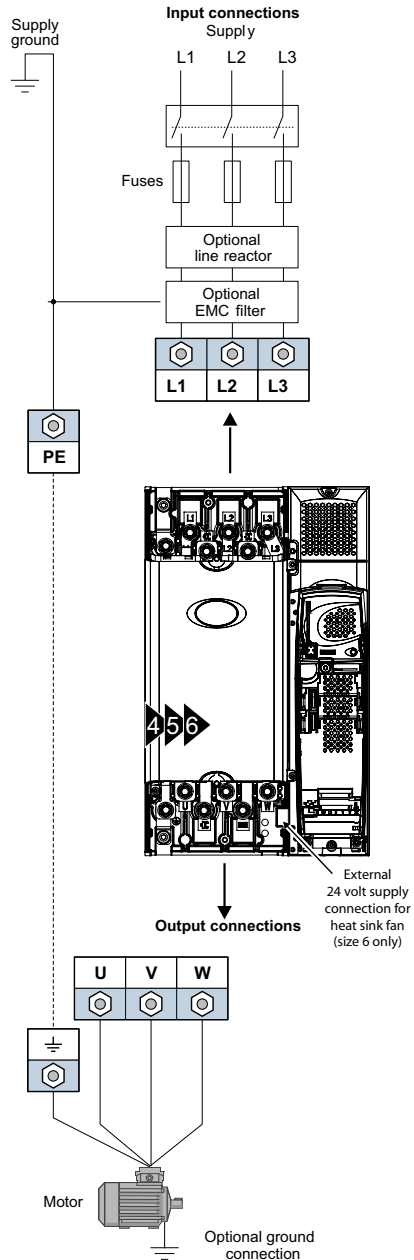
POWER WIRING SIZES 1-3



**Heatsink mounted braking resistor for Size 1 and 2**

A resistor has been especially designed to be mounted within the heatsink of the Unidrive SP (sizes 1 and 2). The design of the resistor is such that no thermal protection circuit is required, as the device will fail safely under fault conditions. On Unidrive SP sizes 1 and 2, the software overload protection is set up at default for the designated heatsink mounted resistor. If an external brake resistor is used, a thermal overload device is required, refer to User Guide. **NOTE: The heatsink mounted resistor is suitable for applications with a low level of regen energy only.**

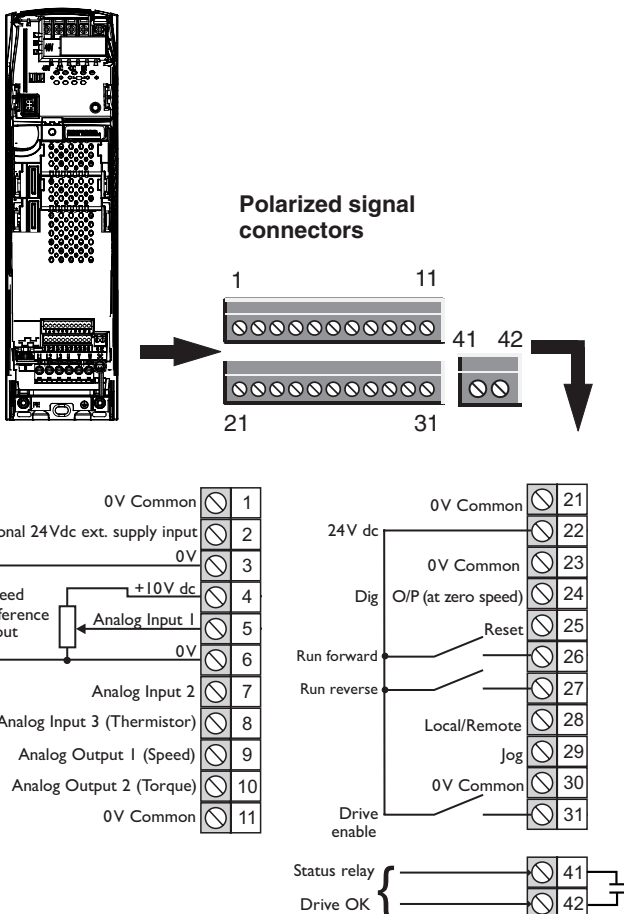
POWER WIRING SIZES 4-6



CONTROL WIRING

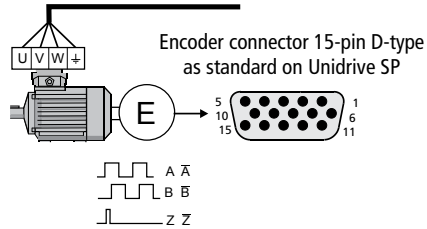
Wire the Unidrive SP control circuits in accordance with the drawing below.

Terminal Strips  
Default Terminal Functions



## ENCODER WIRING

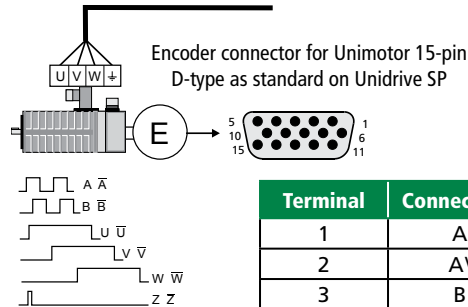
### Closed Loop Vector



Terminal	Connections
1	A
2	A\
3	B
4	B\

Terminal	Connections
5	Z
6	Z\
13	+V
14	0V

### Servo



- Z-Marker pulse is optional.
- Encoder shielding connected to drive 0V and encoder 0V.
- Connections shown are for default Quadrature Incremental Encoder, for other encoder types please refer to User Guide.

Terminal	Connections
1	A
2	A\
3	B
4	B\
5	Z
6	Z\
7	U
8	U\
9	V
10	V\
11	W
12	W\
13	+V
14	0V
15	Th

## KEYPAD & DISPLAY

By default, the keypad display is in 'Status Mode' for viewing current drive conditions, and can be changed to 'Parameter Mode' for viewing and editing drive configuration settings.

### Upper Line

Displays the parameter number or drive status on the left, and parameter value or trip code on the right.

### Lower Lines

Displays the parameter name or help text

### Control Buttons

Fwd/Rev (blue) button  
Stop/Reset (red) button  
Start (green) button

**Mode (black) Button**  
Changes between parameter edit and monitor mode

### Help (?) Button

Displays text describing the selected parameter

**Joypad**  
Used to select a parameter and change its value

### Status Mode

When in Status Mode, the drive Status Message / Alarm / Trip Code is displayed in the left hand side of the Upper Line, i.e., 'rdy', 'inh', 'OVLd', 'trip'. See the 'Display Messages' topic for more details.

### Parameter Mode

When in Parameter Mode, drive functionality can be viewed or modified by using the Keypad. On the upper line of the display, the Parameter Number is shown on the left hand side (ex. 0.10) and the parameter value on the right hand side. The lower two lines display the parameter name, and can display 'Help' text.

### Viewing Parameters

Press the Mode (black) button to change the display from 'Status Mode' to 'Parameter Mode.' The cursor will appear at the parameter number.

The parameter number format is MM.PP, where MM = Menu Number (menus are groupings of common functionalities), and PP = Parameter Number (parameters are specific drive functions). For example: Pr. 0.10 is Menu 0 and Parameter 10, which is the

estimated motor speed in RPM. Note: Menu 0 contains the most common parameters used in a typical setup.

### Navigating Menus and Parameters

You can find any parameter value using the Joypad.

The ► or ◀ buttons on the Joypad are used to navigate between the menus. The ▲ or ▼ buttons on the Joypad are used to navigate between the parameters in a menu.

### To Edit/Modify Parameters

In order to change the value of a parameter, go to the parameter you would like to change and then press the Mode button. Now the cursor shifts to the parameter value. You can increase the parameter value by pressing the Joypad ▲ button or decrease the parameter value by pressing the Joypad ▼ button.

Pressing the Mode button again will set the newly selected parameter value, and the cursor will return to the parameter number. Note: Certain parameters are Read Only (RO) and cannot be changed. For example Pr. 0.11— drive output frequency, cannot be changed.

Pressing the Mode button again will return the keypad to Status Mode. Note: If left untouched in Parameter Mode, eventually the Keypad will automatically return to Status Mode upon timing out. Timeout duration is adjusted by Pr. 11.41.

### To Save parameter values

Changes made to parameter settings will be lost when the drive is turned off, unless saved. To save new settings, enter 1000 into Pr.0.00 and then press the Stop/Reset (red) button.

### To Display On-line Help

When in Parameter Mode, the lower two lines display the parameter name. Help on the selected parameter can be viewed by pressing the Help (?) button. Multi-line text is then displayed on these two lines, which can be scrolled by the ▲ or ▼ buttons on the Joypad. Pressing the Help button again will take the display back to Parameter Mode.

### To Reset to USA (60Hz) defaults

To reset the drive to USA default parameter settings, open drive enable signal (Terminal 31), enter 1244 into Pr 0.00 and then press the Stop/Reset button. Save the parameter values by entering 1000 into Pr.0.00 and then pressing the Off/Reset button.

## DISPLAY MESSAGES

### Status Messages

#### Upper Display *Description*

Auto tune	Autotune in progress. The autotune procedure has been initialized. 'Auto' and 'tunE' will flash alternatively on the display.
dec	Decelerating. The drive is decelerating the motor.
inh	Inhibit. The drive is inhibited and cannot be run. The drive enable signal is not applied to terminal 31 or Pr 6.15 is set to 0.
rdy	Ready. The drive is ready to be run.
run	Running. The drive is running.
stop	Stop or holding zero speed. The drive is holding zero speed.
trip	Trip condition. The drive has tripped and is no longer controlling the motor. The trip code appears on the upper display.
OVLd	Motor overload alarm. The motor I2t accumulator in the drive has reached 75% of the value at which the drive will be tripped and the load on the drive is >100%.

### Trip Codes

#### Lower Display *Function*

UU	Undervoltage
OU	Overvoltage
OI.AC	Instantaneous Overcurrent
Et	External Trip
It.AC	Motor Overload
th	Motor Overtemp or Thermistor circuit open
ph	Input Power Phase Loss
Enc2	Encoder wire break
it.br	Braking resistor trip

For other status messages and trip codes please refer to User Guide.

## OPEN LOOP SETUP

The Unidrive SP default operating mode is Open Loop.

See Control Wiring diagram for default connections.

### Before power-up

Ensure:

- The drive enable signal is open (terminal 31)
- Run signal is open (terminal 26)
- Motor is connected

### Power-up the drive

Ensure:

- Drive displays 'inh' — If the drive trips, see Trip Codes.

### Enter motor nameplate details

Enter:

- Motor rated frequency in Pr 0.47 (Hz)
- Motor rated current in Pr 0.46 (A)
- Motor rated speed in Pr 0.45 (rpm)
- Motor rated voltage in Pr 0.44 (V)

### Set maximum frequency

Enter:

- Maximum frequency in Pr 0.02 (Hz)

### Set acceleration/deceleration rates

Enter:

- Acceleration rate in Pr 0.03 (s/100Hz)
- Deceleration rate in Pr 0.04 (s/100Hz) (If braking resistor fitted, set Pr 0.15 = FAST. )

### Autotune

Unidrive SP is able to perform either a stationary or a rotating autotune. The motor must be at a standstill before an autotune is enabled. A rotating autotune should be used whenever possible.

- A stationary autotune can be used when the motor is loaded and it is not possible to remove the load from the motor shaft. A stationary autotune does not measure the power factor of the motor so the value on the motor nameplate must be entered into Pr 0.43
- A rotating autotune should only be used if the motor is unloaded or the load is uncoupled



**WARNING:** A rotating autotune will cause the motor to accelerate up to 2/3 base speed in the direction selected regardless of the reference provided. Once complete the motor will coast to a stop. The run signal must be removed and reconnected before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the drive enable.

### To perform an autotune:

- Set Pr 0.40 = 1 for a stationary autotune or set Pr 0.40 = 2 for a rotating autotune
- Close the Drive Enable signal (terminal 31). The drive will Display 'rdY'
- Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune
- Wait for the drive to display 'rdY' and for the motor to come to a standstill








Open the run signal from the drive.

### Run

- Drive is now ready to run

## CLOSED LOOP SETUP

See **Control Wiring** section for default connections.

Step	Description	Actions	Display
Allow drive operating mode to be changed	Go to Parameter 0.00 Enter 1254 Finish Step	  	Upper = 0.00 Lower = 1254
Select Servo Operation	Go to Parameter 0.48 Select CL VECt Finish Step	   	Upper = 0.48 Lower = CL

### Before power-up

Ensure:

- Drive Enable signal is not given (terminal 31)
- Run signal is not given (terminal 26)
- Motor and encoder are connected

### Power-up the drive

Ensure:

- Drive displays 'inh' – If the drive trips, see Trip Codes.

### Set motor feedback parameters

Incremental encoder basic set-up

Enter:

- Drive encoder Lines Per Revolution in Pr 0.27 (Set according to encoder)

### Enter motor nameplate details

Enter:

- Motor rated frequency in Pr 0.47 (Hz)
- Motor rated current in Pr 0.46 (A)
- Motor rated full load speed (base speed - slip speed) in Pr 0.45 (rpm)
- Motor rated voltage in Pr 0.44 (V)

### Set maximum speed

Enter:

- Maximum speed in Pr 0.02 (rpm)

### Set acceleration/deceleration rates

- Acceleration rate in Pr 0.03 (s/1000rpm)
- Deceleration rate in Pr 0.04 (s/1000rpm) (If braking resistor fitted, set Pr 0.15 = FAST.)

### Autotune

Unidrive SP is able to perform either a stationary or a rotating autotune. The motor must be at a standstill before an autotune is enabled. A rotating autotune should be used when possible.

- A stationary autotune can be used when the motor is loaded and it is not possible to remove the load from the motor shaft. A stationary autotune does not measure the power factor of the motor so the value on the motor nameplate must be entered into Pr 0.43
- A rotating autotune should only be used if the motor is unloaded or the load is uncoupled



**WARNING:** A rotating autotune will cause the motor to accelerate up to 2/3 base speed in the direction selected regardless of the reference provided. Once complete the motor will coast to a stop. The run signal must be removed and reconnected before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the drive enable.

### To perform an autotune:

- Set Pr 0.40 = 1 for a stationary autotune or set Pr 0.40 = 2 for a rotating autotune
- Close the Drive Enable signal (terminal 31). The drive will display 'rdY'
- Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune.
- Wait for the drive to display 'rdY' and for the motor to come to a standstill








Open the run signal from the drive.

### Run

- Drive is now ready to run

## SERVO SETUP

See **Control Wiring** section for default connections.

Step	Description	Actions	Display
Allow drive operating mode to be changed	Go to Parameter 0.00 Enter 1254 Finish Step	  	Upper = 0.00 Lower = 1254
Select Servo Operation	Go to Parameter 0.48 Select SErVO Finish Step	   	Upper = 0.48 Lower = SErVO

### Before power-up

Ensure:

- Drive Enable signal is open (terminal 31)
- Run signal is open (terminal 26)
- Motor is connected
- Encoder is connected

### Power-up the drive

Ensure:

- Drive displays 'inh' — If the drive trips, see Trip Codes.

### Set motor feedback parameters

Incremental encoder basic set-up

Enter:

- Drive encoder Pulses Per Revolution in Pr 0.27 (set according to encoder)

### Enter motor nameplate details

Enter:

- Motor rated current in Pr 0.46 (A)
- Motor rated voltage in Pr 0.44 (V)
- Number of poles in Pr 0.42 (if Pr 0.42 is set to Auto, then the number of poles is 6)

### Set maximum speed

Enter:

- Maximum speed in Pr 0.02 (rpm)

## BASIC PARAMETERS (MENU O)

### Set acceleration/deceleration rates

- Acceleration rate in **Pr 0.03** (s/1000rpm)
- Deceleration rate in **Pr 0.04** (s/1000rpm) (If braking a resistor is fitted, set **Pr 0.15 = FAST.**)

### Autotune

The load must be removed from the shaft before an Autotune is performed.



**WARNING:** The normal low speed test will rotate the motor by up to 2 revolutions in the direction selected, regardless of the reference provided. Once complete the motor will come to a standstill. The run signal must be removed and reconnected before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the Drive Enable.

### To perform an autotune:

- Set **Pr 0.40 = 2**
- Close the run signal (terminal 26 or 27).
- Close the Drive Enable signal (terminal 31). The lower display will flash **'Auto'** and **'tuneE'** alternatively, while the drive is performing the test.
- Wait for the drive to display **'StoP'** and for the motor to come to a standstill.

If the drive trips, see Trip Codes.

Open the run signal from the drive.

### Run

- Drive is now ready to run

Parameter			Range ( )			Default ( )		
			OL	VT	SV	OL	VT	SV
0.00	xx.00	(x.00)	0 to 32,767			0		
0.01	Minimum reference clamp	(1.07)	±3,000.0Hz ±Speed_limit_max rpm			0.0		
0.02	Maximum reference clamp	(1.06)	0 to 3,000.0Hz	Speed_limit_max rpm		60	1,800	3,000
0.03	Acceleration rate	(2.11)	0.0 to 3,200.0 s/100Hz	0.000 to 3,200.000 s/1,000rpm		5.0	2.0	0.2
0.04	Deceleration rate	(2.21)	0.0 to 3,200.0 s/100Hz	0.000 to 3,200.000 s/1,000rpm		10.0	2.0	0.2
0.05	Reference select	(1.14)	Al .A2 (0), A1.Pr (1), A2.Pr (2), Pr (3), Pad (4), Prc (5)			Al .A2 (0)		
0.06	Current limit	(4.07)	0 to Current_limit_max %			165	175.0	
0.07	OL> Voltage mode select	(5.14)	Ur_5 (0), Ur (1), Fd (2), Ur Auto (3), Ur_1 (4), SrE (5)			Ur_1 (4)		
	CL> Speed controller P gain	(3.10)	0.0000 to 6.5535 1/rad s-1			0.01		
0.08	OL> Voltage boost	(5.15)	0.0 to 25.0% of motor rated voltage			Size 1 to Size 3: 3.0 Size 4 & Size 5: 2.0 Size 6: 1.0		
	CL> Speed controller I gain	(3.11)	0.00 to 655.35 1/rad			1.0		
0.09	OL> Dynamic V/F	(5.13)	OFF ((1) r On)			0		
	CL> Speed controller D gain	(3.12)	0.00000 to 0.65535 (s)			0.0		
0.10	OL> Estimated motor speed	(5.04)	±180,000 rpm					
	CL> Motor speed	(3.02)	±Speed_max rpm					
0.11	OL & VT> Drive output frequency	(5.01)	±Speed_freq_max Hz					
	SV> Drive encoder position	(3.29)			0 to 65,535 1/2 16 ths of a rev.			
0.12	Total motor current	(4.01)	0 to Drive_current_max A					
0.13	OL & VT> Motor active current	(4.02)	±Drive_current_max A					
	SV> Analog input 1 offset trim	(7.07)				±10.000 %		0.0
0.14	Torque mode selector	(4.11)	0 to 1	0 to 4		Speed control mode (0)		
0.15	Ramp mode select	(2.04)	FAST (0) Std (1) Std.hV (2)	FAST (0) Std (1)		Std (1)		
0.16	OL> T28 and T29 auto-selection disable	(8.39)	OFF (0) or On (1)			0		
	CL> Ramp enable	(2.02)	OFF (0) or On (1)			On (1)		
0.17	OL> T29 digital input destination	(8.26)	Pr 0.00 to Pr 21.51			Pr 6.31		
	CL> Current demand filter time constant	(4.12)	0.0 to 25.0 ms			0.0		
0.18	Positive logic select	(8.29)	OFF (0) or On (1)			On (1)		
0.19	Analog input 2 mode	(7.11)	0-20 (0), 20-0 (1), 4-20tr (2), 20-4tr (3), 4-20 (4), 20-4 (5), VOLT (6)			VOLT (6)		
0.20	Analog input 2 destination	(7.14)	Pr 0.00 to Pr 21.51			Pr 1.37		
0.21	Analog input 3 mode	(7.15)	0-20 (0), 20-0 (1), 4-20tr (2), 20-4tr (3), 4-20 (4), 20-4 (5), VOLT (6), th.SC (7), th (8), th.diSp (9)			VOLT (6)		
0.22	Bipolar reference select	(1.10)	OFF (0) or On (1)			OFF (0)		
0.23	Jog reference	(1.05)	0 to 400.0 Hz	0 to 4000.0 rpm		0.0		

Parameter			Range ( )			Default ( )		
			OL	VT	SV	OL	VT	SV
0.24	Pre-set reference 2	(1.21)	±Speed_limit_max rpm			0.0		
0.25	Pre-set reference 2	(1.22)	±Speed_limit_max rpm			0.0		
0.26	OL> Pre-set reference 3	(1.23)	±Speed_freq_max Hz/rpm			0.0		
	CL> Overspeed threshold	(3.08)		0 to 40,000 rpm		0		
0.27	OL> Pre-set reference 4	(1.24)	±Speed_freq_max Hz/rpm			0.0		
	CL> Drive encoder lines per revolution	(3.34)	0 to 50,000				1024	4096
0.28	Keypad fwd/rev key enable	(6.13)	OFF (0) or On (1)			OFF (0)		
0.29	SMARTCARD parameter data	(11.36)	0 to 999			0		
0.30	Parameter cloning	(11.42)	nonE (0), rEAd (1), Prog (2), Auto (3), boot (4)			nonE (0)		
0.31	Drive rated voltage	(11.33)	230 (0), 480 (1), 575 (2), 690 (3) V					
0.32	Drive rated current	(11.32)	0.00 to 9999.99A					
0.33	OL> Catch a spinning motor	(6.09)	0 to 3			0		
	VT> Rated rpm autotune	(5.16)		0 to 2			0	
0.34	User security code	(11.30)	0 to 999			0		
0.35	Serial comms mode	(11.24)	AnSI (0) rtu (1)			rtu (1)		
0.36	Serial comms baud rate	(11.25)	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8) Modbus RTU only, 115200 (9) Modbus RTU only			19200 (6)		
0.37	Serial comms address	(11.23)	0 to 247			1		
0.38	Current loop P gain	(4.13)	0 to 30,000			All voltage ratings: 20	200V drive: 75 400V drive: 150 575V drive: 180 690V drive: 215	
0.39	Current loop I gain	(4.14)	0 to 30,000			All voltage ratings: 40	200V drive: 1000 400V drive: 2000 575V drive: 2400 690V drive: 3000	
0.40	Autotune	(5.12)	0 to 2	0 to 4	0 to 6	0		
0.41	Maximum switching frequency	(5.18)	3 (0), 4 (1), 6 (2), 8 (3), 12 (4), 16 (5) kHz			3 (0)	6 (2)	
0.42	No. of motor poles	(5.11)	0 to 60 (Auto to 120 pole)			0 (Auto)	6 POLE (3)	
0.43	OL & VT> Motor rated power factor	(5.10)	0.000 to 1.000			0.85		
	SV> Encoder phase angle	(3.25)				0.0 to 359.9°	0.0	
0.44	Motor rated voltage	(5.09)	0 to AC_voltage_set max V			200V drive: 230, 400V drive: 460, 575V drive: 575, 690V drive: 690		
0.45	OL & VT> Motor rated full load speed (rpm)	(5.08)	0 to 180,000 rpm	0.00 to 40,000.00 rpm		1800	1770	
	SV> Motor thermal time constant	(4.15)				0.0 to 3000.0	20	
0.46	Motor rated current	(5.07)	0 to Rated_current_max A			Drive rated current [11.32]		
0.47	Rated frequency	(5.06)	0 to 3,000.0 Hz	0 to 1,250.0 Hz		60		
0.48	Operating mode selector	(11.31)	OPEn LP (1), CL VECt (2), SErVO (3), rEGEn (4)			OPEn LP (1)	CL VECt (2)	SErVO (3)
0.49	Security status	(11.44)	L1 (0), L2 (1), Loc (2)					
0.50	Software version	(11.29)	1.00 to 99.99					



# SMARTCARD

## Parameter Storage and Copying



**Pr 0.30 = rEAD +**

Drive reads all parameters from the SMARTCARD



**Pr 0.30 = Prog +**

Programs all drive parameters to the SMARTCARD



**Pr 0.30 = AutO +**

Drive automatically writes to the SMARTCARD when a parameter save is performed



**Pr 0.30 = boot +**

Drive boots from the SMARTCARD on power up and automatically writes to the SMARTCARD when a parameter save is performed

## SUPPORT

For expert support of this product and your application call 1-800-893-2321. From application programming to startup services, Control Techniques is on call 24/7.



For manuals, application notes, and more information on Control Techniques support services, visit:  
**[www.emersonct.com](http://www.emersonct.com)**



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QSG-USP-07



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**Unidrive SP**

**Quick Startup, Operation and Maintenance Guide**



**WARNING:** This is a brief guide only. It does not give safety information. Incorrect installation or operation of the drive could result in injury or equipment damage. Refer to the Unidrive SP User Guide for essential safety information.