Pocket *StartUp*

Quick Instructions for initial start-up of
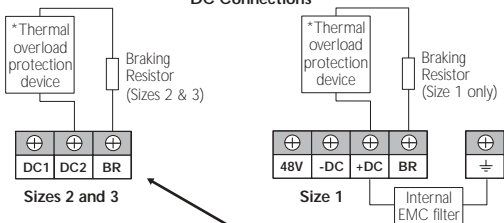
UNIDRIVE SP

THE BENCHMARK

Unidrive SP

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

CONTROL TECHNIQUES
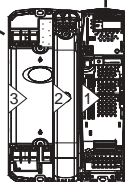*www.controltechniques.com*

Power Wiring

DC Connections

⊕	⊕	⊕
DC1	DC2	BR

Sizes 2 and 3

*Thermal overload protection device

Braking Resistor (Sizes 2 & 3)

⊕	⊕	⊕	⊕
48V	-DC	+DC	BR

⊕
⏚

Size 1

*Thermal overload protection device

Braking Resistor (Size 1 only)
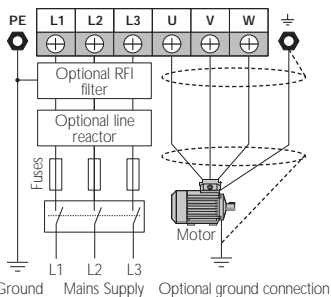
Internal EMC filter

⚠ **WARNING**
For complete wiring and fusing instructions, refer to the Unidrive 𝕊𝕡 User Guide

*Thermal overload for external braking resistor to protect against fire risk. This must be wired to interrupt the AC supply in event of a fault

AC Connections

PE	L1	L2	L3	U	V	W	⏚
⊕	⊕	⊕	⊕	⊕	⊕	⊕	

Optional RFI filter

Optional line reactor

Fuses

Motor

L1 L2 L3
Supply Ground   Mains Supply   Optional ground connection

Heatsink mounted braking resistor

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 in built 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.
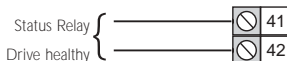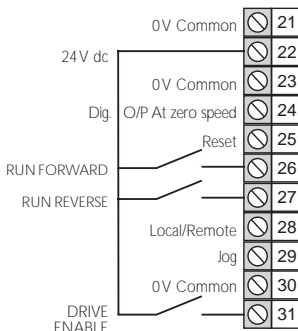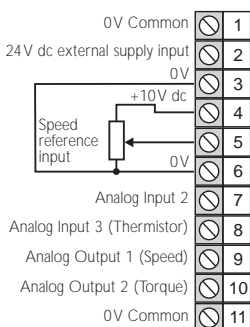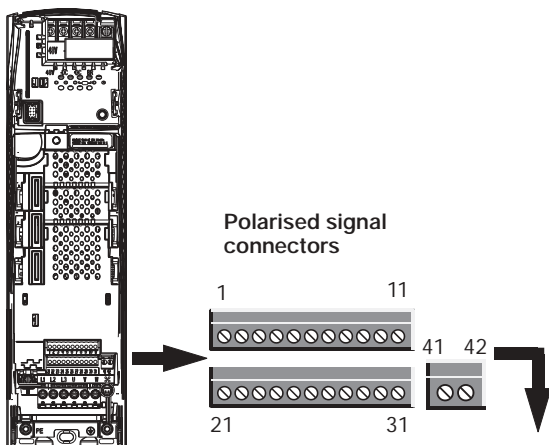**NOTE** The heatsink mounted resistor is suitable for applications with a low level of regen energy only.

Control Wiring

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

Terminal Strips

Default Terminal Functions

Polarised signal connectors

Left terminal	No.		Right terminal	No.
0V Common	1		0V Common	21
24V dc external supply input	2	24V dc		22
0V	3		0V Common	23
+10V dc	4	Dig. O/P At zero speed		24
Speed reference input	5		Reset	25
0V	6	RUN FORWARD		26
Analog Input 2	7	RUN REVERSE		27
Analog Input 3 (Thermistor)	8		Local/Remote	28
Analog Output 1 (Speed)	9		Jog	29
Analog Output 2 (Torque)	10		0V Common	30
0V Common	11	DRIVE ENABLE		31
		Status Relay / Drive healthy		41
				42

3

Encoder Wiring

Closed Loop Vector

Encoder connector 15 way D-type as standard on Unidrive SP
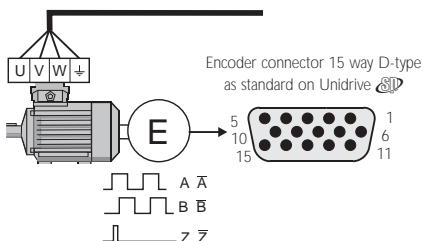
Terminal	Connections
1	A
2	A\
3	B
4	B\

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

Servo

Encoder connector for Unimotor 15 way D-type as standard on Unidrive SP

- Z - Marker pulse is optional.
- Encoder screening connected to drive 0V and encoder 0V.
- Connections shown are for default Quadrature Incremental Encoder, for other encoder types please refer to User Guide.
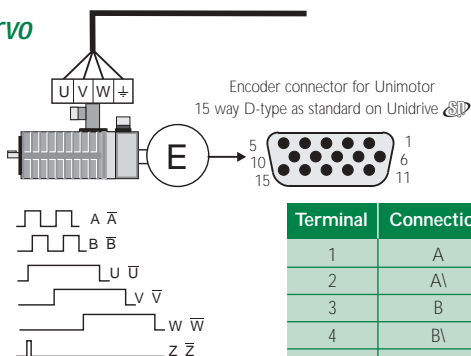
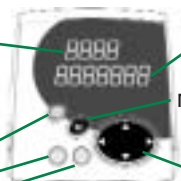| Terminal	Connections
1	A
2	A\
3	B
4	B\
5	Z
6	Z\
7	U
8	U\
9	V
10	V\
11	W
12	W\
13	+V
14	0V
15	Th

Keypad & Display

Upper Display
Parameter number
or drive status

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

Lower Display
Parameter value
or trip code

Mode (black) button
changes between
parameter edit and
monitor mode

Joypad
Used to select a parameter
and change its value

Display Modes

Status Mode
(Display not
flashing)

To enter Parameter
Mode, press **M** key or

Timeout

Timeout

To return to
Status Mode,
press **M** key

**Temporary
Parameter
Mode**
(Upper display
flashing)

Parameter Mode
(Upper display
flashing)

Use keys
to select parameter for editing

When returning
to Parameter
Mode use the

keys to select
another parameter
to change, if
required

To enter Edit Mode,
press **M** key

To exit Edit Mode,
press **M** key

Edit Mode
(Character to be edited in lower line of display flashing)
Change parameter values using keys.

Reset to Factory Defaults

Enter the appropriate value shown below into Pr 0.00 and
then press the ⏺ button.

Lower Display	Function
1233	Resets parameters to 50Hz supply default
1244	Resets parameters to 60Hz supply default

Open Loop Start-up

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 not given (terminal 31)
- Run signal is not given (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) -
  check if λ or Δ connection

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.

> ⚠ *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 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.

- 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

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

Remove the run signal from the drive.

Run

- Drive is now ready to run

Closed Loop Start-up

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

Step	Description	Actions	Display
Allow drive operating mode to be changed	Go to Parameter 0.00 Enter 1253 EUR Enter 1254 USA Finish Step	⬍ Ⓜ ▲ Ⓜ	Upper = `0.00` Lower = `1253`
Select Closed Loop Vector Operation	Go to Parameter 0.48 Select CL.VECt Finish Step	⬍ Ⓜ ▲ Ⓜ ▼	Upper = `0.48` Lower = `CL.VECt`

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) - check if $\curlywedge$ or Δ connection

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 wherever possible.

> ⚠️ *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 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.

- 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

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

Remove the run signal from the drive.

Run

- Drive is now ready to run

Servo Start-up

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

Step	Description	Actions	Display
Allow drive operating mode to be changed	Go to Parameter 0.00 Enter 1253 EUR Enter 1254 USA Finish Step	⬍ Ⓜ ▲ Ⓜ	Upper = 0.00 Lower = 1253
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 not given (terminal 31)
- Run signal is not given (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)

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

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 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 'tunE' 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.

Remove the run signal from the drive.

Run

- Drive is now ready to run

Display Messages

Status Messages

Upper Display Description

Auto tunE	Autotune in progress. The autotune procedure has been initialised. '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
O.IAC	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.

Basic Parameters (Menu 0)

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		EUR> 50.0 USA> 60.0	EUR> 1,500.0 USA> 1800.0	3,000.0
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	2.000	0.200
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	2.000	0.200
0.05	Reference select {1.14}	A1.A2 (0), A1.Pr (1), A2.Pr (2), Pr (3). Pad (4), Prc (5)			A1.A2 (0)		
0.06	Current limit {4.07}	0 to Current_limit_max %			165.0	175.0	
0.07	OL> Voltage mode select {5.14}	Ur_S (0), Ur (1), Fd (2), Ur_Auto (3). Ur_I (4), SrE (5)			Ur_I (4)		
	CL> Speed controller P gain {3.10}	0.0000 to 6.5535 1/rad s⁻¹			0.0100		
0.08	OL> Voltage boost {5.15}	0.0 to 25.0% of motor rated voltage			3.0		
	CL> Speed controller I gain {3.11}	0.00 to 655.35 1/rad			1.00		
0.09	OL> Dynamic V/F {5.13}	OFF (0) or On (1)			0		
	CL> Speed controller D gain {3.12}	0.00000 to 0.65535 (s)			0.00000		
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 1/2¹⁶ths of a revolution			
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 %			0.000
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 (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		
0.24	Pre-set reference 1 {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)		

Parameter		Range(⇕)			Default(⇨)		
		OL	VT	SV	OL	VT	SV
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}	200 (0), 400 (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: 2500 690V drive: 3000	
0.40	Autotune {5.12}	0 to 2	0 to 3		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			0.850		
	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: EUR> 400, USA> 460 575V drive: 575 690V drive: 690		
0.45	OL & VT> Motor rated full load speed (rpm) {5.08}	0 to 3,000.0 rpm	0.00 to 40,000.00 rpm		EUR> 1,500 USA> 1,800	EUR> 1,450.00 USA> 1,770.00	
	SV> Motor thermal time constant {4.15}			0.0 to 400.0			20.0
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		EUR> 50.0 USA> 60.0		
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					

SMART**CARD**▶

Drive reads all parameters from the SMARTCARD

Programs all drive parameters to the SMARTCARD

Pr 0.30 = rEAD +

Pr 0.30 = Prog +

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

Auto Save

Pr 0.30 = Auto +

Boot

Auto Save

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

Pr 0.30 = boot +