a guide to transition...

from **Unidrive V3**

to **Unidrive SP**

RETROFIT GUIDE

CONTROL TECHNIQUES

www.controltechniques.com

Introduction for
Unidrive V3 to Unidrive SP Retrofit Guide

The new Unidrive SP high performance AC drive from Control Techniques lays down new benchmark standards in flexibility and features.

This Transition Guide has been compiled by experienced Control Techniques application engineers who have highlighted the differences between Unidrive V3 and the new Unidrive SP in order to make it quicker and easier for existing Unidrive V3 users to make the change to Unidrive SP.

Users will find that considerable new hardware features (such as 3 universal option slots, SmartCard, EMC filter, removable optional keypad, secure disable, 48V dc supply, etc.) have now been incorporated within the Unidrive SP. The electrical and mechanical installation comparisons within this Retrofit Guide give assistance to the user in order to help them to install and commission the new Unidrive SP.

The software development strategy has been to make the set up parameters for the new Unidrive SP as backwards compatible as possible - however there are specific cases where parameter changes have had to be made differently in order to add more performance features and benefits.

We trust that you will find this Retrofit Guide useful to you, however, if there is any further information that you require please either visit our web site www.ControlTechniques.com or contact our Customer Service Department at your Control Techniques Drive Centre.

Index

I/O Comparison

Unidrive 1 has two control terminal blocks for the I/O, Unidrive SP has the same I/O however these are now distributed across three control terminal blocks as shown below.

NOTE: In Unidrive 1, the default state for digital I/O was negative logic, for Unidrive SP the default state is positive logic.

Terminal	Unidrive 1	Unidrive SP
T1	Status Relay	0V
T2	Status Relay	+24V external input
T3	0V	0V
T4	+10V user output	+10V user output
T5*	Analogue input 1 (non-inverting)	Analogue input 1 (non-inverting)*
T6*	Analogue input 1 (inverting)	Analogue input 1 (inverting)*
T7	Analogue input 2	Analogue input 2
T8**	Analogue input 3 (thermistor)	Analogue input 3**
T9	Analogue output 1	Analogue output 1
T10	Analogue output 2	Analogue output 2
T11	0V	0V

Terminal	Unidrive 1	Unidrive SP
T21	0V	0V
T22	+24V output	+24V output
T23	0V	0V
T24	OL> At Speed, CL> At Zero Speed	At Zero Speed
T25	Reset	Reset
T26	Jog Select	Run Forward
T27	Run Forward	Run Reverse
T28***	Run Reverse	Local/remote***
T29***	Local/remote	Jog Select***
T30	Drive enable (Et)	0V
T31****	0V	Drive enable****

Terminal	Unidrive 1	Unidrive SP
T41	N/A	Status relay
T42	N/A	Status relay

I/O Comparison

* Analogue input 1 (Terminals T5/T6) has improved resolution (16bit plus sign), but is now configured solely as a voltage input.

** The default function of Terminal 8 has changed, previously the motor thermistor input with Unidrive 1, it is now a voltage input with Undrive SP.

*** The functions of Terminals 28 and 29 change from default [above] when the Reference Selector Pr 1.14 is changed. If the Reference Selector is set to either one of the following three A1.Pr, A2.Pr, or Pr then Terminal 28 will automatically become Preset Select Bit 0 and Terminal 29 becomes Preset Select Bit 1. The automatic configuration of both Terminals 28 and 29 can be disabled with Pr 8.39.

**** The External Trip / Drive Enable terminal (T31) is now permanently Positive logic due to the requirements of the Secure disable function, Positive / negative logic operates only on terminals 24~29

Encoder Feedback, 15-way D Type

Unidrive 1 has the same main encoder interface, 15 Way D-Type, as the Unidrive SP however the encoder options which are supported have been extended with the Unidrive SP as shown below.

Terminal	Unidrive 1		Unidrive SP											Terminal
	OL>	CL>	#3.38=0	#3.38=1	#3.38=2	#3.38=3	#3.38=4	#3.38=5	#3.38=6	#3.38=7	#3.38=8	#3.38=9	#3.38=10	
T1	Fin	A	A	F	F	A	F	F	Sin	Sin	Sin			T1
T2	/Fin	/A	/A	/F	/F	/A	/F	/F	Sinref	Sinref	Sinref			T2
T3	Din	B	B	D	R	B	D	R	Cos	Cos	Cos			T3
T4	/Din	/B	/B	/D	/R	/B	/D	/R	Cosref	Cosref	Cosref			T4
T5		Z	Z*							Data				T5
T6		/Z	/Z*							'/Data				T6
T7	Fout	U	Aout (Fout)**			U			Aout (Fout)**					T7
T8	/ Fout	/U	/Aout (/Fout)**			/U			/Aout (/Fout)**					T8
T9	Dout	V	Bout (Dout)**			V			Bout (Dout)**					T9
T10	/ Dout	/ V	/Bout (/Dout)**			/V			/Bout (/Dout)**					T10
T11		W				W					Clock			T11
T12		/ W				/ W					/Clock			T12
T13	+5/+15V		+V***											T13
T14	0v		0v											T14
T15	Motor Thermi-stor		th****											T15

* Marker pulse is optional

** Simulated encoder output only available in open-loop

*** The encoder supply is selectable through parameter configuration to 5Vdc, 8Vdc and 15Vdc

**** Terminal 15 is a parallel connection to T8 analog input 3. If this is to be used as a thermistor input, set Pr 7.15 to 'th.sc' (7), 'th' (8) or 'th.diSP' (9).

Above diagram Similar to table 4-12 in Undrive SP User guide (Iss4), but including information about Unidrive 1

Unidrive 1

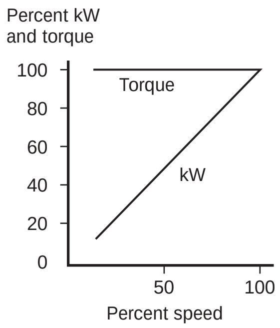
Unidrive 1 has the following default overload capabilities for constant torque loads.

Overload:

- Open loop 150% for 60s
- Closed loop vector 175% for 60s (sizes 1-4), 150%* for 60s (size 5)
- Servo 175% for 4s (sizes 1-4), 150%* for 4s (size 5)
- Regen 150% for 60s

*Multiples of 300A output current with 120% overload or multiples of 240A with 150% overload

Constant Torque Load Characteristic



Rating table information

The current rating(s) for Unidrive size(s) 1~3 (low voltage and standard voltage) are as follows:

Unidrive 1 and Unidrive 1 VTC drive current ratings

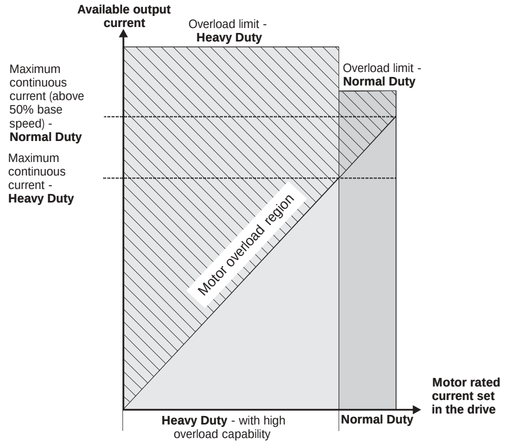
MODEL	Nominal rating		Maximum permissible continuous output current (A) at 40ºC (104ºF) ambient					Maximum permissible continuous output current (A) at 50ºC (122ºF) ambient					Typical input current	Maximum continuous input current
	kW	HP	3kHz	4.5kHz	6kHz	9kHz	12kHz	3kHz	4.5kHz	6kHz	9kHz	12kHz	(A)	(A)
UNI 1201	0.37	0.5	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.4	4.0
UNI 1401	0.75	1.0											3.0	4.5
UNI 1202	0.55	0.75	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.5	6.0
UNI 1402	1.1	1.5											4.3	5.5
UNI 1203	0.75	1.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.3	4.6	8.0
UNI 1403	1.5	2.0											5.8	6.8
UNI 1204	1.1	1.5	5.6	5.6	5.6	5.6	4.5	5.6	5.6	5.1	4.0	3.3	6.5	10.0
UNI 1404	2.2	3.0											8.2	8.6
UNI 1205	2.2	3.0	9.5	9.5	8.5	7.0	5.5	6.9	6.9	5.1	4.0	3.3	8.6	12.5
UNI 1405	4.0	5.0											10.0	12.0
UNI 2201	3.0	4.0	12.0	12.0	12.0	12.0	11.7	12.0	12.0	12.0	11.6	9.7	10.8	13.9
UNI 2401	5.5	7.5											13.0	16.0
UNI 2202	4.0	5.0	16.0	16.0	16.0	14.2	11.7	16.0	16.0	14.7	11.6	9.7	14.3	16.9
UNI 2402	7.5	10											17.0	20.0
UNI 2203	5.5	10.0	25.0	21.7	18.2	14.2	11.7	20.0	17.3	14.7	11.6	9.7	19.8	27.0
UNI 2403	11.0	15											21.0	25.0
UNI 3201	7.5	15	34.0	34.0	34.0	28.0	23.0	34.0	34.0	28.0	21.0	17.9	26	28
UNI 3401	15.0	25											27	34
UNI 3402	18.5	30	40.0	40.0	37.0	28.0	23.0	40.0	34.0	28.0	21.0	17.9	32	39
UNI 3202	11.0	20	46.0	46.0	40.0	32.0	26.6	44.0	36.0	31.0	24.0	20.6	39	43
UNI 3403	22.0	30											40	53
UNI 3203	15.0	25	60.0	47.0	40.0	32.0	26.7	44.0	36.0	31.0	24.0	20.9	53	56
UNI 3404	30.0	40											62	66
UNI 3204	22.0	30	74.0	56.0	46.0	35.0	28.0	50.0	41.0	34.0	26.0	23.0	78	84
UNI 3405	37.0	50	70.0										88	82

Rating table information

Unidrive SP

- The Unidrive SP is dual rated.
- The setting of the motor rated current determines which rating applies -Heavy Duty or Normal Duty
- The two ratings are compatible with motors designed to IEC60034
- The graph aside illustrates the difference between Normal Duty, and Heavy Duty with respect to continuous current rating and short term overload limits

Figure 2-4 Short Term Overload Limits



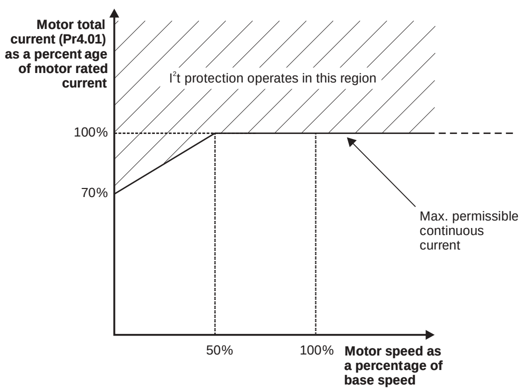
Normal Duty

For applications which use self ventilated induction motors and require a low overload capability (e.g. fans, pumps). Self ventilated induction motors require increased protection against overload due to the reduced cooling effect of the fan at low speed. To provide the correct level of protection the I^2t software operates at a level which is speed dependent. This is illustrated in Figure 2-2.

Operation of motor I^2t protection (it.ac trip) Motor I^2t protection is fixed as shown below and is compatible with:

- Self ventilated induction motors

Figure 2-2 Normal Duty I^2t Protection

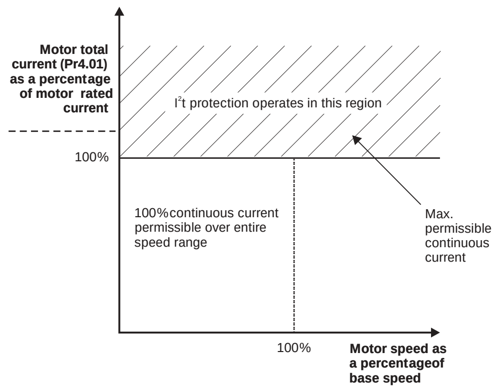


Heavy Duty (default)

For constant torque applications or applications which require a high overload capability (e.g. winders, hoists).The thermal protection is set to protect force ventilated induction motors and permanent magnet servo motors by default. This is illustrated in Figure 2-3. Motor I^2t protection defaults to be compatible with:

- Forced ventilation induction motors
- Permanent magnet servo motors

Figure 2-3 Heavy Duty I^2t Protection



OPERATING MODE	CLOSED LOOP CURRENT	OPEN LOOP CURRENT
Normal Duty overload with motor rated current = drive rated current	110%	110%
Heavy Duty overload with motor rated current = drive rated current	175%	150%
Heavy Duty overload with a typical 4 pole motor	200%	175%

Rating table information

Unidrive SP Maximum permissible continuous output current @40°C (104° F) ambient

MODEL	NORMAL DUTY								HEAVY DUTY							
	Nominal rating		Maximum permissible continuous output current (A) for the following switching frequencies						Nominal rating		Maximum permissible continuous output current (A) for the following switching frequencies					
	kW	HP	3kHz	4kHz	6kHz	8kHz	12kHz	16kHz	kW	HP	3kHz	4kHz	6kHz	8kHz	12kHz	16kHz
SP1201	1.1	1.5	5.2						0.75	1	4.3					
SP1202	1.5	2	6.8						1.1	1.5	5.8					
SP1203	2.2	3	9.6						1.5	2	7.5					
SP1204	3	3	11						2.2	3	10.6					
SP2201	4	5	15.5						3	3	12.6					
SP2202	5.5	7.5	22						4	5	17					
SP2203	7.5	10	28						5.5	7.5	25					
SP3201	11	15	42						7.5	10	31					
SP3202	15	20	54						11	15	42					
SP1401	1.1	1.5	2.8						0.75	1	2.1					
SP1402	1.5	2	3.8						1.1	2	3.0					
SP1403	2.2	3	5.0						1.5	3	4.2					4.0
SP1404	3	5	6.9	6.8					2.2	3	5.8					
SP1405	4	5	8.8						3	5	7.6					
SP1406	5.5	7.5	11				9.5	7.5	4	5	9.5			9.4	7.1	5.6
SP2401	7.5	10	15.3						5.5	10	13					
SP2402	11	15	21						7.5	10	16.5					
SP2403	15	20	29						11	20	25					
SP3401	18.5	25	35						15	25	32					
SP3402	22	30	43						18.5	30	40					
SP3403	30	40	56						22	30	46					
SP3501	3	3	5.4						2.2	2	4.1					
SP3502	4	5	6.1						3	3	5.4					
SP3503	5.5	7.5	8.4						4	5	6.1					
SP3504	7.5	10	11						5.5	7.5	9.5					
SP3505	11	15	16						7.5	10	12					
SP3506	15	20	22						11	15	18					
SP3507	18.5	25	27						15	20	22					

Rating table information

In addition, the design of Unidrive SP allows for IP54 mounting of the heatsink when through panel mounted*

Unidrive SP Maximum permissible continuous output current @40ºC (104° F) with IP54 insert and standard fan fitted

<table>
<tr><th rowspan="3">MODEL</th><th colspan="8">NORMAL DUTY</th><th colspan="8">HEAVY DUTY</th></tr>
<tr><th colspan="2">Nominal rating</th><th colspan="6">Maximum permissible continuous output current (A) for the following switching frequencies</th><th colspan="2">Nominal rating</th><th colspan="6">Maximum permissible continuous output current (A) for the following switching frequencies</th></tr>
<tr><th>kW</th><th>HP</th><th>3kHz</th><th>4kHz</th><th>6kHz</th><th>8kHz</th><th>12kHz</th><th>16kHz</th><th>kW</th><th>HP</th><th>3kHz</th><th>4kHz</th><th>6kHz</th><th>8kHz</th><th>12kHz</th><th>16kHz</th></tr>
<tr><td>SP1201</td><td>1.1</td><td>1.5</td><td colspan="6">5.2</td><td>0.75</td><td>1</td><td colspan="6">4.3</td></tr>
<tr><td>SP1202</td><td>1.5</td><td>2</td><td colspan="5">6.8</td><td>5.7</td><td>1.1</td><td>1.5</td><td colspan="5">5.8</td><td>5.7</td></tr>
<tr><td>SP1203</td><td>2.2</td><td>3</td><td>9.6</td><td>9.5</td><td>8.8</td><td>8.1</td><td>6.8</td><td>5.7</td><td>1.5</td><td>2</td><td colspan="4">7.5</td><td>6.8</td><td>5.7</td></tr>
<tr><td>SP1204</td><td>3</td><td>3</td><td>10.3</td><td>9.8</td><td>8.9</td><td>8.0</td><td>6.6</td><td>5.3</td><td>2.2</td><td>3</td><td>10.3</td><td>9.8</td><td>8.9</td><td>8</td><td>6.6</td><td>5.3</td></tr>
<tr><td>SP2201</td><td>4</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP2202</td><td>5.5</td><td>7.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td>4</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP2203</td><td>7.5</td><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td>5.5</td><td>7.5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP1401</td><td>1.1</td><td>1.5</td><td colspan="5">2.8</td><td>2.2</td><td>0.75</td><td>1</td><td colspan="6">2.1</td></tr>
<tr><td>SP1402</td><td>1.5</td><td>2</td><td colspan="4">3.8</td><td>3.2</td><td>2.2</td><td>1.1</td><td>2</td><td colspan="5">3</td><td>2.2</td></tr>
<tr><td>SP1403</td><td>2.2</td><td>3</td><td colspan="3">5</td><td>4.6</td><td>3.1</td><td>2.2</td><td>1.5</td><td>3</td><td colspan="4">4.2</td><td>3.1</td><td>2.2</td></tr>
<tr><td>SP1404</td><td>3</td><td>5</td><td colspan="2">6.9</td><td>5.6</td><td>4.6</td><td>3.1</td><td>2.2</td><td>2.2</td><td>3</td><td colspan="2">5.8</td><td>5.6</td><td>4.6</td><td>3.1</td><td>2.2</td></tr>
<tr><td>SP1405</td><td>4</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP1406</td><td>5.5</td><td>7.5</td><td>8</td><td>7.1</td><td>5.6</td><td>4.6</td><td>3.1</td><td></td><td>4</td><td>5</td><td>8</td><td>7.1</td><td>5.6</td><td>4.6</td><td>3.1</td><td></td></tr>
<tr><td>SP2401</td><td>7.5</td><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td>5.5</td><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP2402</td><td>11</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td></td><td>7.5</td><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SP2403</td><td>15</td><td>20</td><td></td><td></td><td></td><td></td><td></td><td></td><td>11</td><td>20</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

* Requires fitment of IP54 insert to drive heatsink.

Rating table information

Unidrive SP Maximum permissible continuous output current @50ºC (122° F) ambient

MODEL	NORMAL DUTY								HEAVY DUTY							
	Nominal rating		Maximum permissible continuous output current (A) for the following switching frequencies						Nominal rating		Maximum permissible continuous output current (A) for the following switching frequencies					
	kW	HP	3kHz	4kHz	6kHz	8kHz	12kHz	16kHz	kW	HP	3kHz	4kHz	6kHz	8kHz	12kHz	16kHz
SP1201	1.1	1.5	5.2						0.75	1	4.3					
SP1202	1.5	2	6.8						1.1	1.5	5.8					
SP1203	2.2	3	9.6				8.2	7.1	1.5	2	7.5					7.0
SP1204	3	3	11		10.5	9.6	8.1	6.7	2.2	3	10.5		10.5	9.6	8.1	6.7
SP2201	4	5							3	3						
SP2202	5.5	7.5							4	5						
SP2203	7.5	10							5.5	7.5						
SP3201	11	15							7.5	10						
SP3202	15	20							11	15						
SP1401	1.1	1.5	2.8						0.75	1	2.1					
SP1402	1.5	2	3.8					2.9	1.1	2	3.0					2.9
SP1403	2.2	3	5.0				4.0	2.9	1.5	3	4.2				4.0	2.9
SP1404	3	5	6.9		6.7	5.6	4.0	2.9	2.2	3	5.8			5.6	4.0	2.9
SP1405	4	5							3	5						
SP1406	5.5	7.5	9.5	8.5	6.9	5.6	4.0	2.8	4	5	9.5	8.5	6.9	5.6	4.0	2.8
SP2401	7.5	10							5.5	10						
SP2402	11	15							7.5	10						
SP2403	15	20							11	20						
SP3401	18.5	25							15	25						
SP3402	22	30							18.5	30						
SP3403	30	40							22	30						
SP3501	3	3							2.2	2						
SP3502	4	5							3	3						
SP3503	5.5	7.5							4	5						
SP3504	7.5	10							5.5	7.5						
SP3505	11	15							7.5	10						
SP3506	15	20							11	15						
SP3507	18.5	25							15	20						

Cable and Fusing differences

Unidrive 1

Cable sizes and fuses

Model	Typical input current	Fuse rating	Cable size	
UNI 1201	2.4 A	6A	1.5mm^2	16 AWG
UNI 1401	3.0 A			
UNI 1202	3.5 A	10A	2.5mm^2	14 AWG
UNI 1402	4.3 A			
UNI 1203	4.6 A	10A	2.5mm^2	14 AWG
UNI 1403	5.8 A			
UNI 1204	6.5 A	10A	2.5mm^2	14 AWG
UNI 1404	8.2 A			
UNI 1205	8.6 A	16A	2.5mm^2	14 AWG
UNI 1405	10.0 A			
UNI 2201	10.8 A	16A	2.5mm^2	14 AWG
UNI 2401	13.0 A			
UNI 2202	14.3 A	20A	4mm^2	10 AWG
UNI 2402	17.0 A			
UNI 2203	19.8 A	35A	4mm^2	10 AWG
UNI 2403	21.0 A			
UNI 3201	26 A	40A	6mm^2	8 AWG
UNI 3401	27 A			
UNI 3402	32 A	50A	10mm^2	6 AWG
UNI 3202	39 A	60A	10mm^2	6 AWG
UNI 3403	40 A			
UNI 3203	53 A	70A	16mm^2	4 AWG
UNI 3404	52 A			
UNI 3204	78 A	80A	25mm^2	4 AWG
UNI 3405	66 A			

Unidrive SP

Input current, fuse and cable size ratings (European)

Model	Typical input current A	Maximum continuous input current A	Fuse rating IEC gG A	Cable size EN60204 Input mm^2	Output mm^2
SP1201	7.1	9.5	10	1.5	1
SP1202	9.2	11.3	12	1.5	1
SP1203	12.5	16.4	20	4	1
SP1204	15.4	19.1	20	4	1.5
SP2201	13.4	18.1	20	4	2.5
SP2202	18.2	22.6	25	4	4
SP2203	24.2	28.3	32	6	6
SP3201	35.4	43.1	50	16	16
SP3202	46.8	54.3	63	25	25
SP1401	4.1	4.8	6	1	1
SP1402	5.1	5.8	6	1	1
SP1403	6.8	7.4	8	1	1
SP1404	9.3	10.6	12	1.5	1
SP1405	10	11	12	1.5	1
SP1406	12.6	13.4	16	2.5	1.5
SP2401	15.7	17	20	4	2.5
SP2402	20.2	21.4	25	4	4
SP2403	26.6	27.6	32	6	6
SP3401	34.2	36.2	40	10	10
SP3402	40.2	42.7	50	16	16
SP3403	51.3	53.5	63	25	25
SP3501	5	6.7	8	1	1
SP3502	6	8.2	10	1	1
SP3503	7.8	11.1	12	1.5	1
SP3504	9.9	14.4	16	2.5	1.5
SP3505	13.8	18.1	20	4	2.5
SP3506	18.2	22.2	25	4	4
SP3507	22.2	26	32	6	6

Dynamic Braking comparison

Unidrive 1 and Unidrive SP both have on board braking transistors as standard (except size 5 power modules with Unidrive 1), the Unidrive SP has the option of a zero space braking resistor mounted in the drive heatsink.

The optional braking resistor is of a failsafe design, which does not require external thermal protection circuitry.

Recommended Unidrive 1 braking resistor sizes

BRAKING RESISTOR VALUES

Model	Minimum Resistance Ω	Instantaneous Power Rating kW
UNI 1201 to UNI 1205	20	15
UNI 1401 to UNI 1405	40	
UNI 2201	20	15
UNI 2401	40	
UNI 2202, UNI 2203	15	20
UNI 2402, UNI 2403	30	
UNI 3201 to UNI 3205	5	60
UNI 3401 to UNI 3405	10	
UNI 4401 to UNI 4405	5	120

Recommended Unidrive SP braking resistor sizes

BRAKING RESISTOR VALUES

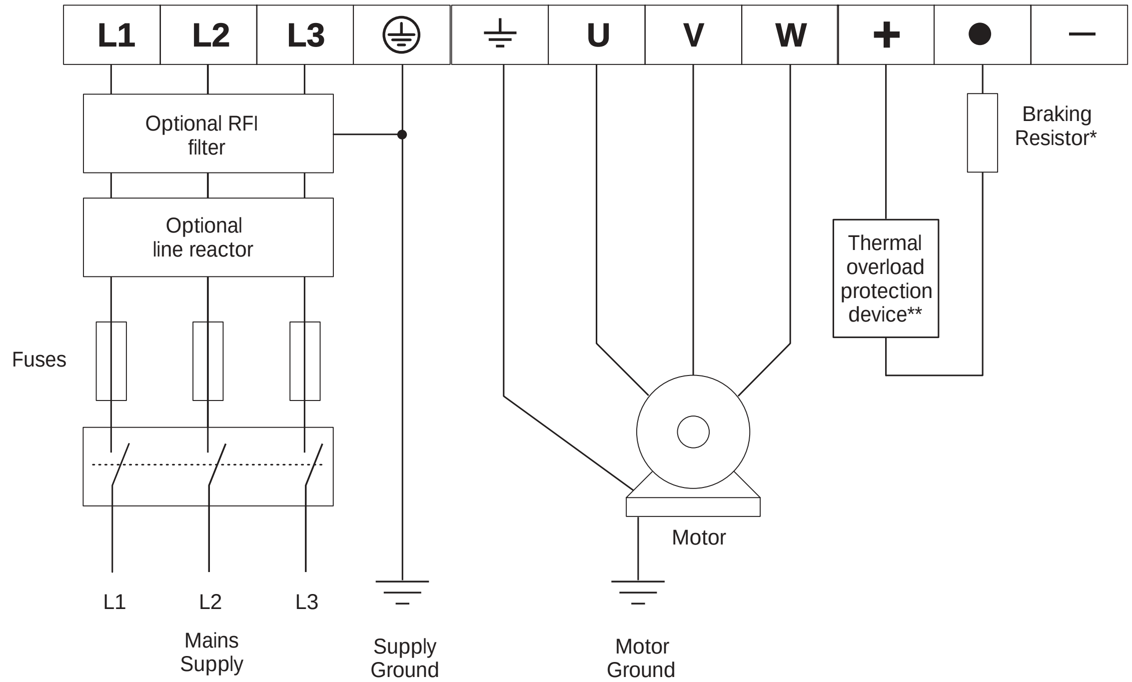
Minimum resistance values and peak power rating for the braking resistor at 40ºC (104ºF)

Model	Minimum Resistance Ω	Instantaneous Power Rating kW
SP1201 to SP1203	40	3.8
SP1204	27	5.6
SP2201	15	10
SP2202		
SP2203		
SP3201		
SP3202		
SP1401 to SP1404	75	8.1
SP1405 to SP1406	53	11.4
SP2401	30	20
SP2402		
SP2403		
SP3401		
SP3402		
SP3403		
SP3501		
SP3502		
SP3503		
SP3504		
SP3505		
SP3506		
SP3507		

Power terminal comparison

Unidrive 1

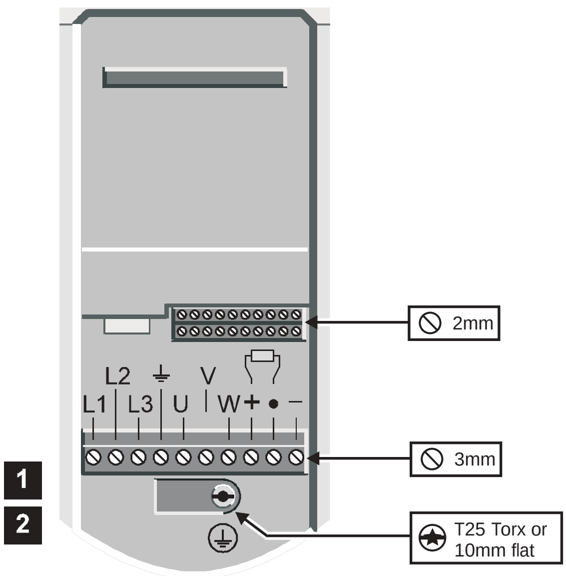
Below are shown the power wiring connections for Unidrive sizes 1~3.

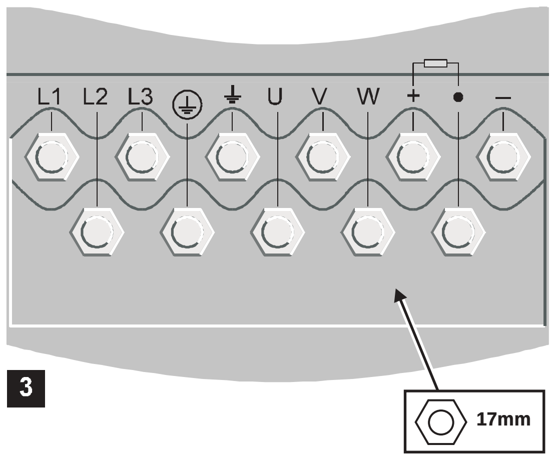


* A braking resistor can be connected as shown for Unidrive sizes 1-4 only. Unidrive size 5 requires a braking option module to be fitted

** A thermal overload protection device should be connected and must interrupt the AC supply on tripping. This applies to all sizes of Unidrive where a braking resistor is used.

For sizes 1~2 power connections are made via plug in power terminals, on Ucdrive 1 size 3 the power connections are made via 16mm stud connections.





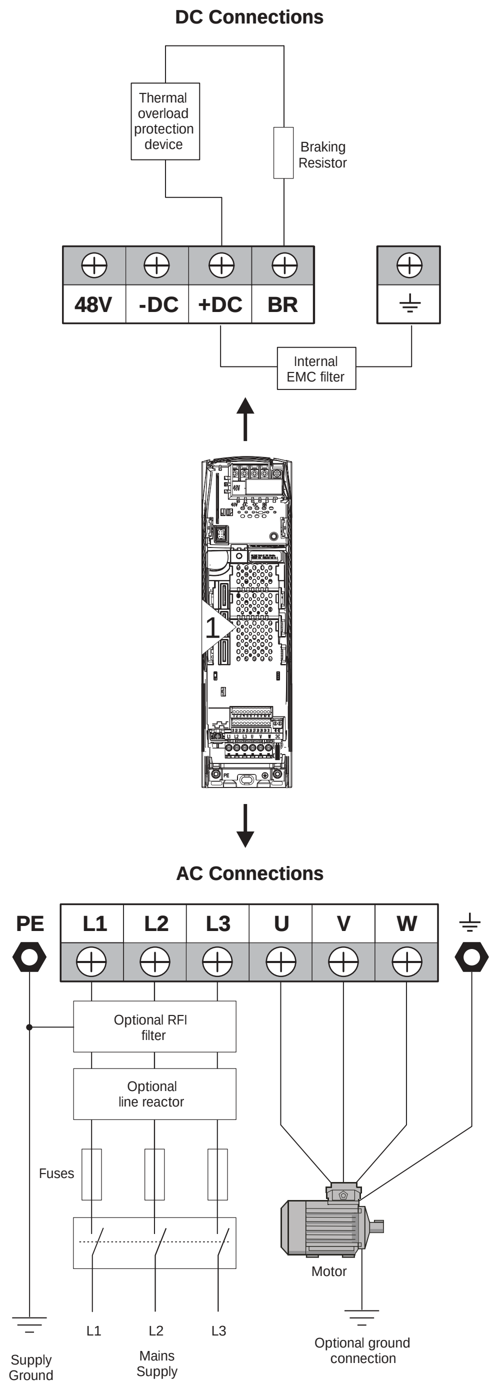
Power terminal comparison

Unidrive SP

Below are shown the power wiring connections for Unidrive SP sizes 1~2.

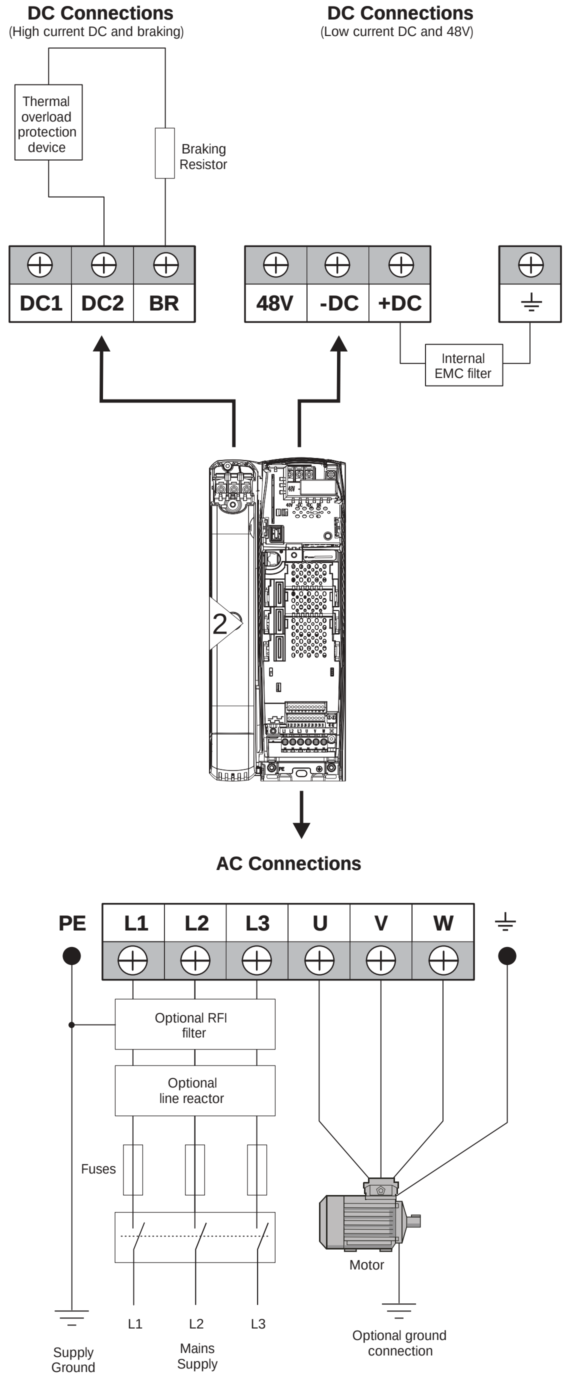
AC AND DC CONNECTIONS

Unidrive SP size 1 power connections



On a Unidrive SP size 1, the AC connections (Power and Motor) are made via a plug-in terminal block, DC power connections are made via a fixed terminal block situated at the top of the drive. (Access to the DC bus connections is made by removing the upper drive cover.)

Unidrive SP size 2 power connections

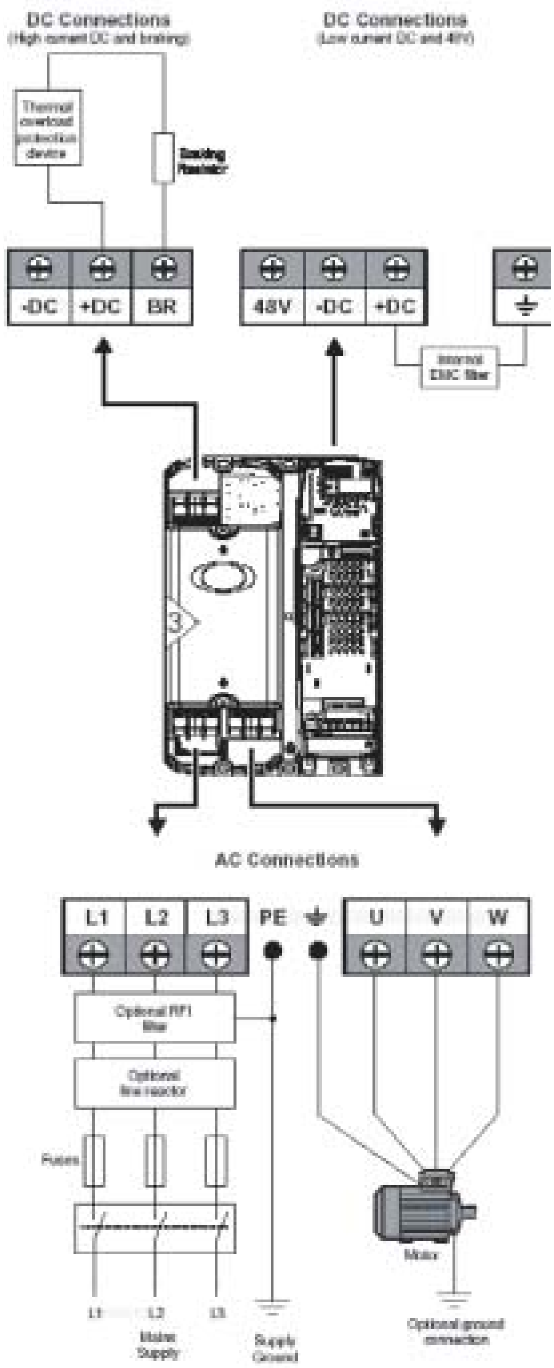


On a Unidrive SP size 2, the AC connections (Power and Motor) are made via a plug-in terminal block, DC power connections are made via fixed terminal block (s) situated at the top of the drive. (Access to the DC bus connections is made by removing the upper drive cover.)

Power terminal comparison

Unidrive SP

Below are shown the power wiring connections for Unidrive SP sizes 3.



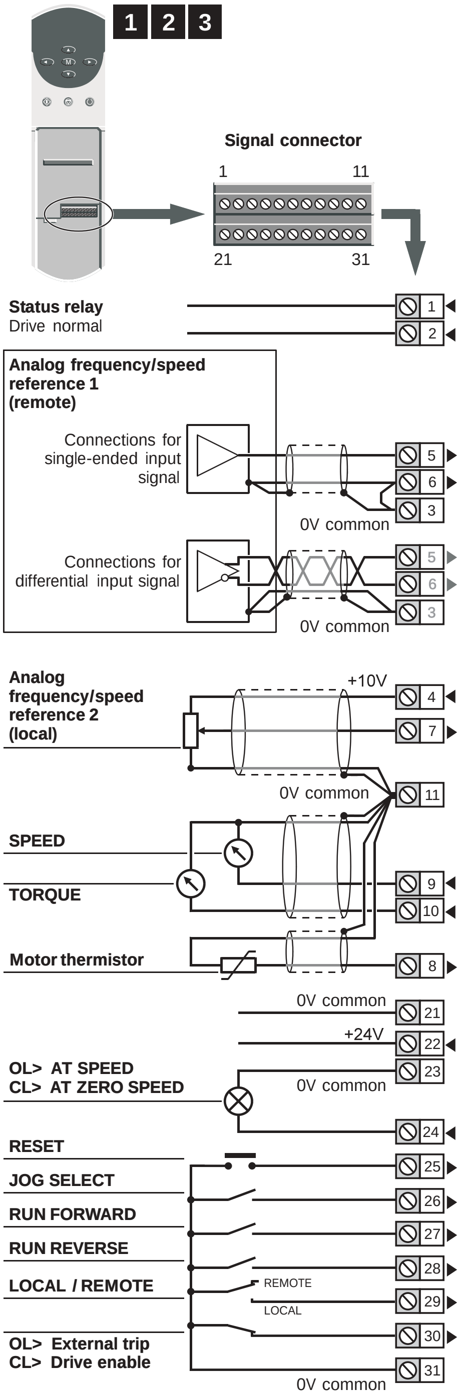
On a Unidrive SP size 3, the AC connections (Power and Motor) are made via fixed terminal block, DC power connections are made via a fixed terminal block situated at the top of the drive. (Access to the DC bus connections is made by removing the upper drive cover.)

Control terminal comparison

For both Unidrive 1 and Unidrive SP, the default control terminal connections are not drive size dependant.

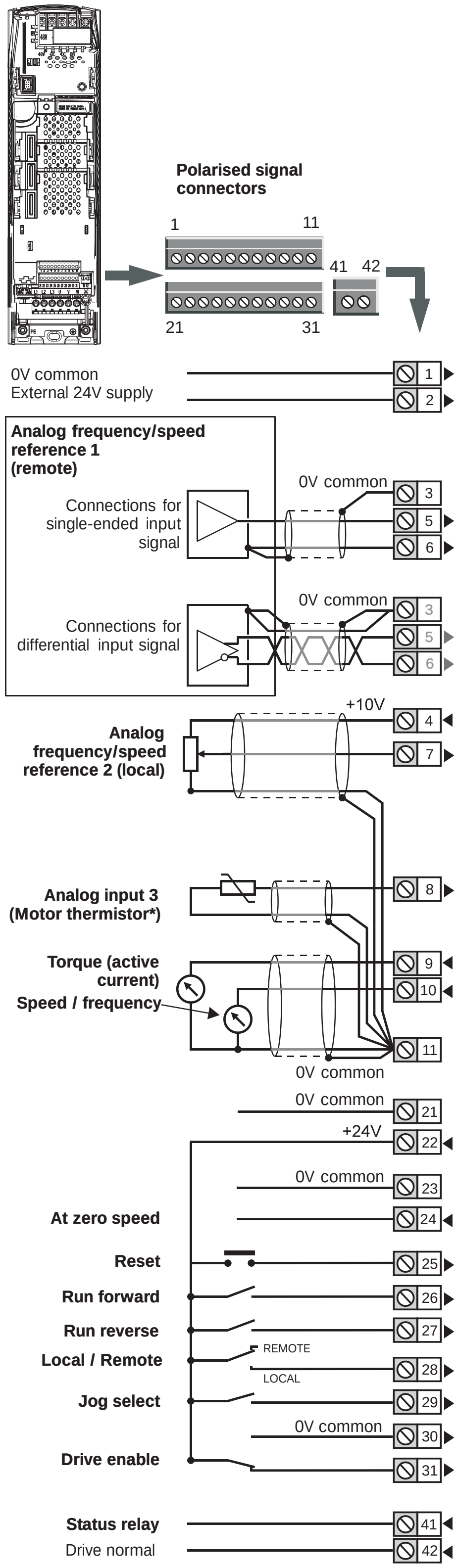
Unidrive 1 (Sizes 1-3)

Unidrive default terminal functions



Unidrive SP (Sizes 1-3)

Unidrive default terminal functions



*Pr 7.15 must be set to th for thermistor input

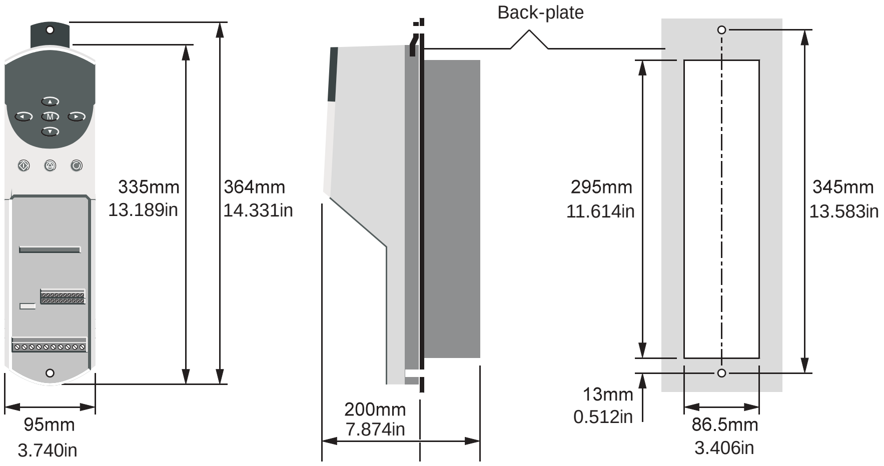
Installation comparison

Unidrive size 1 Overall Dimensions

		Dimensions				
Size 1 chassis		**H**	**W**	**D**	**F**	**R**
Unidrive 1	mm	366mm	95mm	200mm	120mm	80mm
	in	14.409in	3.740in	7.874in	4.724in	3.150in
Unidrive SP	mm	368mm	100mm	219mm	139mm	≤80mm
	in	14.488in	3.937in	8.622in	5.472in	3.150in

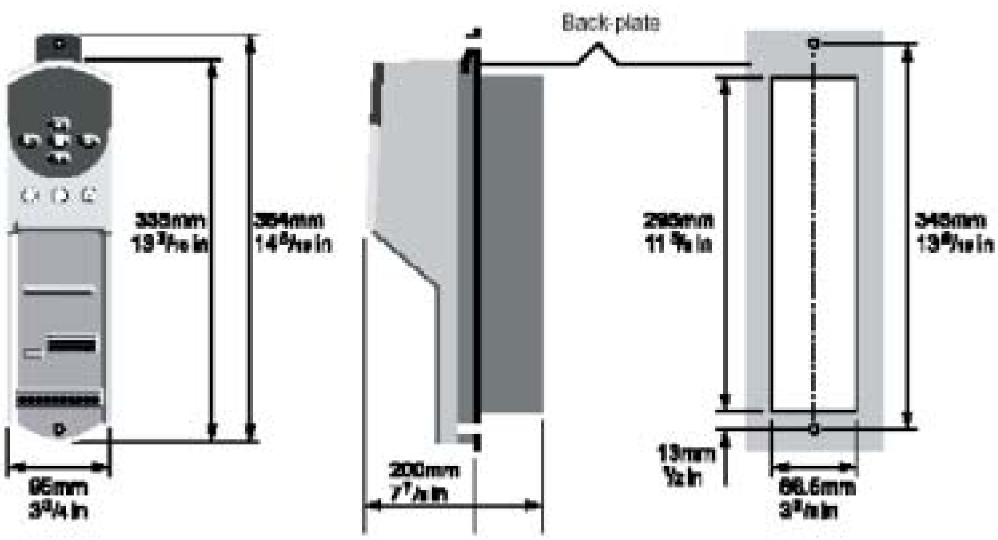
Unidrive 1 size 1 Dimensions (Surface mounting)

Model size 1



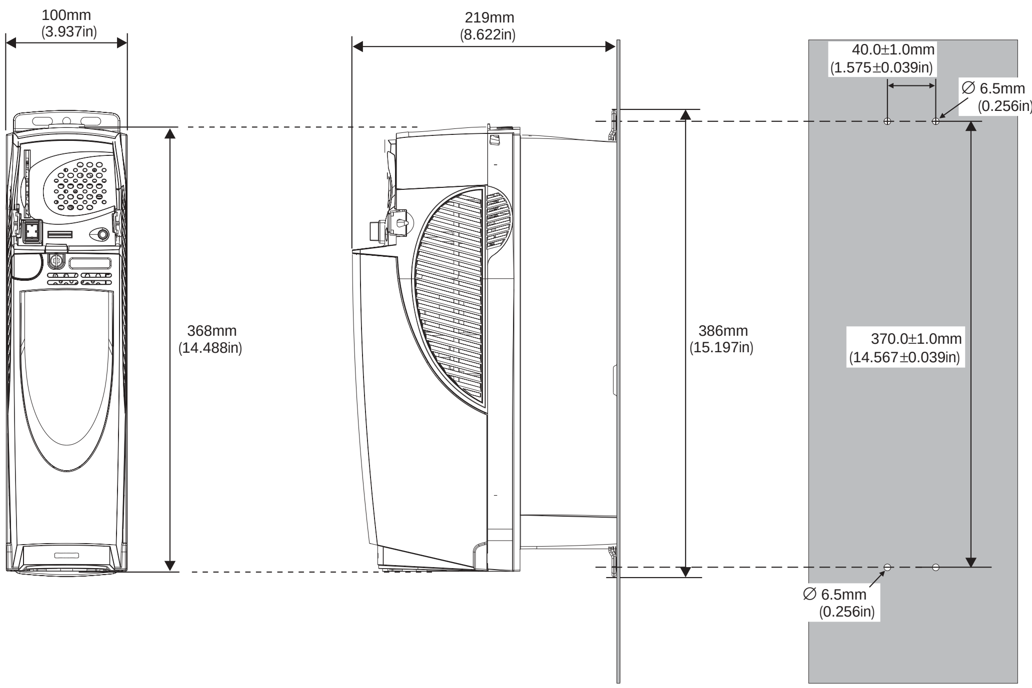
Unidrive 1 size 1 Dimensions (Through panel mounting)

Model size 1

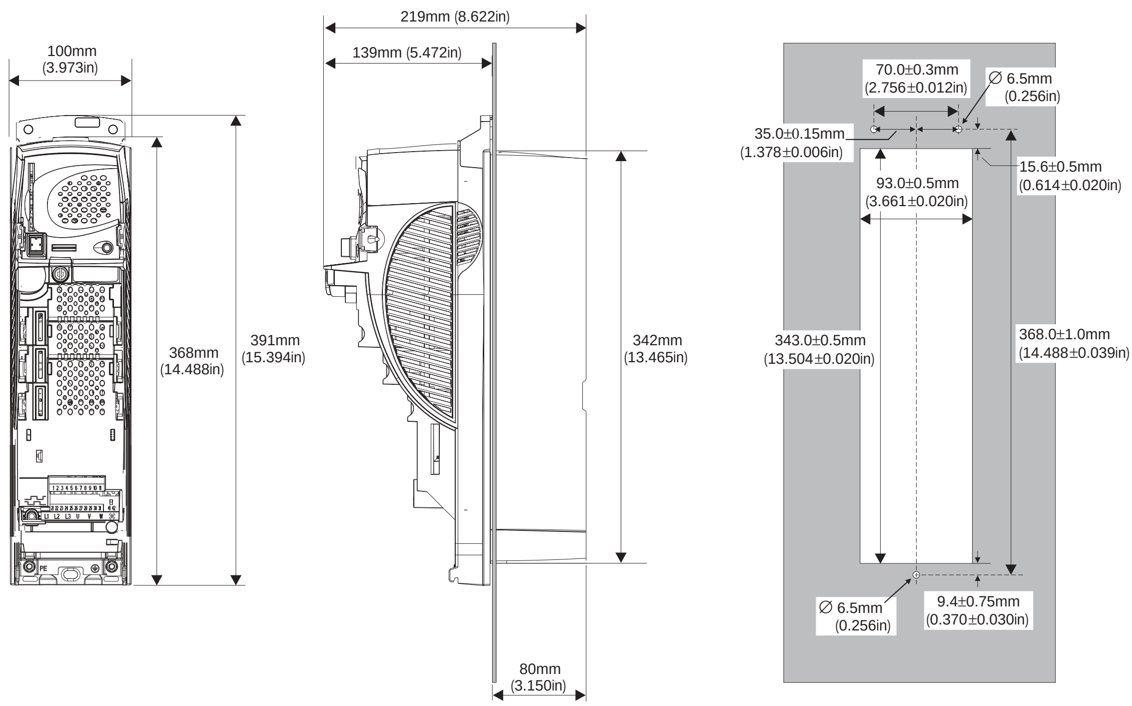


Installation comparison

Unidrive SP size 1 Dimensions (Surface mounting)



Unidrive SP size 1 Dimensions (Through panel mounting)

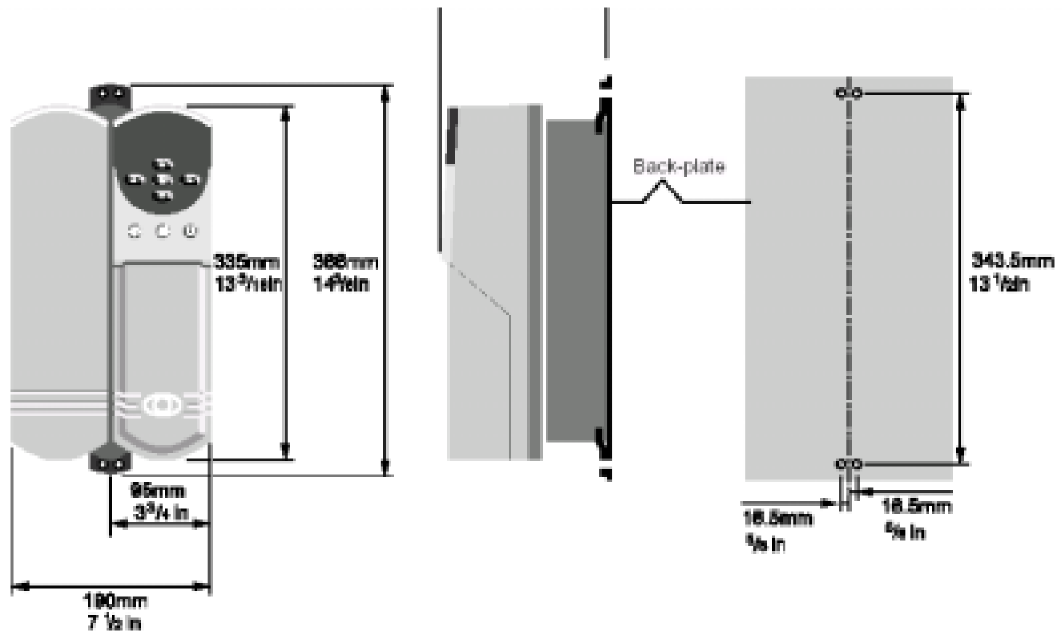


Installation comparison

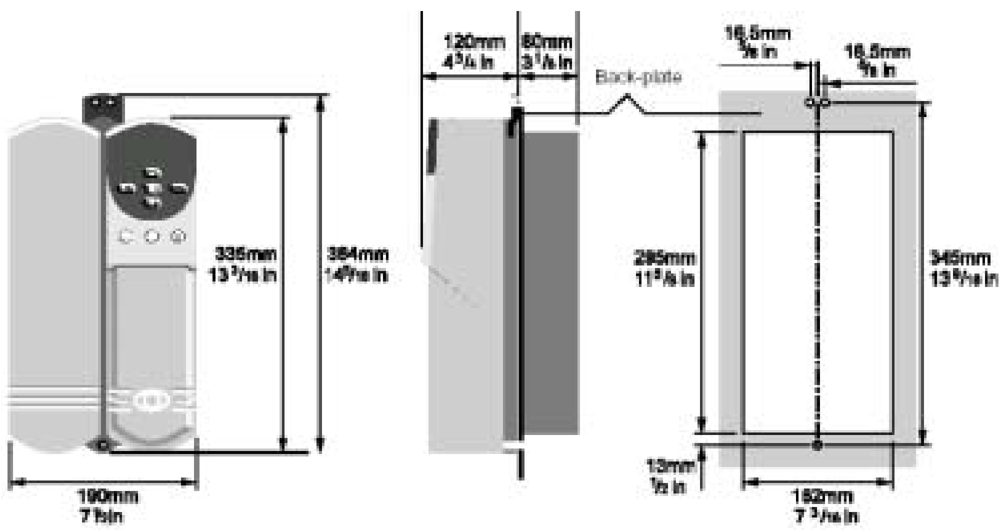
Unidrive size 2 Overall Dimensions

		Dimensions				
Size 2 chassis		**H**	**W**	**D**	**F**	**R**
Unidrive 1	mm	366mm	190mm	200mm	120mm	80mm
	in	14.409in	7.480in	7.874in	4.724in	3.150in
Unidrive SP	mm	368mm	155mm	219mm	139mm	≤80mm
	in	14.488in	3.937in	8.622in	5.472in	3.150in

Unidrive 1 size 2 Dimensions (Surface mounting)

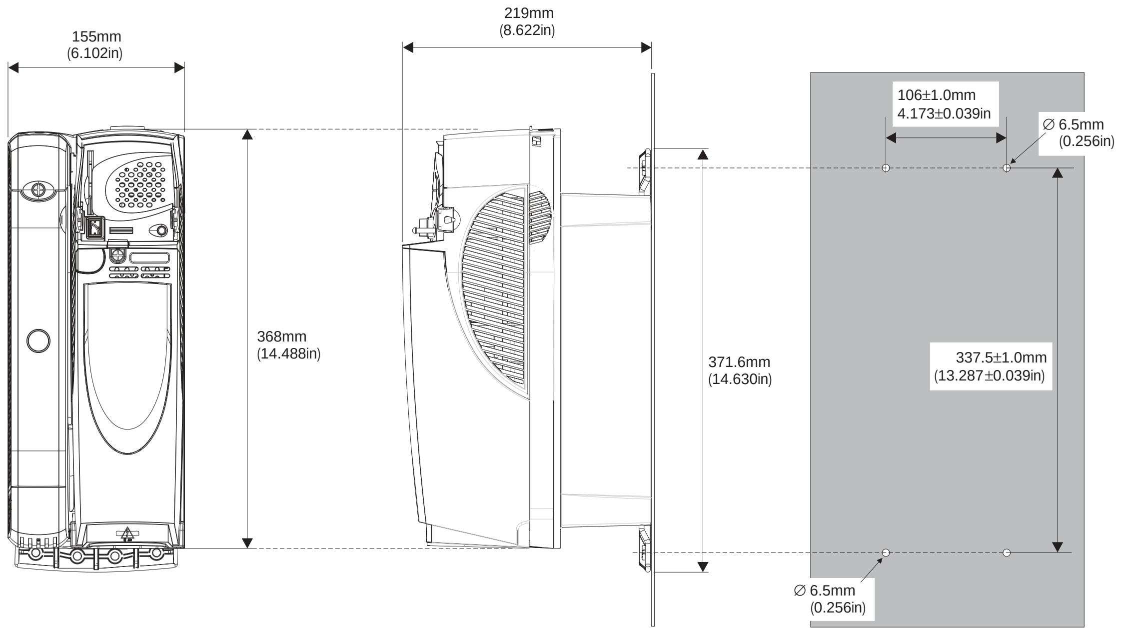


Unidrive 1 size 2 Dimensions (Through panel mounting)

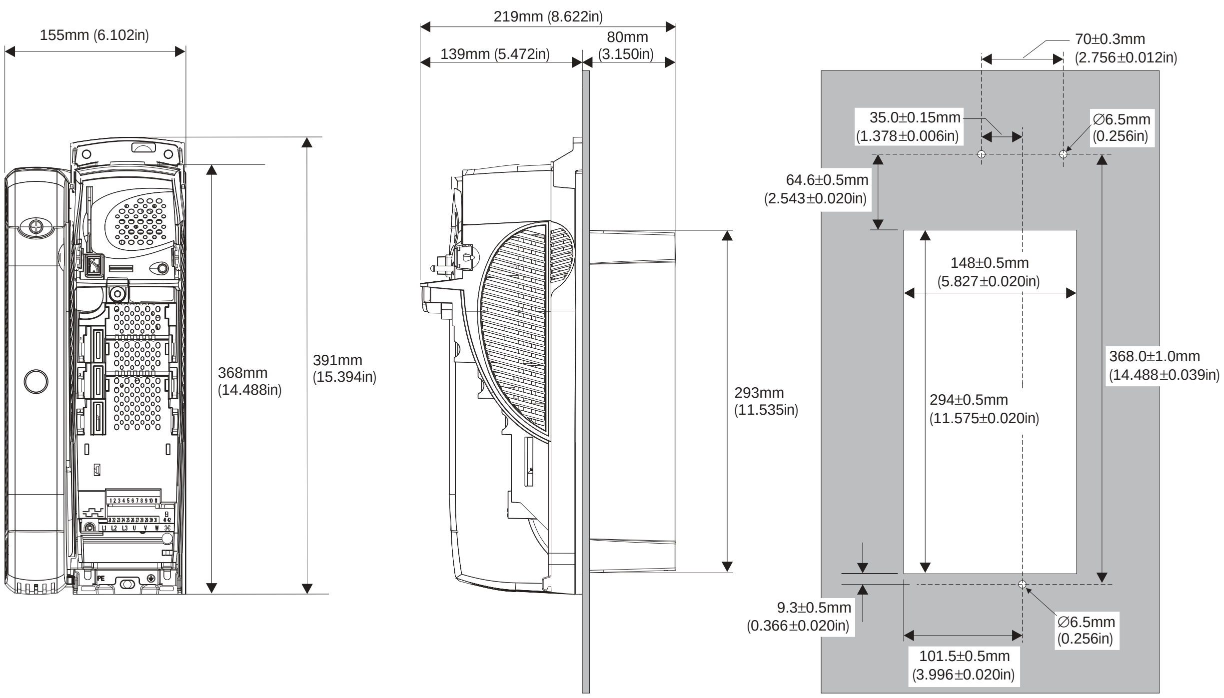


Installation comparison

Unidrive SP size 2 Dimensions (Surface mounting)



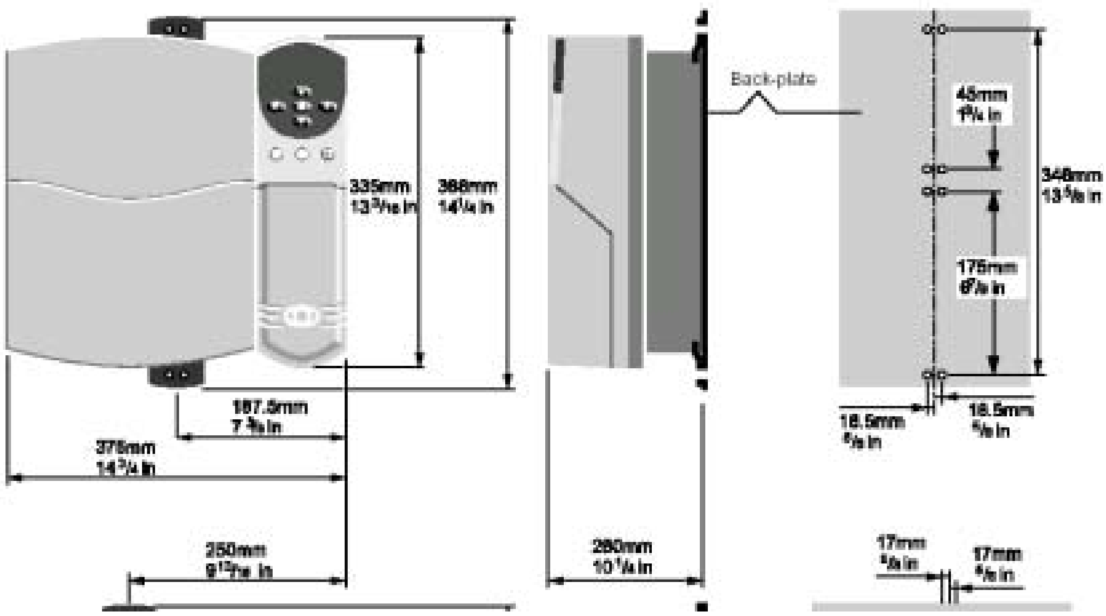
Unidrive SP size 2 Dimensions (Through panel mounting)



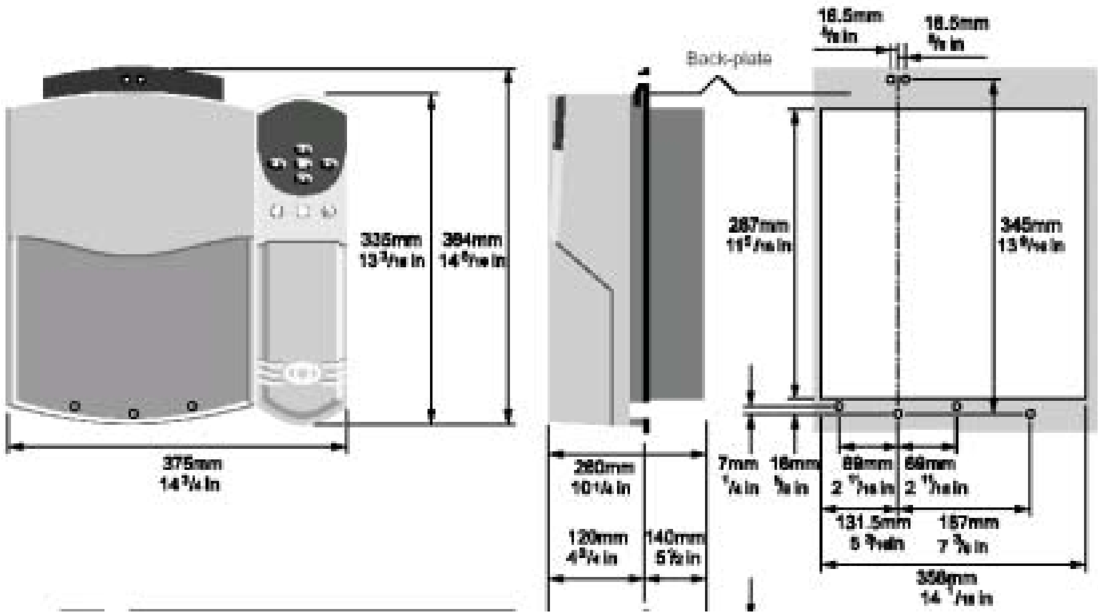
Unidrive size 3 Overall Dimensions

		Dimensions				
Size 3 chassis		**H**	**W**	**D**	**F**	**R**
Unidrive 1	mm	368mm	375mm	260mm	120mm	140mm
	in	14.488in	14.764in	10.236in	4.724in	5.512in
Unidrive SP	mm	368mm	250mm	260mm	140mm	≤120mm
	in	14.488in	9.843in	10.236in	5.512in	4.724in

Unidrive 1 size 3 Dimensions (Surface mounting)

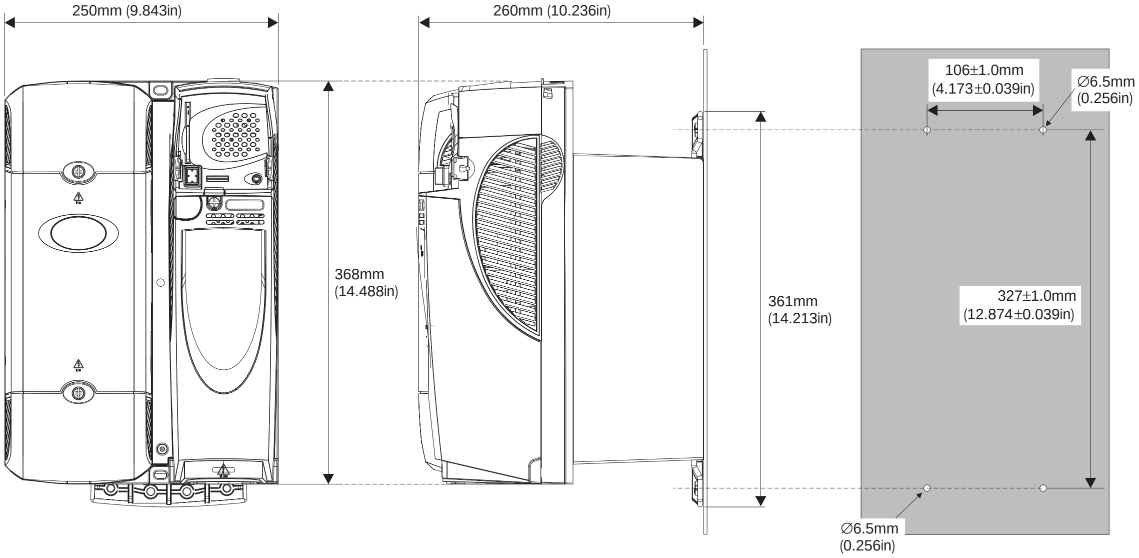


Unidrive 1 size 3 Dimensions (Through panel mounting)

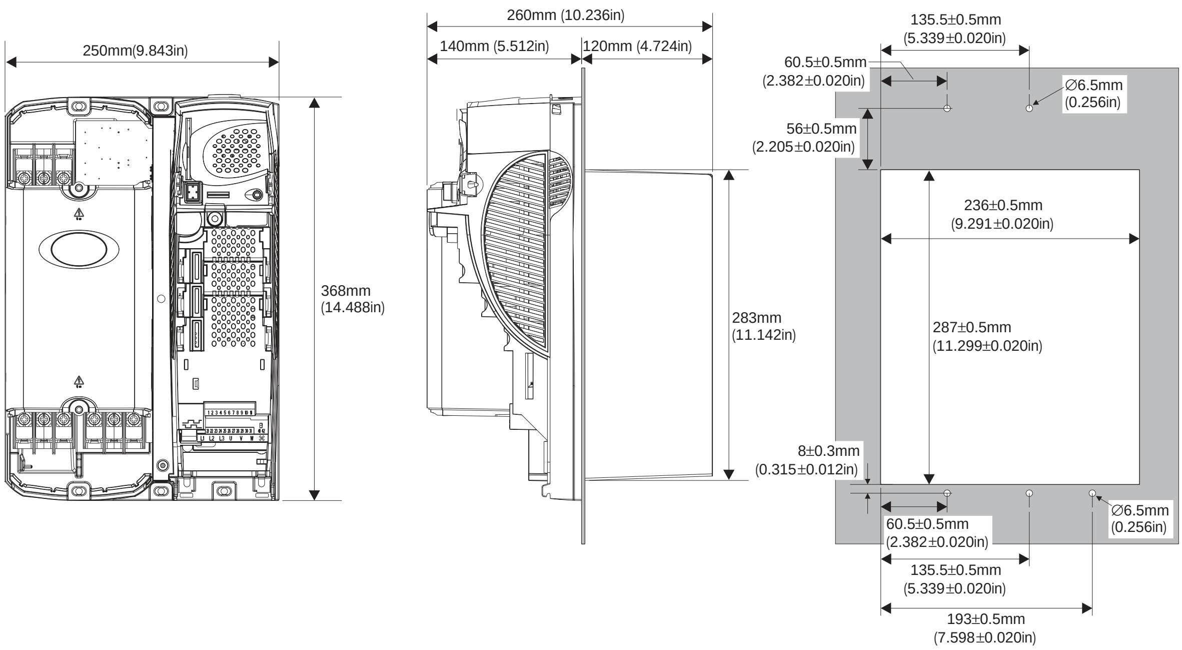


Installation comparison

Unidrive SP size 3 Dimensions (Surface mounting)



Unidrive SP size 3 Dimensions (Through panel mounting)



Drive losses

Unidrive 1 power losses (Size 1~3) @ 40ºC

Power dissipation (all versions)

Model	kW	hp	3kHz	4.5kHz	6kHz	9kHz	12kHz
UNI 1401	0.75	1.0	80	80	90	90	90
UNI 1402	1.1	1.5	90	90	100	100	110
UNI 1403	1.5	2.0	100	110	110	120	130
UNI 1404	2.2	3.0	130	130	130	150	150
UNI 1405	4.0	5.0	180	190	190	190	170
UNI 2401	5.5	7.5	210	230	250	280	310
UNI 2402	7.5	10	270	290	310	320	310
UNI 2403	11.0	15	400	380	360	330	310
UNI 3401	15.0	20	570	620	670	660	630
UNI 3402	18.5	25	660	720	730	660	630
UNI 3403	22.0	30	730	800	770	730	700
UNI 3404	30.0	40	950	830	790	740	710
UNI 3405	37.0	50	1,090	990	920	850	800

Unidrive SP power losses (Size 1~3)

MODEL	Drive losses (W) taking into consideration any current de-rating for the given conditions														
	NORMAL DUTY								HEAVY DUTY							
	Nominal rating		3kHz	4kHz	6kHz	8kHz	12kHz	16kHz	Nominal rating		3kHz	4kHz	6kHz	8kHz	12kHz	16kHz
	kW	HP							kW	HP						
SP1201	1.1	1.5	75	78	83	88	98	108	0.75	1	69	72	76	81	90	99
SP1202	1.5	2	87	90	96	102	113	125	1.1	1.5	80	83	88	93	104	114
SP1203	2.2	3	110	113	121	128	142	156	1.5	2	93	96	102	108	121	133
SP1204	3	3	119	123	132	140	157	174	2.2	3	116	120	128	136	153	170
SP2201	4	5							3	3						
SP2202	5.5	7.5							4	5						
SP2203	7.5	10							5.5	7.5						
SP3201	11	15							7.5	10						
SP3202	15	20							11	15						
SP1401	1.1	1.5	67	72	80	89	107	125	0.75	1	61	65	73	81	96	111
SP1402	1.5	2	76	81	92	102	124	145	1.1	2	69	74	83	92	110	129
SP1403	2.2	3	87	93	106	119	144	170	1.5	3	79	85	96	108	131	150
SP1404	3	5	105	113	130	146	178	185	2.2	3	94	102	116	130	146	150
SP1405	4	5							3	5						
SP1406	5.5	7.5	143	155	180	204	226	225	4	5	128	139	161	181	182	184
SP2401	7.5	10							5.5	10						
SP2402	11	15							7.5	10						
SP2403	15	20							11	20						
SP3401	18.5	25							15	25						
SP3402	22	30							18.5	30						
SP3403	30	40							22	30						
SP3501	3	3							2.2	2						
SP3502	4	5							3	3						
SP3503	5.5	7.5							4	5						
SP3504	7.5	10							5.5	7.5						
SP3505	11	15							7.5	10						
SP3506	15	20							11	15						
SP3507	18.5	25							15	20						

Quick Reference Comparison

Menu 1

Unidrive 1		Open Lp.	Open Lp.	Vector	Vector	Servo	Servo
Menu 1	Reference	Maximum	Default	Maximum	Default	Maximum	Default
1.01	Final reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.02	Pre-filter reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.03	Pre-ramp reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.04	Reference offset	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.05	Jog reference	0 - 400.0Hz	1.5Hz	0 - 4000rpm	50rpm	0 - 4000rpm	50rpm
1.06	Maximum Speed Clamp	0 - 1000.0Hz	50GB, 60USA	0 - 30000.0rpm	1500rpmGB, 1800USA	0 - 30000.0rpm	3000rpm
1.07	Minimum Speed Clamp	0 - Pr 1.06	0Hz	0 - Pr 1.06	0rpm	0 - Pr 1.06	0rpm
1.08	Negative Min speed select	0 - 1	0	0 - 1	0	0 - 1	0
1.09	Reference offset select	0 - 1	0	0 - 1	0	0 - 1	0
1.10	Bipolar select	0 - 1	0	0 - 1	0	0 - 1	0
1.11	Reference On	0 - 1		0 - 1		0 - 1	
1.12	Reverse select	0 - 1		0 - 1		0 - 1	
1.13	Jog select	0 - 1		0 - 1		0 - 1	
1.14	Reference selector	0 - 5	0 GB, 4 USA	0 - 5	0 GB, 4 USA	0 - 5	0 GB, 4 USA
1.15	Preset selector	0 - 9	0	0 - 9	0	0 - 9	0
1.16	Preset Reference select timer	0 - 400.0s	10s	0 - 400.0s	10s	0 - 400.0s	10s
1.17	Keypad reference	±1000Hz	0rpm	±30000rpm	0rpm	±30000rpm	0rpm
1.18	Precision reference	±1000Hz	0Hz	±30000rpm	0rpm	±30000rpm	0rpm
1.19	Precision reference trim	0 - 0.099Hz	0	0 - 0.99rpm	0	0 - 0.99rpm	0
1.20	Precision reference update disable	0 - 1	0	0 - 1	0	0 - 1	0
1.21	Preset reference 1	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.22	Preset reference 2	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.23	Preset reference 3	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.24	Preset reference 4	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.25	Preset reference 5	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.26	Preset reference 6	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.27	Preset reference 7	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.28	Preset reference 8	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.29	Skip Frequency 1	0 - 1000.0Hz	0Hz	0 - 30000.0rpm	0rpm	0 - 30000.0rpm	0rpm
1.30	Skip Frequency band 1	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.31	Skip Frequency 2	0 - 1000.0Hz	0	0 - 30000.0rpm	0	0 - 30000.0rpm	0
1.32	Skip Frequency band 2	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.33	Skip Frequency 3	0 - 1000.0Hz	0	0 - 30000.0rpm	0	0 - 30000.0rpm	0
1.34	Skip Frequency band 3	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.35	Reference in skip band	0 - 1		0 - 1		0 - 1	
1.36	Analogue reference 1	±1000Hz		±30000rpm		±30000rpm	
1.37	Analogue reference 2	±1000Hz		±30000rpm		±30000rpm	
1.38	Percentage trim	±100.0%		±100.0%		±100.0%	
1.39	Velocity feed forward	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.40	Feed forward select	0 - 1		0 - 1		0 - 1	
1.41	Analogue reference 2 select	0 - 1		0 - 1		0 - 1	
1.42	Preset reference select	0 - 1		0 - 1		0 - 1	
1.43	Keypad reference select	0 - 1		0 - 1		0 - 1	
1.44	Precision reference select	0 - 1		0 - 1		0 - 1	
1.45	Preset select bit 0	0 - 1		0 - 1		0 - 1	
1.46	Preset select bit 1	0 - 1		0 - 1		0 - 1	
1.47	Preset select bit 2	0 - 1		0 - 1		0 - 1	
1.48	Timer/Counter reset	0 - 1	0	0 - 1	0	0 - 1	0
1.49	Reference selected	0 - 5		0 - 5		0 - 5	
1.50	Preset selected	0 - 8		0 - 8		0 - 8	

Unidrive SP		Open Lp.	Open Lp.	Vector	Vector	Servo	Servo
Menu 1	Reference	Maximum	Default	Maximum	Default	Maximum	Default
1.01	Frequency/speed ref selected	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.02	Pre-skip filter reference	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.03	Pre-ramp ref	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.04	Reference offset	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.05	Jog reference	0 - 400.0Hz	0.0Hz	0 - 4000.0rpm	0.0rpm	0 - 4000.0rpm	0.0rpm
1.06 (21.01)	Maximum reference clamp	0 - 3000.0Hz	UK 50.0, USA 60.0	± 40,000.0rpm	UK 1500.0, USA 1800.0	± 40,000.0rpm	3000.0rpm
1.07 (21.02)	Minimum reference clamp	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.08	Negative minimum reference clamp enable	0 - 1	0	0 - 1	0	0 - 1	0
1.09	Reference offset select	0 - 1	0	0 - 1	0	0 - 1	0
1.10	Bipolar reference enable	0 - 1	0	0 - 1	0	0 - 1	0
1.11	Reference on	0 - 1		0 - 1		0 - 1	
1.12	Reverse selected	0 - 1		0 - 1		0 - 1	
1.13	Jog selected	0 - 1		0 - 1		0 - 1	
1.14 (21.03)	Reference selector	0 - 5	0	0 - 5	0	0 - 5	0
1.15	Preset selector	0 - 9		0 - 9		0 - 9	
1.16	Preset reference selector timer	0 - 400.0s	10.0s	0 - 400.0s	10.0s	0 - 400.0s	10.0s
1.17	Keypad control mode reference	0 - 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.18	Precision reference coarse	0 - 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.19	Precision reference fine	0.000Hz - 0.099Hz	0.0Hz	0.000rpm - 0.099rpm	0.0rpm	0.000rpm - 0.099rpm	0.0rpm
1.20	Precision reference update disable	0 - 1	0	0 - 1	0	0 - 1	0
1.21	Preset reference 1	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.22	Preset reference 2	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.23	Preset reference 3	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.24	Preset reference 4	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.25	Preset reference 5	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.26	Preset reference 6	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.27	Preset reference 7	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.28	Preset reference 8	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.29	Skip reference 1	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.30	Skip reference band 1	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.31	Skip reference 2	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.32	Skip reference band 2	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.33	Skip reference 3	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.34	Skip reference band 3	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.35	Reference in rejection zone	0 - 1		0 - 1		0 - 1	
1.36	Analogue reference 1	± 3000.0Hz	0	± 40,000.0rpm	0	± 40,000.0rpm	0
1.37	Analogue reference 2	± 3000.0Hz	0	± 40,000.0rpm	0	± 40,000.0rpm	0
1.38	Percentage trim	± 100.00%	0	± 100.00%	0	± 100.00%	0
1.39	Velocity feedforwards	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.40	Velocity feedforwards select	0 - 1		0 - 1		0 - 1	
1.41	Analogue reference 2 select	0 - 1	0	0 - 1	0	0 - 1	0
1.42	Preset reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.43	Keypad reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.44	Precision reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.45	Preset select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
1.46	Preset select bit 1	0 - 1	0	0 - 1	0	0 - 1	0
1.47	Preset select bit 2	0 - 1	0	0 - 1	0	0 - 1	0
1.48	References timer reset flag	0 - 1	0	0 - 1	0	0 - 1	0
1.49	Reference selected indicator	.1 - 5		.1 - 5		.1 - 5	
1.50	Preset reference selected indicator	.1 - 8		.1 - 8		.1 - 8	
1.51	Power-up keypad control mode reference	0 - 2	0	0 - 2	0	0 - 2	0

Menu 2

Menu 2	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
2.01	Post-ramp reference	±1000Hz		±30000rpm		±30000rpm	
2.02	Ramp enable			0 -1	1	0 -1	1
2.03	Ramp Hold	0 -1	0	0 -1	0	0 -1	0
2.04	Ramp mode	0 - 2	2	0 - 2	2	0 - 2	2
2.05	Ramp rate range select			1	0	1	1
2.06	S Ramp enable	0 - 1	0	0 - 1	0	0 - 1	0
2.07	S Ramp acceleration limit	0 - 3000.0s²/100Hz	3.1	0 - 30.000s²/1000rpm	1.5	0 - 30.000s²/1000rpm	0.03
2.08	Standard ramp voltage	0 - 800V	UK 750, USA 775	0 - 800V	UK 750, USA 775	0 - 800V	UK 750, USA 775
2.09	Reverse accel/decel select	0 - 1	0	0 - 1	0	0 - 1	0
2.10	Forward Acceleration selector	0 - 9	0	0 - 9	0	0 - 9	0
2.11	Accel 1 / Forward accel 1	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.12	Accel 2 / Forward accel 2	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.13	Accel 3 / Forward accel 3	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.14	Accel 4 / Forward accel 4	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.15	Accel 5 / Reverse accel 1	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.16	Accel 6 / Reverse accel 2	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.17	Accel 7 / Reverse accel 3	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.18	Accel 8 / Reverse accel 4	0 - 3200.0s/100Hz	5Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.19	Jog acceleration	0 - 3200.0s/100Hz	0.2Hz	0 - 3200s/1000rpm	0	0 - 32.000s/1000rpm	0
2.20	Forward Deceleration selector	0 - 9	0	0 - 9	0	0 - 9	0
2.21	Decel 1 / Forward decel 1	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.22	Decel 2 / Forward decel 2	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.23	Decel 3 / Forward decel 3	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.24	Decel 4 / Forward decel 4	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.25	Decel 5 / Reverse decel 1	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.26	Decel 6 / Reverse decel 2	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.27	Decel 7 / Reverse decel 3	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.28	Decel 8 / Reverse decel 4	0 - 3200.0s/100Hz	10Hz	0 - 3200s/1000rpm	2rpm	0 - 32.000s/1000rpm	0.2rpm
2.29	Jog deceleration	0 - 3200.0s/100Hz	0.2Hz	0 - 3200s/1000rpm	0	0 - 32.000s/1000rpm	0
2.30	Reverse acceleration selector	0 - 4	0	0 - 4	0	0 - 4	0
2.31	Reverse deceleration selector	0 - 4	0	0 - 4	0	0 - 4	0
2.32	Forward acceleration select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
2.33	Forward acceleration select bit 1	0 - 1	0	0 - 1	0	0 - 1	0
2.34	Forward acceleration select bit 2	0 - 1	0	0 - 1	0	0 - 1	0
2.35	Forward deceleration select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
2.36	Forward deceleration select bit 1	0 - 1	0	0 - 1	0	0 - 1	0
2.37	Forward deceleration select bit 2	0 - 1	0	0 - 1	0	0 - 1	0
2.38	Reverse acceleration select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
2.39	Reverse acceleration select bit 1	0 - 1	0	0 - 1	0	0 - 1	0
2.40	Reverse deceleration select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
2.41	Reverse deceleration select bit 1	0 - 1	0	0 - 1	0	0 - 1	0

Menu 2	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
2.01	Post-ramp reference	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
2.02	Ramp enable			0 - 1	0	0 - 1	0
2.03	Ramp hold	0 - 1	0	0 - 1	0	0 - 1	0
2.04	Ramp mode	0 - 2	1	0 - 1	1	0 - 1	1
2.05							
2.06	S Ramp enable	0 - 1	0	0 - 1	0	0 - 1	0
2.07	S Ramp acceleration limit	0.0 to 300.0s²/100Hz	3.1s²/100Hz	0.000 to 100.000s²/1000rpm	1.500s²/1000rpm	0.000 to 100.000s²/1000rpm	0.030s²/1000rpm
2.08	Standard ramp voltage	0 - DC volts set max v	375, 750, 895, 1075	0 - DC volts set max v	375, 750, 895, 1075	0 - DC volts set max v	375, 750, 895, 1075
2.09							
2.10	Acceleration rate selector	0 - 9	0	0 - 9	0	0 - 9	0
2.11	Acceleration rate 1	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.12	Acceleration rate 2	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.13	Acceleration rate 3	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.14	Acceleration rate 4	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.15	Acceleration rate 5	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.16	Acceleration rate 6	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.17	Acceleration rate 7	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.18	Acceleration rate 8	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.19	Jog acceleration rate	0.0 to 3200.0s/100Hz	0.2	0.000 to 3200.000s/1000rpm	0.000	0.000 to 3200.000s/1000rpm	0.000
2.20	Deceleration rate selector	0 - 9	0	0 - 9	0	0 - 9	0
2.21	Deceleration rate 1	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.22	Deceleration rate 2	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.23	Deceleration rate 3	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.24	Deceleration rate 4	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.25	Deceleration rate 5	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.26	Deceleration rate 6	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.27	Deceleration rate 7	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.28	Deceleration rate 8	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200
2.29	Jog deceleration rate	0.0 to 3200.0s/100Hz	0.2	0.000 to 3200.000s/1000rpm	0.000	0.000 to 3200.000s/1000rpm	0.000
2.30							
2.31							
2.32	Acceleration select bit 0	0 - 1		0 - 1		0 - 1	
2.33	Acceleration select bit 1	0 - 1		0 - 1		0 - 1	
2.34	Acceleration select bit 2	0 - 1		0 - 1		0 - 1	
2.35	Deceleration select bit 0	0 - 1		0 - 1		0 - 1	
2.36	Deceleration select bit 1	0 - 1		0 - 1		0 - 1	
2.37	Deceleration select bit 2	0 - 1		0 - 1		0 - 1	
2.38	Inertia compensation torque			± 1000.0%		± 1000.0%	

Menu 3

Menu 3	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
3.01	Final Speed / Slaving demand	±1000Hz		±30000rpm		±30000rpm	
3.02	Speed feedback			±30000rpm		±30000rpm	
3.03	Speed error			±30000rpm		±30000rpm	
3.04	Speed loop output			±30000rpm		±30000rpm	
3.05	Zero speed threshold	0 - 20Hz	1Hz	0 - 200rpm	5rpm	0 - 200rpm	5rpm
3.06	At speed lower limit	±1000Hz	1Hz	0 - 30000rpm	5rpm	0 - 30000rpm	5rpm
3.07	At speed upper limit	±1000Hz	1Hz	0 - 30000rpm	5rpm	0 - 30000rpm	5rpm
3.08	Overspeed threshold	±1000Hz	1000Hz	0 - 30000rpm	2000rpm	0 - 30000rpm	4000rpm
3.09	Absolute at speed detection select	0 - 1	0	0 - 1	0	0 - 1	0
3.10	Speed loop P gain			0 - 32000	200	32000	200
3.11	Speed loop I gain			0 -32000	100	32000	100
3.12	Speed loop D gain			0 - 32000	0	0	0
3.13	Enable frequency slaving	0 - 1	0				
3.14	Slaving ratio nominator	0 - 1.000	1.000				
3.15	Slaving ratio denominator	0.001 - 1.000	1.000				
3.16	Enable frequency output	0 - 1	0				
3.17	Select X1536 output	0 - 1	1				
3.18	Select X192 output	0 - 1	0				
3.19	Hard speed reference			± Pr 1.06	0	± Pr 1.06	0
3.20	Hard speed reference selector			0 - 1	0	0 - 1	0
3.21	No. of Encoder lines / Pulses per rev	256 - 10000	1024	256 - 5000	1024	256 - 5000	4096
3.22	Frequency input select	0 - 1	1	0 - 1	0	0 - 1	0
3.23	Encoder voltage select	0 - 1	0	0 - 1	0	0 - 1	0
3.24	Encoder termination disable	0 - 1	0	0 - 1	0	0 - 1	0
3.25	Encoder phasing test					0 - 1	0
3.26	Encoder 1 input (RPM)	±30000rpm		±30000rpm		±30000rpm	
3.27	Encoder 1 position	0 - 16383 revs/16384		0 - 16383 revs/16384		0 - 16383 revs/16384	
3.28	Phase position			0 - 6143 revs/6143		0 - 6143 revs/6143	
3.29	Open loop overspeed threshold select	0 - 1	0				
3.30	Speed loop window filter period			0 - 10ms	0	0 - 10ms	0
3.31	Servo phasing fail detect enable					0 - 1	0

Menu 3	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
3.01	Frequency slaving demand	± 1000.0Hz					
	Final speed reference			± 40,000rpm		± 40,000rpm	
3.02	Speed feedback						
	Speed feedback			± 40,000rpm		± 40,000rpm	
3.03	Speed error			± 40,000rpm		± 40,000rpm	
3.04	Speed control output			± Torque_prod_I_max%		± Torque_prod_I_max%	
3.05	Zero speed threshold	0.0 - 20.0Hz	1.0Hz	0 - 200rpm	5rpm	0 - 200rpm	5rpm
3.06	At speed lower limit	0.0 - 3000.0Hz	1.0Hz	0 - 40000rpm	5rpm	0 - 40000rpm	5rpm
3.07	At speed upper limit	0.0 - 3000.0Hz	1.0Hz	0 - 40000rpm	5rpm	0 - 40000rpm	5rpm
3.08	Overspeed threshold			0 - 40000rpm	0	0 - 40000rpm	0
3.09	Absolute "at speed" select	0 - 1	0	0 - 1	0	0 - 1	0
3.10 (21.17)	Speed controller proportional gain Kp1			0.0000 - 6.5335$(1/rs^{-1})$	0.0100	0.0000 - 6.5335$(1/rs^{-1})$	0.0100
3.11 (21.18)	Speed controller integral gain Ki1			0.00 - 653.35(1/r)	1.00	0.00 - 653.35(1/r)	1.00
3.12 (21.19)	Speed controller differential feedback gain Kd1			0.00000 - 65336(s)	0.00000	0.00000 - 65336(s)	0.00000
3.13	Enable frequency slaving	0 - 1	0				
	Speed controller proportional gain Kp2			0.0000 - 6.5335(1/rs-1)	0.0100	0.0000 - 6.5335(1/rs-1)	0.0100
3.14	Slaving ratio numerator	0.000 - 1.000	1.000				
	Speed controller integral gain Ki2			0.00 - 653.35(1/r)	1.00	0.00 - 653.35(1/r)	1.00
3.15	Slaving ratio denominator	0.001 - 1.000	1.000				
	Speed controller differential feedback gain Kd2			0.00000 - 65336(s)	0.00000	0.00000 - 65336(s)	0.00000
3.16	Enable frequency slaving output	0 - 1	0				
	Speed controller gain select			0 - 1	0	0 - 1	0
3.17	Select x2048 output	0 - 1	1				
	Speed controller set-up method			0 - 2	0	0 - 2	0
3.18	F and D frequency slaving output	0 - 1	0				
	Motor and load inertia			0.0001 - 100.0000kgm2	0.0000	0.0001 - 100.0000kgm2	0.0000
3.19	Compliance angle			0.0 - 359.9 degrees	4.0	0.0 - 359.9 degrees	4.0
3.20	Bandwidth			0 - 255Hz	10Hz	0 - 255Hz	10Hz
3.21	Damping factor			0.0 - 10.0Hz	1.0Hz	0.0 - 10.0Hz	1.0Hz
3.22	Hard speed reference			± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
3.23	Hard speed reference selector			0 - 1	1	0 - 1	1
3.24	Closed loop vector mode			0 - 3	0		
3.25 (21.20)	Encoder phase angle					0.0 to 359.9 elec degrees	
3.26 (21.21)	Speed feedback selector			0 - 3	0	0 - 3	0
3.27	Drive encoder speed feedback	± 40,000.0rpm		± 40,000.0rpm		± 40,000.0rpm	
3.28	Drive encoder revolution counter	0 to 65535 revolutions		0 to 65535 revolutions		0 to 65535 revolutions	
3.29	Drive encoder position	0 to 65535 $(1/2^{16}$ths of a rev)		0 to 65535 $(1/2^{16}$ths of a rev)		0 to 65535 $(1/2^{16}$ths of a rev)	
3.30	Drive encoder fine position	0 to 65535 $(1/2^{32}$ths of a rev)		0 to 65535 $(1/2^{32}$ths of a rev)		0 to 65535 $(1/2^{32}$ths of a rev)	
3.31	Drive encoder marker position reset disable	0 - 1	0	0 - 1	0	0 - 1	0
3.32	Drive encoder marker flag	0 - 1	0	0 - 1	0	0 - 1	0
3.33	Drive encoder turns bits	0 - 16	16	0 - 16	16	0 - 16	16
3.34	Drive encoder lines per revolution	0 - 50,000	1024	0 - 50,000	1024	0 - 50,000	4096
3.35	Drive encoder single turn comms resolution	0 - 32bits	0	0 - 32bits	0	0 - 32bits	0
3.36	Drive encoder supply voltage	0 - 2	0	0 - 2	0	0 - 2	0
3.37	Drive encoder comms baud rate	0 - 8	2	0 - 8	2	0 - 8	2
3.38	Drive encoder type	0 - 10	0	0 - 10	0	0 - 10	3
3.39	Drive encoder termination disable	0 - 1	0	0 - 1	0	0 - 1	0
3.40	Drive encoder error detection level	0 - 3	1	0 - 3	1	0 - 3	1
3.41	Drive encoder auto-config / SSI format select	0 - 1	0	0 - 1	0	0 - 1	0
3.42	Drive encoder filter	0.0 to 16ms	0	0.0 to 16ms	0	0.0 to 16ms	0
3.43	Maximum drive encoder reference	0 - 40,000rpm	1500	0 - 40,000rpm	1500	0 - 40,000rpm	3000
3.44	Drive encoder reference scaling	0.000 to 4.000	1.000	0.000 to 4.000	1.000	0.000 to 4.000	1.000
3.45	Drive encoder reference	± 100.0%		± 100.0%		± 100.0%	
3.46	Drive encoder reference destination	Pr 00.00 - 21.50	Pr 0.00	Pr 00.00 - 21.50	Pr 0.00	Pr 00.00 - 21.50	Pr 0.00
3.47	Re-initialise position feedback	0 - 1		0 - 1		0 - 1	
3.48	Position feedback initialised	0 - 1		0 - 1		0 - 1	
3.49	Full motor object electronic nameplate transfer	0 - 1		0 - 1		0 - 1	

Menu 4

Unidrive 1

Menu 4	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
4.01	Motor current magnitude	0 - I_{max}A		0 - I_{max}A		0 - I_{max}A	
4.02	Motor active current	$\pm I_{max}$A		$\pm I_{max}$A		$\pm I_{max}$A	
4.03	Torque demand	$\pm I_{max}$%		$\pm I_{max}$%		$\pm I_{max}$%	
4.04	Current demand	$\pm I_{max}$%		$\pm I_{max}$%		$\pm I_{max}$%	
4.05	Motoring current limit	0 - I_{max}%	150%	0 - I_{max}%	150%	0 - I_{max}%	175%
4.06	Regenerating current limit	0 - I_{max}%	150%	0 - I_{max}%	150%	0 - I_{max}%	175%
4.07	Symetrical current limit	0 - I_{max}%	150%	0 - I_{max}%	150%	0 - I_{max}%	175%
4.08	Torque reference	$\pm I_{max}$%	0%	$\pm I_{max}$%	0%	$\pm I_{max}$%	0%
4.09	Torque offset	$\pm I_{max}$%	0	$\pm I_{max}$%	0	$\pm I_{max}$%	0
4.10	Torque offset select	0 - 1	0	0 - 1	0	0 - 1	0
4.11	Torque mode selector	0 - 1	0	0 - 4	0	0 - 4	0
4.12	Current demand filter time constant			0 - 250ms	0	0 - 250ms	0
4.13	Current control P gain	0 - 30000	20	0 - 30000	150	0 - 30000	130
4.14	Current control I gain	0 - 30000	40	0 - 30000	2000	0 - 30000	1200
4.15	Thermal time constant	0 - 400s	89	0 - 400s	89	0 - 400s	7
4.16	Motor protection mode	0 - 1	0	0 - 1	0	0 - 1	0
4.17	Motor magnetising current	$\pm I_{max}$A		$\pm I_{max}$A		$\pm I_{max}$A	
4.18	Overiding current limit	0 - I_{max}%		0 - I_{max}%		0 - I_{max}%	
4.19	Overload accumulator	0 - 100%		0 - 100%		0 - 100%	
4.20	Percentage torque load	0 - I_{max}%		0 - I_{max}%		0 - I_{max}%	

Unidrive SP

Menu 4	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
4.01	Current magnitude	0 - I_{max}A		0 - I_{max}A		0 - I_{max}A	
4.02	Active current	$\pm I_{max}$A		$\pm I_{max}$A		$\pm I_{max}$A	
4.03	Torque demand	$\pm I_{max}$%		$\pm I_{max}$%		$\pm I_{max}$%	
4.04	Current demand	$\pm I_{max}$%		$\pm I_{max}$%		$\pm I_{max}$%	
4.05 (21.27)	Motoring current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0
4.06 (21.28)	Regen current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0
4.07	Symetrical current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0
4.08	Torque reference	$\pm I_{max}$%	0.00	$\pm I_{max}$%	0.00	$\pm I_{max}$%	0.00
	Reactive current reference						
4.09	Torque offset	$\pm I_{max}$%	0.0	$\pm I_{max}$%	0.0	$\pm I_{max}$%	0.0
4.10	Torque offset select	0 - 1	0	0 - 1	0	0 - 1	0
4.11	Torque mode selector	0 - 1	0	0 - 4	0	0 - 4	0
4.12	Current demand filter 1			0.0 to 25.0ms	0.0	0.0 to 25.0ms	0.0
4.13 (21.22)	Current controller Kp gain	0 - 30000	20	0 - 30000	75, 150, 180, 215	0 - 30000	75, 150, 180, 215
4.14 (21.23)	Current controller Ki gain	0 - 30000	40	0 - 30000	1000, 2000, 24000, 3000	0 - 30000	1000, 2000, 24000, 3000
4.15 (21.16)	Thermal time constant	0.0 - 400.0	89.0	0.0 - 400.0	89.0	0.0 - 400.0	20.0
4.16	Thermal protection mode	0 - 1	0	0 - 1	0	0 - 1	0
4.17	Reactive current	$\pm I_{max}$A		$\pm I_{max}$A		$\pm I_{max}$A	
4.18	Overiding current limit	$\pm I_{max}$A		$\pm I_{max}$A		$\pm I_{max}$A	
4.19	Overload accumulator	0 - 100.0%		0 - 100.0%		0 - 100.0%	
4.20	Percentage load	$\pm I_{max}$%		$\pm I_{max}$%		$\pm I_{max}$%	
4.21							
4.22	Inertia compensation enable			0 - 1	0	0 - 1	0
4.23	Current demand filter 2			0.0 to 25.0ms	0.0	0.0 to 25.0ms	0.0
4.24	User current maximum scaling	0.0 to I_{max}%	100.0	0.0 to I_{max}%	100.0	0.0 to I_{max}%	100.0
4.25	Low speed thermal protection mode	0 - 1	0	0 - 1	0	0 - 1	0

Menu 5

Menu 5	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
5.01	Motor frequency	± Pr 1.06					
5.02	Motor Voltage	0 - 528Vac		0 - 528Vac		0 - 528Vac	
5.03	Motor Power	± P_{max} kW		± P_{max} kW		± P_{max} kW	
5.04	Motor RPM	±6000rpm					
5.05	DC link voltage	0 - 830Vdc		0 - 830Vdc		0 - 830Vdc	
5.06	Motor rated frequency	0 - 1000.0Hz	50 UK, 60USA	0 - 1000.0Hz	50 UK, 60USA		
5.07	Motor rated current	0 - FLC A	FLC	0 - FLC A	FLC	0 - FLC A	FLC
5.08	Motor rated full load RPM	0 - 6000rpm	0	0 - 30,000rpm	1450 UK, 1770 USA	0 - 30,000rpm	
5.09	Motor rated voltage	0 - 480VAC	400UK, 460USA	0 - 480VAC	400UK, 460USA	0 - 480VAC	
5.10	Motor rated power factor	0 - 1.000	0.92	0 - 1.000	0.92		
5.11	No. of poles	2 - 32	4	2 - 32	4	2 - 32	6
5.12	Magnetisation current test	0 - 1	0	0 - 1	0		
5.13	Dynamic V-F select	0 - 1	0				
5.14	Voltage mode select	0 - 3	1				
5.15	Voltage boost	0 - 25%	3%	0 - 25%	3%		
5.16	Jog Voltage boost	0 - 25%	3%				
5.17	Stator resistance	0 - 32.000	0				
5.18	Switching frequency	0 - 4	0	0 - 4	0	0 - 4	0
5.19	High stability space vector mod.	0 - 1	0	0 - 1	0	0 - 1	0
5.20	Quasi square operation select	0 - 1	0	0 - 1	0	0 - 1	0
5.21	Field gain reduction			0 - 1	1		
5.22	Maximum RPM X10 select	0 - 1	0				
5.23	Voltage offset	0 - 25.5V	0				
5.24	Machine Inductance			0 - 320.00mH	0	0 - 320.00mH	0
5.25	Open loop output frequency doubling bit	0 - 1	0				
5.26	closed loop x coupling comp enable bit			0 - 1	0	0 - 1	0
5.27	Slip compensation enable	0 - 1	1				
	CL-loop slip auto tune			0 - 1	0		
	Phasing test, high inertia loads, servo					0 - 1	0
5.28	closed loop weak field torq comp disable			0 - 1	0		
5.29	closed loop motor saturation point 1			0 - 100%	50		
5.30	closed loop motor saturation point 2			0 - 100%	75		
5.31	d.c. link controller gain	0 - 30	1	0 - 30	1	0 - 30	1
5.32	Motor full load rpm fine	0 - 0.99	0	0 - 0.99	0		
5.33	Drive thermal model protection enable	0 - 1	1	0 - 1	1	0 - 1	1

Menu 5	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
5.01	Output frequency	± 3000.0Hz		± 1250.0Hz		± 1250.0Hz	
5.02	Output voltage	0 - max Vac		0 - max Vac		0 - max Vac	
5.03	Output power	± P_{max} kW		± P_{max} kW		± P_{max} kW	
5.04	Motor rpm	± 180,000rpm					
5.05	DC link voltage	0 - max Vdc		0 - max Vdc		0 - max Vdc	
5.06 (21.06)	Rated frequency	0 - 3000.0Hz	50Hz	0 - 1250.0Hz	50Hz		
5.07 (21.07)	Motor rated current	0 - FLC A	FLC	0 - FLC A	FLC	0 - FLC A	FLC
	Regen unit rated current						
5.08 (21.08)	Rated load rpm	0 - 180,000rpm	UK 1500, USA 1800	0.00 - 40,000.00rpm	UK 1450.00, USA 1770.00	0.00 - 40,000.00rpm	3000
5.09 (21.09)	Rated voltage	0 - max Vac	200,400,480,575,690	0 - max Vac	200,400,480,575,690	0 - max Vac	200,400,600 or 690
5.10	Rated power factor	0.000 - 1.000	0.85	0.000 - 1.000	0.85	0 - 2	0
5.11	Number of motor poles	0 - 120pole	0 (auto)	0 - 120pole	0 (auto)		
5.12	Auto tune	0 - 2	0	0 - 3	0	0 - 2	0
5.13	Dynamic V to F / flux optimse select	0 - 1	0	0 - 1	0		
5.14	Voltage mode select	0 - 5	4				
5.15	Low frequency voltage boost	0.0 - 25.0%	3.0	0.0 - 25.0%	1.0		
5.16	Rated rpm auto tune			0 - 2	0		
5.17 (21.12)	Stator resistance	0.0 - 30.000	0.0	0.0 - 30.000	0.0		
5.18	Maximum switching frequency	0 - 5	0	0 - 5	0	0 - 5	2
5.19	High stability space vector modulation	0 - 1	0				
5.20	Quasi square enable	0 - 1	0				
5.21	Field gain reduction			0 - 1	0	0 - 1	0
5.22	Enable Field weakening					0 - 1	0
5.23 (21.13)	Voltage offset	0.0 - 25.0V	0				
5.24 (21.14)	Tansient inductance	0.000 - 500.000mH	0.000	0.000 - 500.000mH	0.000	0.000 - 500.000mH	0.000
5.25 (21.24)	Stator inductance			0.00 - 5000.00mH	0.00		
5.26	High dynamic performance enable			0 - 1	0	0 - 1	0
5.27	Enable slip compensation	0 - 1	1				
5.28	Field weakening compensation disable			0 - 1	0		
5.29 (21.25)	Motor saturation breakpoint 1			0 - 100% rated flux	50		
5.30 (21.26)	Motor saturation breakpoint 2			0 - 100% rated flux	75		
5.31	Voltage controller gain	0 - 30	1	0 - 30	1	0 - 30	1
5.32	Motor torque per amp			0.00 - 500.00NmA^{-1}		0.00 - 500.00NmA^{-1}	1.60
5.33	Motor volts per 1000 rpm					0 - 10,000v	98
5.34							
5.35	Disable auto switching frequency change	0 - 1	0	0 - 1	0	0 - 1	0

Menu 6

Unidrive 1

Menu 6	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
6.01	Stop mode	0 - 4	1	0 - 3	1	0 - 3	2
6.02	Auto start mode	0 - 2	0	0 - 2	0	0 - 2	0
6.03	Mains loss mode	0 - 2	0	0 - 2	0	0 - 2	0
6.04	Sequencing mode	0 - 4	4	0 - 4	4	0 - 4	4
6.05	Minimum jog time	0 - 25.0s	0	0 - 25.0s	0	0 - 25.0s	0
6.06	Injection Braking level	0 - 100% FLC	100				
6.07	Injection braking time	0 - 25.0s	5				
6.08	Hold zero speed	0 - 1	0	0 - 1	0	0 - 1	1
6.09	Catch spinning motor	0 - 1	0	0 - 1	1	0 - 1	1
6.10	Spinning motor ramp rate	0 - 25.0 s/100Hz	5				
6.11	Enable keypad run switch	0 - 1	0	0 - 1	0	0 - 1	0
6.12	Enable keypad stop switch	0 - 1	0	0 - 1	0	0 - 1	0
6.13	Enable keypad fwd/rev switch	0 - 1	0	0 - 1	0	0 - 1	0
6.14							
6.15	Drive enable	0 - 1	1	0 - 1	1	0 - 1	1
6.16	Electricity cost / kWh	0 - 600.0	0	0 - 600.0	0	0 - 600.0	0
6.17	Reset power consumption meter	0 - 1	0	0 - 1	0	0 - 1	0
6.18	Time interval between filter changes	0 - 30,000hr	0	0 - 30,000hr	0	0 - 30,000hr	0
6.19	Filter change required / change done	0 - 1	1	0 - 1	1	0 - 1	1
6.20	Time interval between lubrication	0 - 30,000hr	0	0 - 30,000hr	0	0 - 30,000hr	0
6.21	Lubrication required / lubrication done	0 - 1	1	0 - 1	1	0 - 1	1
6.22	Run time log: years.days	0 - 30,365		0 - 30,365		0 - 30,365	
6.23	Run time log: hours. minutes	0 - 23.59		0 - 23.59		0 - 23.59	
6.24	Power consumption: MWh	0 - 30,000		0 - 30,000		0 - 30,000	
6.25	Power consumption: kWh	0 -999.9		0 -999.9		0 -999.9	
6.26	Running cost	0 - 32,000		0 - 32,000		0 - 32,000	
6.27	Time to filter change	0 - 30,000		0 - 30,000		0 - 30,000	
6.28	Time to lubrication due	0 - 30,000		0 - 30,000		0 - 30,000	
6.29	Hardware enable	0 - 1		0 - 1		0 - 1	
6.30	Sequencing bit 0	0 - 1	0	0 - 1	0	0 - 1	0
6.31	Sequencing bit 1	0 - 1	0	0 - 1	0	0 - 1	0
6.32	Sequencing bit 2	0 - 1	0	0 - 1	0	0 - 1	0
6.33	Sequencing bit 3	0 - 1	0	0 - 1	0	0 - 1	0
6.34	Run permit or /Stop	0 - 1	0	0 - 1	0	0 - 1	0
6.35	Limit switch 1 or Forward only	0 - 1		0 - 1		0 - 1	
6.36	Limit switch 2 or Reverse only	0 - 1		0 - 1		0 - 1	
6.37	Spin start voltage	0 - 100.0%	25				
6.38	Spinning motor voltage ramp rate	0 - 2.5s	0.25				

Unidrive SP

Menu 6	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
6.01	Stop mode	0 - 4	1	0 - 2	1	0 - 2	2
6.02							
6.03	Mains loss mode	0 - 2	0	0 - 2	0	0 - 2	0
6.04	Start stop logic select	0 - 4	4	0 - 4	4	0 - 4	4
6.05							
6.06	Injection braking level	0 - 150.0%	100.0%				
6.07	Injection braking time	0.0 - 25.0s	1.0				
6.08	Hold zero speed	0 - 1	0	0 - 1	0	0 - 1	1
6.09	Catch a spinning motor	0 - 3	0	0 - 1	1	0 - 1	1
6.10							
6.11							
6.12	Enable stop key	0 - 1	0	0 - 1	0	0 - 1	0
6.13	Enable forward / reverse key	0 - 1	0	0 - 1	0	0 - 1	0
6.14							
6.15	Drive enable	0 - 1		0 - 1		0 - 1	
6.16	Electricity cost per kWh	0.0 - 600.0 per kWh	0.0	0.0 - 600.0 per kWh	0.0	0.0 - 600.0 per kWh	0
6.17	Reset Energy meter	0 - 1	0	0 - 1	0	0 - 1	0
6.18	Time between filter changes	0 - 30,000hrs	0	0 - 30,000hrs	0	0 - 30,000hrs	0
6.19	Filter change required / change done	0 - 1	0	0 - 1	0	0 - 1	0
6.20	Powered up time years.days	0 - 9.365		0 - 9.365		0 - 9.365	
6.21	Powered up time hours.minutes	0 - 23.59		0 - 23.59		0 - 23.59	
6.22	Run time years.days	0 - 9.365		0 - 9.365		0 - 9.365	
6.23	Run time hours.minutes	0 - 23.59		0 - 23.59		0 - 23.59	
6.24	Energy meter MWh	.-999.9 to 999.9MWh		.-999.9 to 999.9MWh		.-999.9 to 999.9MWh	
6.25	Energy meter kWh	.-99.99 to 99.99kWh		.-99.99 to 99.99kWh		.-99.99 to 99.99kWh	
6.26	Running cost	.±32000		.±32000		.±32000	
6.27	Time before filter change due	0 - 30,000hrs		0 - 30,000hrs		0 - 30,000hrs	
6.28	Select clock for trip log time stamping	0 - 1	0	0 - 1	0	0 - 1	0
6.29	Hardware enable	0 - 1		0 - 1		0 - 1	
6.30	Sequencing bit run forward	0 - 1	0	0 - 1	0	0 - 1	0
6.31	Sequencing bit jog	0 - 1	0	0 - 1	0	0 - 1	0
6.32	Sequencing bit run reverse	0 - 1	0	0 - 1	0	0 - 1	0
6.33	Sequencing bit forward / reverse	0 - 1	0	0 - 1	0	0 - 1	0
6.34	Sequencing bit run	0 - 1	0	0 - 1	0	0 - 1	0
6.35	Forward limit switch	0 - 1	0	0 - 1	0	0 - 1	0
6.36	Reverse limit switch	0 - 1	0	0 - 1	0	0 - 1	0
6.37							
6.38							
6.39	Sequencing bit not stop	0 - 1	0	0 - 1	0	0 - 1	0
6.40	Enable sequencer latching	0 - 1	0	0 - 1	0	0 - 1	0
6.41							
6.42	Control word	0 - 32767	0	0 - 32767	0	0 - 32767	0
6.43	Control word enable	0 - 1	0	0 - 1	0	0 - 1	0
6.44	Active supply	0 - 1		0 - 1		0 - 1	
6.45	Cooling fan to run at full speed	0 - 1	0	0 - 1	0	0 - 1	0

Menu 7

Menu 7	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
7.01	Analogue input 1	±100.0%		±100.0%		±100.0%	
7.02	Analogue input 2	±100.0%		±100.0%		±100.0%	
7.03	Analogue input 3	±100.0%		±100.0%		±100.0%	
7.04	Stack temperature	0 - 100*C		0 - 100*C		0 - 100*C	
7.05	PCB temperature	0 - 100*C		0 - 100*C		0 - 100*C	
7.06	Analogue input 1 mode	0 - 8	0	0 - 8	0	0 - 8	0
7.07	Analogue input 1 offset trim	±10.000%	0	±10.000%	0	±10.000%	0
7.08	Analogue input 1 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.09	Analogue input 1 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.10	Analogue input 1 destination	00.00 to 20.50 menu.pr	1.36	00.00 to 20.50 menu.pr	1.36	00.00 to 20.50 menu.pr	1.36
7.11	Analogue input 2 mode	0 - 8	0	0 - 8	0	0 - 8	0
7.12	Analogue input 2 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.13	Analogue input 2 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.14	Analogue input 2 destination	00.00 to 20.50 menu.pr	1.37	00.00 to 20.50 menu.pr	1.37	00.00 to 20.50 menu.pr	1.37
7.15	Analogue input 3 mode	0 - 10	UK 10, USA 0	0 - 10	UK 10, USA 0	0 - 10	UK 10, USA 0
7.16	Analogue input 3 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.17	Analogue input 3 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.18	Analogue input 3 destination	00.00 to 20.50 menu.pr	0	00.00 to 20.50 menu.pr	0	00.00 to 20.50 menu.pr	0
7.19	Analog output 1 source parameter	00.00 to 20.50 menu.pr	5.01	00.00 to 20.50 menu.pr	3.02	00.00 to 20.50 menu.pr	3.02
7.20	Analog output 1 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.21	Analog output 1 mode selector	0 - 2	0	0 - 2	0	0 - 2	0
7.22	Analog output 2 source parameter	00.00 to 20.50 menu.pr	4.02	00.00 to 20.50 menu.pr	4.02	00.00 to 20.50 menu.pr	4.02
7.23	Analog output 2 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.24	Analog output 2 mode selector	0 - 2	0	0 - 2	0	0 - 2	0
7.25	Calibrate analogue 1 full scale	0 - 1	0	0 - 1	0	0 - 1	0
7.26	V to F sample time			0 - 5.0ms	4.0	0 - 5.0ms	4.0
7.27	Analogue input 1 current loop loss bit	0 - 1		0 - 1		0 - 1	
7.28	Analogue input 2 current loop loss bit	0 - 1		0 - 1		0 - 1	
7.29	Analogue input 3 current loop loss bit	0 - 1		0 - 1		0 - 1	
7.30	Enable analogue output short cutting	0 - 1	0	0 - 1	0	0 - 1	0
7.31	UD78 analogue module fitted	0 - 1		0 - 1		0 - 1	
7.32	IGBT junction temperature	0 - 150*C		0 - 150*C		0 - 150*C	

Menu 7	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
7.01	T5/6 analog input 1 level	±100.00%		±100.00%		±100.00%	
7.02	T7 analog input 2 level	±100.0%		±100.0%		±100.0%	
7.03	T8 analog input 3 level	±100.0%		±100.0%		±100.0%	
7.04	Stack temperature 1	-128 to 127*C		-128 to 127*C		-128 to 127*C	
7.05	Stack temperature 2	-128 to 127*C		-128 to 127*C		-128 to 127*C	
7.06	Control board temperature	-128 to 127*C		-128 to 127*C		-128 to 127*C	
7.07	T5/6 analog input 1 offset trim (0.13)	±10.000%	0.00%	±10.000%	0.00%	±10.000%	0.00%
7.08	T5/6 analog input 1 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.09	T5/6 analog input 1 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.10	T5/6 analog input 1 destination	Pr 00.00 to 21.51	Pr 1.36	Pr 00.00 to 21.51	Pr 1.36	Pr 00.00 to 21.51	Pr 1.36
7.11	T7 analog input 2 mode	0 - 6	6	0 - 6	6	0 - 6	6
7.12	T7 analog input 2 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.13	T7 analog input 2 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.14	T7 analog input 2 destination	Pr 00.00 to 21.51	Pr 1.37	Pr 00.00 to 21.51	Pr 1.37	Pr 00.00 to 21.51	Pr 1.37
7.15	T8 analog input 3 mode	0 - 9	6	0 - 9	6	0 - 9	6
7.16	T8 analog input 3 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.17	T8 analog input 3 invert	0 - 1	0	0 - 1	0	0 - 1	0
7.18	T8 analog input 3 destination	Pr 00.00 to 21.51	Pr 0.00	Pr 00.00 to 21.51	Pr 0.00	Pr 00.00 to 21.51	Pr 0.00
7.19	T9 analog output 1 source	Pr 00.00 to 21.51	Pr 5.01	Pr 00.00 to 21.51	Pr 3.02	Pr 00.00 to 21.51	Pr 3.02
7.20	T9 analog output 1 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.21	T9 analog output 1 mode	0 - 3	0	0 - 3	0	0 - 3	0
7.22	T10 analog output 2 source	Pr 00.00 to 21.51	Pr 4.02	Pr 00.00 to 21.51	Pr 4.02	Pr 00.00 to 21.51	Pr 4.02
7.23	T10 analog output 2 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
7.24	T10 analog output 2 mode	0 - 3	0	0 - 3	0	0 - 3	0
7.25	Calibrate T5/6 analog input 1 full scale	0 - 1	0	0 - 1	0	0 - 1	0
7.26	T5/6 analog input 1 sample time	0 - 8.0ms	4.0	0 - 8.0ms	4.0	0 - 8.0ms	4.0
7.27							
7.28	T7 analog input 2 current loop loss	0 - 1	0	0 - 1	0	0 - 1	0
7.29	T8 analog input 3 current loop loss	0 - 1	0	0 - 1	0	0 - 1	0
7.30	T5/6 analog input 1 offset	±100.00%		±100.00%		±100.00%	
7.31	T7 analog input 2 offset	±100.0%		±100.0%		±100.0%	
7.32	T8 analog input 3 offset	±100.0%		±100.0%		±100.0%	
7.33	T9 analog output 1 control	0 - 2	2	0 - 2	2	0 - 2	2
7.34	IGBT junction temperature	±200*C		±200*C		±200*C	
7.35	Drive thermal protection acumulator	0 - 100.0%		0 - 100.0%		0 - 100.0%	

Menu 8

Unidrive 1

Menu 8	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
8.01	Digital input/output F1 state	0 - 1		0 - 1		0 - 1	
8.02	Digital input/output F2 state	0 - 1		0 - 1		0 - 1	
8.03	Digital input/output F3 state	0 - 1		0 - 1		0 - 1	
8.04	Digital input F4 state	0 - 1		0 - 1		0 - 1	
8.05	Digital input F5 state	0 - 1		0 - 1		0 - 1	
8.06	Digital input F6 state	0 - 1		0 - 1		0 - 1	
8.07	Terminal 30 state	0 - 1		0 - 1		0 - 1	
8.08	Status relay output indicator	0 - 1		0 - 1		0 - 1	
8.09	Terminal 30 function select	0 - 1	0	0 - 1	0	0 - 1	0
8.10	F1 destination/source parameter	00.00 to 20.50 menu.pr	10.06	00.00 to 20.50 menu.pr	10.06	00.00 to 20.50 menu.pr	10.06
8.11	F1 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.12	F1 output enable	0 - 1	1	0 - 1	1	0 - 1	1
8.13	F2 destination/source parameter	00.00 to 20.50 menu.pr	10.33	00.00 to 20.50 menu.pr	10.33	00.00 to 20.50 menu.pr	10.33
8.14	F2 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.15	F2 output enable	0 - 1	0	0 - 1	0	0 - 1	0
8.16	F3 destination/source parameter	00.00 to 20.50 menu.pr	6.31	00.00 to 20.50 menu.pr	6.31	00.00 to 20.50 menu.pr	6.31
8.17	F3 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.18	F3 output enable	0 - 1	0	0 - 1	0	0 - 1	0
8.19	F4 destination parameter	00.00 to 20.50 menu.pr	6.30	00.00 to 20.50 menu.pr	6.30	00.00 to 20.50 menu.pr	6.30
8.20	F4 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.21	F5 destination parameter	00.00 to 20.50 menu.pr	6.32	00.00 to 20.50 menu.pr	6.32	00.00 to 20.50 menu.pr	6.32
8.22	F5 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.23	F6 destination parameter	00.00 to 20.50 menu.pr	1.41	00.00 to 20.50 menu.pr	1.41	00.00 to 20.50 menu.pr	1.41
8.24	F6 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.25	Status relay source parameter	00.00 to 20.50 menu.pr	10.01	00.00 to 20.50 menu.pr	10.01	00.00 to 20.50 menu.pr	10.01
8.26	Status relay invert	0 - 1	0	0 - 1	0	0 - 1	0
8.27	Positive logic select	0 - 1	0	0 - 1	0	0 - 1	0
8.28	Open collector outputs select	0 - 1	0	0 - 1	0	0 - 1	0

Unidrive SP

Menu 8	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
8.01	T24 digital I/O 1 state	0 - 1		0 - 1		0 - 1	
8.02	T25 digital I/O 2 state	0 - 1		0 - 1		0 - 1	
8.03	T26 digital I/O 3 state	0 - 1		0 - 1		0 - 1	
8.04	T27 digital input 4 state	0 - 1		0 - 1		0 - 1	
8.05	T28 digital input 5 state	0 - 1		0 - 1		0 - 1	
8.06	T29 digital input 6 state	0 - 1		0 - 1		0 - 1	
8.07	Relay state	0 - 1		0 - 1		0 - 1	
8.08	T22 24V output state	0 - 1		0 - 1		0 - 1	
8.09	Drive enable indicator	0 - 1		0 - 1		0 - 1	
8.10	Drive enable mode select	0 - 1	0	0 - 1	0	0 - 1	0
8.11	T24 digital I/O 1 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.12	T25 digital I/O 2 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.13	T26 digital I/O 3 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.14	T27 digital input 4 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.15	T28 digital input 5 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.16	T29 digital input 6 invert	0 - 1	0	0 - 1	0	0 - 1	0
8.17	Relay source invert	0 - 1	0	0 - 1	0	0 - 1	0
8.18	T22 24V output source invert	0 - 1	1	0 - 1	1	0 - 1	1
8.19							
8.20	Digital I/O read word	0 - 511		0 - 511		0 - 511	
8.21	T24 digital I/O 1 source / destination	Pr 00.00 to 21.51	Pr 10.03	Pr 00.00 to 21.51	Pr 10.03	Pr 00.00 to 21.51	Pr 10.03
8.22	T25 digital I/O 2 source / destination	Pr 00.00 to 21.51	Pr 10.33	Pr 00.00 to 21.51	Pr 10.33	Pr 00.00 to 21.51	Pr 10.33
8.23	T26 digital I/O 3 source / destination	Pr 00.00 to 21.51	Pr 6.30	Pr 00.00 to 21.51	Pr 6.30	Pr 00.00 to 21.51	Pr 6.30
8.24	T27 digital input 4 destination	Pr 00.00 to 21.51	Pr 6.32	Pr 00.00 to 21.51	Pr 6.32	Pr 00.00 to 21.51	Pr 6.32
8.25	T28 digital input 5 destination	Pr 00.00 to 21.51	Pr 1.41	Pr 00.00 to 21.51	Pr 1.41	Pr 00.00 to 21.51	Pr 1.41
8.26	T29 digital input 6 destination	Pr 00.00 to 21.51	Pr 6.31	Pr 00.00 to 21.51	Pr 6.31	Pr 00.00 to 21.51	Pr 6.31
8.27	Relay source	Pr 00.00 to 21.51	Pr 10.01	Pr 00.00 to 21.51	Pr 10.01	Pr 00.00 to 21.51	Pr 10.01
8.28	T22 24V output source	Pr 00.00 to 21.51	Pr 0.00	Pr 00.00 to 21.51	Pr 0.00	Pr 00.00 to 21.51	Pr 0.00
8.29	Positive logic select	0 - 1	1	0 - 1	1	0 - 1	1
8.30	Open collector output	0 - 1	0	0 - 1	0	0 - 1	0
8.31	T24 digital I/O 1 output select	0 - 1	1	0 - 1	1	0 - 1	1
8.32	T25 digital I/O 2 output select	0 - 1	0	0 - 1	0	0 - 1	0
8.33	T26 digital I/O 3 output select	0 - 1	0	0 - 1	0	0 - 1	0
8.34							
8.35							
8.36							
8.37							
8.38							
8.39	T28 & T29 digital input auto-selection disable	0 - 1	0	0 - 1	0	0 - 1	0

Menu 9

Unidrive 1

Menu 1	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
1.01	Final reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.02	Pre-filter reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.03	Pre-ramp reference	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.04	Reference offset	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.05	Jog reference	0 - 400.0Hz	1.5Hz	0 - 4000rpm	50rpm	0 - 4000rpm	50rpm
1.06	Maximum Speed Clamp	0 - 1000.0Hz	50GB, 60USA	0 - 30000.0rpm	1500rpmGB, 1800USA	0 - 30000.0rpm	3000rpm
1.07	Minimum Speed Clamp	0 - Pr 1.06	0Hz	0 - Pr 1.06	0rpm	0 - Pr 1.06	0rpm
1.08	Negative Min speed select	0 - 1	0	0 - 1	0	0 - 1	0
1.09	Reference offset select	0 - 1	0	0 - 1	0	0 - 1	0
1.10	Bipolar select	0 - 1	0	0 - 1	0	0 - 1	0
1.11	Reference On	0 - 1		0 - 1		0 - 1	
1.12	Reverse select	0 - 1		0 - 1		0 - 1	
1.13	Jog select	0 - 1		0 - 1		0 - 1	
1.14	Reference selector	0 - 5	0 GB, 4 USA	0 - 5	0 GB, 4 USA	0 - 5	0 GB, 4 USA
1.15	Preset selector	0 - 9	0	0 - 9	0	0 - 9	0
1.16	Preset Reference select timer	0 - 400.0s	10s	0 - 400.0s	10s	0 - 400.0s	10s
1.17	Keypad reference	±1000Hz	0rpm	±30000rpm	0rpm	±30000rpm	0rpm
1.18	Precision reference	±1000Hz	0Hz	±30000rpm	0rpm	±30000rpm	0rpm
1.19	Precision reference trim	0 - 0.099Hz	0	0 - 0.99rpm	0	0 - 0.99rpm	0
1.20	Precision reference update disable	0 - 1	0	0 - 1	0	0 - 1	0
1.21	Preset reference 1	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.22	Preset reference 2	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.23	Preset reference 3	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.24	Preset reference 4	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.25	Preset reference 5	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.26	Preset reference 6	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.27	Preset reference 7	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.28	Preset reference 8	±1000.0Hz	0Hz	±30000.0rpm	0rpm	±30000.0rpm	0rpm
1.29	Skip Frequency 1	0 - 1000.0Hz	0Hz	0 - 30000.0rpm	0rpm	0 - 30000.0rpm	0rpm
1.30	Skip Frequency band 1	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.31	Skip Frequency 2	0 - 1000.0Hz	0	0 - 30000.0rpm	0	0 - 30000.0rpm	0
1.32	Skip Frequency band 2	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.33	Skip Frequency 3	0 - 1000.0Hz	0	0 - 30000.0rpm	0	0 - 30000.0rpm	0
1.34	Skip Frequency band 3	0 - 5.0Hz	0.5Hz	50rpm	5rpm	50rpm	5rpm
1.35	Reference in skip band	0 - 1		0 - 1		0 - 1	
1.36	Analogue reference 1	±1000Hz		±30000rpm		±30000rpm	
1.37	Analogue reference 2	±1000Hz		±30000rpm		±30000rpm	
1.38	Percentage trim	±100.0%		±100.0%		±100.0%	
1.39	Velocity feed forward	±1000.0Hz		±30000.0rpm		±30000.0rpm	
1.40	Feed forward select	0 - 1		0 - 1		0 - 1	
1.41	Analogue reference 2 select	0 - 1		0 - 1		0 - 1	
1.42	Preset reference select	0 - 1		0 - 1		0 - 1	
1.43	Keypad reference select	0 - 1		0 - 1		0 - 1	
1.44	Precision reference select	0 - 1		0 - 1		0 - 1	
1.45	Preset select bit 0	0 - 1		0 - 1		0 - 1	
1.46	Preset select bit 1	0 - 1		0 - 1		0 - 1	
1.47	Preset select bit 2	0 - 1		0 - 1		0 - 1	
1.48	Timer/Counter reset	0 - 1	0	0 - 1	0	0 - 1	0
1.49	Reference selected	0 - 5		0 - 5		0 - 5	
1.50	Preset selected	0 - 8		0 - 8		0 - 8	

Unidrive SP

Menu 1	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
1.01	Frequency/speed ref selected	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.02	Pre-skip filter reference	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.03	Pre-ramp ref	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.04	Reference offset	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.05	Jog reference	0 - 400.0Hz	0.0Hz	0 - 4000.0rpm	0.0rpm	0 - 4000.0rpm	0.0rpm
1.06 (21.01)	Maximum reference clamp	0 - 3000.0Hz	UK 50.0, USA 60.0	± 40,000.0rpm	UK 1500.0, USA 1800.0	± 40,000.0rpm	3000.0rpm
1.07 (21.02)	Minimum reference clamp	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.08	Negative minimum reference clamp enable	0 - 1	0	0 - 1	0	0 - 1	0
1.09	Reference offset select	0 - 1	0	0 - 1	0	0 - 1	0
1.10	Bipolar reference enable	0 - 1	0	0 - 1	0	0 - 1	0
1.11	Reference on	0 - 1		0 - 1		0 - 1	
1.12	Reverse selected	0 - 1		0 - 1		0 - 1	
1.13	Jog selected	0 - 1		0 - 1		0 - 1	
1.14 (21.03)	Reference selector	0 - 5	0	0 - 5	0	0 - 5	0
1.15	Preset selector	0 - 9		0 - 9		0 - 9	
1.16	Preset reference selector timer	0 - 400.0s	10.0s	0 - 400.0s	10.0s	0 - 400.0s	10.0s
1.17	Keypad control mode reference	0 - 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.18	Precision reference coarse	0 - 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.19	Precision reference fine	0.000Hz - 0.099Hz	0.0Hz	0.000rpm - 0.099rpm	0.0rpm	0.000rpm - 0.099rpm	0.0rpm
1.20	Precision reference update disable	0 - 1	0	0 - 1	0	0 - 1	0
1.21	Preset reference 1	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.22	Preset reference 2	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.23	Preset reference 3	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.24	Preset reference 4	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.25	Preset reference 5	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.26	Preset reference 6	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.27	Preset reference 7	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.28	Preset reference 8	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm
1.29	Skip reference 1	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.30	Skip reference band 1	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.31	Skip reference 2	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.32	Skip reference band 2	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.33	Skip reference 3	0.0Hz - 3000.0Hz	0.0Hz	0rpm - 40000rpm	0rpm	0rpm - 40000rpm	0rpm
1.34	Skip reference band 3	0.0Hz to 25.0Hz	0.5Hz	0rpm - 250rpm	5rpm	0rpm - 250rpm	5rpm
1.35	Reference in rejection zone	0 - 1		0 - 1		0 - 1	
1.36	Analogue reference 1	± 3000.0Hz	0	± 40,000.0rpm	0	± 40,000.0rpm	0
1.37	Analogue reference 2	± 3000.0Hz	0	± 40,000.0rpm	0	± 40,000.0rpm	0
1.38	Percentage trim	± 100.00%	0	± 100.00%	0	± 100.00%	0
1.39	Velocity feedforwards	± 3000.0Hz		± 40,000.0rpm		± 40,000.0rpm	
1.40	Velocity feedforwards select	0 - 1		0 - 1		0 - 1	
1.41	Analogue reference 2 select	0 - 1	0	0 - 1	0	0 - 1	0
1.42	Preset reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.43	Keypad reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.44	Precision reference select	0 - 1	0	0 - 1	0	0 - 1	0
1.45	Preset select bit 0	0 - 1	0	0 - 1	0	0 - 1	0
1.46	Preset select bit 1	0 - 1	0	0 - 1	0	0 - 1	0
1.47	Preset select bit 2	0 - 1	0	0 - 1	0	0 - 1	0
1.48	References timer reset flag	0 - 1	0	0 - 1	0	0 - 1	0
1.49	Reference selected indicator	.1 - 5		.1 - 5		.1 - 5	
1.50	Preset reference selected indicator	.1 - 8		.1 - 8		.1 - 8	
1.51	Power-up keypad control mode reference	0 - 2	0	0 - 2	0	0 - 2	0

Menu 10

Unidrive 1

Menu 10	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
10.01	Drive healthy	0 -1		0 -1		0 -1	
10.02	Drive running	0 -1		0 -1		0 -1	
10.03	Zero Speed	0 -1		0 -1		0 -1	
10.04	At minimum speed	0 -1		0 -1		0 -1	
10.05	Below set speed	0 -1		0 -1		0 -1	
10.06	At speed	0 -1		0 -1		0 -1	
10.07	Above set speed	0 -1		0 -1		0 -1	
10.08	Load reached	0 -1		0 -1		0 -1	
10.09	Current limit	0 -1		0 -1		0 -1	
10.10	Regenerating	0 -1		0 -1		0 -1	
10.11	Dynamic brake active	0 -1		0 -1		0 -1	
10.12	Dynamic brake alarm	0 -1		0 -1		0 -1	
10.13	Direction commanded	0 -1		0 -1		0 -1	
10.14	Direction running	0 -1		0 -1		0 -1	
10.15	Mains loss	0 -1		0 -1		0 -1	
10.16	Motor thermistor over temperature	0 -1		0 -1		0 -1	
10.17	Motor Overload alarm	0 -1		0 -1		0 -1	
10.18	Heatsink temperature alarm	0 -1		0 -1		0 -1	
10.19	Ambient temperature alarm	0 -1		0 -1		0 -1	
10.20	Last trip	0 - 200		0 - 200		0 - 200	
10.21	Trip before one above	0 - 200		0 - 200		0 - 200	
10.22	Trip before one above	0 - 200		0 - 200		0 - 200	
10.23	Trip before one above	0 - 200		0 - 200		0 - 200	
10.24	Trip before one above	0 - 200		0 - 200		0 - 200	
10.25	Trip before one above	0 - 200		0 - 200		0 - 200	
10.26	Trip before one above	0 - 200		0 - 200		0 - 200	
10.27	Trip before one above	0 - 200		0 - 200		0 - 200	
10.28	Trip before one above	0 - 200		0 - 200		0 - 200	
10.29	Trip before one above	0 - 200		0 - 200		0 - 200	
10.30	Full power braking time	0 - 400.0s	0	0 - 400.0s	0	0 - 400.0s	0
10.31	Full power braking period	0 - 25.0 min	0	0 - 25.0 min	0	0 - 25.0 min	0
10.32	External trip	0 -1		0 -1		0 -1	
10.33	Drive reset	0 -1	0	0 -1	0	0 -1	0
10.34	No. of auto reset attempts	0 - 5	0	0 - 5	0	0 - 5	0
10.35	Auto reset delay	0 - 25.0s	1	0 - 25.0s	1	0 - 25.0s	1
10.36	Hold drive healthy until last attempt	0 -1	0	0 -1	0	0 -1	0
10.37	Stop drive on non-important trips	0 -1	0	0 -1	0	0 -1	0
10.38	User trip	0 - 200	0	0 - 200	0	0 - 200	0
10.39	Braking energy O/L accumulator	0 - 100.0%		0 - 100.0%		0 - 100.0%	
10.40	Status word	0 - 32,767		0 - 32,767		0 - 32,767	
10.41	UD78 aux power supply active	0 -1		0 -1		0 -1	
10.42	IGBT junction temp above 135*C	0 -1		0 -1		0 -1	

Unidrive SP

Menu 10	Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
10.01	Drive healthy	0 - 1		0 - 1		0 - 1	
10.02	Drive active	0 - 1		0 - 1		0 - 1	
10.03	Zero Speed	0 - 1		0 - 1		0 - 1	
10.04	Running at/below min speed	0 - 1		0 - 1		0 - 1	
10.05	Below set speed	0 - 1		0 - 1		0 - 1	
10.06	At speed	0 - 1		0 - 1		0 - 1	
10.07	Above set speed	0 - 1		0 - 1		0 - 1	
10.08	Load reached	0 - 1		0 - 1		0 - 1	
10.09	Drive output is at current limit	0 - 1		0 - 1		0 - 1	
10.10	Regenerating	0 - 1		0 - 1		0 - 1	
10.11	Braking IGBT active	0 - 1		0 - 1		0 - 1	
10.12	Braking resistor alarm	0 - 1		0 - 1		0 - 1	
10.13	Direction commanded	0 - 1		0 - 1		0 - 1	
10.14	Direction running	0 - 1		0 - 1		0 - 1	
10.15	Mains loss	0 - 1		0 - 1		0 - 1	
10.16	Under voltage active	0 - 1		0 - 1		0 - 1	
10.17	Overload alarm	0 - 1		0 - 1		0 - 1	
10.18	Drive overtemperature alarm	0 - 1		0 - 1		0 - 1	
10.19	Drive warning	0 - 1		0 - 1		0 - 1	
10.20	Trip 0	0 - 230		0 - 230		0 - 230	
10.21	Trip 1	0 - 230		0 - 230		0 - 230	
10.22	Trip 2	0 - 230		0 - 230		0 - 230	
10.23	Trip 3	0 - 230		0 - 230		0 - 230	
10.24	Trip 4	0 - 230		0 - 230		0 - 230	
10.25	Trip 5	0 - 230		0 - 230		0 - 230	
10.26	Trip 6	0 - 230		0 - 230		0 - 230	
10.27	Trip 7	0 - 230		0 - 230		0 - 230	
10.28	Trip 8	0 - 230		0 - 230		0 - 230	
10.29	Trip 9	0 - 230		0 - 230		0 - 230	
10.30	Full power braking time	0.0 - 400.00s	table below	0.0 - 400.00s	table below	0.0 - 400.00s	table below
10.31	Full power braking period	0.0 - 1500.0s	table below	0.0 - 1500.0s	table below	0.0 - 1500.0s	table below
10.32	External trip	0 - 1	0	0 - 1	0	0 - 1	0
10.33	Drive reset	0 - 1	0	0 - 1	0	0 - 1	0
10.34	No. of auto reset attempts	0 - 5	0	0 - 5	0	0 - 5	0
10.35	Auto reset delay	0.0 - 25.0s	1	0.0 - 25.0s	1	0.0 - 25.0s	1
10.36	Hold drive healthy until last attempt	0 - 1	0	0 - 1	0	0 - 1	0
10.37	Action on trip detection	0 - 3	0	0 - 3	0	0 - 3	0
10.38	User trip	0 - 255	0	0 - 255	0	0 - 255	0
10.39	Braking energy O/L accumulator	0.0 - 100.0%		0.0 - 100.0%		0.0 - 100.0%	
10.40	Status word	0 - 32,767		0 - 32,767		0 - 32,767	
10.41	Trip 0 time: years.days	0.000 - 9,365		0.000 - 9,365		0.000 - 9,365	
10.42	Trip 0 time: hours.minutes	00.00 - 23.59		00.00 - 23.59		00.00 - 23.59	
10.43	Trip 1 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.44	Trip 2 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.45	Trip 3 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.46	Trip 4 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.47	Trip 5 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.48	Trip 6 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.49	Trip 7 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.50	Trip 8 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	
10.51	Trip 9 time	0 - 600.00 hr.min		0 - 600.00 hr.min		0 - 600.00 hr.min	

Drive	Pr10.30	Pr 10.31
200V size 1	0.02	10.0
200V size 2	0.02	10.0
400V size 1	0.09	10.0
400V size 2	0.09	10.0
all others	0.00	0.00

Menu 11

Menu 11	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
11.01	Parameter 0.11 assignment	0.00 - 20.50 menu.pr	1.03	0.00 - 20.50 menu.pr	1.03	0.00 - 20.50 menu.pr	1.03
11.02	Parameter 0.12 assignment	0.00 - 20.50 menu.pr	2.01	0.00 - 20.50 menu.pr	2.01	0.00 - 20.50 menu.pr	2.01
11.03	Parameter 0.13 assignment	0.00 - 20.50 menu.pr	4.02	0.00 - 20.50 menu.pr	4.02	0.00 - 20.50 menu.pr	4.02
11.04	Parameter 0.14 assignment	0.00 - 20.50 menu.pr	1.05	0.00 - 20.50 menu.pr	1.05	0.00 - 20.50 menu.pr	1.05
11.05	Parameter 0.15 assignment	0.00 - 20.50 menu.pr	2.04	0.00 - 20.50 menu.pr	2.04	0.00 - 20.50 menu.pr	2.04
11.06	Parameter 0.16 assignment	0.00 - 20.50 menu.pr	6.01	0.00 - 20.50 menu.pr	6.01	0.00 - 20.50 menu.pr	6.01
11.07	Parameter 0.17 assignment	0.00 - 20.50 menu.pr	4.11	0.00 - 20.50 menu.pr	4.11	0.00 - 20.50 menu.pr	4.11
11.08	Parameter 0.18 assignment	0.00 - 20.50 menu.pr	2.06	0.00 - 20.50 menu.pr	2.06	0.00 - 20.50 menu.pr	2.06
11.09	Parameter 0.19 assignment	0.00 - 20.50 menu.pr	2.07	0.00 - 20.50 menu.pr	2.07	0.00 - 20.50 menu.pr	2.07
11.10	Parameter 0.20 assignment	0.00 - 20.50 menu.pr	1.29	0.00 - 20.50 menu.pr	1.29	0.00 - 20.50 menu.pr	1.29
11.11	Parameter 0.21 assignment	0.00 - 20.50 menu.pr	1.3	0.00 - 20.50 menu.pr	1.3	0.00 - 20.50 menu.pr	1.3
11.12	Parameter 0.22 assignment	0.00 - 20.50 menu.pr	1.31	0.00 - 20.50 menu.pr	1.31	0.00 - 20.50 menu.pr	1.31
11.13	Parameter 0.23 assignment	0.00 - 20.50 menu.pr	1.32	0.00 - 20.50 menu.pr	1.32	0.00 - 20.50 menu.pr	1.32
11.14	Parameter 0.24 assignment	0.00 - 20.50 menu.pr	7.06	0.00 - 20.50 menu.pr	7.06	0.00 - 20.50 menu.pr	7.06
11.15	Parameter 0.25 assignment	0.00 - 20.50 menu.pr	7.11	0.00 - 20.50 menu.pr	7.11	0.00 - 20.50 menu.pr	7.11
11.16	Parameter 0.26 assignment	0.00 - 20.50 menu.pr	7.14	0.00 - 20.50 menu.pr	7.14	0.00 - 20.50 menu.pr	7.14
11.17	Parameter 0.27 assignment	0.00 - 20.50 menu.pr	UK 8.27 USA 6.04	0.00 - 20.50 menu.pr	UK 8.27 USA 6.04	0.00 - 20.50 menu.pr	UK 8.27 USA 6.04
11.18	Parameter 0.28 assignment	0.00 - 20.50 menu.pr	UK 4.13 USA 1.01	0.00 - 20.50 menu.pr	UK 4.13 USA 1.01	0.00 - 20.50 menu.pr	UK 4.13 USA 1.01
11.19	Parameter 0.29 assignment	0.00 - 20.50 menu.pr	UK 4.14 USA 8.23	0.00 - 20.50 menu.pr	UK 4.14 USA 8.23	0.00 - 20.50 menu.pr	UK 4.14 USA 8.23
11.20	Parameter 0.30 assignment	0.00 - 20.50 menu.pr	6.13	0.00 - 20.50 menu.pr	6.13	0.00 - 20.50 menu.pr	6.13
11.21	Parameter 0.30 scaling	0 - 4.000	1	0 - 4.000	1	0 - 4.000	1
11.22	Initial parameter displayed	0.00 - 0.50 menu.pr	0.10	0.00 - 0.50 menu.Pr	0.10	0.00 - 0.50 menu.Pr	0.10
11.23	S comms address	0 - 9.9 group.unit	1.1	0 - 9.9 group.unit	1.1	0 - 9.9 group.unit	1.1
11.24	S comms mode	0 - 3	1	0 - 3	1	0 - 3	1
11.25	S comms baud rate	0 - 3	0	0 - 3	0	0 - 3	0
11.26	S comms 2-wire mode delay	0 - 255ms	0	0 - 255ms	0	0 - 255ms	0
11.27	S comms source/dest parameter	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0
11.28	S comms parameter scaling	0 -4.000	1	0 -4.000	1	0 -4.000	1
11.29	Drive software version	1.00 - 99.99		1.00 - 99.99		1.00 - 99.99	
11.30	User security code	0 - 255	149	0 - 255	149	0 - 255	149
11.31	Drive operating mode	0 - 3	0	0 - 3	1	0 - 3	2
11.32	Drive rated current (FLC)	2.10 - 1920		2.10 - 1920		2.10 - 1920	
11.33	Drive voltage rating	220 - 690		220 - 690		220 - 690	
11.34	Drive software build number	0 - 99		0 - 99		0 - 99	
11.35	No. of size 5 modules connected	0 - 255		0 - 255		0 - 255	
11.36	Drive with slow speed fans	0 - 1		0 - 1		0 - 1	
11.37	Macro number	0 - 9		0 - 9		0 - 9	
11.38	Cloning module Pr set	0 - 8	0	0 - 8	0	0 - 8	0
11.39	Clonging module Pr set drive type	0 - 4	4	0 - 4	4	0 - 4	4
11.40	Cloning module Pr checksum	0 - 16,383		0 - 16,383		0 - 16,383	

Menu 11	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
11.01	Parameter 0.11 setup	Pr 1.00 - 21.51	Pr 5.01	Pr 1.00 - 21.51	Pr 5.01	Pr 1.00 - 21.51	Pr 3.29
11.02	Parameter 0.12 setup	Pr 1.00 - 21.51	Pr 4.01	Pr 1.00 - 21.51	Pr 4.01	Pr 1.00 - 21.51	Pr 4.01
11.03	Parameter 0.13 setup	Pr 1.00 - 21.51	Pr 4.02	Pr 1.00 - 21.51	Pr 4.02	Pr 1.00 - 21.51	Pr 7.07
11.04	Parameter 0.14 setup	Pr 1.00 - 21.51	Pr 4.11	Pr 1.00 - 21.51	Pr 4.11	Pr 1.00 - 21.51	Pr 4.11
11.05	Parameter 0.15 setup	Pr 1.00 - 21.51	Pr 2.04	Pr 1.00 - 21.51	Pr 2.04	Pr 1.00 - 21.51	Pr 2.04
11.06	Parameter 0.16 setup	Pr 1.00 - 21.51	Pr 8.39	Pr 1.00 - 21.51	Pr 2.02	Pr 1.00 - 21.51	Pr 2.02
11.07	Parameter 0.17 setup	Pr 1.00 - 21.51	Pr 8.26	Pr 1.00 - 21.51	Pr 4.12	Pr 1.00 - 21.51	Pr 4.12
11.08	Parameter 0.18 setup	Pr 1.00 - 21.51	Pr 8.29	Pr 1.00 - 21.51	Pr 8.29	Pr 1.00 - 21.51	Pr 8.29
11.09	Parameter 0.19 setup	Pr 1.00 - 21.51	Pr 7.11	Pr 1.00 - 21.51	Pr 7.11	Pr 1.00 - 21.51	Pr 7.11
11.10	Parameter 0.20 setup	Pr 1.00 - 21.51	Pr 7.14	Pr 1.00 - 21.51	Pr 7.14	Pr 1.00 - 21.51	Pr 7.14
11.11	Parameter 0.21 setup	Pr 1.00 - 21.51	Pr 7.15	Pr 1.00 - 21.51	Pr 7.15	Pr 1.00 - 21.51	Pr 7.15
11.12	Parameter 0.22 setup	Pr 1.00 - 21.51	Pr 1.10	Pr 1.00 - 21.51	Pr 1.10	Pr 1.00 - 21.51	Pr 1.10
11.13	Parameter 0.23 setup	Pr 1.00 - 21.51	Pr 1.05	Pr 1.00 - 21.51	Pr 1.05	Pr 1.00 - 21.51	Pr 1.05
11.14	Parameter 0.24 setup	Pr 1.00 - 21.51	Pr 1.21	Pr 1.00 - 21.51	Pr 1.21	Pr 1.00 - 21.51	Pr 1.21
11.15	Parameter 0.25 setup	Pr 1.00 - 21.51	Pr 1.22	Pr 1.00 - 21.51	Pr 1.22	Pr 1.00 - 21.51	Pr 1.22
11.16	Parameter 0.26 setup	Pr 1.00 - 21.51	Pr 1.23	Pr 1.00 - 21.51	Pr 3.08	Pr 1.00 - 21.51	Pr 3.08
11.17	Parameter 0.27 setup	Pr 1.00 - 21.51	Pr 1.24	Pr 1.00 - 21.51	Pr 3.34	Pr 1.00 - 21.51	Pr 3.34
11.18	Parameter 0.28 setup	Pr 1.00 - 21.51	Pr 6.13	Pr 1.00 - 21.51	Pr 6.13	Pr 1.00 - 21.51	Pr 6.13
11.19	Parameter 0.29 setup	Pr 1.00 - 21.51	Pr 11.36	Pr 1.00 - 21.51	Pr 11.36	Pr 1.00 - 21.51	Pr 11.36
11.20	Parameter 0.30 setup	Pr 1.00 - 21.51	Pr 11.42	Pr 1.00 - 21.51	Pr 11.42	Pr 1.00 - 21.51	Pr 11.42
11.21	Parameter scaling	0.000 - 9.999	1.000	0.000 - 9.999	1.000	0.000 - 9.999	1.000
11.22	Parameter displayed at power-up	Pr 0.00 - 00.50	Pr 0.10	Pr 0.00 - 00.50	Pr 0.10	Pr 0.00 - 00.50	Pr 0.10
11.23	Serial address	0 - 247	1	0 - 247	1	0 - 247	1
11.24	Serial mode	0 - 1	1	0 - 1	1	0 - 1	1
11.25	Baud rate	0 - 9	6	0 - 9	6	0 - 9	6
11.26	Min comms transmit delay	0 - 250ms	2	0 - 250ms	2	0 - 250ms	2
11.27							
11.28							
11.29	Software version	1.00 - 99.99		1.00 - 99.99		1.00 - 99.99	
11.30	User security code	0 -999	0	0 -999	0	0 -999	0
11.31	User drive mode	1 - 4	1	1 - 4	2	1 - 4	3
11.32	Max industrial current rating	0.00 - 9999.99		0.00 - 9999.99		0.00 - 9999.99	
11.33	Drive voltage rating	0 - 3		0 - 3		0 - 3	
11.34	Software sub-version	0 - 99		0 - 99		0 - 99	
11.35	Number of size 5 modules connected	1 - 8		1 - 8		1 - 8	
11.36	SMARTCARD data previously loaded	0 - 999	0	0 - 999	0	0 - 999	0
11.37	SMARTCARD data number	0 - 1000	0	0 - 1000	0	0 - 1000	0
11.38	SMARTCARD data type / mode	0 - 17		0 - 17		0 - 17	
11.39	SMARTCARD data version	0 - 9,999	0	0 - 9,999	0	0 - 9,999	0
11.40	SMARTCARD data checksum	0 - 65,335		0 - 65,335		0 - 65,335	
11.41	Status mode timeout	0 - 250s	240	0 - 250s	240	0 - 250s	240
11.42	Parameter cloning	0 - 4	0	0 - 4	0	0 - 4	0
11.43	Load defaults	0 - 2	0	0 - 2	0	0 - 2	0
11.44	Security status	0 - 2		0 - 2		0 - 2	
11.45	Select motor 2 parameters	0 - 1	0	0 - 1	0	0 - 1	0
11.46	Defaults previously loaded	0 - 2000		0 - 2000		0 - 2000	
11.47	Ladder program enable	0 - 1	0	0 - 1	0	0 - 1	0
11.48	Drive user program status	-128 to +127		-128 to +127		-128 to +127	
11.49	Drive user programming events	0 to 65535		0 to 65535		0 to 65535	
11.50	User program max scan time	0 to 65535 ms		0 to 65535 ms		0 to 65535 ms	
11.51	Drive user program first run	0 - 1	0	0 - 1	0	0 - 1	0

Menu 12

Menu 12	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
12.01	Comparitor 1 output indicator	0 -1		0 -1		0 -1	
12.02	Comparitor 2 output indicator	0 - 1		0 - 1		0 - 1	
12.03	Comparitor 1 input source Pr	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0
12.04	Comparitor 1 threshold level	0 - 100.0%	0	0 - 100.0%	0	0 - 100.0%	0
12.05	Comparitor 1 hysteresis	0 - 25.0%	0	0 - 25.0%	0	0 - 25.0%	0
12.06	Comparitor 1 output invert	0 - 1	0	0 - 1	0	0 - 1	0
12.07	Comparitor 1 output destination	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0
12.08							
12.09							
12.10							
12.11							
12.12							
12.13	Comparitor 2 input source Pr	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0
12.14	Comparitor 2 threshold level	0 - 100.0%	0	0 - 100.0%	0	0 - 100.0%	0
12.15	Comparitor 2 hysteresis	0 - 25.0%	0	0 - 25.0%	0	0 - 25.0%	0
12.16	Comparitor 2 output invert	0 - 1	0	0 - 1	0	0 - 1	0
12.17	Comparitor 2 output destination	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0

Menu 12	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
12.01	Threshold detector 1 output	0 -1		0 -1		0 -1	
12.02	Threshold detector 2 output	0 - 1		0 - 1		0 - 1	
12.03	Threshold detector 1 source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.04	Threshold detector 1 level	0.00 - 100.00%	0.00	0.00 - 100.00%	0.00	0.00 - 100.00%	0.00
12.05	Threshold detector 1 hysteresis	0.00 - 25.00%	0.00	0.00 - 25.00%	0.00	0.00 - 25.00%	0.00
12.06	Threshold detector 1 output invert	0 - 1	0	0 - 1	0	0 - 1	0
12.07	Threshold detector 1 destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.08	Variable selector 1 source 1	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.09	Variable selector 1 source 2	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.10	Variable selector 1 mode	0 - 8	0	0 - 8	0	0 - 8	0
12.11	Variable selector 1 destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.12	Variable selector 1 output	± 100.00%		± 100.00%		± 100.00%	
12.13	Variable selector 1 soucre 1 scaling	± 4.000	1.000	± 4.000	1.000	± 4.000	1.000
12.14	Variable selector 1 soucre 2 scaling	± 4.000	1.000	± 4.000	1.000	± 4.000	1.000
12.15	Variable selector 1 control	0.00 - 100.00	0.00	0.00 - 100.00	0.00	0.00 - 100.00	0.00
12.16							
12.17							
12.18							
12.19							
12.20							
12.21							
12.22							
12.23	Threshold detector 2 source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.24	Threshold detector 2 level	0.00 - 100.00%	0.00	0.00 - 100.00%	0.00	0.00 - 100.00%	0.00
12.25	Threshold detector 2 hysteresis	0.00 - 25.00%	0.00	0.00 - 25.00%	0.00	0.00 - 25.00%	0.00
12.26	Threshold detector 2 output invert	0 - 1	0	0 - 1	0	0 - 1	0
12.27	Threshold detector 2 destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.28	Variable selector 2 source 1	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.29	Variable selector 2 source 2	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.30	Variable selector 2 mode	0 - 8	0	0 - 8	0	0 - 8	0
12.31	Variable selector 2 destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
12.32	Variable selector 2 output	± 100.00%		± 100.00%		± 100.00%	
12.33	Variable selector 2 soucre 1 scaling	± 4.000	1.000	± 4.000	1.000	± 4.000	1.000
12.34	Variable selector 2 soucre 2 scaling	± 4.000	1.000	± 4.000	1.000	± 4.000	1.000
12.35	Variable selector 2 control	0.00 - 100.00	0.00	0.00 - 100.00	0.00	0.00 - 100.00	0.00

Menu 13

Menu 13	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
13.01	Position loop error	± 16,384		± 16,384		± 16,384	
13.02	Reference encoder input	±100.0%		±100.0%		±100.0%	
13.03	Maximum reference speed	0 - 30,000rpm	1,500	0 - 30,000rpm	1,500	0 - 30,000rpm	1,500
13.04	Reference encoder scaling	0 - 4.000	1	0 - 4.000	1	0 - 4.000	1
13.05	% input select			0 - 1	0	0 - 1	0
13.06	Reference input destination Pr	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0	0.00 - 20.50 menu.pr	0
13.07	Reference encoder ratio	0 - 4.000	1	0 - 4.000	1	0 - 4.000	1
13.08	Position loop mode select	0 - 2	0	0 - 2	0	0 - 2	0
13.09	Position loop gain	0 - 4.000	0.1	0 - 4.000	0.1	0 - 4.000	0.1
13.10	Position speed-limit	0 - 250rpm	150	0 - 250rpm	150	0 - 250rpm	150
13.11	Orientation position reference			0 - 4095	0	0 - 4095	0
13.12	Orientation acceptance window			0 - 200	20	0 - 200	20
13.13	Encoder sample time			0 - 5.0ms	4.0	0 - 5.0ms	4.0
13.14	Reset reference revolution counter	0 - 1	0	0 - 1	0	0 - 1	0
13.15	Reset feedback revolution counter	0 - 1	0	0 - 1	0	0 - 1	0
13.16	Reference Encoder revolution counter	0 - 16,384		0 - 16,384		0 - 16,384	
13.17	Feedback Encoder revolution counter	0 - 16,384		0 - 16,384		0 - 16,384	
13.18	Orientation complete indicator			0 -1		0 -1	
13.19	Reference feedback invert	0 - 1	0	0 - 1	0	0 - 1	0

Menu 13	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
13.01	Revolutions error	± 32,768%		± 32,768%		± 32,768%	
13.02	Position error	± 32,768%		± 32,768%		± 32,768%	
13.03	Fine position	± 32,768%		± 32,768%		± 32,768%	
13.04	Position controller reference source	0 - 4	0	0 - 4	0	0 - 4	0
13.05	Position controller feedback source	0 - 3	0	0 - 3	0	0 - 3	0
13.06	Position reference invert	0 - 1	0	0 - 1	0	0 - 1	0
13.07	Ratio numerator	0.000 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
13.08	Ratio denominator	0.001 to 1.000	1.000	0.001 to 1.000	1.000	0.001 to 1.000	1.000
13.09	Position controller P gain	0.00 - 100.00rads	25.00	0.00 - 100.00rads	25.00	0.00 - 100.00rads	25.00
13.10	Position controller mode	0 - 2	0	0 - 6	0	0 - 6	0
13.11	Absolute mode enable	0 - 1	0	0 - 1	0	0 - 1	0
13.12	Position controller speed clamp	0 - 250	150	0 - 250	150	0 - 250	150
13.13	Orientation position reference			0 - 65,535	0	0 - 65,535	0
13.14	Orientation acceptance window			0 - 4,096	256	0 - 4,096	256
13.15	Orientation position complete	0 - 1		0 - 1		0 - 1	
13.16	Position error reset	0 - 1	0	0 - 1	0	0 - 1	0
13.17	Relative jog reference			0.0 - 4,000.0rpm	0.0	0.0 - 4,000.0rpm	0.0
13.18	Relative jog enable			0 -1	0	0 -1	0
13.19	Relative jog reverse			0 - 1	0	0 - 1	0
13.20	Local reference turns	0 - 65,536	0	0 - 65,536	0	0 - 65,536	0
13.21	Local reference position	0 - 65,536	0	0 - 65,536	0	0 - 65,536	0
13.22	Local reference fine position	0 - 65,536	0	0 - 65,536	0	0 - 65,536	0
13.23	Local reference disable	0 - 1	0	0 - 1	0	0 - 1	0

Menu 14

Menu 14	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
14.01	PID output	±100.0%		±100.0%		±100.0%	
14.02	Main reference source	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0
14.03	PID reference source	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0
14.04	PID feedback source	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0
14.05	Invert reference	0 - 1	0	0 - 1	0	0 - 1	0
14.06	Invert feedback	0 - 1	0	0 - 1	0	0 - 1	0
14.07	PID reference slew rate limit	0.0 - 3,200.0s	0.00	0.0 - 3,200.0s	0.00	0.0 - 3,200.0s	0.00
14.08	PID enable	0 - 1	0	0 - 1	0	0 - 1	0
14.09	Optional PID enable source	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0
14.10	Proportional gain	0.000 - 4.000	1.000	0.000 - 4.000	1.000	0.000 - 4.000	1.000
14.11	Integral gain	0.000 - 4.000	0.500	0.000 - 4.000	0.500	0.000 - 4.000	0.500
14.12	Derivative gain	0.000 - 4.000	0.000	0.000 - 4.000	0.000	0.000 - 4.000	0.000
14.13	PID High limit	0.00 - 100.00%	100.00	0.00 - 100.00%	100.00	0.00 - 100.00%	100.00
14.14	PID Low limit	±100.0%	-100	±100.0%	-100	±100.0%	-100
14.15	PID output scaling	0.000 - 4.000	1.000	0.000 - 4.000	1.000	0.000 - 4.000	1.000
14.16	PID output destination	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0	Pr 0.00 - 20.50	0
14.17	Hold Integrator	0 - 1	0	0 - 1	0	0 - 1	0
14.18	Symetrical limit enable	0 - 1	0	0 - 1	0	0 - 1	0
14.19	PID main reference	±100.0%		±100.0%		±100.0%	
14.20	PID reference	±100.0%		±100.0%		±100.0%	
14.21	PID feedback	±100.0%		±100.0%		±100.0%	
14.22	PID error	±100.0%		±100.0%		±100.0%	

Menu 14	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
14.01	PID output	±100.00%		±100.00%		±100.00%	
14.02	Main reference source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
14.03	PID reference source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
14.04	PID feedback source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
14.05	Invert reference	0 - 1	0	0 - 1	0	0 - 1	0
14.06	Invert feedback	0 - 1	0	0 - 1	0	0 - 1	0
14.07	PID reference slew rate limit	0.0 - 3,200.0s	0.00	0.0 - 3,200.0s	0.00	0.0 - 3,200.0s	0.00
14.08	PID enable	0 - 1	0	0 - 1	0	0 - 1	0
14.09	Optional PID enable source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
14.10	Proportional gain	0.000 - 4.000	1.000	0.000 - 4.000	1.000	0.000 - 4.000	1.000
14.11	Integral gain	0.000 - 4.000	0.500	0.000 - 4.000	0.500	0.000 - 4.000	0.500
14.12	Derivative gain	0.000 - 4.000	0.000	0.000 - 4.000	0.000	0.000 - 4.000	0.000
14.13	PID High limit	0.00 - 100.00%	100.00	0.00 - 100.00%	100.00	0.00 - 100.00%	100.00
14.14	PID Low limit	±100.0%	100.00	±100.0%	100.00	±100.0%	100.00
14.15	PID output scaling	0.000 - 4.000	1.000	0.000 - 4.000	1.000	0.000 - 4.000	1.000
14.16	PID output destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
14.17	Hold Integrator	0 - 1	0	0 - 1	0	0 - 1	0
14.18	Symetrical limit enable	0 - 1	0	0 - 1	0	0 - 1	0
14.19	PID main reference	±100.0%		±100.0%		±100.0%	
14.20	PID reference	±100.0%		±100.0%		±100.0%	
14.21	PID feedback	±100.0%		±100.0%		±100.0%	
14.22	PID error	±100.0%		±100.0%		±100.0%	

Menu 16 with Extended I/O

I/O module	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
16.01	Option module code	0 - 100	1	0 - 100	1	0 - 100	1
16.02	Relay 2 output indicator	0 -1		0 -1		0 -1	
16.03	Relay 3 output indicator	0 -1		0 -1		0 -1	
16.04	Analog input 4	±100.0%		±100.0%		±100.0%	
16.05	Analog input 5	±100.0%		±100.0%		±100.0%	
16.06							
16.07	Logic input / output F7 indicator	0 -1		0 -1		0 -1	
16.08	Logic input / output F8 indicator	0 -1		0 -1		0 -1	
16.09	Logic input / output F9 indicator	0 -1		0 -1		0 -1	
16.10	Logic input F10 indicator	0 -1		0 -1		0 -1	
16.11	Logic input F11 indicator	0 -1		0 -1		0 -1	
16.12	Logic input F12 indicator	0 -1		0 -1		0 -1	
16.13	Analog input 4 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
16.14	Analog input 4 invert	0 -1	0	0 -1	0	0 -1	0
16.15	Analog input 4 destination	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.16	Analog input 5 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
16.17	Analog input 5 invert	0 -1	0	0 -1	0	0 -1	0
16.18	Analog input 5 destination	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.19	DAC output 3 source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.20	DAC output 3 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
16.21	F7 input destination/ output source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.22	F7 input/output invert	0 -1	0	0 -1	0	0 -1	0
16.23	F7 output enable	0 -1	0	0 -1	0	0 -1	0
16.24	F8 input destination/ output source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.25	F8 input/output invert	0 -1	0	0 -1	0	0 -1	0
16.26	F8 output enable	0 -1	0	0 -1	0	0 -1	0
16.27	F9 input destination/ output source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.28	F9 input/output invert	0 -1	0	0 -1	0	0 -1	0
16.29	F9 output enable	0 -1	0	0 -1	0	0 -1	0
16.30	F10 input destination	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.31	F10 input invert	0 -1	0	0 -1	0	0 -1	0
16.32	F11 input destination	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.33	F11 input invert	0 -1	0	0 -1	0	0 -1	0
16.34	F12 input destination	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.35	F12 input invert	0 -1	0	0 -1	0	0 -1	0
16.36	Relay 2 source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.37	Relay 2 output invert	0 -1	0	0 -1	0	0 -1	0
16.38	Relay 3 source	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00	0.00 - 20.50 menu.pr	0.00
16.39	Relay 3 output invert	0 -1	0	0 -1	0	0 -1	0
16.40	Logic input polarity	0 -1	0	0 -1	0	0 -1	0
16.41	Open collector outputs	0 -1	0	0 -1	0	0 -1	0

I/O module	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
x.01	Solutions module ID	0 - 499		0 - 499		0 - 499	
x.02							
x.03	T4 digital i/o 3 state indicator	0 -1		0 -1		0 -1	
x.04	T6 digital input 4 state indicator	0 -1		0 -1		0 -1	
x.05	T7 digital input 5 state indicator	0 -1		0 -1		0 -1	
x.06	T8 digital input 6 state indicator	0 -1		0 -1		0 -1	
x.07	Relay 1 indicator	0 -1		0 -1		0 -1	
x.08	Relay 2 indicator	0 -1		0 -1		0 -1	
x.09	T2 digital i/o 1 state indicator	0 -1		0 -1		0 -1	
x.10	T3 digital i/o 2 state indicator	0 -1		0 -1		0 -1	
x.11	T2 digital i/o 1 invert	0 -1	0	0 -1	0	0 -1	0
x.12	T3 digital i/o 2 invert	0 -1	0	0 -1	0	0 -1	0
x.13	T4 digital i/o 3 invert	0 -1	0	0 -1	0	0 -1	0
x.14	T6 digital input 4 invert	0 -1	0	0 -1	0	0 -1	0
x.15	T7 digital input 5 invert	0 -1	0	0 -1	0	0 -1	0
x.16	T8 digital input 6 invert	0 -1	0	0 -1	0	0 -1	0
x.17	Relay 1 invert	0 -1	0	0 -1	0	0 -1	0
x.18	Relay 2 invert	0 -1	0	0 -1	0	0 -1	0
x.19							
x.20							
x.21	T2 digital i/o 1 destination / source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.22	T3 digital i/o 2 destination / source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.23	T4 digital i/o 3 destination / source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.24	T6 digital input 4 destination	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.25	T7 digital input 5 destination	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.26	T8 digital input 6 destination	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.27	Relay 1 source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.28	Relay 2 source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.29	Logic input polarity	0 -1	1	0 -1	1	0 -1	1
x.30							
x.31	T2 digital i/o 1 select	0 -1	0	0 -1	0	0 -1	0
x.32	T3 digital i/o 2 select	0 -1	0	0 -1	0	0 -1	0
x.33	T4 digital i/o 3 select	0 -1	0	0 -1	0	0 -1	0
x.34							
x.35							
x.36							
x.37							
x.38							
x.39							
x.40	T9 analog input 4	±100.0%		±100.0%		±100.0%	
x.41	T9 analog input 4 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
x.42	T9 analog input 4 invert	0 -1	0	0 -1	0	0 -1	0
x.43	T9 analog input 4 destination	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.44	T10 analog input 5	±100.0%		±100.0%		±100.0%	
x.45	T10 analog input 5 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000
x.46	T10 analog input 5 invert	0 -1	0	0 -1	0	0 -1	0
x.47	T10 analog input 5 destination	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.48	T12 analog output 3 source	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00	Pr 0.00 to 21.51	Pr 0.00
x.49	T12 analog output 3 scaling	0 - 4.000	1.000	0 - 4.000	1.000	0 - 4.000	1.000

Menu 16 with Sine Cosine Encoder

encoder	Unidrive 1 Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
16.01	Option module code	0 - 100	2	0 - 100	2	0 - 100	2
16.02	Encoder 2 input rpm	±30000rpm		±30000rpm		±30000rpm	
16.03	Encoder 2 position	0 - 16,384 revs/16,384		0 - 16,384 revs/16,384		0 - 16,384 revs/16,384	
16.04	No. encoder lines/pulses per rev	0 - 10,000(FD) 0 - 5,000(AB)	1024	0 - 10,000(FD) 0 - 5,000(AB)	1024	0 - 10,000(FD) 0 - 5,000(AB)	1024
16.05	Frequency input select	0 - 1	0	0 - 1	0	0 - 1	0
16.06	Encoder output select	0 - 1	0	0 - 1	0	0 - 1	0
16.07	Encoder output scaling	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0
16.08	F/D output select	0 - 1	0	0 - 1	0	0 - 1	0
16.09	Encoder termination disable	0 - 1	0	0 - 1	0	0 - 1	0
16.10	Enable freeze input (disable z output)	0 - 1	0	0 - 1	0	0 - 1	0
16.11	Disable freeze input termination	0 - 1	0	0 - 1	0	0 - 1	0
16.12	Encoder marker sync disable	0 - 1	0	0 - 1	0	0 - 1	0
16.13	Encoder marker sync disable inactive	0 - 1		0 - 1		0 - 1	
UD52 module							
16.01	Option module code	0 - 100	4	0 - 100	4	0 - 100	4
16.02	Sincos encoder rpm	±30000rpm		±30000rpm		±30000rpm	
16.03	Sincos encoder rev count	0 -32,767		0 -32,767		0 -32,767	
16.04	Sincos encoder position fine	0 - 16383 revs/16,384		0 - 16383 revs/16,384		0 - 16383 revs/16,384	
16.05	Sincos encoder position fine	0 - 255 revs/4,194,304		0 - 255 revs/4,194,304		0 - 255 revs/4,194,304	
16.06	Sincos encoder output select	0 - 1	0	0 - 1	0	0 - 1	0
16.07	Sincos encoder output scaling	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0
16.08	F/D output select	0 - 1	0	0 - 1	0	0 - 1	0
16.09	Phasing offset	0 -6143		0 -6143		0 -6143	
16.10	Sincos encoder phasing test	0 - 1	0	0 - 1	0	0 - 1	0
16.11	Update disable	0 - 1	0	0 - 1	0	0 - 1	0
16.12	Number of encoder lines per rev	0 - 4	1	0 - 4	1	0 - 4	1
16.13	Number of encoder turns	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0	0 - 15 (power of 2)	0
16.14	Sincos as auxilliary encoder	0 - 1	0	0 - 1	0	0 - 1	0
16.15	Sincos encoder supply voltage	0 - 1	0	0 - 1	0	0 - 1	0
16.16	Serial comms disable	0 - 1	0	0 - 1	0	0 - 1	0
16.17	Interpolation disable	0 - 1	0	0 - 1	0	0 - 1	0

encoder	Unidrive SP Reference	Open Lp. Maximum	Open Lp. Default	Vector Maximum	Vector Default	Servo Maximum	Servo Default
x.01	Solutions module ID	0 - 499		0 - 499		0 - 499	
x.02	Solutions module software version						
x.03	Speed	±40,000.0		±40,000.0		±40,000.0	
x.04	Revolution counter	0 - 65,535		0 - 65,535		0 - 65,535	
x.05	Position	0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)	
x.06	Fine Position	0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)	
x.07	Marker position reset disable	0 - 1	0	0 - 1	0	0 - 1	0
x.08	Marker flag	0 - 1	0	0 - 1	0	0 - 1	0
x.09	Encoder turns	0 - 16	16	0 - 16	16	0 - 16	16
x.10	Equivalent lines per rev	0 - 50,000	4096	0 - 50,000	4096	0 - 50,000	4096
x.11	Encoder comms resolution	0 - 32	0	0 - 32	0	0 - 32	0
x.12	Motor thermistor check enable	0 - 1	0	0 - 1	0	0 - 1	0
x.13	Encoder supply voltage	0 - 2	0	0 - 2	0	0 - 2	0
x.14	Encoder comms baud rate	0 - 8	2	0 - 8	2	0 - 8	2
x.15	Encoder type	0 - 10	0	0 - 10	0	0 - 10	0
x.16	Encoder termination	0 - 2	1	0 - 2	1	0 - 2	1
x.17	Error detection level	0 - 7	0	0 - 7	0	0 - 7	0
x.18	Auto configuration	0 - 1	0	0 - 1	0	0 - 1	0
x.19	Feedback filter			0 - 5	0	0 - 5	0
x.20	Max feedback reference	0.0 - 40,000.0		0.0 - 40,000.0		0.0 - 40,000.0	
x.21	Feedback reference	±100.0%		±100.0%		±100.0%	
x.22	Feedback reference scaling	0.000 - 4.000	1.000	0.000 - 4.000	1.000	0.000 - 4.000	1.000
x.23	Feedback reference destination	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
x.24	Encoder simulation source	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00	Pr 0.00 - 21.51	Pr 0.00
x.25	Encoder simulation ratio numerator	0.0000 - 3.0000	1.0000	0.0000 - 3.0000	1.0000	0.0000 - 3.0000	1.0000
x.26	Encoder simulation ratio denominator	0.0000 - 3.0000	1.0000	0.0000 - 3.0000	1.0000	0.0000 - 3.0000	1.0000
x.27	Encoder simulation resolution select	0 - 1	0	0 - 1	0	0 - 1	0
x.28	Encoder simulation mode	0 - 2	0	0 - 2	0	0 - 2	0
x.29	Non-marker reset rev counter	0 - 65,535		0 - 65,535		0 - 65,535	
x.30	Non-marker reset postion	0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)	
x.31	Non-marker reset fine position	0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)	
x.32	Marker rev counter	0 - 65,535		0 - 65,535		0 - 65,535	
x.33	Marker position	0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)	
x.34	Marker fine position	0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)	
x.35	Freeze revolution counter	0 - 65,535		0 - 65,535		0 - 65,535	
x.36	Freeze position	0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)		0 - 65,535 (1/2^{16} rev)	
x.37	Freeze fine position	0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)		0 - 65,535 (1/2^{32} rev)	
x.38	Freeze input mode selection	0 - 3	1	0 - 3	1	0 - 3	1
x.39	Freeze flag	0 - 1	0	0 - 1	0	0 - 1	0
x.40	Freeze main drive position	0 - 1	0	0 - 1	0	0 - 1	0
x.41	Freeze invert	0 - 1	0	0 - 1	0	0 - 1	0
x.42	Encoder comms transmit reister	0 - 65,535		0 - 65,535		0 - 65,535	
x.43	Encoder comms receive register	0 - 65,535	0	0 - 65,535	0	0 - 65,535	0
x.44	Disable encoder position check	0 - 1	0	0 - 1	0	0 - 1	0
x.45	Position feedback initialised	0 - 1		0 - 1		0 - 1	
x.46	Liner per rev divider	1 - 1024	1	1 - 1024	1	1 - 1024	1
x.47	SSI output turns	0 -16	16	0 -16	16	0 -16	16
x.48	SSI output comms resolution	0 - 32 bits	0	0 - 32 bits	0	0 - 32 bits	0
x.49							

Menu 16 with Resolver

	Unidrive 1	Open Lp.	Open Lp.	Vector	Vector	Servo	Servo			Unidrive SP	Open Lp.	Open Lp.	Vector	Vector	Servo	Servo
resolver	Reference	Maximum	Default	Maximum	Default	Maximum	Default		resolver	Reference	Maximum	Default	Maximum	Default	Maximum	Default
16.01	Option module code			0 - 100	1	0 - 100	1		x.01							
16.02	Resolver rpm			.±30000rpm		.±30000rpm			x.02							
16.03	Resolver position			0 - 16,384 revs/16,384		0 - 16,384 revs/16,384			x.03							
16.04									x.04							
16.05	Resolver phasing test			0 - 1	0	0 - 1	0		x.05							
16.06	Encoder output select			0 - 1	0	0 - 1	0		x.06							
16.07	Encoder output scaling			0 - 15 (power of 2)	0	0 - 15 (power of 2)	0		x.07							
16.08	F/D output select			0 - 1	0	0 - 1	0		x.08							
16.09	Phasing offset			0 - 6143		0 - 6143			x.09							
16.10	Low ratio resolver select			0 - 1	0	0 - 1	0		x.10							
16.11									x.11							
16.12	Encoder marker sync disable			0 - 1	0	0 - 1	0		x.12							
16.13	Encoder marker sync disable inactive			0 - 1		0 - 1			x.13							
									x.14							
									x.15							
									x.16							
									x.17							
									x.18							
									x.19							
									x.20							
									x.21							
									x.22							
									x.23							
									x.24							
									x.25							
									x.26							
									x.27							
									x.28							
									x.29							
									x.30							
									x.31							
									x.32							
									x.33							
									x.34							
									x.35							
									x.36							
									x.37							
									x.38							
									x.39							
									x.40							
									x.41							
									x.42							
									x.43							
									x.44							
									x.45							
									x.46							
									x.47							
									x.48							
									x.49							

Menus 18, 19 & 20

	Unidrive 1	Open Lp.	Open Lp.	Vector	Vector	Servo	Servo
Menu 18	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
18.01	Application menu 1 R/W integer	± 32,000	0	± 32,000	0	± 32,000	0
18.02 - 18.10	Application menu 1 RO integers	± 32,000	0	± 32,000	0	± 32,000	0
18.11 - 18.30	Application menu 1 R/W integers	± 32,000	0	± 32,000	0	± 32,000	0
18.31 - 18.50	Application menu 1 R/W bits	0 - 1	0	0 - 1	0	0 - 1	0
	Unidrive 1	**Open Lp.**	**Open Lp.**	**Vector**	**Vector**	**Servo**	**Servo**
Menu 19	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
19.01	Application menu 2 R/W integer	± 32,000	0	± 32,000	0	± 32,000	0
19.02 - 19.10	Application menu 2 RO integers	± 32,000	0	± 32,000	0	± 32,000	0
19.11 - 19.30	Application menu 2 R/W integers	± 32,000	0	± 32,000	0	± 32,000	0
19.31 - 19.50	Application menu 2 R/W bits	0 - 1	0	0 - 1	0	0 - 1	0
	Unidrive 1	**Open Lp.**	**Open Lp.**	**Vector**	**Vector**	**Servo**	**Servo**
Menu 20	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
20.01 - 20.20	Application menu 3 R/W integers	± 32,000	0	± 32,000	0	± 32,000	0
20.01 - 20.40	Application menu 3 R/W long integers	± 32,000	0	± 32,000	0	± 32,000	0
20.41 - 20.49	Application menu 1 R/W variables	± 32,000	0	± 32,000	0	± 32,000	0
20.50	Status communications Pr	0 - 1	0	0 - 1	0	0 - 1	0
	Available with Large Option Module Only						

	Unidrive SP	Open Lp.	Open Lp.	Vector	Vector	Servo	Servo
Menu 18	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
18.01	Application menu 1 R/W integer	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
18.02 - 18.10	Application menu 1 RO integers	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
18.11 - 18.30	Application menu 1 R/W integers	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
18.31 - 18.50	Application menu 1 R/W bits	0 - 1	0	0 - 1	0	0 - 1	0
	Unidrive SP	**Open Lp.**	**Open Lp.**	**Vector**	**Vector**	**Servo**	**Servo**
Menu 19	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
19.01	Application menu 2 R/W integer	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
19.02 - 19.10	Application menu 2 RO integers	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
19.11 - 19.30	Application menu 2 R/W integers	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
19.31 - 19.50	Application menu 2 R/W bits	0 - 1	0	0 - 1	0	0 - 1	0
	Unidrive SP	**Open Lp.**	**Open Lp.**	**Vector**	**Vector**	**Servo**	**Servo**
Menu 20	**Reference**	**Maximum**	**Default**	**Maximum**	**Default**	**Maximum**	**Default**
20.01 - 20.20	Application menu 3 R/W integers	-32,768 to +37,767	0	-32,768 to +37,767	0	-32,768 to +37,767	0
20.21 - 20.40	Application menu 3 R/W long integers	-2^{31} to $2^{31}-1$	0	-32,768 to +37,767	0	-32,768 to +37,767	0

Menu 21

	Unidrive SP	Open Lp.	Open Lp.	Vector	Vector	Servo	Servo	Regen	Regen
Menu 21	Reference	Maximum	Default	Maximum	Default	Maximum	Default	Maximum	Default
21.01	Maximum reference clamp	0 - 3000.0Hz	UK 50.0, USA 60.0	± 40,000.0rpm	UK 1500.0, USA 1800.0	± 40,000.0rpm	3000.0rpm		
21.02	Minimum reference clamp	± 3000.0Hz	0.0Hz	± 40,000.0rpm	0.0rpm	± 40,000.0rpm	0.0rpm		
21.03	Reference selector	0 - 5	0	0 - 5	0	0 - 5	0		
21.04	Acceleration rate	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200		
21.05	Deceleration Rate	0.0 to 3200.0s/100Hz	5.0	0.000 to 3200.000s/1000rpm	2.000	0.000 to 3200.000s/1000rpm	0.200		
21.06	Rated frequency	0 - 3000.0Hz	50Hz	0 - 1250.0Hz	50Hz				
21.07	Rated current	0 - FLC A	FLC	0 - FLC A	FLC	0 - FLC A	FLC	0 - FLC A	FLC
21.08	Rated load rpm	0 - 180,000rpm	UK 1500, USA 1800	0.00 - 40,000.00rpm	UK 1450.00, USA 1770.00	0.00 - 40,000.00rpm	3000		
21.09	Rated voltage	0 - max Vac	200,400,480,575,690	0 - max Vac	200,400,480,575,690	0 - max Vac	200,400,600 or 690		
21.10	Rated power factor	0.000 - 1.000	0.85	0.000 - 1.000	0.85	0 - 2	0		
21.11	Number of motor poles	0 - 120pole	0 (auto)	0 - 120pole	0 (auto)	0 - 120pole	3 (6 pole)		
21.12	Stator resistance	0.0 - 30.000	0.0	0.0 - 30.000	0.0	0.0 - 30.000	0.0		
21.13	Voltage offset	0.0 - 25.0V	0						
21.14	Tansient inductance	0.000 - 500.000mH	0.000	0.000 - 500.000mH	0.000	0.000 - 500.000mH	0.000		
21.15	Motor 2 active	0 - 1	0	0 - 1	0	0 - 1	0		
21.16	Thermal time constant	0.0 - 400.0	89.0	0.0 - 400.0	89.0	0.0 - 400.0	20.0	0.0 - 400.0	89.0
21.17	Speed controller Kp gain			0.0000 - 6.5335(1/rs^{-1})	0.0100	0.0000 - 6.5335(1/rs^{-1})	0.0100		
21.18	Speed controller Ki gain			0.00 - 653.35(1/r)	1.00	0.00 - 653.35(1/r)	1.00		
21.19	Speed controller Kd gain			0.00000 - 65336(s)	0.00000	0.00000 - 65336(s)	0.00000		
21.20	Encoder phase angle					0.0 to 359.9 elec degrees			
21.21	Speed feedback selector			0 - 3	0	0 - 3	0		
21.22	Current controller Kp gain	0 - 30000	20	0 - 30000	75, 150, 180, 215	0 - 30000	75, 150, 180, 215	0 - 30000	55, 110, 130, 160
21.23	Current controller Ki gain	0 - 30000	40	0 - 30000	1000, 2000, 24000, 3000	0 - 30000	1000, 2000, 24000, 3000	0 - 30000	1000, 2000, 24000, 3000
21.24	Stator inductance			0.00 - 5000.00mH	0.00				
21.25	Motor saturation breakpoint 1			0 - 100% rated flux	50				
21.26	Motor saturation breakpoint 2			0 - 100% rated flux	75				
21.27	Motoring current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0		
21.28	Regen current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0		
21.29	Symmetrical current limit	0 - I_{max}%	165.0	0 - I_{max}%	175.0	0 - I_{max}%	175.0		
21.30	Motor volts per 1000rpm					0 - 10,000	98		

Menu 1: Frequency / Speed reference

There are a number of parameters in menu 1 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detailed explanation of the changes are shown overleaf

Parameter	Function	Details
1.01 - 1.04, 1.06 - 1.07, 1.17 - 1.18, 1.21 - 1.28, 1,29, 1.31, 1.33 1.36 - 1.37, 1.39	Minimum and Maximum frequencies/speeds	With Unidrive SP, the ± limits of Frequency / Speed ranges have been increased which affect: All References, Clamps, and Offsets, Skip frequencies/speed, Bands and Velocity Feedforwards. From ± 1000.0Hz to ± 3000.0Hz (OL>) and ± 30,000.0rpm to ± 40,000.0rpm (CL>)
1.05	Jog Function	Previously, the default Jog Reference with Unidrive 1 was at 1.5Hz OL> and 50rpm CL> with Unidrive SP these are now both 0.0 Hz/rpm
1.11~1.13	Reference control flag(s) 1,2,3	Previously called Reference enabled indicator (Pr1.11), Reverse selected indicator (Pr1.12) & Jog selected Indicator (Pr1.13) in Undrive 1,now called Reference control flag 1, Reference control flag 2 & Reference control flag 3 in Unidrive SP. The parameters function as in Unidrive 1
1.14	Reference selector	With Unidrive SP, Reference selector operates similarly to that in SP, options being:- A1.A2 (0), A1.Pr (1), A2.Pr (2), Pr(3), PAD(4) and Prc (5), details overleaf
1.17	Keypad control mode reference	On Unidrive 1 the Keypad Reference is saved at its last value on power down, with Unidrive SP the Keypad Reference is automatically set to zero at default, but this can be reconfigured using Pr 1.51 (details below)
1.18	Precision reference coarse	With Unidrive SP,the Precision Reference Resolution has changed from 0 Hz/rpm to 0.0 Hz/rpm
1.19	Precision reference trim	With Unidrive SP, the Precision Reference Trim resolution has changed from 0.00 Hz/rpm to 0.000 Hz/rpm
1.30 1.32 1.34	Skip reference bands 1, 2 and 3	The maximum range for the Skip Reference bands have now increased with Unidrive SP from 5.0Hz to 25.0Hz and 50rpm to 250rpm
1.38	Percentage trim	The Precision Trim resolution has changed from 0.0% to 0.00% on Unidrive SP
1.41~1.47	Analog reference 2 select Preset Reference select Keypad reference select Precision reference select Preset reference 1 select Preset reference 2 select Preset reference 3 select	With Unidrive SP, the bit parameters used to select Analogue reference 2, Preset reference, Keypad reference, precision reference and preset select bits 1~3 are Read/write parameters, previously RO in Unidrive 1
1.51	Power-up keypad control mode reference	New parameter in Unidrive SP, selects value of keypad control mode at power-up details below

Menu 1: Frequency / Speed reference

01.01	Frequency/speed reference selected															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1		1				
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Update rate	4ms write															

01.02	Pre-skip filter reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1		1				
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Update rate	4ms write															

01.03	Pre-ramp reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1		1				
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Update rate	4ms write															

01.04	Reference offset															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1		
Range	Open-loop Closed-loop vector and Servo								±3000.0Hz ±40,000.0rpm							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read when precision reference is active 4ms read otherwise															

See parameter 01.09.

Menu 1: Frequency / Speed reference

01.05	Jog reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop Closed-loop vector and Servo								0 to 400.0Hz 0 to 4000.0rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms read															

Reference used for jogging. See menu 6 for details on when the jog mode can be activated. The jog reference can be used for relative jogging in digital lock mode (see menu 13).

01.06	Maximum reference clamp															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo : VM = 1															
Range	Open-loop Closed-loop vector and Servo								0 to 3000.0Hz SPEED_LIMIT_MAX rpm							
Default	Closed-loop vector Servo								1500.0 3000.0							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.01							
Update rate	Background read															

01.07	Minimum reference clamp															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1					1	1	1		
	Closed-loop vector and servo : VM = 1															
Range	Open-loop Closed-loop vector and Servo								-3000.0Hz to 3000.0Hz -SPEED_LIMIT_MAX to SPEED_LIMIT_MAX rpm							
Default	Open-loop Closed-loop vector, Servo								0.0 0.0							
Second motor parameter	Open-loop, Closed-loop vector, Servo								21.02							
Update rate	Background read															

The range shown for parameter 01.07 shows the range used for scaling purposes (i.e. for routing to an analogue output etc.). Further range restrictions are applied as given below.

01.08 (Neg min ref enable)	01.10 (Bipolar mode enable)	Open-loop	Closed-loop vector & Servo
0	0	0 to 01.06	0 to 01.06
0	1	0	0
1+	0	-3000 to 0Hz	-SPEED_LIMIT_MAX to 0 rpm
1+	1	-3000 to 0Hz	-SPEED_LIMIT_MAX to 0 rpm

The same limits are applied to parameter 21.02, but based on the value of parameter 21.01.

01.14	Reference selector															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1					1			1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 5							
Default	Open-loop, Closed-loop vector, Servo								0 (A1.A2)							
Second motor parameter	Open-loop, Closed-loop vector, Servo								21.03							
Update rate	4ms read															

With Unidrive SP, Reference selector (1.14) now controls configuration on digital input terminals T28 & T29, as below:

Reference select 01.14		Terminal 28 (08.25)set to:	Terminal 29 (08.26)set to:
A1.A2 (0)	Reference selection by terminal input	01.41 - local/remote	06.31 - jog
A1.Pr (1)	Analogue reference 1 or presets selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
A2.Pr (2)	Analogue reference 2 or presets selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
Pr (3)	Preset reference selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
Pad (4)	Keypad reference selected	01.41 - local/remote	06.31 - jog
Prc (5)	Precision reference selected	01.41 - local/remote	06.31 - jog

01.17	Keypad control mode reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1			1		1				1
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms read															

01.18	Precision reference coarse															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1						1	1		
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	Background read															

01.19	Precision reference fine															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop Closed-loop vector and Servo								0.000Hz to 0.099Hz 0.000rpm to 0.099rpm							
Default	Open-loop, Closed-loop vector, Servo								0.000							
Update rate	Background read															

Open loop

The frequency reference resolution is restricted to 0.1Hz from normal parameters, but the resolution can be improved by using the precision reference. Parameter 01.18 defines the coarse part of reference (either positive or negative) with a resolution of 0.1Hz and parameter 01.19 defines the fine part of the reference (always positive) with a resolution of 0.001Hz. The final reference is given by Pr 01.18 + Pr 01.19. Therefore Pr 01.19 increases positive references away from zero, and decreases negative references towards zero.

Closed loop

As with open-loop a higher resolution speed reference can be programmed by selecting these parameters. In this case the speed will have a resolution of 0.001 rpm.

01.21 - 01.28	Preset references															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1						1	1		
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms read															

01.29 01.31 01.33	Skip references															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo : DP = 0															
Range	Open-loop Closed-loop vector and Servo								0.0Hz to 3000.0Hz 0rpm to 40,000rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0 0							
Update rate	Background read															

01.30 01.32 01.34	Skip reference bands															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo : DP = 0															
Range	Open-loop Closed-loop vector and Servo								0.0Hz to 25.0Hz 0rpm to 250rpm							
Default	Open-loop Closed-loop vector and Servo								0.5 5							
Update rate	Background read															

Three skip references are available to prevent continuous operation at a speed that would cause mechanical resonance. When a skip reference parameter is set to 0 that filter is disabled. The skip reference band parameters define the frequency or speed range either side of the programmed skip reference, over which references are rejected. The actual reject band is therefore twice that programmed in these parameters, the skip reference parameters defining the centre of the band. When the selected reference is within a band the lower limit of the band is passed through to the ramps such that reference is always less than demanded.

01.36, 01.37	Analogue references															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1						
Range	Open-loop Closed-loop vector and Servo								-SPEED_FREQ_MAX to SPEED_FREQ_MAX Hz/rpm							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms write															

Although most parameters can be controlled from analogue inputs, these two parameters are special case in that if an analogue input programmed in voltage mode is directed to one of these parameters, the scan rate of that analogue input is increased. These are special parameters when a non-bit type quantity uses these parameters as a destination (not just from analogue inputs). The scaling and limiting applied is as described with parameter 01.08.

01.39	Velocity feed forward															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1		1				
Range	Open-loop Closed-loop vector and Servo								-3000.0Hz to 3000.0Hz -40,000.0rpm to 40,000.0rpm							
Update rate	4ms write															

This parameter indicates the velocity feed forward reference when position control is used (see Menu 13).

01.41 - 01.47	Reference select flags															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

Parameters 01.41 to 01.44 control parameter 01.49. The priority order is 01.44 (highest), 01.43, 01.42, 01.41 (lowest). If more than one parameter is active, the highest priority takes precedence.

01.41 Force parameter 01.49 = 2 (see table in menu 1 block diagram)

01.42 Force parameter 01.49 = 3 (always selects preset references)

01.43 Force parameter 01.49 = 4 (always selects keypad control mode)

01.44 Force parameter 01.49 = 5 (always selects precision reference)

Parameters 01.45 to 01.47 control parameter 01.50.

01.45 Controls parameter 01.50 bit 0

01.46 Controls parameter 01.50 bit 1

01.47 Controls parameter 01.50 bit 2

1.51	Power-up keypad control mode reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	N/A															

Selects the power-up value of the keypad control mode Pr 1.17

0 rESEt zero

1 LASt last value used before power-down

2 PrS1 Preset 1, Pr 1.21, before power-down

Menu 2: Ramps

There are a number of parameters in menu 2 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detailed explanation of the changes are shown overleaf.

Parameter	Function	Details
2.01	Post ramp reference	With Unidrive SP, Range of Post ramp reference has been increased to from +/-1000Hz (Unidrive 1) to +/-3,000Hz in Unidrive SP, details overleaf
2.04	Ramp mode select	With Unidrive SP, Default values and available ramp modes have changed, details overleaf
2.05		Previously Ramp times set in ms (Unidrive I), no longer required in Unidrive SP due to increased resolution of ramps in CL>
2.07	S Ramp acceleration limit	With Unidrive SP, S Ramp resolution has changed in CL>, from 0.000~ 30.000 (Unidrive 1) to 0.000 ~100.000 (Unidrive SP), details overleaf
2.08	Standard Ramp voltage	With Unidrive SP, range of Standard ramp voltage has change due to increased voltage range of available drives 200v 0~375v 400v 0~750 Eur 0~775v USA 575v 0~895v 690v 0~1075v details overleaf
2.09		Previously Reverse accel/decel select (Unidrive I), option to divide the 8 acceleration and deceleration ramps into 4 forward and 4 reverse no longer available in Unidrive SP,now choice of 8 forward and reverse acceleration and deceleration ramps.
2.11 - 2.19 2.21 - 2.29	Acceleration, deceleration and jog ramp limits (closed loop vector only)	With Unidrive SP, in CL> the resolution of the ramps have changed from 0.0- 3200.0 Hz/rpm (Unidrive 1) to 0.000 - 3200.000 Hz/rpm, details overleaf
2.11 - 2.18	Acceleration rates 1 - 8	With Unidrive SP, the range and resolution and default values of the ramps have changed, details overleaf
2.21 - 2.28	Deceleration rates 1 - 8	
2.30	Relay source invert	Previously Reverse acceleration selector (Pr2.30)and Reverse deceleration selector(Pr2.31) (Unidrive I), no longer applicable in Unidrive SP due to the functional changes in the acceleration and deceleration ramps
2.31		
2.32 - 2.34	Acceleration select bits	With Unidrive SP, Operation of Acceleration/Deceleration ramps has been simplified, selection requires 3bits for Accel ramps (Pr2.32~2.34) and 3bits for Decel ramps (Pr2.35~2.37), details overleaf
2.35 - 2.37	Deceleration select bits	
2.38	Inertia compensation torque	Previously Reverse acceleration bit 0 (Unidrive I), no longer applicable in Unidrive SP due to the functional changes, Pr2.38 now Inertia compensation torque, torque required to compensate for calculated inertia during acceleration/deceleration,details overleaf
2.39, 2.40, 2.41		Previously Reverse acceleration select bit 0 (Pr2.39), Reverse deceleration select bit 0 (Pr2.40) & Reverse deceleration select bit 1 (Pr2.41) in Unidrive 1, no longer in required Unidrive SP due to simplified Ramp rate selection. see Pr2.32~ P2.37 overleaf for details

Menu 2: Ramps

2.01	Post ramp reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1		1				
Range	Open-loop Closed-loop vector and Servo								-3000Hz to +3000Hz -40000rpm to +40000rpm							
Update rate	4ms write															

2.04	Ramp mode select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop Closed-loop vector, Servo								2 1							
Default	Open-loop, Closed-loop vector, Servo								1							
Update rate	4ms read															

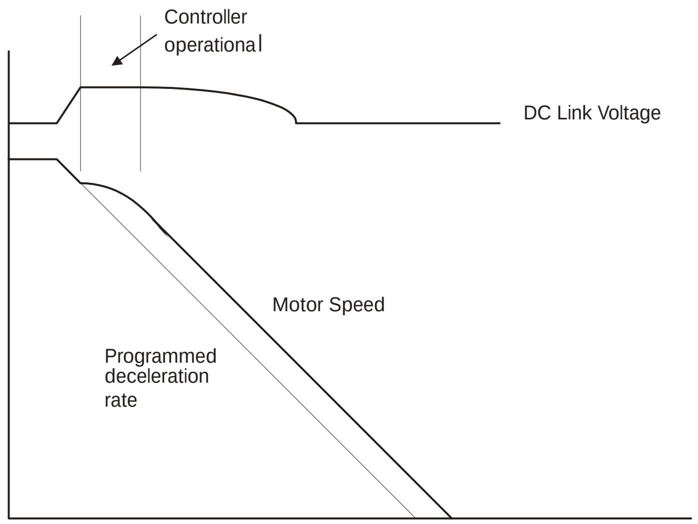
This parameter does not affect the acceleration ramp, and the ramp output always rises at the programmed acceleration rate subject to the current limits. It is possible under some unusual circumstances in open-loop mode (i.e. highly inductive supply) for the motor to reach a low speed in standard ramp mode, but not completely stop. It is also possible if the drive attempts to stop the motor with an overhauling load in any mode that the motor will not stop when standard ramp mode or fast ramp mode is used. If the drive is in the deceleration state the rate of fall of the frequency or speed is monitored. If this does not fall for 10 seconds the drive forces the frequency or the speed reference to zero. This only applies when the drive is in the deceleration state and not when the reference is simply set to zero.

0: Fast ramp

Fast ramp is used where the deceleration follows the programmed deceleration rate subject to current limits.

1: Standard ramp

Standard ramp is used. During deceleration, if the voltage rises to the standard ramp level (Pr 2.08) it causes a controller to operate, the output of which changes the demanded load current in the motor. As the controller regulates the link voltage, the motor deceleration increases as the speed approaches zero speed. When the motor deceleration rate reaches the programmed deceleration rate the controller ceases to operate and the drive continues to decelerate at the programmed rate. If the standard ramp voltage (Pr 2.08) is set lower than the nominal DC bus level the drive will not decelerate the motor, but it will coast to rest. The output of the ramp controller (when active) is a current demand that is fed to the frequency changing current controller (Open-loop mode) or the torque producing current controller (Closed-loop vector or Servo modes). The gain of these controllers can be modified with Pr 4.13 and Pr 4.14.

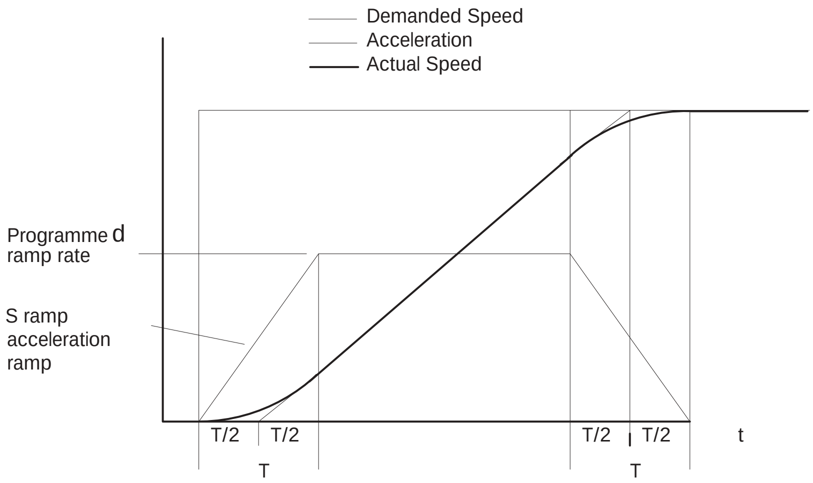


2: Standard ramp with motor voltage boost

This mode is the same as normal standard ramp mode except that the motor voltage is boosted by 20%. This increases the losses in the motor giving faster deceleration.

02.07	S ramp acceleration limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 300.0 s^2/100Hz 0.000 to 100.000 s^2/1000rpm							
Default	Open-loop Closed-loop vector Servo								3.1 1.500 0.030							
Update rate	Background read															

This parameter defines the maximum rate of change of acceleration/deceleration. The default values have been chosen such that for the default ramps and maximum speed, the curved parts of the S will be 25% of the original ramp if S ramp is enabled.



Since the ramp rate is defined in s/100Hz or s/1000rpm and the S ramp parameter is defined in s2/100Hz or s2/1000rpm, the time T for the 'curved' part of the S can be determined from:

T = S ramp rate of change / Ramp rate

Enabling S ramp increases the total ramp time by the period T since an additional T/2 is added to each end of the ramp in producing the S.

02.08	Standard ramp voltage															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1			1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 1150V							
Default	Open-loop, Closed-loop vector, Servo								200V rating drive: 375 400V rating drive: 750 575V rating drive: 895 690V rating drive: 1075							
Update rate	Background read															

This voltage is used as the control level for standard ramp mode. If this parameter is set too low the machine will coast to rest, and if it is set too high and no braking resistor is used the drive may give an OU trip. The minimum level should be greater than the voltage produced on the DC bus by the highest supply voltage. Normally the DC bus voltage will be approximately the rms supply line voltage √2.

02.11 - 02.18	Acceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								5.0 2.000 0.200							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.04 for parameter 02.11 only							
Update rate	4ms read															

02.19	Jog acceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								0.2 0.000 0.000							
Update rate	Background read															

The jog acceleration rate is only used when accelerating towards the jog reference and when changing the jog reference.

02.21 - 02.28	Deceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								10.0 2.000 0.200							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.05 for parameter 02.21 only							
Update rate	4ms read															

02.29	Jog deceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								0.2 0.000 0.000							
Update rate	4ms read															

The jog deceleration rate is only used when the drive is changing speed because the jog reference has changed or to stop from the jog reference. It is not used to go from the jog to the run state. This prevents the fast ramps normally used with jog from being used when changing between running and jogging.

02.32- 02.37	Ramp rate select bits															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Update rate	4ms read															

These bits are provided for control by logic input terminals for external ramp selection (see parameters 02.22 to 02.25).

02.32 Acceleration select bit 0

02.33 Acceleration select bit 1

02.34 Acceleration select bit 2

02.35 Deceleration select bit 0

02.36 Deceleration select bit 1

02.37 Deceleration select bit 2

02.38	Inertia compensation torque															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1		1				
Range	Closed-loop vector and Servo								-1000.0 to 1000.0%							
Update rate	4ms write															

The motor and load inertia (parameter 03.18), motor torque per amp (parameter 05.32) and the rate of change of the ramp output (parameter 02.01) are used to produce a torque feed forward value that should accelerate or decelerate the load at the required rated. This value can be used as a feed forward term that is added to the speed controller output if parameter 04.22 is set to one. Parameter 02.38 shows the torque value as a percentage of rated active current.

Menu 3: Frequency slaving, speed feedback & speed control

There are a number of parameters in menu 3 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detailed explanation of the changes are shown overleaf.

Parameter	Function	Details
3.01	Final Speed reference	With Unidrive SP, Ranges of Final speed reference, Speed Feedback & Speed error have increased to from +/-30,000RPM (Unidrive 1) to +/-40,000RPM, details overleaf
3.02	Speed Feedback	
3.03	Speed error	
3.04	Speed controller output	With Unidrive SP, Range of Speed controller output has increased to from +/-400% (Unidrive 1) to +/-1000%, details overleaf
3.06	At Speed lower limit	With Unidrive SP, Ranges of At Speed, lower limit, At Speed upper limit, Overspeed threshold have increased to from:- 0~1000Hz(OL>), 0~30,000RPM(CL>) Unidrive 1 to 0~3000Hz(OL>), 0~40,000RPM(CL>) Unidrive SP details overleaf
3.07	At Speed upper limit	
3.08	Overspeed threshold	
3.10	Speed controller proportional gain Kp1	With Unidrive SP (CL>), the range and default values of the speed loop P, I & D (Pr3.10, 3.11 & 3.12) gains have been changed, details overleaf
3.11	Speed controller integral gain Ki1	
3.12	Speed controller differential f/b gain Kd1	
3.17	OL> Select x 2048 output	Previously Frequency slaving ratio bit 1 in Unidrive 1,with Unidrive SP Pr 3.17 and Pr 3.18, select x2048 option. When F and D frequency slaving Pr 3.18 is used. The output frequency is either x1 or x 2048 times the drive fundamental output frequency (selected by Pr 3.17). Previously with Unidrive 1 the range for selection was x1, x192 and x1536 with the F and D output.When quadrature A/B signals are used, the slaving output frequency is effectively divided by 2 giving either 0.5 or 1024 times the drive fundamental output frequency with Unidrive SP, details overleaf
3.18	OL> Select F & D frequency slaving output	
3.13	CL> Speed controller Proportional gainKp2	New parameters with Unidrive SP (CL>), a second set of P, I & D gains (Pr3.13, Pr3.14 & Pr3.15) has been included, these additional gains have identical range & resolution to Pr3.11, Pr3.11, Pr3.12 and are selectable via Pr 31.6 Speed controller gain select, details overleaf.
3.14	CL> Speed controller integral gain Ki2	
3.15	Speed controller differential f/b gain Kd1	
3.16	CL> Speed controller gain select	New parameter in UnIdrive SP (CL>), selects second set of P I D speed loop gains, details overleaf
3.17	CL> Speed controller gain select	New parameter in UnIdrive SP (CL>), allows 3 methods for calculation of Pr3.10~3.15) 0 User set-up, 1 Bandwidth set-up, 2 compliance angle set-up Details overleaf

Menu 3: Frequency slaving, speed feedback & speed control

Parameter	Function	Details
3.18	CL> Motor and load inertia	New parameter in Unidrive SP (CL>), total inertia driven by the motor, can be calculated as part of autotune function, details overleaf
3.19	Compliance angle	Previously Hard speed reference in Unidrive1, Pr3.22 now Hard speed reference in Unidrive SP, details overleaf
3.20	Bandwidth	Previously Hard speed reference selector in Unidrive1 (CL>), Pr3.23 now Hard speed reference selector in Unidrive SP, details overleaf
3.21	Damping factor	Previously No of Encoder lines/pulses per rev in Unidrive1 (CL>), No of Encoder lines/pulses per rev now Pr3.34 in Unidrive SP. Pr3.21 now Damping factor in Unidrive SP (CL>), details overleaf
3.22	Hard speed reference	Previously Frequency input select in Unidrive1 (CL>), Frequency input select now configured using Pr3.38 Drive encoder type in Unidrive SP. Pr3.22 now Hard speed reference in Unidrive SP (CL>), details overleaf
3.23	Hard speed reference selector	Previously Encoder supply voltage select in Unidrive1 (CL>), Encoder supply voltage select now Pr3.36 Encoder supply voltage in Unidrive SP. Pr3.23 now Hard speed reference in Unidrive SP (CL>), details overleaf
3.24	Closed loop vector mode	Previously Encoder termination disable in Unidrive1 (CL>), Encoder termination disable now Pr3.39 Encoder termination select in Unidrive SP. Pr3.24 now Closed loop vector mode in Unidrive SP(CL>), details overleaf
3.25	Encoder phase angle	Previously Encoder phasing test in Unidrive1 (CL>), Encoder phasing test now Pr5.12 Magnetizing current test enable in Unidrive SP. Pr3.25 now Encoder phase angle in Unidrive SP(CL>), details overleaf
3.26	Speed feedback selector	Previously Encoder 1 input (RPM) in Unidrive1 (CL>), Encoder 1 input (RPM) now Pr3.27 in Unidrive SP. Pr3.26 now Speed feedback selector in Unidrive SP(CL>), details overleaf
3.27	Drive encoder speed feedback	Previously Encoder 1 position in Unidrive1, Encoder 1 position now Pr3.29 in Unidrive SP. Pr3.27 now Drive encoder speed feedback in Unidrive SP, details overleaf
3.28	Drive encoder revolution counter	Previously Phase position in Unidrive1, Phase position now Pr3.25 vin Unidrive SP. Pr3.28 now Drive encoder revolution counter in Unidrive SP, details overleaf
3.29	Drive encoder position	Previously Overspeed threshold mode select in Unidrive1, Overspeed threshold mode select now replaced operation of Pr3.08 in Unidrive SP. Pr3.29 now Drive encoder position in Unidrive SP, details overleaf
3.30	Drive encoder fine position	Previously Speed loop window filter period in Unidrive1, Speed loop window filter period (Drive encoder filter) now Pr3.42 in Unidrive SP. Pr3.30 now Drive encoder fine position in Unidrive SP, details overleaf

Menu 3: Frequency slaving, speed feedback & speed control

Parameter	Function	Details
3.31	Drive encoder marker position reset disable	Previously Servo phasing fail detect enable in Unidrive1, Servo phasing fail detect enable now redundant in Unidrive SP. Pr3.30 now Drive encoder marker position reset disable in Unidrive SP, details overleaf
3.32	Drive encoder marker flag	New parameter, details overleaf
3.33	Drive encoder turns bits	New parameter, details overleaf
3.34	Drive encoder lines per revolution	Parameter changes detailed below
3.35	Drive encoder single turn comms resolution	New parameter, details below
3.36	Drive encoder supply voltage	New parameter with Unidrive SP, the encoder supply voltage range has been increased, Pr 3.36 = 0(5V), 1(8V), or 2(15V).details overleaf
3.37	Drive encoder comms baud rate	New parameter, details overleaf
3.38	Drive encoder type	New parameter, details overleaf
3.39	Drive encoder termination disable	Previously Pr3.24 in Unidrive 1, range of options improved with Unidrive SP, specific termination resistors can be enabled / disabled with Unidrive SP, details overleaf
3.40	Drive encoder error detection level	New parameter with Unidrive SP, details overleaf
3.41	Drive encoder auto-config / SSI format select	New parameter with Unidrive SP, details overleaf
3.42	Drive encoder filter	Increased functionality with Unidrive SP
3.43	Maximum drive encoder reference	New parameter with Unidrive SP, details overleaf
3.44	Drive encoder reference scaling	New parameter with Unidrive SP, details overleaf
3.45	Drive encoder reference	New parameter with Unidrive SP, details overleaf
3.46	Drive encoder reference destination	New parameter with Unidrive SP, details overleaf
3.47	Re-initialize position feedback	New parameter with Unidrive SP, details overleaf
3.48	Position feedback initialized	New parameter with Unidrive SP, details overleaf
3.49	Full motor object electronic nameplate transfer	New parameter with Unidrive SP, details overleaf

Open loop only

03.06	At speed lower limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP=0															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3000.0Hz 0 to 40,000rpm							
Default	Open-loop Closed-loop vector and Servo								1.0 5							
Update rate	Background read															

03.07	At speed upper limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP=0															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3000.0Hz 0 to 40,000rpm							
Default	Open-loop Closed-loop vector and Servo								1.0 5							
Update rate	Background read															

03.09	Absolute “at speed” select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1						1						1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

“At speed” flag (10.06) is set if the post-ramp reference (02.01) is on the boundaries or within the at speed window. Flags 10.07 and 10.05 are set if the reference is above or below the window respectively.

If 03.09=0 reference window mode is used and the “at speed” condition is true if (|01.03| - 03.06) (|02.01| ((|1.03| + 03.07)
(If the lower limit is less than zero then zero is used as the lower limit.)

If 03.09=1 absolute window mode is used and the “at speed” condition is true if 03.06 (|02.01| (03.07

The speed detector system also includes an overspeed trip in open-loop mode. The level cannot be set by the user, but the drive produces an overspeed trip if the final frequency (parameter 05.01) exceeds 1.2 x SPEED_FREQ_MAX.

03.17	Select x2048 output															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1	1	
Default	Open-loop								1							
Update rate	Background read															

03.18	F and D frequency slaving output															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop								0							
Update rate	Background read															

The frequency slaving output is in the form of F and D or quadrature A/B signals (03.18=0 gives quadrature, 03.18=1 gives F and D). When F and D is used the output frequency is either 1 or 2048 times the drive fundamental output frequency (selected by parameter 03.17). When quadrature A/B signals are used, the slaving output frequency is effectively divided by 2 giving either 0.5 or 1024 times the drive fundamental output frequency. When the drive output frequency changes direction there is always a period of 250µs where no pulses are produced. This ensures that with an F and D output there is a set-up time of 250µs for the direction signal before an edge occurs on the frequency signal. The frequency slaving output operates up to 1000Hz, above this frequency the outputs could be undefined.

Closed loop only

03.01	Final speed reference															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Closed-loop vector, Servo								-40,000 to 40,000 rpm							
Update rate	4ms write															

Final speed demand at the input to the speed regulator formed by the sum of the ramp output and the hard speed reference (if the hard speed reference is enabled). If the drive is disabled this parameter will show 0.0.

03.02	Speed feedback															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Closed-loop vector, Servo								-40,000 to 40,000 rpm							
Update rate	4ms write															

The speed feedback can be taken from the drive encoder connector or a position feedback module fitted in any slot as selected with parameter 03.26. This parameter shows the speed feedback used by the speed controller. The speed feedback from an encoder includes quantisation ripple given by

Encoder speed ripple = 60 / $250x10^{-6}$ / ELPR x 4

where ELPR is the equivalent encoder lines per revolution as defined in Section 4. For example, with a 4096 line encoder the speed ripple is 14.6rpm. If a SINCOS encoder is used then the ripple is reduced by 1/256. The value seen on the drive display is filtered so that it can be read by the user, however, the actual parameter held within the drive is not filtered. If the parameter is routed to an analogue output or used by an option module the ripple is present. It should be noted that the quantisation of the speed feedback does not affect the resolution or accuracy of the speed controller. The ripple is passed to the torque/current controller via the speed controller gains and can cause ripple in the current applied to the motor, which in turn results in acoustic noise. The noise can be reduced by using a position feedback device with higher resolution, or by filtering the speed feedback (see parameter 03.41) or the current demand (see parameter 04.12).

03.03	Speed error															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Closed-loop vector, Servo								-40,000 to 40,000 rpm							
Update rate	4ms write															

The speed error is the difference between the final speed demand and the speed feedback in rpm. This does not include the effect of the D term in the speed controller feedback branch.

03.04	Speed controller output															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Closed-loop vector, Servo								-1000.0 to 1000.0 %							
Update rate	4ms write															

The output of the speed regulator is a torque demand given as a percentage of rated motor torque. This is then modified to account for changes in motor flux if field weakening is active, and then used as the torque producing current reference.

03.05	Zero speed threshold															
Drive modes	, Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP=0															
Range	and Open-loop Closed-loop vector and Servo								0.0 to 20.0Hz 0 to 200rpm							
Default	and Open-loop Closed-loop vector and Servo								1.0 5							
Update rate	Background read															

If the speed feedback (parameter 03.02) is at or below the level defined by this parameter in either direction the Zero speed flag (parameter 10.03) is 1, otherwise the flag is 0.

03.06	At speed lower limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP=0															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3000.0Hz 0 to 40,000rpm							
Default	Open-loop Closed-loop vector and Servo								1.0 5							
Update rate	Background read															

3.07	At speed upper limit															
Drive modes	Open-loop, Closed-loop vector and Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP=0															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3000.0Hz 0 to 40,000rpm							
Default	Open-loop Closed-loop vector and Servo								1.0 5							
Update rate	Background read															

“At speed” flag (10.06) is set if the speed feedback (03.02) is on the boundaries or within the at speed window. Flags 10.07 and 10.05 are set if the reference is above or below the window respectively.

If 03.09=0 reference window mode is used and the “at speed” condition is true if (|01.03| - 03.06) (|03.02| ((|1.03| + 03.07)

(If the lower limit is less than zero then zero is used as the lower limit.)

If 03.09=1 absolute window mode is used and the “at speed” condition is true if 03.06 (|03.02| (03.07

03.08	Overspeed threshold															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector, Servo								0 to 40,000rpm							
Default	Closed-loop vector, Servo								0							
Update rate	Background read															

If the speed feedback (parameter 03.02) exceeds this level in either direction an overspeed trip is produced. If this parameter is set to zero the overspeed threshold is automatically set to 1.2 x SPEED_FREQ_MAX.

03.09	Absolute “at speed” detect															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

See parameters 03.06 and 03.07.

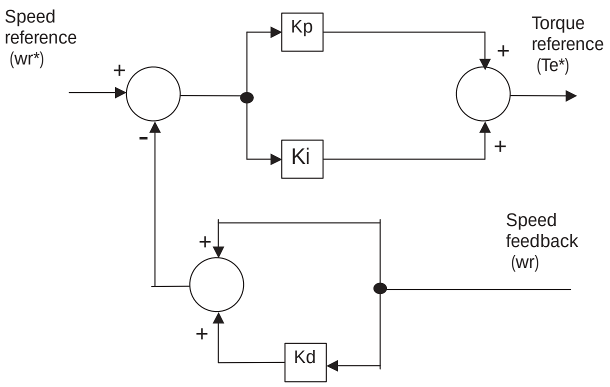
03.10, 03.13	Speed controller proportional gains (Kp1, Kp2)															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							4						1	1	1	
Range	Closed-loop vector, Servo								0.0000 to 6.5335(1/ rad/s)							
Default	Closed-loop vector, Servo								0.0100							
Second motor parameter	Closed-loop vector, Servo								21.17							
Update rate	Background read															

03.11, 03.14	Speed controller integral gains (Ki1, Ki2)															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Closed-loop vector, Servo								0.00 to 653.35(1/rad)							
Default	Closed-loop vector, Servo								1.00							
Second motor parameter	Closed-loop vector, Servo								21.18							
Update rate	Background read															

03.12, 03.15	Speed controller differential feedback gains (Kd1, Kd2)															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							5						1	1	1	
Range	Closed-loop vector, Servo								0.00000 to 0.65335(s / (rad/s))							
Default	Closed-loop vector, Servo								0.00000							
Second motor parameter	Closed-loop vector, Servo								21.19							
Update rate	Background read															

3.16	Speed controller gain select															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Closed-loop vector, Servo								0							
Update rate	4ms read															

The diagram below shows a generalised representation of the speed controller. The controller includes proportional (Kp) and integral (Ki) feedforward terms, and a differential (Kd) feedback term. The drive holds two sets of these gains and either set may be selected for use by the speed controller with Pr 3.16. If Pr 3.16 = 0, gains Kp1, Ki1 and Kd2 are used, if Pr 3.16 = 1, gains Kp2, Ki2 and Kd2 are used. Pr 3.16 may be changed when the drive is enabled or disabled.



Proportional gain (Kp)

If Kp has a value and Ki is set to zero the controller will only have a proportional term, and there must be a speed error to produce a torque reference. Therefore as the motor load increases there will be a difference between the reference and actual speeds. This effect, called regulation, depends on the level of the proportional gain, the higher the gain the smaller the speed error for a given load. If the proportional gain is too high either the acoustic noise produced by speed feedback quantisation (using digital encoders, resolvers, etc.) becomes unacceptable, or the closed-loop stability limit is reached (using SinCos encoders).

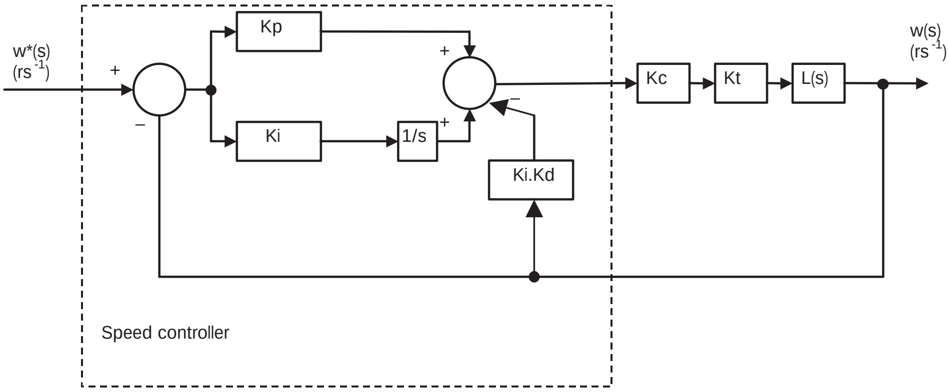
Integral gain (Ki)

The integral gain is provided to prevent speed regulation. The error is accumulated over a period of time and used to produce the necessary torque demand without any speed error. Increasing the integral gain reduces the time taken for the speed to reach the correct level and increases the stiffness of the system, i.e. it reduces the positional displacement produced by applying a load torque to the motor. Unfortunately increasing the integral gain also reduces the system damping giving overshoot after a transient. For a given integral gain the damping can be improved by increasing the proportional gain. A compromise must be reached where the system response, stiffness and damping are all adequate for the application. The integral term is implemented in the form of ((Ki x error), and so the integral gain can be changed when the controller is active without causing large torque demand transients.

Differential gain (Kd)

The differential gain is provided in the feedback of the speed controller to give additional damping. The differential term is implemented in a way that does not introduce excessive noise normally associated with this type of function. Increasing the differential term reduces the overshoot produced by under-damping, however, for most applications the proportional and integral gains alone are sufficient.

To analyse the performance of the speed controller it may be represented as an s-domain model as shown below.



where:

Kc is the conversion between the speed controller output and torque producing current. A value of unity at the input to this block gives a torque producing current equivalent to the rated current of the drive. The drive automatically compensates the torque producing current for flux variations in field weakening, and so Kc can be assumed to have a constant value.

Kc= Drive rated current

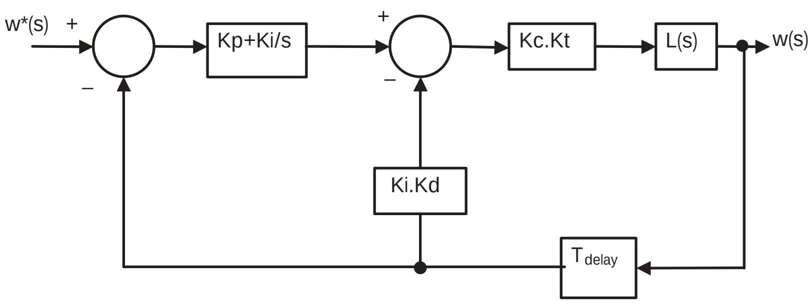
Kt is the torque constant of the motor (i.e. torque in Nm per amp of torque producing current). This value is normally available for a servomotor from the manufacturer, however, induction motor the value must be calculated from

Kt= Motor rated torque / Motor rated torque producing current

= Motor rated torque / (√Motor rated current^2 - No load current^2)

L(s) is the transfer function of the load.

The s-domain system above may be used to determine the performance of systems with a relatively low bandwidth. However, the real drive system also includes non-ideal delays due to the torque controller response, and speed measurement and control delays. These delays, which can be approximated with a simple unity gain transport delay (Tdelay) as shown below, should be taken into account for more accurate results.



The table below shows the delays that should be used with different switching frequencies assuming that the current controllers have been set up correctly.

Switching frequency	Speed measurement delay	Torque reference calculation delay	Torque reference calculation delay	T_{delay}
3, 6, 12kHz	125µs	83µs	333µs	541µs
4, 8, 16kHz	125µs	125µs	500µs	750µs

The speed controller gains used in previous Unidrive products were in internal drive units. Conversion between the previous internal units and the SI units used in this product are given in the table below.

Gain	Conversion from previous internal units to new SI units
Kp	Kp_old / 17103
Ki	Ki_old / 94.41
Kd	Kd_old / 46376

3.17	Speed controller set-up method														
Drive modes	Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector, Servo								0 to 2							
Default	Closed-loop vector, Servo								0							
Update rate	Background (1s) read															

The user may enter the required speed controller gains into Pr 3.10 to Pr 3.15. However, if the load is predominantly a constant inertia and constant torque, the drive can calculate the required Kp and Ki gains, provided a value of motor plus load inertia (Pr 3.18) and the motor torque per amp for Servo mode (Pr 5.32) are set-up correctly.

The gain values are calculated to give a required compliance angle or bandwidth. The calculated values for Kp and Ki are written to Pr 3.10 and Pr 3.11 once per second when one of these set-up methods is selected (i.e. Pr 3.17 = 1 or 2). The values are calculated from a linear model assuming a pure inertia load, not including the speed and current controller delays. The Kd gain is not affected

0: user set-up

With the default value the user should enter the required speed controller gains.

1: Bandwidth set-up

If bandwidth based set-up is required the following parameters must be set correctly: Pr 3.20=required bandwidth, Pr 3.21=required damping factor, Pr 3.18=motor+load inertia (it is possible to measure the load inertia as part of the auto-tuning process, see Pr 5.12), Pr 5.24=motor torque per amp (for Servo mode only).

$Ki = (J / (Kc \times Kt) \times (2\pi \times Bandwidth / Kbw)^2 = (Pr\ 3.18 / (Pr\ 5.07 \times Pr\ 5.32) \times (2\pi \times Pr\ 3.20 / Kbw)^2$

where $Kwb = \sqrt{[(2\xi^2 + 1) + \sqrt{((2\xi^2 + 1)^2 + 1)}]}$

$Kp = 2 \zeta \sqrt{[(Ki \times J) / (Kc \times Kt)]} = 2 \zeta \sqrt{[(Pr\ 3.11 \times Pr\ 3.18) / (Pr\ 5.07 \times Pr\ 5.32)]}$

2: Compliance angle set-up

If compliance angle based set-up is required the following parameters must be set correctly: Pr 3.19=required compliance angle, Pr 3.21=required damping factor, Pr 3.18=motor+load inertia (it is possible to measure the load inertia as part of the auto-tuning process, see Pr 5.12), Pr 5.24=motor torque per amp (for Servo mode only).

Ki = 1 / Compliance angle (rs^{-1})

Kp = 2 ζ √ [(Ki x J) / (Kc x Kt)] = 2 ζ √ [(Pr 3.11 x Pr 3.18) / (Pr 5.07 x Pr 5.32)]

3.18	Motor and load inertia															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							4						1	1	1	
Range	Closed-loop vector, Servo								0.0001 to 100.0000 kgm^2							
Default	Closed-loop vector, Servo								0.0000							
Update rate	Background (1s) read															

The motor and load inertia represents the total inertia driven by the motor. This is used to set the speed controller gains (see Pr 3.13 - Pr 3.15) and to provide torque feedforwards during when acceleration is required (see Pr 4.11).

(It is possible to measure the inertia as part of the auto-tune process, see Pr 5.12).

3.19	Compliance angle															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Closed-loop vector, Servo								0.0 to 359.9degrees							
Default	Closed-loop vector, Servo								4.0							
Update rate	Background (1s) read															

The compliance angle is the required angular displacement when the drive delivers a torque producing current equivalent to the motor rated current (Pr 5.07) with no field weakening.

3.20	Bandwidth															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector, Servo								0 to 255Hz							
Default	Closed-loop vector, Servo								10Hz							
Update rate	Background (1s) read															

The bandwidth is defined as the theoretical 3dB point on the closed-loop gain characteristic of the speed controller as a second order system. At this point the phase shift is approximately 60deg.

3.21	Damping factor															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Closed-loop vector, Servo								0.0 to 10.0							
Default	Closed-loop vector, Servo								1.0							
Update rate	Background (1s) read															

This is the damping factor related to the response of the system to a torque transient, and so if the damping factor is unity the response to a load torque transient is critically damped. The step response of the speed controller gives approximately 10% overshoot with unity damping factor.

3.22	Hard speed reference															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1						1	1	1	
Range	Closed-loop vector, Servo								±SPEED_FREQ_MAX rpm							
Default	Closed-loop vector, Servo								0.0							
Update rate	4ms read															

The hard speed reference is a reference value, which does not pass through the ramp system (Menu 2). It is added to the normal post ramp speed reference. Its value may be written from the keypad, via serial comms, from an analogue input or from an encoder input. This parameter can also be used by the position controller (Menu 13) as the speed correction input.

3.24	Closed-loop vector mode															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector								0 to 3							
Default	Background read								0							
Update rate	4ms read															

0: Closed-loop vector mode with position feedback
The drive uses the closed-loop vector algorithm with the selected position feedback.

1: Closed-loop vector mode without position feedback
The drive uses the closed-loop vector algorithm and derives the position feedback internally.

2: Closed-loop vector mode with no maximum speed limit

3: Closed-loop vector mode without position feedback with no maximum speed limit

In some applications using closed-loop vector control the maximum speed of the system is above the speed at which the encoder feedback frequency is too high to be used by the drive. For these type of applications Pr 3.24 should be set to 2 for low speed operation and 3 for high speed operation. It should be noted that the drive no longer checks that the maximum encoder frequency cannot be exceeded in closed-loop vector control, and so the user must ensure that Pr 3.24 is set to 3 before the encoder frequency limit is reached.

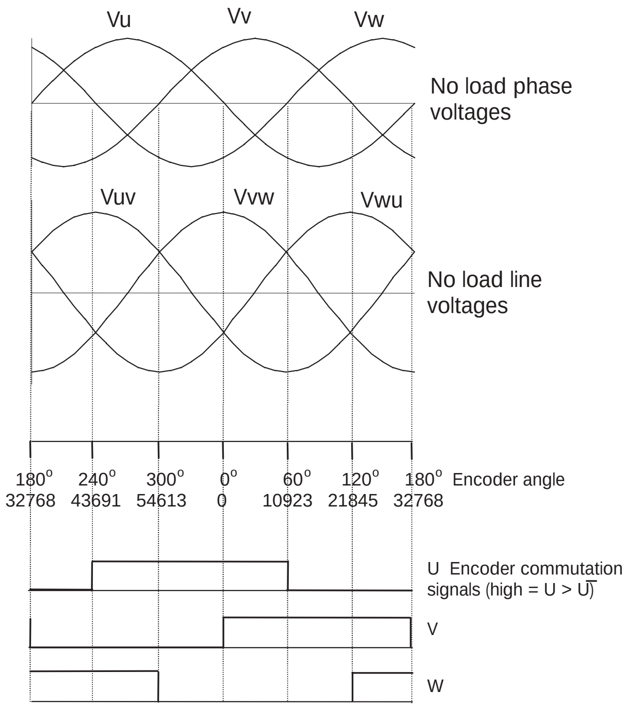
3.25	Encoder phase angle															
Drive modes	Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1				1	1	1
Range	Servo								0.0 to 359.9deg electrical							
2nd motor Parameter	Servo								21.20							
Update rate	Background read															

The phase angle between the rotor flux in a servomotor and the encoder position is required for the motor to operate correctly. If the phase angle is known it can be set in this parameter by the user. Alternatively the drive can automatically measure the phase angle by performing a phasing test (see Pr 5.12). When the test is complete the new value is written to this parameter. The encoder phase angle can be modified at any time and becomes effective immediately. This parameter has a factory default value of 0.0, but is not affected when defaults are loaded by the user.

The alignment required for zero encoder phase angle (i.e. Pr 3.25=0.0) is given below for different feedback devices. Forward rotation of the motor is produced when Vu leads Vv leads Vw. Although it is not essential, forward rotation of a motor is normally defined as clockwise when looking at the motor shaft end. When the motor is rotating forwards the motor speed is shown as positive and the position increases.

Encoder with commutation signals

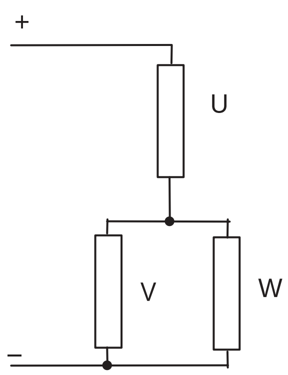
The alignment required between the no-load motor voltages and the commutation signals are shown in the diagram below for a 2-pole motor.



Encoder alignment for zero encoder phase angle

When commutation signals are used with a motor that has more than 2 poles the sequence shown above must be repeated for each pole pair and aligned in the same way with the motor voltages.

The encoder can be aligned statically by connecting the motor to a d.c power supply as shown.



The motor will move to one of a number of positions. The number of positions in defined by the number of motor pole pairs (i.e. 3 positions for a six pole motor, etc.). The encoder should be adjusted so that the U commutation signal is high, W is low and V is toggling in one of these positions.

Absolute encoder or resolver

The alignment required between the no-load motor voltages and the commutation signals is shown in the alignment diagram above. The encoder can be aligned statically by connecting the motor to a d.c power supply as shown above. The motor will move to one of a number of positions. The number of positions in defined by the number of motor pole pairs (i.e. 3 positions for a six pole motor, etc.). The encoder should be adjusted so that the position displayed by the drive is n x 65536 / pole_pairs, where n = 0, 1, ... (pole_pairs - 1).

3.26	Speed feedback selector															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Closed-loop vector, Servo								0 to 3							
Default	Closed-loop vector, Servo								0							
2nd motor Parameter	Closed-loop vector, Servo								21.21							
Update rate	Background read (Only has any effect when the drive is disabled)															

0, drv: Drive encoder

The position feedback from the encoder connected to the drive itself is used to derive the speed feedback for the speed controller and to calculate the motor rotor flux position.

1, Slot1: Option module in slot 1

The position feedback from the option module in option module slot 1 is used to derive the speed feedback for the speed controller and to calculate the motor rotor flux position. If a position feedback category option module is not fitted in slot 1 the drive produces an EnC8 trip.

2, Slot2: Option module in slot 2

3, Slot3: Option module in slot 3

3.28	Drive encoder revolution counter															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1					1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65535 revolutions							
Update rate	4ms write															

Provided the set-up parameters for the drive encoder are correct this parameter shows the encoder revolution counts.

3.29	Drive encoder position															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1					1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65535 (1/2^{16}ths of a rev)							
Update rate	4ms write															

Provided the set-up Pr for the drive encoder are correct this Pr shows the encoder position.

3.30	Drive encoder fine position															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1					1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65535 (1/2^{32}ths of a rev)							
Update rate	4ms write															

These Pr effectively give the encoder position with a resolution of 1/2^{32}ths of a revolution as a 48-bit number as shown below.

47 32	31 16	15 0
Revolutions	Position	Fine position

Provided the encoder set-up Pr are correct, the position is always converted to units of 1/2^{32}ths of a revolution, but some parts of the value may not be relevant depending on the resolution of the feedback device.

For example a 1024 line digital encoder produces 4096 counts per revolution, and so the position is represented by the bits in the shaded area only.

47 32	31 20	19 16	15 0
Revolutions	Position		Fine position

When the encoder rotates by more than one revolution, the revolutions in Pr 3.28 increment or decrement in the form of a sixteen-bit rollover counter. If an absolute position feedback device (except an encoder with commutation signals) is used the position is initialised at power-up with the absolute position. If a multi-turn absolute encoder is used the revolution counter is also initialised with the absolute revolutions at power-up.

3.31	Drive encoder marker position reset disable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

3.32	Drive encoder marker flag														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms write															

An incremental digital encoder may have a marker channel and when this channel becomes active it may be used to reset the encoder position and set the marker flag (03.31=0), or just to set the marker flag (03.31=1). When the position is reset by the marker, Pr 3.29 and 3.30 are reset to zero. The marker flag is set each time the marker input becomes active, but it is not reset by the drive, and so this must be done by the user.

The marker function only operates when Ab, Fd, Fr, Ab.Servo, Fd.Servo, Fr.Servo type encoders are selected with Pr 3.38.

3.33	Drive encoder turns bits															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 16							
Default	Open-loop, Closed-loop vector, Servo								16							
Update rate	Background read (Only has any effect when the drive is disabled)															

When an encoder without comms is used it is sometimes desirable to mask off the most significant bits of the revolution counter. Normally this would be required with an absolute multi-turn encoder where the number of turns measured is less than 65536. If Pr 3.33 is zero the revolution counter (3.28) is held at zero. If Pr 3.33 has any other value it defines the maximum number of the revolution counter before it is reset to zero. For example, if 3.33=5, then 3.28 counts up to 31 before being reset.

When an encoder with comms is used, 3.33 must contain the number of bits in the comms message used to give the multi-turn information. For a single turn comms encoder, 3.33 must be set to zero. It is possible for the drive to set up this Pr automatically from information obtained from the encoder via Hiperface or EnDat interfaces (see Pr 3.41).

3.34	Drive encoder lines per revolution															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 50,000							
Default	Open-loop and Closed-loop vector Servo								2048 4096							
Update rate	Background read (Only has any effect when the drive is disabled)															

When Ab, Fd, Fr, AbServo, Fd.Servo, Fr.Servo or SINCOS signals are used the equivalent number of encoder lines per revolution must be set-up correctly in Pr 3.34 to give the correct speed and position feedback. This is particularly important if the encoder is selected for speed feedback with Pr 3.26. The equivalent number of encoder lines per revolution (ELPR) is defined as follows.

Position feedback device	ELPR
Ab, Ab.Servo	number of lines per revolution
Fd, Fr, Fd.Servo, Fr.Servo	number of lines per revolution / 2
SC.Hiper, SC.EnDat, SC	number of sine waves per revolution

Although Pr 3.34 can be set to any value from 0 to 50,000 there are restrictions on the values actually used by the drive as follows:

Position feedback device	ELPR used by the drive
Ab, Fd, Fr	3.34 < 2, ELPR = 2 3.34 <= 16383, ELPR = 3.34 3.34 > 16383, ELPR = 3.34 rounded down to nearest value divisible by 4
Ab.Servo, Fd.Servo, Fr.Servo, SC.Hiper, SC.EnDat, SC	3.34 < 2, ELPR = 2 3.34 > 16384, ELPR = 16384 Otherwise, 3.34 rounded down to the nearest value that is a power of 2

Where encoder comms alone is used as position feedback, the equivalent lines per revolution Pr 3.34) is not used in setting up the encoder interface. It is possible for the drive to set up this Pr automatically from information obtained from the encoder via Hiperface or EnDat interfaces (see Pr 3.41).

3.35	Drive encoder single turn comms resolution															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 32 bits							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read (Only has any effect when the drive is disabled)															

Where encoder comms is used for initial setting of absolute position (SC.Hiper or SC.EnDat), the single turn comms resolution in bits must be set correctly. This is the number of bits used to represent one revolution of the encoder.

The single turn comms resolution may be higher than the resolution of the sine waves per revolution.

Where encoder comms alone is used the encoder single turn comms resolution (3.35) and the encoder turns bits (3.33) must be set correctly. Although Pr 3.35 can be set to any value from 0 to 32, if the value is less than 1, the resolution is 1 bit. Some SSI encoders include a power supply monitor alarm using the least significant bit of the position. It is possible for the drive to monitor this bit and produce an EnC6 trip if the power supply is too low (see Pr 3.40). If the encoder gives this information the comms resolution should be set up to include this bit whether or not it is being monitored by the drive

It is possible for the drive to set up this Pr automatically from information obtained from the encoder via Hiperface or EnDat interfaces (see Pr 3.41).

3.37	Drive encoder comms baud rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 8							
Default	Open-loop, Closed-loop vector, Servo								2							
Update rate	Background read (Only has any effect when the drive is disabled)															

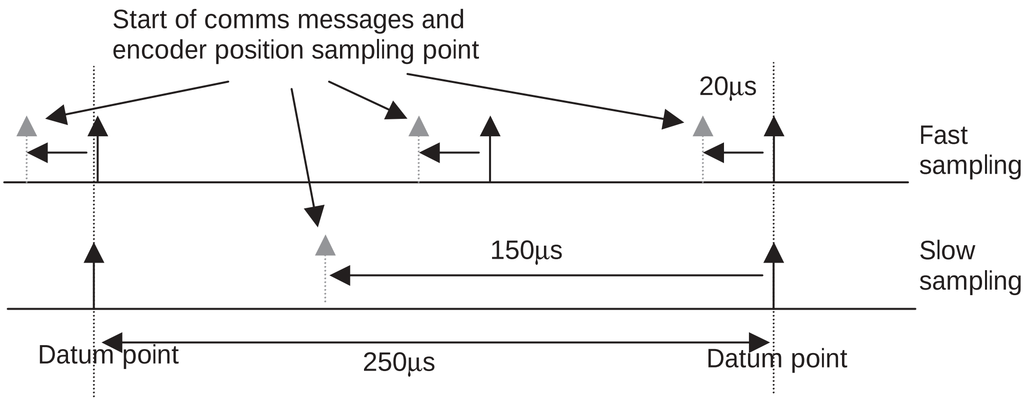
This Pr defines the baud rate for the encoder comms when using SSI or EnDat encoders. However, a fixed baud rate of 9600 baud is used with Hiperface encoders and this Pr has no effect.

Pr value	Pr string	Baud rate
0	100	100k
1	200	200k
2	300	300k
3	400	400k
4	500	500k
5	1000	1M
6	1500	1.5M
7	2000	2M
8	4000	4M

Any baud rate can be used when encoder comms is used with a SINCOS encoder to obtain the absolution position during initialisation.

When encoder comms is used alone the time taken to obtain the comms position must be 160µs or less, otherwise the drive initiates an EnC4 trip.

There is a delay associated with obtaining the position from an encoder using comms alone to transmit the position. The length of this delay affects the sample rate and timing of the position used by the drive for control and the position passed to option modules. If the position within one turn can be obtained in 30µs and the whole comms message including CRC (if appropriate) can be obtained in 60µs then fast sampling is used, otherwise slow sampling is used as shown below. In each case the encoder position is sampled by the encoder at the start of the comms message.



In the example the current/torque-sampling rate is 4kHz, but this will change if a different switching frequency is selected. If fast sampling is used the control position used to define the drive reference frame is obtained every current/torque control sample and the position passed to option modules is obtained 20µs before the datum point where other types of encoders are sampled. If slow sampling is used both the control position and the position passed to option modules is obtained 150µs before the datum. When fast sampling is used the delay introduced into the control system by the encoder is less, and so a higher control system bandwidth will be possible. So that the position values from the encoder can be used in a position control system compensation is provided for the delay in obtaining the position before it is made available to option modules or in the drive position Pr so that it appears to have been sampled at the datum. This compensation is based on the delay (i.e. 20µs or 150µs) and the change of position over the previous sample (between the last two datum points).

EnDat comms

The following equations are used by the drive to determine the time taken to obtain the position information from an EnDat encoder. These are based on tcal (5µs, where tcal is the time from the first clock edge of the position command message from the drive to the first clock edge when the encoder responds as defined in the EnDat specification. This limit of 5us includes may exclude a small number of EnDat encoders from being used by the drive as a comms only feedback device. It is also assumed that tD (1.25µs where tD is the data delay from the encoder as defined by the EnDat specification for 105m of cable. It should be noted that all values are rounded up to the nearest microsecond.

Command message time = $t_{command}$	= 10T or t_{cal} whichever is the longest where T = 1/Baud Rate, t_{cal} = 5µs
Time for single turn position	= $t_{command}$ + t_D + (2 + Single turn resolution) x T
	= $t_{command}$ + t_D + (2 + 03.35) x T
where t_D = 1.25µs	
Time for whole message including CRC	= Time for single turn position + (Number of turns bits + 5) x T
	= Time for single turn position + (3.33 + 5) x T

For example an encoder with 12 turns bits, 13 bit single turn resolution and a baud rate of 2M would give the following times:

Time for single turn position	= 14µs (13.75µs rounded up)
Time for the whole message including CRC	= 23µs (22.25µs rounded up)

SSI comms

The whole position must be obtained from an SSI encoder before it can be used by the drive, therefore the time for the single turn position and the time for the whole message are the same.

Time to obtain the position = (Number of turns bits + Single turn resolution + 1) x T
= (3.33 + 3.35 + 1) x T

For example and encoder with 12 turns bits, 13 bit single turn resolution and a baud rate of 1M would give the following time:
Time to obtain the position data = 28µs (27.25µs rounded up)

3.38	Drive encoder type															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 10							
Default	Open-loop, Closed-loop vector Servo								0 3							
Update rate	Background read (Only has any effect when the drive is disabled)															

The following encoders can be connected to the drive encoder connector:

0, Ab: Quadrature incremental encoder, with or without marker pulse

1, Fd: Incremental encoder with frequency and direction outputs, with or without marker pulse

2, Fr: Incremental encoder with forward and reverse outputs, with or without marker pulse

3, Ab.Servo: Quadrature incremental encoder with commutation outputs, with or without marker pulse

4, Fd.Servo: Incremental encoder with frequency, direction and commutation outputs, with or without marker pulse

5, Fr.Servo: Incremental encoder with forward, reverse and commutation outputs, with or without marker pulse
U, V, W commutation signals are required with an incremental type encoder when used with a servomotor. The UVW commutation signals are used to define the motor position during the first 120deg electrical rotation after the drive is powered-up or the encoder is initialised.

6, SC: SinCos encoder with no serial communications
This type of encoder gives incremental position and can only be used for control in Closed-loop vector mode.

7, SC.Hiper: Absolute SinCos encoder using Stegmann 485 comms protocol (Hiperface).
This type of encoder gives absolute position and can be used for motor control in closed-loop vector or servo modes. The drive can check the position from the sine and cosine waveforms against the internal encoder position using serial communications and if an error occurs the drive trips. An applications or fieldbus option module can communicate with the encoder via Pr that are not visible from the keypad or drive 485 comms.

8, EnDAt: Absolute EnDat only encoder
This type of encoder gives absolute position and can be used for motor control in closed-loop vector or servo modes. Additional communications with the encoder from an applications or fieldbus module is not possible.

9, SC.Endat: Absolute SinCos encoder using EnDat comms protocol
This type of encoder gives absolute position and can be used for motor control in closed-loop vector or servo modes. The drive can check the position from the sine and cosine waveforms against the internal encoder position using serial communications and if an error occurs the drive trips. An applications or fieldbus option module can communicate with the encoder via Pr that are not visible from the keypad or drive 485 comms.

10, SSI: Absolute SSI only encoder
This type of encoder gives absolute position and can be used for motor control in closed-loop vector or servo modes. Additional communications with the encoder from an applications or fieldbus module is not possible. SSI encoders use either gray code or binary format, which can be selected with Pr 3.41. Most SSI encoders use 13-bit single turn position information, and so Pr 3.35 should normally be set to 13. If the single turn resolution of the encoder is lower then the least significant bits of the data are always zero. Some SSI encoders use the least significant bit to show the status of the encoder power supply. In this case the single turn position resolution should be set to include this bit, but the drive should be set up to monitor it via Pr 3.40. Some SSI encoders use a right shifted format where the unused single turn position bits are removed instead of being set to zero. For these encoders the single turn position resolution should be set to the number of bits used for the single turn position.

It should be noted that all SINCOS encoders and encoders using communications must be initialised before their position data can be used. The encoder is automatically initialised at power-up, after trips EnC1 - Enc8 are reset, or when the initialisation Pr 3.47 is set to 1. If the encoder is not initialised or the initialisation is invalid the drive initiates trip EnC8.

3.39	Drive encoder termination selection															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1		
Range	Open-loop, Closed-loop vector, Servo								2							
Default	Open-loop, Closed-loop vector, Servo								1							
Update rate	Background read															

The terminations may be enabled/disabled by this Pr as follows:

Encoder input	3.39=0	3.39=1	3.39=2
A-A\	Disabled	Enabled	Enabled
B-B\	Disabled	Enabled	Enabled
Z-Z\	Disabled	Disabled	Enabled
U-U\, V-V\, W-W\	Enabled	Enabled	Enabled

A-A\ and B-B\ terminations cannot be disabled when encoders with SinCos waveforms are selected. Z-Z\ terminations cannot be disabled except when Ab, Fd, Fr, Ab.Servo, Fd.Servo, Fr.Servo encoders are selected.

3.40	Drive encoder error detection level															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 7							
Default	Open-loop Closed-loop vector Servo								0 1							
Update rate	Background read															

Any encoder that is connected to the drive is monitored for various errors as shown in the table below.

	Encoders	Reason for error	Drive trip
0	All	No fault detected	
1	All	Power supply short circuit	EnC1
2	Ab, Fd, Fr, Ab.Servo, Fd.Servo, Fr.Servo, SC, SC.Hiper, SC.EnDat	+#Wire-break detect on A, B and Z inputs	EnC2
3	Ab.Servo, Fd.Servo, Fr.Servo SC.Hiper, SC.EnDat	+*UVW phase angle incorrect whilst running, i.e. incremental pulses not counted correctly.	EnC3
	SC.Hiper, SC.EnDat	+*Sine/cosine phase error	
4	SC.Hiper, SC.EnDat, EnDat	Comms failure (timeout) Comms failure or transfer time too long	EnC4
	SSI	Comms transfer time is too long	
5	SC.Hiper, SC.EnDat, EnDat	Checksum or CRC error	EnC5
6	SC.Hiper, SC.EnDat, EnDat SSI	The encoder has indicated an error Data was not at one before position was transmitted +Power supply failure	EnC6
7	SC, SC.Hiper, SC.EnDat, EnDat, SSI	Initialisation failed	EnC7
8	SC.Hiper, SC.EnDat, EnDat	Auto configuration requested and failed	EnC8
9	All	Speed feedback selected from an option slot that does not have a position feedback category option module fitted	EnC9

* Phase errors are detected when the error is greater than 10º electrical over ten consecutive one second samples.
\+ These trips can be enabled/disabled by Pr 3.40.
\# If the terminations are not enabled on the A, B or Z inputs the wire break system will not operate. (Note that as default the Z input terminations are disabled to disable wire break detection on this input.)

Encoder initialisation will occur when trips Enc1 to Enc8 are reset. This causes an encoder with comms to be re-initialised and auto-configuration to be performed if selected. Ab.Servo, Fd.Servo and Fr.Servo encoders will use the UVW commutation signals for the first 120deg electrical when the motor is restarted.

It is important that a break in the connections between the drive and the position feedback device can be detected. This feature is provided either directly or indirectly as listed below.

Device	Detection method	Error produced
Ab, Fd, Fr, Ab.Servo, Fd.Servo, Fr.Servo	Hardware detectors on the A(F), B(D,R) and Z signal detect a wire break	2
SC, SC.Hiper, SC.EnDat	The differential levels of the sine and cosine waveforms are available to the drive. The drive detects wire break if Sine^2+Cosine^2 is less than the value produced by two valid waveforms with a differential peak to peak magnitude of 0.25V (1/4 of the nominal level). This detects wire break in the sine and cosine connections	2
SC.Hiper, SC.EnDat, EnDat	Wire break in the comms link is detected by a CRC or timeout error	4, 5

Trips can be enabled/disabled-using Pr 3.40 as follows:

Bit	Function
0	Wire break detect
1	Phase error detect
2	SSI power supply monitor

3.41	Drive encoder auto configuration enable / SSI binary format select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1	1	
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

SC.Hiper, SC.EnDat, EnDat

When a SC.Hiper, SC.EnDat or EnDat encoder is being used, the drive will interrogate the encoder on power-up. If Pr 3.41 is set and the encoder type is recognised based on the information provided by the encoder, the drive will set the encoder turns (3.33), the equivalent lines per revolution (3.34) and the encoder comms resolution (3.35) for the encoder. If the encoder is recognised these Pr will all become read only.

If the encoder is not recognised, the drive initiated an Enc7 trip to prompt the user to enter the information. The drive should be able to auto-configure with any EnDat encoder where the number of turns and lines per revolution are a power of 2, and the following Hiperface encoders: SCS 60/70, SCM 60/70, SRS 50/60, SRM 50/60, SHS 170, LINCODER, SCS-KIT 101.

SSI

SSI encoders normally use gray code data format. However, some encoders use binary format, which may be selected by setting this parameter to one.

3.42	Drive encoder filter															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 5 (0 to16ms)							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Menu 3: Frequency slaving, speed feedback & speed control

A sliding window filter may be applied to the feedback taken from the drive encoder. This is particularly useful in applications where the drive encoder is used to give speed feedback for the speed controller and where the load includes a high inertia, and so the speed controller gains are very high. Under these conditions, without a filter on the feedback, it is possible for the speed loop output to change constantly from one current limit to the other and lock the integral term of the speed controller.

3.43	Maximum drive encoder reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 40,000rpm							
Default	Open-loop, Closed-loop vector Servo								1500 3000							
Update rate	Background read															

3.44	Drive encoder reference scaling															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.000 to 4.000							
Default	Open-loop, Closed-loop vector, Servo								1.000							
Update rate	Background read															

3.45	Drive encoder reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1				1					1				
Range	Open-loop, Closed-loop vector, Servo								-100.0 to 100.0%							
Update rate	4ms write															

3.46	Drive encoder reference destination															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
				1			2					1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.50							
Default	Open-loop, Closed-loop vector, Servo								00.00							
Update rate	Read on reset															

Menu 3: Frequency slaving, speed feedback & speed control

The drive encoder input can be used as a reference to control a drive parameter. The drive encoder reference Pr 3.45 gives the speed of the encoder input as a percentage of the maximum drive encoder reference provided that the number of encoder lines per revolution Pr 3.34 has been set up correctly. This may then be scaled and routed to any non-protected drive parameter.

3.47	Re-initialise position feedback															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Update rate	Background read															

3.48	Position feedback initialised															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background write															

At power-up Pr 3.48 is initially zero, but is set to one when the drive encoder and any encoders connected to position category modules have been initialised. The drive cannot be enabled until this parameter is one.

If the encoder power-supply is lost, or the encoder type parameter is changed for an encoder connected to the drive or to a position category option module, and the encoder type is SC, SC.Hiper, SC.EnDat or EnDat the encoder will no longer be initialised. When an encoder is no longer initialised Pr 3.48 is reset to zero and the drive cannot be enabled. The encoder may be re-initialised, provided the drive is not active, by setting Pr 3.47 to one. This parameter is automatically reset to zero when the initialisation is complete.

3.49	Full motor object electronic nameplate transfer															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Read on reset															

When this parameter is set to one additional information for the motor object can be transferred from Pr 18.11 to Pr 18.17 as shown below.

18.11	Motor object version number
18.12	Motor type (MSW)
18.13	Motor type (LSW)
18.14	Motor manufacturer
18.15	Motor serial number (MSW)
18.16	Motor serial number
18.17	Motor serial number (LSW)

Menu 4: Torque & current control

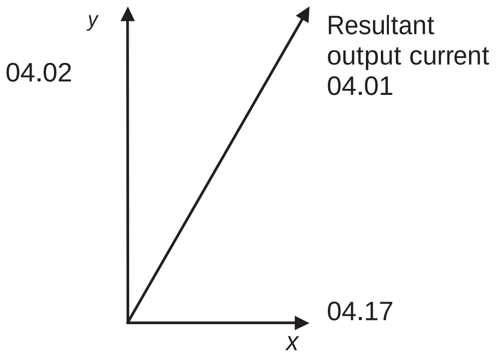
There are a number of parameters in menu 4 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
4.01	Current magnitude	With Unidrive SP, Current magnitude and Active current ranges have increased to include 575 / 690v drives and larger frame sizes, details overleaf
4.02	Active current	
4.03	Torque demand	With Unidrive SP, Torque demand and Current demand ranges have increased due to Normal/Heavy duty current rating strategy, details overleaf
4.04	Current demand	
4.05	Motoring current limit	With Unidrive SP, Current limit (Motoring, Regenerative, Symmetrical) defaults and ranges have changed, details overleaf
4.06	Regenerative current limit	
4.07	Symmetrical current limit	
4.08	Torque reference	With Unidrive SP, Ranges and resolution of Torque reference & Torque offset have changed, details overleaf
4.09	Torque offset	
4.12	Current demand filter 1 time constant	With Unidrive SP, Current demand filter 1 has replaced Current demand filter time constant (Unidrive 1), limits have changed from 0 ~ 250ms (Unidrive 1)to 0.0 - 25.0ms.(Unidrive SP) resolution also changed, details overleaf
4.13	Current controller Kp gain	With Unidrive SP, the current loop gain calculations have now changed with Unidrive SP as detailed below. The default values for OL> and CL> vary with voltage and gains for servo these have increased from 130 and 1200 to 150 and 2000 in Unidrive SP. These gains can also be calculated through an autotune Pr 5.12 with Unidrive SP
4.14	Current controller Ki gain	
4.15	Thermal time constant	With Unidrive SP, the thermal time constant has now increased at default when operating in servo mode from 7.0 to 20.0 for Unidrive SP
4.18	Overriding current limit	With Unidrive SP, Overriding current limit default and range have changed, details overleaf
4.20	Percentage load	With Unidrive SP, Percentage load range has increased due to Normal/Heavy duty current rating strategy, details overleaf
4.22	Inertia compensation enable	New parameter with Unidrive SP, adds calculated inertia value to speed loop output for accelerating inertia loads, details overleaf
4.23	Current demand filter 2	New parameter with Unidrive SP, Current demand filter 2 has been added limits and resolution are as Pr4.12 Current demand filter, details overleaf
4.24	User current maximum scaling	New parameter with Unidrive SP, defines maximum value for Pr4.08(Torque reference) and Pr4.20 (Percentage load), details overleaf
4.25	Low speed thermal protection mode	New parameter (details below)

Menu 4: Torque & current control

04.01	Current magnitude															
Drive modes	Open-loop, Closed-loop vector, Servo, Regen															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	2	1		1		1			1	
Range	Open-loop,Closed-loop vector, Servo, Regen								0 to DRIVE_CURRENT_MAX A							
Update rate	4ms write															

This parameter is the r.m.s. current from each output phase of the drive. The phase currents consist of an active component and a reactive component. The three phase currents can be combined to form a resultant current vector as shown below:



The resultant current magnitude is displayed by this parameter. The active current is the torque producing current for a motor drive and the real current for a regen unit. The reactive current is the magnetising or flux producing current for a motor drive.

04.02	Active current															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	2	1		1		1				
Range	Open-loop, Closed-loop vector, Servo, Regen								-DRIVE_CURRENT_MAX to DRIVE_CURRENT_MAX A							
Update rate	4ms write															

Open-loop, Closed-loop vector and Servo

The active current is the torque producing current in a motor drive.

Direction of active current	Direction of rotation	Torque direction
+	+	Forward (accelerating)
-	+	Reverse (decelerating)
+	-	Forward (decelerating)
-	-	Reverse (accelerating)

The active current is aligned with the y axis of the reference frame. In open-loop modes the x axis of the reference frame is aligned with the stator flux vector. In Closed-loop vector and Servo modes the x axis of the reference frame is aligned with the rotor flux vector. The motor torque is proportional to the torque producing current when field weakening is not active. Once field weakening is active the torque producing current is boosted to compensate for the reduction in motor flux.

Regen

The active current is the real current in a regen unit.

Direction of active current	Power flow
+	From supply
-	Into supply

The active current is aligned with the y axis of the reference frame. The y axis of the reference frame is aligned with the regen unit terminal voltage vector.

04.03	Torque demand															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-1000.0 to 1000.0 %							
Update rate	4ms write															

Open-loop

The torque demand is the sum of the torque reference (parameter 04.08) and the torque offset (parameter 04.09), if enabled. The units of the torque demand are % of rated torque. 100% rated torque is defined as the torque produced by 100% rated active current.

Closed-loop vector

The torque demand can be derived from the speed controller and/or the torque reference and offset. The units of the torque demand are % of rated torque. 100% rated torque is defined as the torque produced by 100% rated active current.

04.04	Current demand															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Open-loop,Closed-loop vector, Servo, Regen								-1000.0 to 1000.0 %							
Update rate	4ms write															

Open-loop

The current demand is derived from the torque demand. Provided the motor is not field weakened the torque and current demands are the same. In field weakening the current demand is increased with reduced flux :

04.04 = 04.03 x frequency / rated frequency

The current demand is subject to the current limits.

Closed-loop vector and Servo

The current demand is derived from the torque demand. Provided the motor is not field weakened the torque and current demands are the same. In the field weakening range the current demand is increased with reduced flux unless parameter 05.28=1. The level of flux is derived from the motor model within the drive controllers.

04.04 = 04.03 x flux / rated flux

Regen

The current demand is the output of the voltage controller in Menu 3 subject to the current limits.

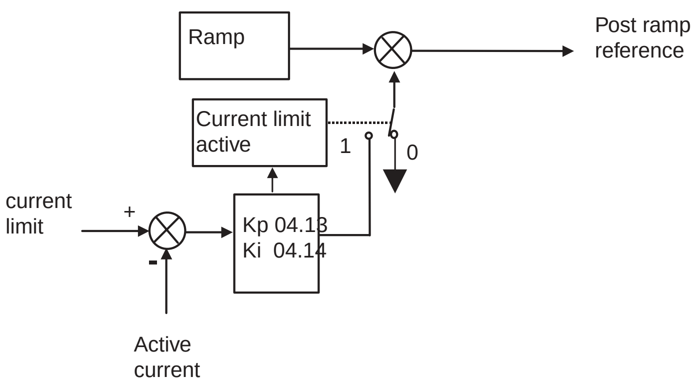
04.05	Motoring current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to MOTOR1_CURRENT_LIMIT_MAX %							
Default	Open-loop Closed-loop vector, Servo								165.0 175.0							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.27							
Update rate	Background read															

04.06	Regen current limit														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to MOTOR1_CURRENT_LIMIT_MAX %							
Default	Open-loop Closed-loop vector, Servo								165.0 175.0							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.28							
Update rate	Background read															

04.07	Symmetrical current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to MOTOR1_CURRENT_LIMIT_MAX %							
Default	and Open-loop Closed-loop vector, Servo								165.0 175.0							
Second motor parameter	Open-loop Closed-loop vector, Servo								21.29							
Update rate	Background read															

Open-loop

The motoring current limit applies in either direction of rotation when the machine is producing motoring torque. Similarly the regen current limit applies in either direction when the machine is producing regenerating torque. The symmetrical current limit can override either motoring or regenerating current limit if it is set at a lower value than either limit.



Menu 4: Torque & current control

The current limits are compared with the active current and if the current exceeds a limit the error value passes through the PI controller to give a frequency component which is used to modify the ramp output. The direction of the modification is always to reduce the frequency to zero if the active current is over the motoring limit, or to increase the frequency towards the maximum if the current is over the regenerating limit. Even when the current limit is active the ramp still operates, therefore the proportional and integral gains (parameters 04.13 and 04.14) must be high enough to counter the effects of the ramp. See parameters 04.13 and 04.14 for gain setting.

Closed-loop vector and Servo

The motoring current limit applies in either direction of rotation when the machine is producing motoring torque. Similarly the regen current limit applies in either direction when the machine is producing regenerating torque. The symmetrical current limit can override either motoring or regenerating current limit if it is set at a lower value than either limit.

04.08	Torque reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	2						1	1		
Range	Open-loop, Closed-loop vector, Servo								-USER_CURRENT_MAX to USER_CURRENT_MAX %							
Default	Open-loop, Closed-loop vector, Servo								0.00							
Update rate	4ms read															

04.09	Torque offset															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1						1	1		
Range	Open-loop, Closed-loop vector, Servo								-USER_CURRENT_MAX to USER_CURRENT_MAX %							
Default	Open-loop, Closed-loop vector, Servo								0.00							
Update rate	4ms read															

04.10	Torque offset select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

The torque offset is added to the torque reference when parameter 04.10 is one. The torque offset is updated every 4ms when connected to an analogue input, and so parameter 04.08 should be used for fast updating if required.

04.12	Current demand filter 1															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Closed-loop vector, Servo								0.0 to 25.0ms							
Default	Closed-loop vector, Servo								0.0							
Update rate	Background read															

A first order filter, with a time constant defined by this parameter, is provided on the current demand to reduce acoustic noise and vibration produced as a result of position feedback quantisation noise. The filter introduces a lag in the speed loop, and so the speed loop gains may need to be reduced to maintain stability as the filter time constant is increased. Alternative time constants can be selected depending on the value of the speed controller gain selector (parameter 03.16). If 03.16 = 0 parameter 04.12 is used, if 03.16 = 1 parameter 04.23 is used.

4.13	Current controller Ki gain															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 30000							
Default	Drive voltage rating : Open-loop, Closed-loop vector, Servo								200V 20 75	400V 20 150	575V 20 180	690V 20 215				
Normal Parameter	Closed-loop vector, Servo								21.22							
Update rate	Background read															

4.14	Current controller Ki gain															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 30000							
Default	Drive voltage rating : Open-loop, Closed-loop vector, Servo								200V 40 1000	400V 40 2000	575V 40 2400	690V 40 3000				
Normal Parameter	Closed-loop vector, Servo								21.23							
Update rate	Background read															

Open-loop

These parameters control the proportional and integral gains of the current controller used in the open loop drive. As already mentioned the current controller either provides current limits or closed loop torque control by modifying the drive output frequency. The control loop is also used in its torque mode during mains loss, or when the controlled mode standard ramp is active and the drive is decelerating, to regulate the flow of current into the drive. Although the default settings have been chosen to give suitable gains for less demanding applications it may be necessary for the user to adjust the performance of the controller. The following is a guide to setting the gains for different applications.

Current limit operation

The current limits will normally operate with an integral term only, particularly below the point where field weakening begins. The proportional term is inherent in the loop. The integral term must be increased enough to counter the effect of the ramp which is still active even in current limit. For example, if the drive is operating at constant frequency and is overloaded the current limit system will try to reduce the output frequency to reduce the load. At the same time the ramp will try to increase the frequency back up to the demand level. If the integral gain is increased too far the first signs of instability will occur when operating around the point where field weakening begins. These oscillations can be reduced by increasing the proportional gain. A system has been included to prevent regulation because of the opposite actions of the ramps and the current limit. This can reduce the actual level that the current limit becomes active by 12.5%. This still allows the current to increase up to the current limit set by the user. However the current limit flag (10.09) could become active up to 12.5% below the current limit depending on the ramp rate used.

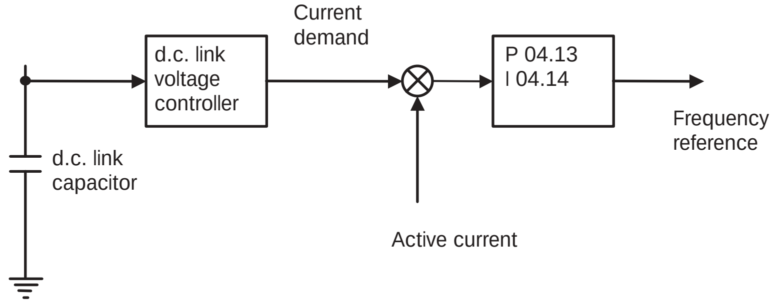
Torque control

Again the controller will normally operate with an integral term only, particularly below the point where field weakening begins. The first signs of instability will appear around base speed, and can be reduced by increasing the proportional gain. The controller can be less stable in torque control mode rather than when it is used for current limiting. This is because load helps to stabilise the controller, and under torque control the drive may operate with light load. Under current limit the drive is often under heavy load unless the current limits are set at a low level.

Mains loss and controlled standard ramp

The d.c link voltage controller becomes active if mains loss detection is enabled and the drive supply is lost or controlled standard ramp is being used and the machine is regenerating. The d.c link controller attempts to hold the d.c link voltage at a fixed level by controlling the flow of current from the drive inverter into its d.c link capacitors. The output of the d.c link controller is a current demand which is fed into the current PI controller as shown below:

Although it is not usually necessary the d.c link voltage controller can be adjusted with Pr 5.31. However, it may often be necessary to adjust the current controller gains to obtain the required performance. If the gains are not suitable it is best to set up the drive in torque control first. Set the gains to a value that does not cause instability around the point at which field weakening occurs. Then revert back to open loop speed control in standard ramp mode. To test the controller the supply should be removed whilst the motor is running. It is likely that the gains can be increased further if required because the d.c link voltage controller has a stabilising effect, provided that the drive is not required to operate in torque control mode.



Closed-loop vector and Servo

The Kp and Ki gains are used in the voltage based current controller. The default values give satisfactory operation with most motors. However it may be necessary to change the gains to improve the performance. The proportional gain Pr 4.13 is the most critical value in controlling the performance. Either the value can be set by auto-tuning (see Pr 5.12) or it can be set by the user so that

Pr 4.13 = Kp = (L / T) x (I_{fs} / V_{fs}) x (256 / 4)

where

T is the sample time of the current controllers. The drive compensates for any change of sample time, and so it should be assumed that the sample time is equivalent to the lowest sample rate of 167µs.

L is the motor inductance. For a servomotor this is half the phase to phase inductance that is normally specified by the manufacturer. For an induction motor this is the per phase transient inductance ((Ls). This is the inductance value stored in Pr 5.24 after the auto-tune test is carried out. If (Ls cannot be measured it can be calculated (see Pr 5.24).

Ifs is the peak full scale current feedback = Rated drive current x (2 / 0.45. Where rated drive current is given by Pr 11.32.

Vfs is the maximum d.c. link voltage.

Therefore

Pr 4.13 = Kp = (L / 167µs) x (Rated drive current x √2 / 0.45 / V_{fs}) x (256 / 4)

= K x L x Rated drive current

where

K = (2 / √0.45 x V_{fs} x 167µs) x (256 / 4)

Drive voltage rating	V_{fs}	K
200V	415V	2902
400V	830V	1451
575V	990V	1217
690V	1190V	1013

This set up will give a step response with minimum overshoot after a step change of current reference. The approximate performance of the current controllers will be as given below. The proportional gain can be increased by a factor of 1.5 giving a similar increase in bandwidth, however, this gives at step response with approximately 12.5% overshoot.

Switching frequency (kHz)	Current control sample time (us)	Gain bandwidth (Hz)	Phase delay (us)
3	167	500	667
4	125	670	444
6	83	1000	333
8	125	670	444
12	83	1000	333
16	125	670	444

The integral gain (Pr 4.14) is less critical and should be set so that

Pr 4.14 = Ki = Kp x 256 x T / τm

where

τm is the motor time constant (L / R).

R is the per phase stator resistance of the motor (i.e. half the resistance measured between two phases).

Therefore

Pr 4.14 = Ki = (K x L x Rated drive current) x 256 x 167µs x R / L

= 0.0427 x K x R x Rated drive current

The above equation gives a conservative value of integral gain. In some applications where it is necessary for the reference frame used by the drive to dynamically follow the flux very closely (i.e. high speed closed-loop induction motor applications) the integral gain may need to have a significantly higher value.

04.15	Thermal time constant															
Drive modes	Open-loop, Closed-loop vector, Servo, Regen															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo, Regen								0.0 to 400.0							
Default	Open-loop,Closed-loop vector Servo Regen								89.0 20.0 89.0							
Second motor parameter	Open-loop, Closed-loop vector, Servo, Regen								21.16							
Update rate	Background read															

04.18	Overriding current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1	1		1		1			1	
Range	Open-loop Closed-loop vector, Servo								165.0 175.0							
Update rate	Background write															

Open-loop, Closed-loop vector, Servo

The current limit applied at any time depends on whether the drive is motoring or regenerating and also on the level of the symmetrical current limit. Parameter 04.18 gives the limit level that applies at any instant.

04.20	Percentage load															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
Range	Open-loop Closed-loop vector, Servo								-USER_CURRENT_MAX to USER_CURRENT_MAX %							
Update rate	Background write															

Open-loop, Closed-loop vector, Servo

This parameter displays the actual torque producing current (parameter 04.02) as a percentage of rated active current. Positive values indicate motoring and negative values indicate regenerating.

Regen

This parameter displays the active current (parameter 04.02) as a percentage of the rated current (parameter 05.07 or 21.07). Positive values indicate power flow from the supply and negative values indicate power into the supply.

4.22	Inertia compensation enable															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Closed-loop vector, Servo								0							
Update rate	Background read															

If this parameter is set to one, the drive calculates a torque reference from the motor and load inertia (Pr 3.18) and the rate of change of speed reference. The torque reference is added to the speed controller output to provide inertia compensation. This can be used in speed or torque control applications to produce the torque required to accelerate or decelerate the load inertia.

4.23	Current demand filter 2															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Closed-loop vector, Servo								0.0 to 25.0ms							
Default	Closed-loop vector, Servo								0.0							
Update rate	Background read															

The current demand filter time constant is defined by this parameter if the speed gain select (Pr 3.16) is one.

4.24	User current maximum scaling															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.0 to 1000.0 %							
Default	Open-loop, Closed-loop vector, Servo								100.0							
Update rate	Background read															

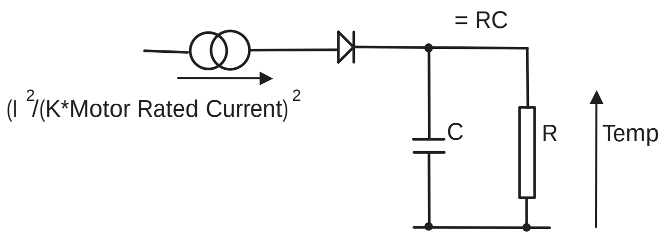
The maximum values for Pr 4.08, Torque Reference and Pr 4.20, Percentage Load are defined by this parameter.

4.25	Low speed thermal protection mode															
Drive modes	Open-loop, Closed-loop, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop, Servo								0							
Update rate	Background read															

See Pr 4.26 following

4.16	Thermal protection mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 1							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

The motor is modelled thermally in a way that is equivalent to the electrical circuit shown below.

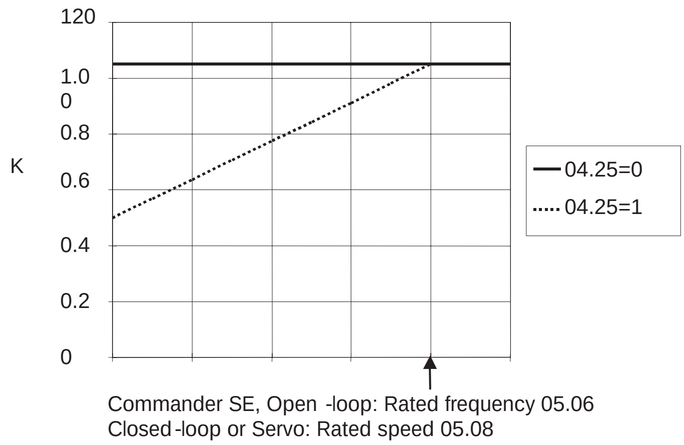


The temperature of the motor as a percentage of maximum temperature, with a constant current magnitude of I, constant value of K and constant value of Motor Rated Current after time t is given by

$$Temp = I^2 / (K \text{ x Motor rated current})^2] (1 - e^{-t/t}) \text{ x } 100\%$$

This assumes that the maximum allowed motor temperature is produced by K x Motor rated current and that t is the thermal time constant of the point in the motor that reaches its maximum allowed temperature first. is defined by Pr 4.15. The estimated motor temperature is given by Pr 4.19 as a percentage of maximum temperature. If Pr 4.15 is set to zero the thermal protection system is disabled. Otherwise Pr 4.15 defines the thermal time constant, except if the parameter has a value between 0.0 and 1.0 the thermal time constant is taken as 1.0.

The value of K is defined as shown in the diagram below.



Pr 4.25 is used to enable additional protection for low speed operation with motors that do not have auxiliary forced cooling, where the cooling ability of the motor fan reduces with motor speed producing a higher temperature for a given current. If the rated current (defined by parameter Pr 5.07 or Pr 21.07 depending on which motor is selected) is increased above the maximum industrial rated current level then an additional limit is applied which restricts the maximum value of K to 1.0 and forces the reduction of K at low speeds whatever the value of Pr 4.25. Also the thermal model cannot be disabled by setting Pr 4.15 to zero if the rated current is above the maximum industrial current level.

When the estimated temperature reaches 100% the drive takes some action depending on the setting of Pr 4.16. If Pr 4.16 is 0, the drive trips when the threshold is reached. If Pr 4.16 is 1, the current limit is reduced to (K - 0.05) x 100% when the temperature is 100%. The current limit is set back to the user defined level when the temperature falls below 95%. In servo and regen modes the current magnitude and the active current controlled by the current limits should be similar, and so this system should ensure that the motor operates just below its thermal limit.

The time for some action to be taken by the drive from cold with constant motor current is given by:

$$T_{trip} = -(Pr\ 4.15) \times \ln(1 - (K \times Pr\ 5.07 / Pr\ 4.01)^2)$$

Alternatively the thermal time constant can be calculated from the trip time with a given current from

$$Pr\ 4.15 = -T_{trip} / \ln(1 - (K / Overload)^2)$$

For example, if the drive should trip after supplying 150% overload for 60 seconds with K = 1.05 then

$$Pr\ 4.15 = -60 / \ln(1 - (1.05 / 1.50)^2) = 89$$

The thermal protection system can be used in regen mode to protect the input inductors. The rated current (Pr 5.07) should be set to the rated current for the inductors. The thermal model temperature accumulator is reset to zero at power-up and accumulates the temperature of the motor whilst the drive remains powered-up. Each time Pr 11.45 is changed to select a new motor, or the rated current defined by Pr 5.07 or Pr 21.07 (depending on the motor selected) is altered, the accumulator is reset to zero.

Menu 5: Motor Control

There are a number of parameters in menu 5 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
5.01, 5.04	Motor speed	With Unidrive SP, limits have been increased as following + 1000.0Hz to + 3000.0Hz O/L + 1000.0Hz to + 1250.0Hz C/L 6000rpm to 180,000rpm O/L 30,000rpm to 40,000.00rpm C/L, details overleaf
5.06, 5.08	Motor rated speed	
5.02	Output voltage	With Unidrive SP, Motor voltage range increased to include 575 & 690V drives, details overleaf
5.03	Motor power	With Unidrive SP, Motor power range increased due to drive voltage and frame size changes, details overleaf
5.05	DC Bus voltage	With Unidrive SP, DC bus voltage range increased to include 575 & 690V drives, details overleaf
5.07	Motor rated current	With Unidrive SP, Motor rated current range increased due to drive voltage and frame size changes, details overleaf
5.09	Rated voltage	With Unidrive SP, Motor rated voltage range increased to include 575 & 690V drives, details overleaf
5.10	Rated power factor	With Unidrive SP, method of calculation and default value have changed, details overleaf
5.11	No. of poles	With Unidrive SP, Maximum limit increased from 32 pole (Unidrive 1) upto 120 pole, details overleaf
5.12	Autotune	Replaces magnetisation test. The “Autotune”.with Unidrive SP offers **Open loop** 1: Stationary Test 2: Rotating Test **Closed Loop** 1: Stationary Test 2: Rotating Test 3: Inertia Measurement **Servo** 1: Low Speed Test 2: Inertia Measurement details overleaf
5.13	Dynamic V to F /Flux optimize select	With Unidrive SP, selects V/f mode in OL>, reduces flux with load in CL> mode, details overleaf
5.14	Voltage mode select	With Unidrive SP, Increased functionality (6 modes), Ur_S, Ur_I, Ur, and Fd (Unidrive 1) Ur_S, Ur, Fd, Ur Auto, Ur_I, SrE, (Unidrive SP), details overleaf
5.15	Low frequency voltage boost	With Unidrive SP, operates as Unidrive 1, used in closed loop during the autotune and with jog function, details overleaf

Menu 5: Motor Control

Parameter	Function	Details
5.16	Rated rpm auto tune	Previously Jog voltage boost in Unidrive 1. With Unidrive SP,5.16 Rated rpm auto tune replaces CL slip auto tune Pr 5.27(Unidrive 1) and has increased functionality, details overleaf
5.18	Maximum switching frequency	With Unidrive SP, Maximum range increases to 16.6kHz, details overleaf
5.20	Quasi square wave	Not available at 16kHz switching frequency with Unidrive SP
5.22		Not available with Unidrive SP, previously Maximum speed x10bit (Unidrive 1)
5.23	Voltage offset	With Unidrive SP, range changed 0.0~25.5V (Unidrive 1) to 0~25.0 (Unidrive SP), details overleaf
5.24	Transient inductance	With Unidrive SP ,the transient inductance is as previously described as the “Motor leakage inductance”
5.25	Stator inductance	Previously output doubling frequency select in Unidrive 1 (not required with speed range increases in Unidrive SP), details overleaf
5.26	High dynamic performance enable	With Unidrive SP, operates as CL x coupling compensation enable bit (Unidrive 1)
5.27		Previously Auto-optimise rated speed enable in Unidrive 1 (OL>), Not required with speed range increases in Unidrive SP
		Previously Phasing test type select for drives with High inertia loads in Unidrive 1 (SV>), Included as option in Pr5.12 Auto tune with Unidrive SP
	Slip compensation enable	With CL> mode, operates as Unidrive 1
5.32	Motor torque per amp (K_t)	Previously Motor full load speed fine trim, Motor full load speed fine trim not required with Unidrive SP details overleaf Details of Motor torque per amp overleaf
5.33	Motor volts per 1000rpm (K_e)	Previously Thermal model protection enable.replaced by parameter 5.35 Disable auto switching frequency change in Unidrive SP. Details of k_e overleaf
5.35	Disable auto switching frequency change	New parameter with Unidrive SP,operates as Pr5.33 Thermal model protection enable in Unidrive 1,details overleaf

Menu 5: Motor Control

05.01	Output frequency															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	1	1		1		1				
	Closed-loop vector, Servo VM = 0															
Range	Open-loop								-SPEED_FREQ_MAX to SPEED_FREQ_MAX							
	Closed-loop vector, Servo								-1250.0Hz to 1250.0Hz -100.0Hz to 100.0Hz							
Update rate	250us write															

Open-loop

Although the range for scaling purposes is -SPEED_FREQ_MAX to SPEED_FREQ_MAX, the actual parameter value can be increased beyond this range by slip compensation. This parameter gives the output frequency of the drive, i.e. the sum of the post ramp reference and the slip compensation.

Closed-loop vector and Servo

In these modes the output frequency is not controlled directly, and so the output frequency displayed in this parameter is calculated by measuring the frequency of the controller reference frame.

Regen

In Regen mode the supply frequency is shown. Negative values indicate negative phase rotation of the supply.

05.02	Output voltage															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1		1		1		1				
Range	Open-loop, Closed-loop vector, Servo								0 to AC_VOLTAGE_MAX V							
Update rate	Background write															

This is the modulus of the r.m.s. fundamental line to line voltage at the inverter output.

05.03	Output power															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1	2	1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-POWER_MAX to +POWER_MAX kW							
Update rate	Background write															

Open-loop, Closed-loop vector and Servo modes

The output power is the dot product of the output voltage and current vectors. Positive power indicates power flowing from the drive to the motor (motoring) and negative power indicates power flowing from the motor to the drive (regen).

05.04	Motor rpm															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1					1		1		1				
Range	Open-loop								-180,000 to +180,000 rpm							
Update rate	Background write															

The motor rpm is calculated from the post ramp reference (parameter 02.01) for normal operation, or the slave frequency demand (parameter 03.01) if frequency slaving is being used. The speed of rotation is calculated as follows:

rpm = 60 x frequency / no. of pole pairs

This calculation relies on the number of motor poles being set up correctly in parameter 05.11, or if auto mode is selected (parameter 0.511=0) then it relies on a reasonably accurate value of motor rated speed being set in parameter 05.08 to allow correct calculation of the motor poles. If frequency slaving is being used there will be an error due to the slip frequency. However, in normal operation the result will be reasonably accurate provided that the slip compensation has been set up correctly with the rated full load rpm parameter (05.08).

05.05	d.c. link voltage															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1			1		1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to +DC_VOLTAGE_MAX V							
Update rate	Background write															

Voltage across the internal d.c. link of the drive.

05.06	Rated frequency															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop, Closed-loop vector								0 to 3000.0Hz 0 to 1250.0Hz							
Default	Open-loop,Closed-loop vector								50.0Hz							
Second motor parameter	Open-loop, Closed-loop vector								21.06							
Update rate	Background read															

Open loop

The motor rated frequency and the motor rated voltage (parameter 05.09) are used to define the voltage to frequency characteristic applied to the drive (see parameter 05.09). The motor rated frequency is also used in conjunction with the motor full load rpm to calculate the rated slip for slip compensation (see parameter 05.08).

Closed loop vector

The motor rated frequency is used in conjunction with the motor full load rpm to calculate the rated slip of the machine for the vector control algorithm (see parameter 05.08). The test frequency used for the rotating auto-tune test is 2/3 x 05.06.

05.07	Motor rated current															
Drive modes	Open-loop, Closed-loop vector, Servo, Regen															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	2		1				1	1	1	
Range	Open-loop, Closed-loop, Servo								0 to RATED_CURRENT_MAX A							
Default	Open-loop, Closed-loop, Servo								Drive rated current (Param 11.32)							
Second motor parameter	Open-loop, Closed-loop, Servo								21.07							
Update rate	Background read															

The rated current should be set at the motor nameplate value for rated current. The value of this parameter is used in the following:

Open-loop	Current limits Motor thermal protection Vector mode voltage control Slip compensation Dynamic V to F control
Closed-loop vector	Current limits Motor thermal protection Vector control algorithm
Servo	Current limits Motor thermal protection

05.08	Rated load rpm/rated speed															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
	Closed-loop vector DP = 2															
Range	Open-loop, Closed-loop vector, Servo								0 to 180,000rpm 0.00 to 40,000.00rpm							
Default	Open-loop, Closed-loop vector Servo								1450.00 3000.00							
Second motor parameter	Open-loop, Closed-loop vector, Servo								21.08							
Update rate	Background read															

Open loop

The rated load rpm is used with the motor rated frequency and No. of poles to calculate the rated slip of induction machines in Hz.

rated slip (Hz) = rated motor frequency - (no. of pole pairs x motor full load rpm / 60)

= 05.06 - ((05.11 / 2) x 05.08 / 60)

If parameter 05.08 is set to 0 or to synchronous speed slip compensation is disabled. If slip compensation is required this parameter should be set to the nameplate value, which should give the correct rpm for a hot machine. Sometimes it will be necessary to adjust this when the drive is commissioned because the nameplate value may be inaccurate. Slip compensation will operate correctly both below base speed and within the field weakening region. Slip compensation is normally used to correct for the motor speed to prevent speed variation with load. The rated load rpm can be set higher than synchronous speed to deliberately introduce speed droop. This can be useful to aid load sharing with mechanically coupled motors.

Closed loop vector

Rated load rpm is used with motor rated frequency to determine the full load slip of the motor which is used by the vector control algorithm. Incorrect setting of this parameter has the following effects:

- Reduced efficiency of motor operation
- Reduction of maximum torque available from the motor
- Reduced transient performance
- Inaccurate control of absolute torque in torque control modes

The nameplate value is normally the value for a hot machine, however, some adjustment may be required when the drive is commissioned if the nameplate value is inaccurate. Either a fixed value can be entered in this parameter or an optimisation system may be used to automatically adjust this parameter (see parameter 05.16). It should be noted that the optimisation system does not operate when closed-loop vector mode is used with no position feedback (see parameter 03.24).

Servo

The Rated speed defines the rated speed of the motor and is only used in the motor thermal protection scheme (see parameter 04.16) and to determine the speed used in the auto tuning inertia test (see parameter 05.12).

5.09	Rated voltage															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	TE	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1			1				1	1	1	
Range	Open-loop, Closed-loop, Servo								0 to AC_Voltage_Set_Max V							
Default	Open-loop, Closed-loop vector, Servo								200V rating drive: 200V 400V rating drive: 400V 575V rating drive: 575V 690V rating drive: 690V							
Normal Parameter	Open-loop, Closed-loop vector, Servo								Pr 21.09							
Update rate	Level 4 read															

Open loop

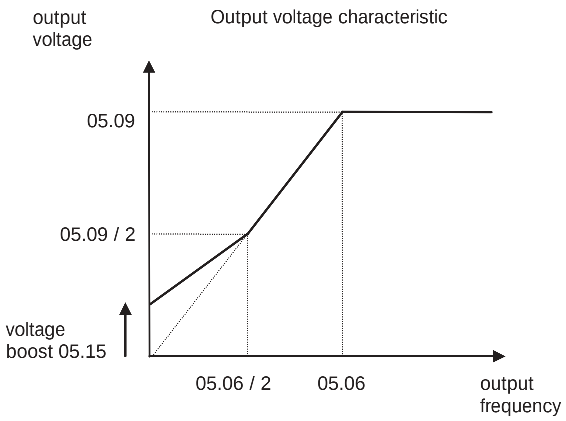
The rated voltage is used in conjunction with the motor rated frequency (Pr 5.06) to define the voltage to frequency characteristic applied to the motor. The following operating methods selected by Pr 5.14 are used to define the drive frequency to voltage characteristic.

Open-loop vector mode: Ur_S, Ur or Ur_I

A linear characteristic is used from 0Hz to rated frequency, and then a constant voltage above rated frequency. When the drive operates between rated frequency/50 and rated frequency/4, full vector based stator resistance (Rs) compensation is applied. However there is a delay of 0.5s when the drive is enabled during which only partial vector based compensation is applied to allow the machine flux to build up. When the drive operates between rated frequency/4 and rated frequency/2 the Rs compensation is gradually reduced to zero as the frequency increases. For the vector modes to operate correctly the stator resistance (Pr 5.17), motor rated power factor (Pr 5.10) and voltage offset (Pr 5.24) are all required to be set up accurately.

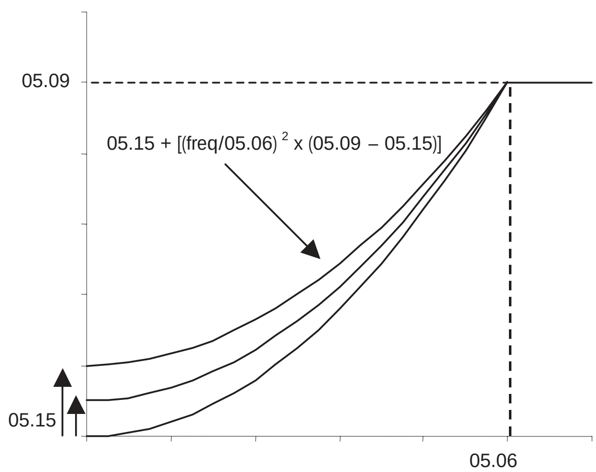
Fixed boost mode: Fd

A linear characteristic is used from 0Hz to rated frequency, and then constant voltage above rated frequency. Low frequency voltage boost as defined by Pr 5.15 is applied as shown below.



Square law mode: SrE

A square law characteristic is used from 0Hz to rated frequency, and then constant voltage above rated frequency. Low voltage boost raises the start point of the square law characteristic as shown below.



Closed loop vector

The rated voltage is used by the field controller to limit the voltage applied to the motor. Normally this is set to the nameplate value. So that current control can be maintained it is necessary for the drive to leave some ‘headroom’ between the machine terminal voltage and the maximum available drive output voltage. The drive allows over-modulation of the PWM inverter which can produce a fundamental voltage that is higher than the drive input voltage, but would cause substantial odd harmonic distortion if used in steady state operation. Therefore the drive uses a headroom limit which allows the inverter to give a steady state output voltage equivalent to the input voltage minus voltage drops inside the drive. This gives enough headroom for the current controllers to operate satisfactorily. However, for good transient performance at high speed the rated voltage should be set below 95% of the minimum supply voltage to the drive.

The rated voltage is also used in conjunction with the motor rated frequency (Pr 5.06) during the rotating auto-tune test (see Pr 5.12) and in the calculations required for automatic optimisation of the rated motor slip. It is important, therefore that the correct rated voltage for the motor is used. In some applications it may be necessary to restrict the voltage applied to the motor to a level lower than the nameplate rated voltage of the motor. In this case the rated frequency (Pr 5.06) must be adjusted to maintain the ratio of rated voltage and frequency given on the motor nameplate. The rated frequency will then be different to the nameplate value, and so the rated speed must be changed from the nameplate value to give the correct rated slip.

Servo

The rated voltage is used by the field controller to limit the voltage applied to the motor if field-weakening operation is required. As in closed-loop vector mode some headroom must be left for the current controllers to operate, and so the drive will use the voltage level set by this parameter or the headroom limit whichever is the lower. This is used in conjunction with the Rated rpm (Pr 5.08) and the transient inductance (Pr 5.24) to set up the current controller integral terms to prevent current transients when the drive is enabled and the motor is spinning, and also to provided a voltage feed forward term if high dynamic performance is selected with Pr 5.26.

5.10	Rated power factor															
Drive modes	Open-loop, Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop, Closed-loop vector								0.000 to 1.000							
Default	Open-loop, Closed-loop vector								0.85							
Normal Parameter	Open-loop, Closed-loop vector								Pr 21.10							
Update rate	Background read															

Open loop

The power factor is the true power factor of the motor, i.e. the angle between the motor voltage and current. The power factor is used in conjunction with the motor rated current (Pr 5.07) to calculate the rated active current and magnetising current of the motor. The rated active current is used extensively to control the drive, and the magnetising current is used in vector mode Rs compensation. It is important that this parameter is set up correctly.

Closed loop vector

The power factor is the true power factor of the motor, i.e. the angle between the motor voltage and current.

If the stator inductance is set to zero (Pr 5.25) then the power is used in conjunction with the motor rated current and other motor parameters to calculate the rated active and magnetising currents which are used in the vector control algorithm. If the stator inductance has a non-zero value this parameter is not used by the drive, but is continuously written with a calculated value of power factor.

05.11	Number of motor poles															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 60 (Auto to 120 POLE)							
Default	Open-loop, Closed-loop vector Servo								0 (Auto) 3 (Auto)							
Normal Parameter	Open-loop, Closed-loop vector, Servo								21.11							
Update rate	Background read															

Open-loop

This parameter is used in the calculation of motor speed and in applying the correct slip compensation. When auto is selected the number of motor poles is automatically calculated from the rated frequency (parameter 05.06) and the rated load rpm (parameter 05.08). The number of poles = 120 x rated frequency / rpm rounded to the nearest even number.

Closed-loop vector

This parameter must be set correctly for the vector control algorithms to operate correctly. When auto is selected the number of motor poles is automatically calculated from the rated frequency (parameter 05.06) and the rated load rpm (parameter 05.08). The number of poles = 120 x rated frequency / rpm rounded to the nearest even number.

Servo

This parameter must be set correctly for the vector control algorithms to operate correctly. When auto is selected the number of poles is set to 6.

5.12	Auto-tune															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
														1	1	
Range	Open-loop, Servo Closed-loop vector								0 to 2 0 to 3							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

If this parameter is set to a non-zero value and the drive is enabled and a run command is applied in either direction the drive performs an auto-tune test for the drive modes listed below. The test will not start unless the drive is disabled before the test is initiated by applying the enable or run, i.e. it will not start if the drive is in the stop state. In closed-loop modes it is not possible to go into the stop state if Pr 5.12 has a non-zero value.

It is important that the drive is at standstill before the auto-tune test is performed if the correct results are to be obtained. The parameters modified by the auto-tune tests are defined below when the second motor parameters are not selected (i.e. Pr 11.45=0). If the second motor is selected for the duration of the tests (i.e. Pr 11.45=1), the second motor parameters in menu 21 are modified and not the parameters described below. All modified parameters are saved to EEPROM immediately after the auto-tune is complete. When the test is completed successfully the drive is disabled. The motor can only be restarted if the drive is first in a state where the run command is not applied (i.e. the run or enable command must be removed, or the drive must be tripped etc.)

Open-loop

In these modes the following parameters are used in the vector control algorithm.

	Parameter	Basic algorithm	Slip compensation
Rated frequency	5.06	√	√
Rated current	5.07	√	√
Rated load rpm	5.08		√
Rated voltage	5.09	√	
Power factor	5.10	√	
No. of poles	5.11		√
Stator resistance (R_S)	5.17	√	
Transient inductance (σLs)	5.24		

All these parameters can be set by the user except the transient inductance. The auto-tune test can be used to overwrite the user or default settings as described below. Accurate values of stator resistance and voltage offset are required even for moderate performance in vector mode (an accurate value of power factor is less critical).

1: Stationary test

The stationary test measures the stator resistance (Pr 5.17) and voltage offset (Pr 5.23). The power factor (Pr 5.10) is not affected.

2: Rotating test

A stationary test is performed to measure stator resistance (Pr 5.17), voltage offset (Pr 5.23) and transient inductance (Pr 5.24). The transient inductance is not used directly by the drive, but is an intermediate value in determining the power factor after the rotating test. This is followed by a rotating test in which the motor is accelerated with the currently selected ramps to 2/3 of rated speed and held at this speed for several seconds. Once the test is complete the power factor (Pr 5.10) is updated and the motor coasts to a stop. The motor should be unloaded for this test to produce correct results.

Closed-loop vector

In this mode the following parameters are used in the vector control algorithm.

	Parameter	If L_S is zero	If L_S is not zero	Reqd. for moderate performance
Rated frequency	5.06	√	√	√
Rated current	5.07	√	√	√
Rated load rpm	5.08	√	√	√
Rated voltage	5.09	√	√	√
Power factor	5.10	√		√
No. of poles	5.11	√	√	√
Stator resistance (R_S)	5.17	√	√	√
Transient inductance (σL_S)	5.24	√	√	√
Stator inductance (L_S)	5.24		√	
Motor saturation breakpoint 1	5.25	√	√	
Motor saturation breakpoint 2	5.29	√	√	

All these parameters can be set by the user. The motor set-up is constantly recalculated in background, therefore modifying these parameters even after auto-tune will affect the performance of the drive. The auto-tune test can be used to overwrite the user or default settings as described below.

1. Stationary test

The stationary test measures the stator resistance (Pr 5.17) and transient inductance (Pr 5.24). When this test is complete the current loop gains (Pr 4.13 and Pr 4.14) are overwritten with the correct values based on the calculations given in Menu 4. A moderately accurate value of (1 as described in menu 4 can be obtained to set the correct current limits and flux level in the motor.

2. Rotating test

A stationary test is performed to measure stator resistance (Pr 5.17) and transient inductance (Pr 5.24). The current loop gains (Pr 4.13 and Pr 4.14) are overwritten with the correct values based on the calculations given in Menu 4. After this first stage the updated parameters are saved in EEPROM, provided the drive has not tripped.

The second stage is a rotating test in which the motor is accelerated using the ramp rate defined by Pr 2.11 (or Pr 21.04 if motor 2 is selected) to 2/3 of rated frequency and held at this frequency for up to 36 seconds. During the rotating test the stator inductance (Pr 5.25), and the motor saturation breakpoints (Pr 5.29 and Pr 5.30) are modified by the drive. The power factor is also modified for user information only, but is not used after this point because the stator inductance will have a non-zero value. When the test is complete the motor coasts to a stop. The motor should be unloaded for this test to produce correct results. After this first stage the parameters updated during this stage are saved in EEPROM, provided the drive has not tripped during the second stage.

3. Inertia measurement

The motor speed changes from 1/3 to 2/3 rated speed in the forward direction several times to measure the motor and load inertia. The motor can be loaded with a constant torque load and still give an accurate result, however, non-linear loads and loads that change with speed will cause measurement errors.

Servo

In this mode the following parameters are used in the vector control algorithm.

	Parameter	Required. for moderate performance	Required. for good performance
Encoder phase angle	3.25	√	√
No. of poles	5.11	√	√
Transient inductance (σL_S)	5.24		√

1: Short low speed test

The motor is rotated by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the forward direction.

The drive applies rated current to the motor during the test and measures the encoder phase angle (Pr 3.25) only. The phase angle measurement is taken when the motor has stopped at the end of the test, therefore there must be no load on the motor when it is at rest for the correct angle to be measured. This test takes approximately 2 seconds to complete and can only be used where the rotor settles to a stable position in a short time.

2. Normal low speed test

The motor is rotated by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the forward direction.

The drive applies rated current to the motor during the test and measures the encoder phase angle (Pr 3.25). The phase angle measurement is taken when the motor has stopped at the end of the test, therefore there must be no load on the motor when it is at rest for the correct angle to be measured. After this first stage the updated parameters are saved in EEPROM, provided the drive has not tripped.

The motor resistance (Pr 5.17) and inductance (Pr 5.24) are then measured, and the measured values are used to set up the current loop gains (Pr 4.13 and Pr 4.14) based on the calculations given in Menu4. After this first stage the parameters updated during this stage are saved in EEPROM, provided the drive has not tripped during the second stage. It should be noted that the inductance measured is the inductance in the flux axis. For many motors this will be 20 to 30% less that the inductance in the other axis. The inductance for the other axis could be used to calculate the current controller proportional gain if required because there are no transient changes of current reference flux axis. Therefore the gain can be increased by the user if required. The inductance for the other axis should be use to obtain optimal cross coupling cancellation (see Pr 5.26), and so the transient inductance (Pr 5.24) could also be increased by the user if required.

The whole test takes approximately 20 seconds and can be used with motors that take time to settle after the rotor has moved. During the motor inductance measurement the drive applies current pulses to the motor that produces flux that opposes the flux produced by the magnets. The maximum current applied is a quarter of rated current (Pr 5.07 or Pr 21.07). This current is unlikely to affect the motor magnets, however, if this level of current could permanently de-magnetise the magnets the rated current should be set to a lower level for the tests to avoid this.

Either the short or normal low speed tests could be used with a servomotor that does not have an absolute encoder (i.e. incremental without UVW commutation signals, SinCos without comms etc.) to control a servomotor. A phasing test would need to be performed after each power-up or loss of encoder power supply if the motor rotates while the supply is not present before the motor could be controlled by the drive. If this method of control is used the drive cannot do any error checking to ensure that the absolute position has not been lost due to unwanted encoder counts due to noise.

3: Inertia measurement

The motor speed changes from 1/3 to 2/3 rated speed in the forward direction several times to measure the motor and load inertia. The motor can be loaded with a constant torque load and still give an accurate result, however, non-linear loads and loads that change with speed will cause measurement errors.

The auto-tune tests may be aborted by removing the run command or the enable or if a trip occurs. During the auto-tune tests the following trips can occur in addition to the other drive trips.

Trip code	Reason	Test which can cause trip
TunE1	The position feedback did not change (i.e. motor did not turn or feedback failed)	Closed-loop vector 2 Servo 1,2
TunE2	Position feedback direction incorrect	Closed-loop vector 2 Servo 1,2
TunE3	Drive encoder commutation signals connected incorrectly, i.e. direction incorrect. (Drive encoder only.)	Servo 1,2
TunE4	Drive encoder U commutation signal fail (Drive encoder only.)	Servo 1,2
TunE5	Drive encoder V commutation signal fail (Drive encoder only.)	Servo 1,2
TunE6	Drive encoder W commutation signal fail (Drive encoder only.)	Servo 1,2
TunE7	Motor poles set-up incorrectly This trip may also occur if the encoder lines parameter is incorrect. This trip will not occur if the motor poles are more than 12. Closed-loop vector 2	Closed-loop vector 2 Servo 1,2
TunE	Auto-tune stopped before completion	All
RS	Stator resistance too high	Open-loop 1, 2 Closed-loop vector 1 Servo 2

The RS trip is produced if the drive cannot achieve the necessary current levels to measure the stator resistance during the test (i.e. there is no motor connected to the drive), or if the necessary current level can be achieved, but the calculated resistance exceeds the maximum values for the particular drive size. The maximum measurable value can be calculated from the following formula.

Rs_{max} = DC_VOLTAGE_MAX / Drive rated current / 0.45 / $\sqrt{2}$

05.13	Dynamic V to F / flux optimise select															
Drive modes	Open-loop, Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector								0							
Update rate	Background read															

Open-loop

Setting this bit enables dynamic V to f mode which is intended for applications where power loss should be kept to a minimum under low load conditions. The rated frequency used to derive the voltage to frequency characteristic of the drive is varied with load:

if [active current] < 0.7 x rated active current
motor rated frequency = 05.06 x (2 - (active current / (0.7 x rated active current))

else if [active current] ≥ 0.7 x rated active current
motor rated frequency = 05.06

Although the rated frequency varies the value shown as parameter 05.06 does not vary from that set by the user.

Closed-loop vector

At light load the losses in the motor can be reduced by reducing the motor flux. When flux optimisation is selected the flux producing current in the motor is reduced under light load conditions so that it is equal to the torque producing current with a minimum limit of half the rated flux producing current. This optimises the copper losses in the motor and reduces the iron losses.

5.14	Voltage mode select															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Default	Open-loop								0 to 5							
Range	Open-loop								4							
Update rate	Background read															

0: Ur_S, Stator resistance and voltage offset measured at each start

The stator resistance and the voltage offset are measured and the parameters for the selected motor map are over-written each time the drive is started. This test can only be done with a stationary machine where the flux has decayed to zero. Therefore this mode should only be used if the machine is guaranteed to be stationary each time the drive is enabled. To prevent the test from being done before the flux has decayed there is a period of 1 second after the drive has been in the ready state during which the test is not done if the drive is re-started. In this case, previously measured values are used. The new values of stator resistance and voltage offset are not automatically saved to EEPROM.

1: Ur, No measurements

The stator resistance and voltage offset are not measured. The user can enter the motor and cabling resistance into the stator resistance parameter. However this will not include resistance effects within the drive inverter. Therefore if this mode is to be used, it is best to use the auto-tuning stationary test initially to measure the stator resistance.

2: Fd, Fixed boost mode

Neither the stator resistance nor the voltage offset are used, instead a fixed characteristic with boost applied as defined by Pr 5.15 is used.

3: Ur_Auto, Stator resistance and voltage offset measured at first drive enable

The stator resistance and voltage offset are measured once, the first time the drive is enabled. After the test has been completed successfully the mode is changed to Ur mode. The stator resistance and voltage offset are written to the parameters for the currently selected motor map and these parameters along with this parameter are saved in the EEPROM. (If the test fails the stator resistance and voltage offset are not updated, the mode is changed to Ur, but no parameters are saved.)

4: Ur_I, Stator resistance and voltage offset measured at each power-up

The stator resistance and voltage offset are measured when the drive is first enabled after at each power-up. The new values of stator resistance and voltage offset are not automatically saved to EEPROM.

5: SrE: Square law characteristic

Neither the stator resistance nor the voltage offset are used, instead a fixed square law characteristic with boost applied as defined by Pr 5.15 is used.

05.15	Low frequency voltage boost															
Drive modes	Open-loop, Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop,Closed-loop vector								0.0 to 25.0 % of motor rated voltage							
Default	Open-loop Closed-loop vector								3.0 1.0							
Update rate	Background read															

The voltage boost is used in fixed boost mode and square law mode in Open-loop modes, jog function and during the rotating auto-tune test in Closed-loop vector mode.

5.16	Rated rpm auto-tune															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1		
Default	Closed-loop vector								0 to 2							
Range	Closed-loop vector								0							
Update rate	Background read															

The motor rated full load rpm Pr 5.08 in conjunction with the motor rated frequency Pr 5.06 defines the full load slip of the motor. The slip is used in the motor model for closed-loop vector control. The full load slip of the motor varies with rotor resistance, which can vary significantly with motor temperature. When this parameter is set to 1 or 2 the drive can automatically sense if the value of slip defined by Pr 5.06 and Pr 5.08 has been set incorrectly or has varied with motor temperature. If the value is incorrect Pr 5.08 is automatically adjusted. Pr 5.08 is not saved at power-down, and so when the drive is powered-down and up again it will return to the last value saved by the user. If the new value is required at the next power-up the user must save it. Automatic optimisation is only can be enabled when the frequency is above rated frequency/8, and when the load on the motor load rises above 5/8 rated load. Optimisation is disabled again if the load falls below half rated load. For best optimisation results the correct values of stator resistance (Pr 5.17), transient inductance (Pr 5.24), stator inductance (Pr 5.25) and saturation breakpoints (Pr 5.29, Pr 5.30) should be stored in the relevant parameters. Rated rpm auto-tune is not available if the drive is not using external position/speed feedback.

The gain of the optimiser, and hence the speed with which it converges, can be set at a normal low level when Pr 5.16 is set to 1. If this parameter is set to 2 the gain is increased by a factor of 16 to give faster convergence.

5.18	Maximum switching frequency															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1				1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 5 (3, 4, 6, 8, 12, 16kHz)							
Default	Open-loop, Closed-loop vector Servo								0 (3kHz) 2 (6kHz)							
Update rate	Background read															

This parameter defines the required switching frequency. The drive may automatically reduce the actual switching frequency (without changing this parameter) if the power stage becomes too hot. An estimate of the IGBT junction temperature is made based on the heatsink temperature and an instantaneous temperature drop using the drive output current and switching frequency. The estimated IGBT junction temperature is displayed in Pr 7.34. If the temperature exceeds 145ºC the switching frequency is reduced if this is possible (i.e >3kHz) and this mode is enabled (see Pr 5.35). Reducing the switching frequency reduces the drive losses and the junction temperature displayed in Pr 7.34 also reduces. If the load condition persists the junction temperature may continue to rise. If it again rises above 145ºC and the drive cannot reduce the switching frequency further the drive will initiate an O.ht1 trip. Every 20ms the drive will attempt to restore the switching frequency to the level set in Pr 5.18. The switching frequency will remain at the level in Pr 5.18 until the junction temperature again rises above 145ºC again. The following table gives the sampling rate for different sections of the control system for different switching frequencies.

Level	3, 6, 12kHz	4, 8, 16kHz	Open-loop	Closed-loop vector	Servo	Regen
1	3=167µs 6=83µs 12=83µs	125µs	Peak limit	Current controllers	Current controllers	Current controllers
2	250µs	250µs	Current limit and ramps	Speed controller and ramps	Speed controller and ramps	Voltage controller
3	1ms	1ms	Voltage controller	Voltage controller	Voltage controller	
4	4ms	4ms	Time critical user interface	Time critical user interface	Time critical user interface	Time critical user interface
Band	N/A	N/A	Non-time critical user interface	Non-time critical user interface	Non-time critical user interface	Non-time critical user interface

5.20	Quasi-square enable															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop								0							
Update rate	Background read															

Open loop

The maximum modulation level of the drive is normally limited to unity giving an output voltage equivalent to the drive input voltage minus voltage drops within the drive. If the motor rated voltage is set at the same level as the supply voltage some pulse deletion will occur as the drive output voltage approaches the rated voltage level. If Pr 5.22 is set to 1 the modulator will allow over modulation, so that as the output frequency increases beyond the rated frequency the voltage continues to increase above the rated voltage. The modulation depth will increase beyond unity; first producing trapezoidal and then quasi-square waveforms. This can be used for example to obtain high output frequencies with a low switching frequency which would not be possible with space vector modulation limited to unity modulation depth. The disadvantage is that the machine current will be distorted as the modulation depth increases above unity, and will contain a significant amount of low order odd harmonics of the fundamental output frequency. It is not possible to select quasi-square operation when the switching frequency is 16kHz (Pr 5.18=5).

05.23	Voltage offset															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1		1				1	1	1	
Range	Open-loop								0.0 to 25.0 V							
Default	Open-loop								0.0							
Second motor parameter	Open-loop								21.13							
Update rate	Background read															

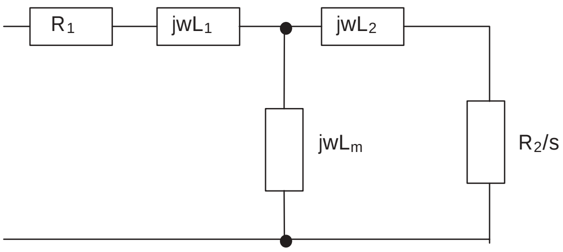
Due to various effects in the drive inverter a voltage offset must be produced before any current flows. To obtain good performance at low frequencies where the machine terminal voltage is small this offset must be taken into account. The value shown in parameter 05.23 is this offset given in line to line rms volts. It is not possible for the user to measure this voltage easily, and so the automatic measurement procedure should be used (see parameter 05.14).

5.24	Transient inductance (σL_S)															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
Open-loop							3		1				1		1	
Closed-loop							3		1				1	1	1	
Range	Open-loop,Closed-loop vector, Servo								0.000 to 500.000 mH							
Default	Open-loop,Closed-loop vector, Servo								0.000							
Second motor parameter	Open-loop,Closed-loop vector, Servo								Pr 21.14							
Update rate	Background read															

Open-loop, Closed-loop vector

With reference to the diagram below, the transient inductance is defined as

$\sigma L_s = L_1 + (L_2.L_m / (L_2 + L_m))$.



Steady state per phase equivalent circuit
of an induction motor

Based on the parameters normally used for the motor equivalent circuit for transient analysis, i.e. $L_s = L_1 + L_m$, $L_r = L_2 + L_m$, the transient inductance is given by

$\sigma L_s = L_s - (L_m^2 / L_r)$

The transient inductance is used as an intermediate variable to calculate the power factor in open-loop mode. It is used in the vector algorithm, for cross-coupling compensation and to set the current controller gains in Closed-loop vector mode.

Servo

The transient inductance is the phase inductance for a servomotor. This is half the inductance measured from phase to phase. This value is used for cross-coupling compensation and to set the current controller gains.

5.25	Stator inductance (L_s)															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2		1				1	1	1	
Range	Closed-loop vector								0.00 to 5000.00 mH							
Default	Closed-loop vector								0.00							
Second motor parameter	Closed-loop vector								21.24							
Update rate	Background read															

This parameter holds the stator inductance of the motor with rated flux. If the motor flux is reduced the value of stator inductance used by the vector control algorithm is modified using the motor saturation breakpoints (Pr 5.29 and Pr 5.30). Stator inductance (L_s) = L1 + L_m from the steady state equivalent circuit. It should be noted that if this parameter is changed from a non-zero value to zero the power factor (Pr 5.10) is automatically set to 0.850. The same applies to the motor map 2 stator inductance (Pr 21.24) and motor map 2 power factor (Pr 21.10).

05.26	High dynamic performance enable															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Closed-loop vector, Servo								0							
Update rate	Background read															

When this bit is set the drive provides a cross-coupling feed forward voltage as produced by the transient inductance and a frequency based voltage feed forward term. These voltages improve the transient performance of the current controllers.

05.32	Motor torque per amp															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1							1	
Range	Closed-loop vector								0.00 to 500.00NmA^{-1}							
Update rate	Background (1s) write															

5.32	Motor torque per amp															
Drive modes	Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Servo								0.00 to 500.00NmA^{-1}							
Default	Servo								1.60							
Update rate	Background (1s) read															

This parameter shows the motor torque per amp of active (torque producing) current used to calculate the speed controller gains when the automatic set-up methods are active (i.e. Pr 3.17=1 or 2).

Closed-loop vector

The drive calculated the motor torque per amp of active current using the motor parameters as shown below assuming a motor efficiency of 90%.

$$K_t = \frac{\sqrt{3}\ \text{Vrated} \times \text{Irated} \times \text{Rated powerFactor} \times \text{Efficiency}}{\text{Rated speed (rs}^{-1}\text{)} \times \text{Rated active current}}$$

$$= \frac{\sqrt{3}\ 05.09 \times 05.07 \times 05.10 \times 0.9}{2\pi \times 05.08 \times 60 \times \text{Rated active current}}$$

Rated active current is the active current when the motor current is equal to the rated motor current and is defined as the start of the description of menu 4.

Servo

The motor torque per amp (Kt) must be entered in this parameter by the user for the automatic gain calculation system to operate correctly.

05.33	Motor volts per 1000rpm															
Drive modes	Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Servo								0 to 10000							
Default	Servo								98							
Second motor parameter	Servo								21.30							
Update rate	Background read															

This parameter is used to set up the current controller integral terms when the drive is disabled to prevent current transients when the drive is enabled with a spinning motor. It is also used to provide a voltage feed forward term if high dynamic performance is selected with parameter 05.26.

05.35	Disable auto-switching frequency change															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

The drive thermal protection scheme (see parameter 05.18) reduces the switching frequency automatically when necessary to prevent the drive from overheating. It is possible to disable this feature by setting this bit parameter to one. If the feature is disabled the drive trips immediately when the IGBT temperature is too high.

Menu 6: Sequencer & Clock

There are a number of parameters in menu 6 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
6.01	Stop mode	With Unidrive SP, stop and orientate function controlled via position controller mode
6.02	Auto start mode	Not available with Unidrive SP
6.03	Mains loss mode	With Unidrive SP, Control voltage levels changed, details overleaf
6.04	Sequencing mode	With Unidrive SP this is now Start/stop logic select, functional changes over Unidrive 1. details overleaf
6.05	Minimum jog time	Not available with Unidrive SP
6.06	Injection braking level	With Unidrive SP, parameter range has changed from 100% (Unidrive 1) to 150%, details overleaf
6.09	Catch a spinning motor	With Unidrive SP, Catch a spinning motor now has an additional 2 modes, detect positive frequencies only and detect negative frequencies only. details overleaf
6.10	Spinning motor ramp rate	Not available with Unidrive SP
6.11	Enable keypad run switch	Not available with Unidrive SP
6.12	Enable stop key	With Unidrive SP, conditions for operation have changed over Unidrive 1. details overleaf
6.20	Powered-up time: years.days	Previously Time interval before lubrication in Unidrive 1, details overleaf. Lubrication timer is not available in Unidrive SP
6.21	Powered-up time: hours.minutes	Previously Lubrication required/done in Unidrive 1, details overleaf. Lubrication timer is not available in Unidrive SP
6.22	Run time log: Years.days	With Unidrive SP, parameter range has changed from 0 ~ 30.365 Years.Days(Unidrive 1) to 0 ~ 9.365 Years.Days, details overleaf
6.24	Energy meter:MWh	With Unidrive SP, range of parameter has changed to ±999.9 MWh, previously 0~30,000 MWh with Unidrive 1
6.25	Energy meter:KWh	With Unidrive SP, range of parameter has changed to ±99.99 KWh, previously 0~999.9 KWh with Unidrive 1
6.26	Running cost	With Unidrive SP, range of parameter has changed to ±32,000, previously 0~30,000 with Unidrive 1
6.28	Select clock for trip log time stamping	Previously Time before lubrication due in Unidrive 1, details overleaf. Lubrication timer is not available in Unidrive SP

Menu 6: Sequencer & Clock

Parameter	Function	Details
6.30	Sequencing bit 0	Sequencer bits are re-named but have the same flexibility as with Unidrive. Details overleaf and in menu 6 of Unidrive SP Advanced User guide
6.31	Sequencing bit 1	
6.32	Sequencing bit 2	
6.33	Sequencing bit 3	
6.34	Sequencing bit 3	
6.35	Forward limit switch	Faster sampling with Unidrive SP, details overleaf
6.35	Reverse limit switch	
6.37		Previously Spin start voltage in Unidrive 1, Not available in Unidrive SP due to changes in Pr 6.09
6.38		Previously Spinning motor voltage ramp rate in Unidrive 1, Not available in Unidrive SP due to changes in Pr 6.09
6.39	Sequencing bit not stop	New Unidrive SP parameter, works in conjunction with Pr 6.40, this must be set to a one in order for the sequencer bits to be latching, if set to zero all latching bits are cleared
6.40	Enable sequencer latching	For Unidrive SP the sequencer bits can be configured to be latching using this parameter
6.42	Control word	For Unidrive SP Pr 6.42 and Pr 6.43 provide a method of controlling the sequencer inputs from a single control word, details overleaf
6.43	Control word enable	
6.44	Active supply	New parameter, indicates which supply is currently active (48Vdc or Vac supply). Details overleaf
6.45	Force cooling fan to run at full speed	The fan can be forced to operate at full speed if this parameter is set to one (normally controlled by the drives thermal model system)

06.01	Stop mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop Closed-loop vector and Servo								0 to 4 0 to 2							
Default	Open-loop Closed-loop vector Servo								1 1 2							
Update rate	Background read															

Open-loop

Stopping is in two distinct phases: decelerating to stop, and stopped.

Stopping Mode	Phase 1	Phase 2	Comments
0: Coast	Inverter disabled	Drive cannot be re-enabled for 1s	Delay in phase 2 allows rotor flux to decay
1: Ramp	Ramp down to zero frequency	Wait for 1s with inverter enabled	
2: Ramp followed by D.C. injection	Ramp down to zero frequency	Inject d.c at level specified by parameter 06.06 for time defined by 06.07	
3: D.C injection with zero speed detection	Low frequency current injection with detection of low speed before next phase	Inject d.c at level specified by parameter 06.06 for time defined by 06.07	The drive automatically senses low speed and therefore it adjusts the injection time to suit the application. If the injection current level is too small the drive will not sense low speed (normally a minimum of 50-60% is required)
4: Timed DC injection braking stop	Inject d.c. at level specified by parameter 06.06 for time specified by 06.07	No phase 2	

Once modes 3 or 4 have begun the drive must go through the ready state before being restarted either by stopping, tripping or being disabled.

Closed-loop vector and Servo

Only one stopping phase exists and the ready state is entered as soon as the single stopping action is complete.

Stopping Mode	Action
0: Coast	Inhibits the inverter
1: Ramp	Stop with ramp
2: No ramp	Stop with no ramp

The motor can be stopped with position orientation after stopping. This mode is selected with the position controller mode parameter (13.10). When this mode is selected parameter 06.01 has no effect.

06.03	Mains loss mode														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

0: dis

There is no mains loss detection and the drive operates normally only as long as the DC link voltage remains within specification (i.e. >Vuu). Once the voltage falls below Vuu a UU trip occurs and this will reset itself if the voltage rises again above VuuRestart in the table below.

1: Stop - Open-loop

The action taken by the drive is the same as for ride through mode, except the ramp down rate is at least as fast as the deceleration ramp setting and the drive will continue to decelerate and stop even if the mains is re-applied. If normal or timed injection braking is selected the drive will use ramp mode to stop on loss of the supply. If ramp stop followed by injection braking is selected the drive will ramp to a stop and then attempt to apply d.c. injection. At this point, unless the mains has been restored the drive is likely to initiate a UU trip.

1: Stop - Closed-loop vector or Servo

The speed reference is set to zero and the ramps are disabled allowing the drive to decelerate the motor to a stop under current limit. If the mains is re-applied whilst the motor is stopping any run signal is ignored until the motor has stopped. If the current limit value is set at a very low level the drive may trip UU before the motor has stopped.

2: ride.th

The drive detects mains loss when the d.c. link voltage falls below Vml1. The drive then enters a mode where a closed-loop controller attempts to hold the d.c. link level at Vml_2. This causes the motor to decelerate at a rate that increases as the speed falls. If the mains is re-applied it will force the d.c. link voltage above the detection threshold Vml1 and the drive will continue to operate normally. The output of the mains loss controller is a current demand that is fed into the current control system and therefore the gain parameters 04.13 and 04.14 must be set up for optimum control. See parameters 04.13 and 04.14 for set-up details.

The following table shows the voltage levels used by drives with each voltage rating.

Voltage level	200V drive	400V drive	575V drive	690V drive
Vuu	175	330	435	435
Vml_1	205	410	540	540
Vml_2	195	390	515	515
VuuRestart	215	425	590	590

6.04	Start/stop logic select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 4							
Default	Open-loop, Closed-loop vector, Servo								4							
Update rate	Background read															

This parameter is provided to allow the user to select several predefined digital input routing macros to control the sequencer. When a value between 0 and 3 is selected the drive processor continuously updates the destination parameters for digital I/O F2, F3 and F4, and to the enable sequencer latching bit (Pr 6.40). When a value of 4 is selected the destination parameters for these digital I/O and Pr 6.40 can be modified by the user. (Note any changes made to the destination parameters only become active after a drive reset.)

6.04	F2	F3	F4	6.40
0	6.29	6.30 Run Forward	6.32 Run Reverse	0 (non latching)
1	6.39 Not stop	6.30 Run Forward	6.32 Run Reverse	1 (latching)
2	6.29	6.34 Run	6.33 Fwd /Rev	0 (non latching)
3	6.39 Not stop	6.34 Run	6.33 Fwd/Rev	1 (latching)
4	User prog	User prog	User prog	User prog

06.06	Injection braking level															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1		1				1	1	1	
Range	Open-loop								0 to 150.0%							
Default	Open-loop								100.0%							
Update rate	Background read															

Defines the current level used during d.c. injection braking as a percentage of motor rated current as defined by parameter 05.07.

6.09	Catch a spinning motor															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop Closed-loop vector and Servo								3 1							
Default	Open-loop Closed-loop vector and Servo								0 1							
Update rate	Background read															

Open-loop

When the drive is enabled with this parameter at zero, the output frequency starts at zero and ramps to the required reference. When the drive is enabled with this parameter at a non-zero value, the drive performs a start-up test to determine the motor speed and then sets the initial output frequency to the synchronous frequency of the motor. The test is not carried out, and the motor frequency starts at zero, if the run command is given when the drive is in the stop state, or when the drive is first enabled after power-up with Ur_I voltage mode, or when the run command is given with Ur_S voltage mode. With default parameters the length of the test is approximately 250ms, however, if the motor has a long rotor time constant (usually large motors) it may be necessary to extend the test time. The drive will do this automatically if the motor parameters including the rated load rpm are set up correctly for the motor.

For the test to operate correctly it is important that the stator resistance (Pr 5.17, Pr 21.12) is set up correctly. This applies even if fixed boost (Fd) or square law (SrE) voltage mode is being used. The test uses the rated magnetising current of the motor during the test, therefore the rated current (Pr 5.07, Pr 21.07 and Pr 5.10, Pr 21.10) and power factor should be set to values close to those of the motor, although these parameters are not as critical as the stator resistance.

It should be noted that a stationary lightly loaded motor with low inertia may move slightly during the test. The direction of the movement is undefined. Restrictions may be placed on the direction of this movement and on the frequencies detected by the drive as follows:

6.09	Function
0	Disabled
1	Detect all frequencies
2	Detect positive frequencies only
3	Detect negative frequencies only

Closed-loop vector and Servo

When the drive is enabled with this parameter at zero, the post ramp reference (Pr 2.01) starts at zero and ramps to the required reference. When the drive is enabled with this parameter at one, the post ramp reference is set to the motor speed.

6.12	Enable stop key															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

This parameter permanently enables the Stop key on the drive such that the drive will always stop when the stop switch is pressed. If keypad mode is selected this has no effect because the stop key is automatically enabled.

If sequencer latching is not enabled (Pr 6.40=0) and Pr 6.12=1, the drive will stop when the stop key is pressed. The drive can only then be restarted if the sequencer inputs are first in a state that would not cause the drive to run, i.e.

1. Run forward, Run reverse and Run sequencing bits all zero

2. OR the drive is disabled via Pr 6.15 or Pr 6.29

3. OR Run forward and Run reverse are both active and have been for 60ms.

The drive can then be restarted by activating the necessary bits to give a normal start. This means that the drive cannot restart automatically after a trip, for example, by pressing the stop key.

If sequencer latching is enabled (Pr 6.40=1) and Pr 6.12=1, the drive will stop when the stop key is pressed. The drive can only then be restarted if the sequencer inputs are first in a state that would not cause the drive to run, i.e.

1. Run forward, Run reverse and Run sequencing bits all zero after the latches

2. OR Not stop sequencing bit is zero

3. OR the drive is disabled via Pr 6.15 or Pr 6.29

4. OR Run forward and Run reverse are both active and have been for 60ms.

The drive can then be restarted by activating the necessary bits to give a normal start. This means that the drive cannot restart automatically after a trip, for example, by pressing the stop key. Note that Run forward and Run reverse together will reset the stop key condition, but the latches associated with Run forward and Run reverse must then be reset before the drive can be restarted. It should be noted that the function of holding the run key and pressing the stop key to reset the drive without stopping does not apply unless keypad reference mode is selected.

06.20	Powered-up time: years.days															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3	1		1		1		1	1	
Coding	RW, U, S, P															
Default	Open-loop, Closed-loop vector, Servo								0 to 9.365 Years.Days							
Update rate	Background write															

6.21	Powered-up time: hours.minutes															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1		1		1	1	
Default	Open-loop, Closed-loop vector, Servo								0 to 23.59 hours.minutes							
Update rate	Background write															

The powered-up clock always starts at zero each time the drive is powered-up. The time can be changed by the user from the keypad, serial comms or an application module. If the data is not written with the various parts in the correct range (i.e. minutes are greater than 59, etc.) the clock is written to zero on the next minute. This clock may be used for time stamping the trip log if Pr 6.28 = 0.

06.24	Energy meter: MWh															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1		1				1
Default	Open-loop,Closed-loop vector, Servo								-999.9 to 999.9 MWh							
Update rate	Background write															

06.25	Energy meter: kWh															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1		1				1
Coding	RO, U, S, P															
Default	Open-loop, Closed-loop vector, Servo								-99.99 to 99.99 kWh							
Update rate	Background write															

Parameters 06.24 and 06.25 form the energy meter that indicates energy supplied to/from the drive in kWh.

For motor control modes a positive value indicates net transfer of energy from the drive to the motor. For Regen mode a positive value indicates a net transfer of energy from the supply to the drive. The energy meter is reset and held at zero when parameter 06.17 is one.

06.26	Running cost															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
			1					1		1		1				
Range	Open-loop,Closed-loop vector, Servo								-32000 to 32000							
Update rate	Background write															

Instantaneous read out of the cost/hour of running the drive. This requires parameter 06.16 to be set up correctly.

06.28	Select clock for trip log time stamping															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector,Servo								0							
Update rate	Background read															

The trip log includes time stamping for individual trips. If parameter 06.28 = 0, the powered-up clock is used for time stamping. If parameter 06.28 = 1, the run time clock is used for time stamping. It should be noted that changing this parameter clears the trip and trip time logs.

06.30	Sequencing bit: Run forward															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector,Servo								0							
Update rate	4ms read															

06.31	Sequencing bit: Jog															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector,Servo								0							
Update rate	4ms read															

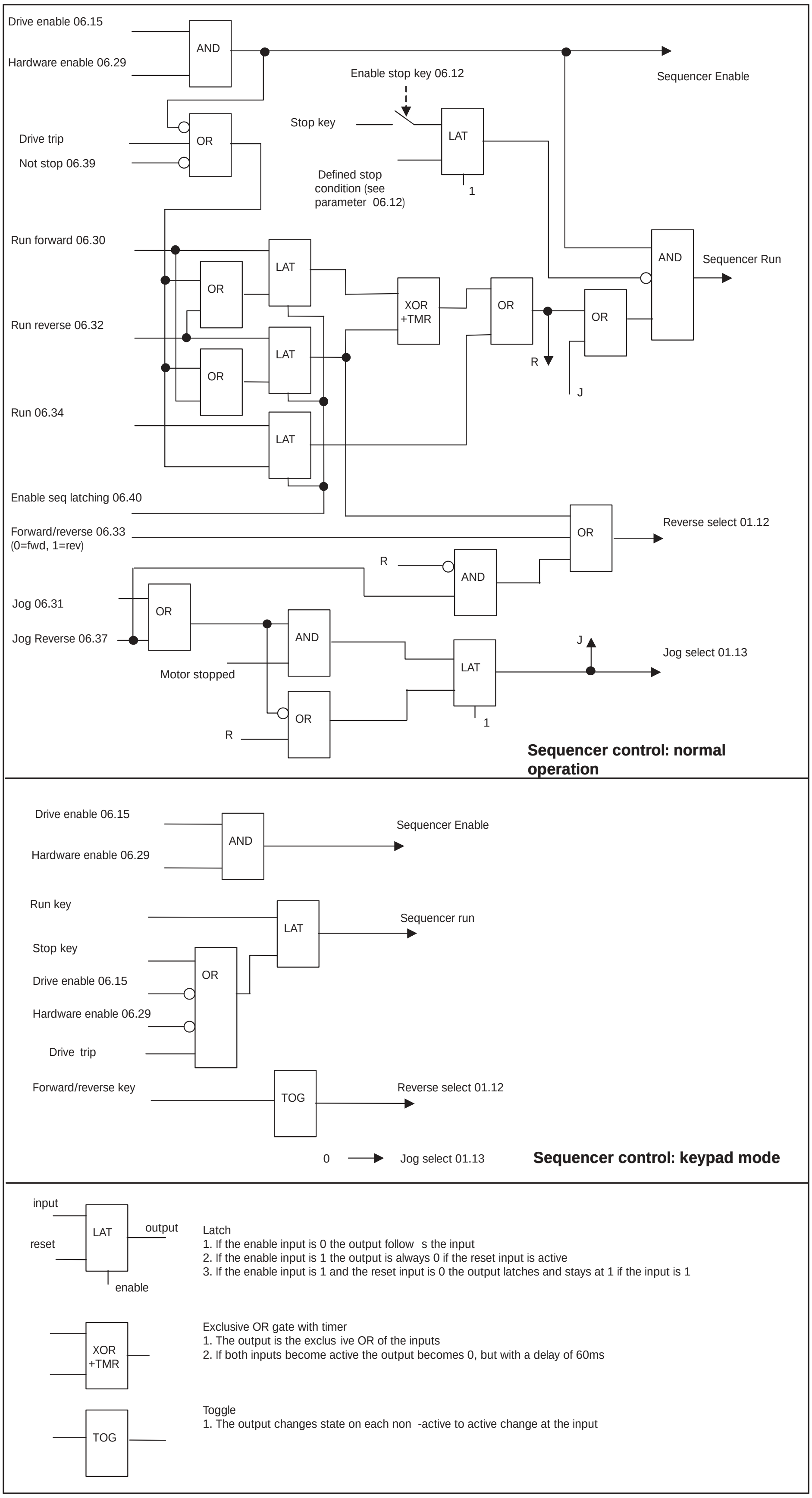
06.32	Sequencing bit: Run reverse															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Coding	RW, Bit															
Default	Open-loop,Closed-loop vector, Servo								0							
Update rate	4ms read															

06.33	Sequencing bit: Forward/reverse															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector,Servo								0							
Update rate	4ms read															

06.34	Sequencing bit: Run															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector,Servo								0							
Update rate	4ms read															

The diagram below shows the main operation of the sequencer in normal and keypad modes. The diagram shows normal control where the sequencer bits are used as inputs and keypad mode where the keypad keys are used as inputs. In normal operation the sequencer has been designed to operate with Run forward / Run reverse controls, or with a Run control and a forward reverse selector. If Run forwards / Run reverse control is required then bits 06.30 and 06.32 should be used to control the drive (digital inputs should not be routed to bits 06.33 and 6.34). If Run control with a forward reverse selector is required then bits 06.33 and 06.34 should be used to control the drive (digital inputs should not be routed to bits 06.30 and 6.32).

Run forward and reverse, or using Run, can be made latching by setting bit 06.40. The Not stop bit (06.39) should be one to allow the sequencing bit to be latched. If the Not stop bit is zero all latches are cleared and held at zero. The jog or jog reverse sequencing bits can also cause the drive to run provided the motor is stopped when these bits are activated and the normal run sequencing bits are not providing a run signal.


Drive enable 06.15
Hardware enable 06.29
AND
Enable stop key 06.12
Sequencer Enable
Stop key
LAT
Drive trip
OR
Not stop 06.39
Defined stop condition (see parameter 06.12)
1
Run forward 06.30
LAT
AND
Sequencer Run
OR
XOR +TMR
OR
OR
Run reverse 06.32
LAT
R
OR
J
Run 06.34
LAT
Enable seq latching 06.40
Forward/reverse 06.33 (0=fwd, 1=rev)
OR
Reverse select 01.12
R
AND
Jog 06.31
OR
Jog Reverse 06.37
AND
J
Jog select 01.13
LAT
Motor stopped
OR
1
R
Sequencer control: normal operation
Drive enable 06.15
AND
Sequencer Enable
Hardware enable 06.29
Run key
LAT
Sequencer run
Stop key
OR
Drive enable 06.15
Hardware enable 06.29
Drive trip
Forward/reverse key
TOG
Reverse select 01.12
0
Jog select 01.13
Sequencer control: keypad mode
input
LAT
output
reset
enable
Latch
1. If the enable input is 0 the output follow s the input
2. If the enable input is 1 the output is always 0 if the reset input is active
3. If the enable input is 1 and the reset input is 0 the output latches and stays at 1 if the input is 1
XOR +TMR
Exclusive OR gate with timer
1. The output is the exclus ive OR of the inputs
2. If both inputs become active the output becomes 0, but with a delay of 60ms
TOG
Toggle
1. The output changes state on each non -active to active change at the input

06.35	Forward limit switch															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Default	Open-loop, Closed-loop vector,Servo								0							
Update rate	250µs read															

06.36	Reverse limit switch															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	250µs read															

Digital inputs connected to limit switches should be routed to these parameters if fast stopping is required at a limit. In Open-loop mode the drive will respond in 4.5ms (500µs digital input filter delay + 4ms software delay) and stop the motor using the currently selected ramp rate. In Closed-loop vector and Servo modes the drive will respond in 750us (500µs digital input filter delay + 250µs software delay) and stop the motor with zero ramp rate (i.e. in current limit). The limit switches are direction dependant so that the motor can rotate in a direction that allows the system to move away from the limit switch. (In open-loop frequency slaving mode both limit switches are active.)

Open-loop

Pre-ramp reference > 0Hz	Forward limit switch active
Pre-ramp reference < 0Hz	Reverse limit switch active
Pre-ramp reference = 0Hz	Both limit switches active

Closed-loop and Servo

Pre-ramp reference+hard speed reference > 0rpm	Forward limit switch active
Pre-ramp reference+hard speed reference < 0rpm	Reverse limit switch active
Pre-ramp reference+hard speed reference = 0rpm	Both limit switches active

06.39	Sequencing bit: Not stop															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

06.40	Enable sequencer latching															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

06.42	Control word															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	0 to 32767															
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Bits 0 -7: 4ms read, Bits 8-15: Background read															

6.43	Control word enable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Related to bits 0-7: 4ms read, related to bits 8-15: Background read															

Pr 6.42 and Pr 6.43 provide a method of controlling the sequencer inputs and other functions directly from a single control word. If Pr 6.43=0 the control word has no effect, if Pr 6.43=1 the control word is enabled. Each bit of the control word corresponds to a sequencing bit or function as shown below. Bits marked with * have no effect in Regen mode.

Bit	Function	Equivalent Pr
0	Drive enable	6.15
1*	Run forward	6.30
2*	Jog	6.31
3*	Run reverse	6.32
4*	Forward/reverse	6.33
5*	Run	6.34
6*	Not stop	6.39
7	Auto/manual	
8*	Analogue/Preset reference	1.42
9	Jog reverse	
10	Reserved	
11	Reserved	
12	Trip drive	
13	Reset drive	10.33
14	Keypad watchdog	
15	Reserved	User prog

Bits 0-7: sequencing control

When the control word is enabled (Pr 6.43=1), and the Auto/manual bit (bit7) are both one, bits 0 to 6 of the control word become active. These bits do not modify the equivalent parameters, but become inactive when the equivalent bits in the control word are active. When the bits are active they replace the functions of the equivalent parameters. For example, if Pr 6.43=1 and bit 7 or Pr 6.42=1 one the drive enable is no longer controlled by Pr 6.15, but by bit 0 of the control word. If either Pr 6.43=0, or bit 7 of Pr 6.42=0, the drives enable is controlled by Pr 6.15.

Bit8: Analogue/preset reference

When the control word is enabled (Pr 6.43) bit 8 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) The state of bit 8 is written to Pr 1.42. With default drive settings this selects analogue reference 1 (bit8=0) or preset reference 1 (bit8=1). If any other drive parameters are routed to Pr 1.42 the value of Pr 1.42 is undefined.

Bit12: Trip drive

When the control word is enabled (Pr 6.43) bit 12 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) When bit 12 is set to one a CL.bit trip is initiated. The trip cannot be cleared until the bit is set to zero.

Bit13: Reset drive

When the control word is enabled (Pr 6.43) bit 13 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) When bit 13 is changed from 0 to 1 the drive is reset. This bit does not modify the equivalent Pr (10.33).

Bit14: Keypad watchdog

When the control word is enabled (Pr 6.43) bit 14 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) A watchdog is provided for an external keypad or other device where a break in the communication link must be detected. The watchdog system can be enabled and/or serviced if bit 14 of the control word is changed from zero to one with the control word enabled. Once the watchdog is enabled it must be serviced at least once every second or an “SCL” trip occurs. The watchdog is disabled when an “SCL” trip occurs, and so it must be re-enabled when the trip is reset.

6.44	Active supply														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background write															

The drive can operate from the following supplies as indicated by this parameter. The drive will only change between supply modes as the UU trip is reset.

0: main power terminals

The drive power circuit, gate drives, control circuits and option modules are using the main power terminals to derive their supplies. The drive will operate normally. Parameters that are saved at power-down are saved when the supply is removed in this mode and a UU trip occurs.

1: 48V power

The drive is being supplied using the 48V auxiliary power input. The drive will operate normally except that mains loss detection is disabled, and all parameters that are calculated based on voltage on the auxiliary supply and not the supply from the main power terminals. Parameters that are saved at power-down are not saved when power is removed in this mode. In this mode 24V must also be supplied via the 24V power supply input. When operating in 48V the voltage levels contained in the following table are used instead of the normal high voltage levels whatever the voltage rating of the drive.

Voltage level	
DC_VOLTAGE_MAX	72V
DC_VOLTAGE_SET_MAX	60V
Braking IGBT threshold voltage	66V
Under voltage trip level	36V
Restart voltage level after UU trip	40V

06.45	Force cooling fan to run at full speed														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Update rate	Background read															

The drive thermal model system normally controls the fan speed, however the fan can be forced to operate at full speed if this parameter is set to one. When this is set to one the fan remains at full speed until 10s after this parameter is set to zero.

Menu 7: Analogue I/O

There are a number of parameters in menu 7 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
7.01	T5/6 analog input 1 level 1	Parameter resolution increased from ±100.0% to ±100.00% with Unidrive SP
7.04	Stack temperature 1	Parameter range increased upto -128 to 127ºC with Unidrive SP
7.05	Stack temperature 2	Previously "Control board temperature" in Unidrive 1, details overleaf
7.06	Control board temperature	Previously "Analog input 1 mode selector in Unidrive 1, details overleaf. Analog input 1 mode selector is not required in Unidrive SP, as T5/6 analog 1input is voltage only
7.11	T7 Analogue input 2 mode selector	With Unidrive SP, range of selection has now changed, details overleaf
7.15	T8 Analogue input 3 mode selector	With Unidrive SP, range of selection has now changed, details overleaf
7.21, 7.24	T9/T10 Analogue output 1, 2 mode	Range for these parameters has now changed from 0 - 2 in Unidrive 1 to 0 - 3 with Unidrive SP, details overleaf
7.26	T5/6 Analogue input 1 sample time	Range now increased from 0 ~ 5.0 ms in Unidrive 1 to 0 ~ 8.0 ms.in Unidrive SP
7.27		Not used in Unidrive SP, as T5/6 analog 1input is voltage only
7.28	T7 Analogue input 2 current loop loss	With Unidrive SP, loss detection is selectable
7.29	T8 Analogue input 3 current loop loss	With Unidrive SP, loss detection is selectable
7.30	T5/6 Analogue input 1 offset	Previously Analogue output short cut enable in Unidrive 1, details overleaf. Not used with Unidrive SP, as each Analogue output can select shortcut option (Pr7.21 / 7.24)
7.31		Previously UD78 large option module fitted in Unidrive 1, details overleaf. Not used with Unidrive SP, UD78 option not used
7.32	T7 Analogue input 2 offset	Previously IGBT Junction temperature in Unidrive 1, details overleaf. IGBT Junction temperature Now Pr7.34
7.33	T9 Analogue output 1 control	New parameter with Unidrive SP for the set-up of analogue output 1 details overleaf
7.34	IGBT junction temperature	Additional parameter with Unidrive SP, previously Pr7.32 in Unidrive 1
7.35	Drive thermal protection accumulator	New parameter with Unidrive SP, Drive thermal protection accumulator, details overleaf

Menu 7: Analogue I/O

07.01	Analogue input 1															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-100.00% to +100.00%							
Update rate	4ms write															

7.04	Stack temperature 1															
7.05	Stack temperature 2															
7.06	Control board temperature															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-128 to 127˚C							
Update rate	Background write															

These parameters display the temperature of various parts of the drive in degrees Celsius. The power stage is monitored at two points (Pr 7.04 and Pr 7.05) and the control board is also monitored (Pr 7.06). The following trips and alarms are produced from the values in these parameters:

Parameter	Trip	Alarm
7.04 Stack temperature 1	"O.ht2" if 07.04 > Trip threshold (Can be reset if 7.04 < Trip threshold - 5ºC)	"hot" if Pr 7.04 > Alarm threshold
7.05 Stack temperature 2	"O.ht2" if 07.05 > Trip threshold (Can be reset if 7.05 < Trip threshold - 5ºC)	"hot" if Pr 7.05 > Alarm threshold
7.06 Control board temperature	"O.Ctl" if 07.06 > 90ºC (Can be reset if 07.04 < 85ºC)	"hot" if Pr 7.06 > 85ºC

The threshold levels for the stack temperature trips and alarm vary between drive sizes.

The values displayed in the parameter are normally between -20 and +127ºC. If the value measured from the thermistor exceeds the range from -20 to +150ºC it is assumed that the device is either open-circuit or short-circuit. If this occurs the following hardware fault trips are initiated:

Stack temperature 1 - HF27
Stack temperature 2 - HF28
Control board temperature - HF29

The drives cooling fan is controlled as follows:

1. If Pr 6.45 = 1 the fan is at full speed for at least 10s.
2. If an option module indicates too hot, the fan is at full speed for at least 10s.
3. If the highest of the two stack temperatures is above the alarm level (i.e. hot alarm is being displayed) the fan is at full speed.
4. If the drive is enabled and the highest of the two stack temperatures is above a level defined for each drive size (lower than the alarm level) the fan is at full speed.
5. Otherwise the fan is set to its low speed with 5ºC hysteresis (drive sizes 1 and 2) or variable speed controlled between its low and high speed (drive sizes 3 to 6).

7.11	Analogue input 2 mode															
7.15	Analogue input 3 mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 6							
Default	Open-loop, Closed-loop vector, Servo								6							
Update rate	Background read															

The following modes are available for analogue inputs 2 and 3. Modes 7, 8 and 9 are only available with analogue input 3.

In modes 2 and 3 a current loop loss trip is generated if the input current falls below 3mA. In modes 4 and 5 the analogue input level goes to 0.0% if the input current falls below 3mA.

	Pr Settings		Mode	Comments
	7.11	7.15		
0	0-20	0-20	0 - 20mA	
1	20-0	20-0	20 - 0mA	
2	4-20.tr	4-20.tr	4 -20mA with trip on loss	Trip if I < 3mA
3	20-4.tr	20-4.tr	20 - 4mA with trip on loss	Trip if I < 3mA
4	4-20	4-20	4 - 20mA with no trip on loss	
5	20-4	20-4	20 - 4mA with no trip on loss	0.0% if I < 4mA
6	VOLt	VOLt	Voltage mode	
7		th.SC	Thermistor with short circuit detection	TH trip if R > 3k3 TH reset if R < 1k8 THS trip if R < 50R
8		th	Thermistor without short circuit detection	TH trip if R > 3k3 TH reset if R < 1k8
9		th.diSp	Thermistor display only with no trip	

7.21	Analogue output 1 mode															
7.24	Analogue output 2 mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 3							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

The following modes are available for the analogue outputs.

Pr value	Pr string	Mode
0	VOLt	Voltage mode
1	0-20	0 - 20mA
2	4-20	4 - 20mA
3	H.Spd	High speed up date mode

If high speed update mode is selected and the source for the output is one of the parameters designated for high speed analogue output operation (see start of this section) the output is updated at a higher rate with special scaling. If the parameter selected is not designated for this mode the output is updated at the normal rate. If speed feedback or power is selected for high speed mode for both analogue output 1 and analogue output 2 the setting is ignored for analogue output 2. If the high speed mode is selected the output is always a voltage signal.

07.26	Analogue input 1 sample time															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 8.0ms							
Default	Open-loop, Closed-loop vector, Servo								4.0							
Update rate	Background read															

Analogue input 1 is filtered using a window filter to remove quantisation noise and adjust the resolution of this input. The length of the window can be adjusted with this parameter. The shortest possible window is 250µs. It should be noted that if this input is not used as a speed reference (01.36, 01.37) or as a hard speed reference (03.22) the sample time affects the resolution. The nominal resolution is given by 07.26 x 106, therefore the default setting gives approximately 12 bit resolution.

07.28 - 07.29	Analogue input current loop loss															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background read															

If an analogue input is used with 4-20mA or 20-4mA current loop modes the respective bit (07.28 - analogue input 2 and 07.29 - 3) is set to one if the current falls below 3mA. If the current is above 3mA with these modes or another mode is selected the respective bit is set to zero.

07.30	Analogue input 1 sample time															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1		
Range	Open-loop, Closed-loop vector, Servo								-100.00% to 100.00%							
Default	Open-loop, Closed-loop vector, Servo								0.00							
Update rate	Background read															

07.31 - 07.32	Analogue input 2 and 3 offsets															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1		
Range	Open-loop, Closed-loop vector, Servo								-100.0% to 100.0%							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	Background read															

An offset can be added to each analogue input with a range from -100% to 100%. If the sum of the input and the offset exceeds ±100% the results is limited to ±100%.

7.33	Analogue output 1 control															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2							
Default	Open-loop, Closed-loop vector, Servo								2							
Update rate	Background read															

This offers a simple control of Pr 7.19 to change the source for the analogue output for use from Menu 0. When this parameter is set to 0 or 1 the drive constantly writes Pr 5.01 or Pr 4.02 to Pr 7.19 respectively.

Pr value	Pr string	Action
0	Fr	Write Pr 7.19=5.01
1	Ld	Write Pr 7.19=4.02
2	AdV	No action

7.34	IGBT junction temperature															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-200 to 200ºC							
Update rate	Background write															

The IGBT junction temperature is calculated using Stack 1 temperature (Pr 7.04) and a thermal model of the drive power stage. The resulting temperature is displayed in this parameter. The calculated IGBT junction temperature is used to modify the drive switching frequency to reduce losses if the devices become too hot (see Pr 5.18).

7.35	Drive thermal protection accumulator															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 100.0%							
Update rate	Background write															

In addition to monitoring the IGBT junction temperatures the drive includes a thermal protection system to protect the other components within the drive. This includes the effects of drive output current and D.C. Link ripple. The estimated temperature is displayed as a percentage of the trip level in this parameter. If the parameter value reaches 100% an Oht3 trip is initiated.

7.51	Analogue input 1 full scale															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1	1	1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 153600							
Update rate	Background read															

When analogue input 1 is calibrated the number of V to F converter counts over 256 x 250µs periods is stored here. The maximum input frequency is 2.4MHz, and so the maximum for this parameter is 76800. If calibration is performed so that the drive 10V reference is used this parameter is zero.

Menu 8: Digital I/O

There are a number of parameters in menu 8 of the Unidrive SP which have changed from Unidrive 1. Basic change information is shown below, detail explanation of the changes are shown overleaf.

A maximum of two digital inputs when routed to Pr 6.35 and Pr 6.36 only will be sampled at 250µs otherwise the digital inputs will be sampled at the normal rate of 4ms.

Parameter	Function	Details
8.07	Relay State	Previously “Terminal 30 state” in Unidrive 1, details overleaf. Terminal 30 state (Drive enable indicator) now Pr8.09 with Unidrive SP
8.08	T22 24V output state	Previously “Status relay output indicator” in Unidrive 1, details overleaf. Status relay output indicator (Relay state) now Pr8.07 with Unidrive SP
8.09	Drive enable indicator	Previously “Terminal 30 function select” in Unidrive 1, details overleaf. Terminal 30 function select (Drive enable mode select) now Pr8.10 with Unidrive SP
8.10	Drive enable model select	Previously “F1 destination/source parameter” in Unidrive 1, details overleaf. F1 destination/source parameter (T24 Digital I/O 1 source/destination) now Pr8.21 with Unidrive SP
8.12	T25 Digital I/O 2 invert	Previously “F1 output enable” in Unidrive 1, details overleaf. F1 output enabler (T24 Digital I/O output 1 select) now Pr8.31 with Unidrive SP
8.13	T26 Digital I/O 3 invert	Previously “F2 destination/source parameter” in Unidrive 1, details overleaf. F2 destination/source parameter (T25 Digital I/O 2 source/destination) now Pr8.22 with Unidrive SP
8.14	T27 Digital input 4 invert	Previously “F2 invert” in Unidrive 1, details overleaf. F2 invert (T25 Digital I/O 2 invert) now Pr8.12 with Unidrive SP
8.15	T28 Digital input 5 invert	Previously “F2 output enable” in Unidrive 1, details overleaf. F2 output enabler (T25 Digital I/O output 2 select) now Pr8.32 with Unidrive SP
8.16	T29 Digital input 6 invert	Previously “F3 destination/source parameter” in Unidrive 1, details overleaf. F3 destination/source parameter (T26 Digital I/O 3 source/destination) now Pr8.23 with Unidrive SP
8.17	Relay source invert	Previously “F3 invert” in Unidrive 1, details overleaf. F3 invert (T26 Digital I/O 3 invert) now Pr8.13 with Unidrive SP
8.18	T22 24V output source invert	Previously “F3 output enable” in Unidrive 1, details overleaf. F3 output enabler (T26 Digital I/O output 2 select) now Pr8.33 with Unidrive SP
8.19		Previously “F4 destination” in Unidrive 1. F4 destination parameter (T27 Digital I/O 4 source/destination) now Pr8.24 with Unidrive SP

Menu 8: Digital I/O

Parameter	Function	Details
8.20	Digital I/O read word	Previously “F4 invert” in Unidrive 1, details overleaf. F4 invert (T27 Digital input 4 invert) now Pr8.14 with Unidrive SP
8.21	T24 Digital I/O 1 source/destination	Previously “F5 destination parameter” in Unidrive 1, details overleaf. F5 destination parameter (T28 Digital Input 5 destination) now Pr8.25 with Unidrive SP
8.22	T25 Digital I/O 2 source/destination	Previously “F5 invert” in Unidrive 1, details overleaf. F5 invert (T28 Digital input 5 invert) now Pr8.15 with Unidrive SP
8.23	T26 Digital I/O 3 source/destination	Previously “F6 destination parameter” in Unidrive 1,details overleaf. F6 destination parameter (T29 Digital Input 6 destination) now Pr8.26 with Unidrive SP
8.24	T27 Digital Input 4 destination	Previously “F6 invert” in Unidrive 1, details overleaf. F6 invert (T29 Digital input 6 invert) now Pr8.16 with Unidrive SP
8.25	T28 Digital Input 5 destination	Previously “Status relay source parameter” in Unidrive 1, details overleaf. Status relay source parameter (Relay source) now Pr8.27 with Unidrive SP
8.26	T29 Digital Input 6 destination	Previously “Status relay invert” in Unidrive 1, details overleaf. Status relay invert (Relay source invert) now Pr8.17 with Unidrive SP
8.27	Relay source	Previously “Positive logic select” in Unidrive 1, details overleaf. Positive logic select now Pr8.29 with Unidrive SP
8.28	T22 24v output source	Previously “Open-collector outputs select” in Unidrive 1, details overleaf. Open-collector outputs select now Pr8.30 with Unidrive SP
8.29	Positive logic select	Additional parameter with Unidrive SP, details overleaf
8.30	Open-collector outputs select	Additional parameter with Unidrive SP, details overleaf
8.31	T24 Digital I/O 1 output select	Additional parameter with Unidrive SP, details overleaf
8.32	T25 Digital I/O 2 output select	Additional parameter with Unidrive SP, details overleaf
8.33	T26 Digital I/O 3 output select	Additional parameter with Unidrive SP, details overleaf
8.39	T28 & T29 digital input auto-selection disable	New parameter with Unidrive SP, configures T28 and T29, details overleaf

08.07	Relay state															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Default	Open-loop, Closed-loop vector, Servo								See table 8.1							
Update rate	4ms write															

08.08	T22 24V output state															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Default	Open-loop, Closed-loop vector, Servo								1							
Update rate	4ms write															

08.09	Drive enable indicator															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Default	Open-loop, Closed-loop vector, Servo								See table 8.1							
Update rate	4ms write															

08.10	Enable mode select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Unidrive has a dedicated hardware enable input, which always controls parameter 06.29. If the enable is inactive the IGBT firing signals are turned off without software intervention. As default (08.10 = 0) the drive is in the inhibit mode when the enable in inactive. Setting this parameter to one causes the enable to behave as an Et trip input. When the input becomes inactive an Et trip is initiated. This does not affect parameter 10.32 (Et tip parameter), therefore an Et trip can be initiated in this mode either by making the enable inactive or setting parameter 10.32 to one.

08.11- 08.18	I/O invert															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Default	Open-loop, Closed-loop vector, Servo								See table 8.1							
Update rate	4ms write															

08.20	Digital I/O read word															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 511							
Update rate	Background write															

This word is used to determine the status of the digital I/O by reading one parameter. The bits in this word reflect the state of parameters 08.01 to 08.09.

Bit	**Digital I/O**
0	T24 input / output1
1	T25 input / output 2
2	T26 input / output 3
3	T27 input 4
4	T28 input 5
5	T29 input 6
6	Relay
7	T22 24V output
8	Enable

08.21- 08.26	I/O Source destination															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
				1			2					1	1	1	1	
Default	Open-loop, Closed-loop vector, Servo								See table							
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Update rate	Read on drive reset															

08.27, 08.28	Relay Source T22 24V output source															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2					1	1	1	1	
Default	Open-loop, Closed-loop vector, Servo								See table							
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Update rate	Read on drive reset															

8.29	I/O polarity select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1											1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								1							
Update rate	Background read															

This parameter changes the logic polarity for digital inputs and digital outputs, but not the enable input, the relay output or the 24V output.

	08.29=0 (negative logic)	08.29=1 (positive logic)
Inputs	<5V = 1, >15V = 0	<5V = 0, >15V = 1
Non-relay Outputs	on(1) = <5V, off(0) = >15V	off(0) = <5V, on(1) = >15V
Relay outputs	off(0) = open, on(1) = closed	off(0) = open, on(1) = closed
24V output (T22)	off(0) = 0V, on(1) = 24V	off(0) = 0V, on(1) = 24V

8.30	Open collector output															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1													1	1	
Range	Open-loop, Closed-loop vector, Servo								0							
Default	Background read															

When this parameter is zero digital outputs are in push-pull mode. When this parameter is one either the high-side drive (negative logic polarity) or the low-side driver (positive logic polarity) is disabled. This allows outputs to be connected in a wire-ORed configuration.

08.31 - 08.33	Output select															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								See table							
Default	Background read															

08.39	T28 and T29 auto-selection															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Default	Background read															

When this parameter is 0, parameters 08.25 and 08.26 are set up automatically according to the setting of the reference select parameter 01.14. Setting this parameter to 1 disables this function.

Reference select 01.14		08.25 set to:	08.26 set to:
0, A1.A2	Reference selection by terminal input	01.41 - local/remote	06.31 - jog
1, A1.Pr	Analogue reference 1 or presets selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
2, A2.Pr	Analogue reference 2 or presets selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
3, Pr	Preset reference selected by terminal input	01.45 - preset select bit 0	01.46 - preset select bit 1
4, Pad	Keypad reference selected	01.41 - local/remote	06.31 - jog
5, Prc	Precision reference selected	01.41 - local/remote	06.31 - jog

This parameter has no effect in Regen mode.

Table 8.1

Terminal + type	I/O State	Invert		Source/Destination		I/O State	I/O State
	Pr	Pr	Default	Pr	Default	Pr	Default
T24 input/output 1	08.01	08.11	0	08.21	10.03 - zero speed	08.31	1
T25 input/output 2	08.02	08.12	0	08.22	10.33 - drive reset	08.32	0
T26 input/output 3	08.03	08.13	0	08.23	06.30 - run forward	08.32	0
T27 input 4	08.04	08.14	0	08.24	06.32 - run reverse		
T28 input 5	08.05	08.15	0	08.25	01.41 - local/remote		
T29 input 6	08.06	08.16	0	08.26	06.31- jog		
T41 / 42 Relay	08.07	08.17	0	08.27	10.01 - drive healthy		
T22 24V output	08.08	08.18	1	08.28	00.00		
T31 Enable	08.09						

Menu 9: Programmable logic, motorised pot & Binary sum

There are a number of parameters in menu 9 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

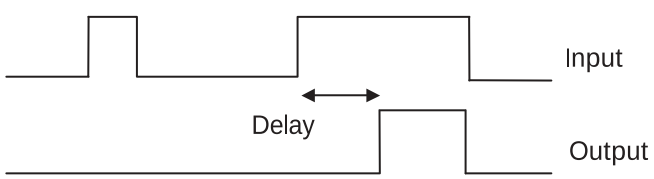
Parameter	Function	Details
9.03	Motorised potentiometer output	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
9.09	Logic function 1,2 delay	With Unidrive SP, now allows for positive and negative delays, details overleaf
9.21	Motorised pot zero start select	Previously "Motorised Pot zero start select" in Unidrive 1, details overleaf

09.03	Motorised pot output															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1		1				1
Range	Open-loop, Closed-loop vector, Servo								-100.00 to 100.00%							
Update rate	4ms x number of menu 9 or 12 functions active write															

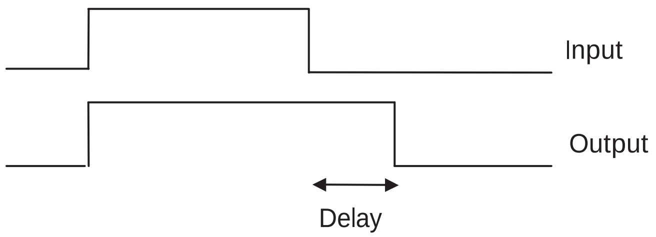
Indicates the level of the motorised pot prior to scaling. If parameter 09.21 is set to 0 or 2 this parameter is set to 0 at power-up, otherwise it retains its value at the last power-down.

09.09, 09.19	Logic function 1,2 delay															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1		
Range	Open-loop, Closed-loop vector, Servo								-25.0 to 25.0s							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms x number of menu 9 or 12 functions active read															

If the delay parameter is positive, the delay ensures that the output does not become active until an active condition has been present at the input for the delay time as shown below.



If the delay parameter is negative, the delay holds the output active for the delay period after the active condition has been removed as shown below. Therefore an active input that lasts for 4ms or more will produce an output that lasts at least as long as the delay time.



09.21	Motorised pot mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop, Servo								0 to 3							
Default	Open-loop, Closed-loop vector, Servo								2							
Update rate	Background read															

The motorised pot modes are given in the table below.

9.21	Mode	Comments
0	Zero at power-up	Reset to zero at each power-up. Up, down and reset are active at all times
1	Last value at power-up	Set to value at power-down when drive powered-up. Up, down and reset are active at all times
2	Zero at power-up and only change when drive running	Reset to zero at each power-up. Up and down are only active when the drive is running (i.e. inverter active). Reset is active at all times
3	Last value at power-up and only change when drive running	Set to value at power-down when drive powered-up. Up and down are only active when the drive is running (i.e. inverter active). Reset is active at all times

Menu 10: Status and trips

There are a number of parameters in menu 10 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
10.15	Mains loss	With Unidrive SP, Mains loss trip only operates if configured via Pr06.03 AC Supply loss mode, details overleaf
10.16	Under voltage active	Under voltage active Previously "Motor thermistor over temperature indicator" in Unidrive 1, details overleaf
10.18	Drive over temperature alarm	Previously "Heatsink temperature alarm" in Unidrive 1, details overleaf
10.19	Drive warning	Previously "Ambient temperature alarm" in Unidrive 1, details overleaf
10.20 ~10.29	Trip 0 ~Trip 9	Previously "Last Trip~ Tenth last trip" in Unidrive 1, details overleaf
10.30	Full power braking time	With Unidrive SP, braking voltage modified to include 575 & 690v drives, details overleaf
10.37	Action on trip detection	Previously "Stop drive on non-important trips" in Unidrive 1, details overleaf
10.41	Trip 0 time: years.days	Previously "UD78 aux. power supply active" in Unidrive 1, details overleaf
10.42	Trip 0 time: hours.minutes	Previously "IGBT junction temp above 135°C" in Unidrive 1, details overleaf. IGBT junction temp above 135°C indicator now Pr 7.34 with Unidrive SP
10.43	Trip 1 time	New parameter with Unidrive SP details overleaf
10.44	Trip 2 time	New parameter with Unidrive SP details overleaf
10.45	Trip 3 time	New parameter with Unidrive SP details overleaf
10.46	Trip 4 time	New parameter with Unidrive SP details overleaf
10.47	Trip 5 time	New parameter with Unidrive SP details overleaf
10.48	Trip 6 time	New parameter with Unidrive SP details overleaf
10.49	Trip 7 time	New parameter with Unidrive SP details overleaf
10.50	Trip 8 time	New parameter with Unidrive SP details overleaf
10.51	Trip 9 time	New parameter with Unidrive SP details overleaf

10.15	Mains loss															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	4ms write															

Open-loop, Closed-loop vector, Servo

Indicates that the drive has detected mains loss from the level of the d.c. link voltage. This parameter can only become active if mains loss ride through or mains loss stop modes are selected (see parameter 06.03).

10.16	Under voltage active															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background write															

This parameter is set to one when a UU trip is active.

10.18	Drive over temperature alarm															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background write															

Indicates that either the heat sink temperature is greater than or equal to 90ºC, or the control board temperature is greater than or equal to 90oC, or the IGBT junction temperature calculated from the drive thermal model is above 135ºC (see Pr 5.18 and Pr 7.06).

10.19	Drive warning															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	Background write															

Indicates that one of the drive alarms is active, i.e. Pr 10.19 = Pr10.12 or Pr 10.17 or Pr 10.18.

10.20-10.29	Trip 0 - Trip 9															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1			1		1		1			1	1
Range	Open-loop, Closed-loop vector, Servo								0 to 230							
Update rate	Background write															

Contains the last 10 drive trips. Parameter 10.20 is the most recent trip and 10.29 the oldest. When a new trip occurs all the parameters move down one, the current trip is put in 10.20 and the oldest trip is lost off the bottom of the log. Possible trips for Unidrive are shown in the table below. A time stamp is stored for each trip (see parameters 10.41 to 10.51). All trips are stored including HF trips numbered from 20 to 30. (HF trips below numbered from 1 to 19 are not stored in the trip log.) UU trips are not stored unless the drive is running when the trip occurs. Any trip can be initiated by the actions described or by writing the relevant trip number to parameter 10.38. If any trips shown as user trips are initiated the trip string is "txxx", where xxx is the trip number.

No.	String	Cause of trip
1	UU	DC link under voltage
2	OU	DC link over voltage. This could be because the d.c. link voltage has exceeded the maximum level or has remained above the maximum continuous level for more than 30s. This trip cannot be reset until the voltage falls below the maximum controllable voltage. Drive voltage rating / Instantaneous trip / Max continuous level 200V / 415V / 405V 400V / 830V / 810V 575V / 990V / 965V 690V / 1190V / 1160V
3	OI.AC	AC instantaneous over current
4	OI.br	Braking resistor instantaneous current trip
5	PS	Internal drive power supply trip
6	Et	External trip (see 10.32)
7	O.SPd	Overspeed
8	PS.10V	10V user power supply overload
9	PS.24V	24V internal power supply overload
10	t010	User trip
11	tunE1	The position feedback did not change or required speed could not be reached during the inertia test (see 05.12)
12	tunE2	Position feedback direction incorrect or motor could not be stopped during the inertia test(see 05.12)
13	tunE3	Drive encoder commutation signals connected incorrectly or measured inertia out of range (see 05.12)
14	tunE4	Drive encoder U commutation signal fail (see 05.12)

15	tunE5	Drive encoder V commutation signal fail (see 05.12)
16	tunE6	Drive encoder W commutation signal fail (see 05.12)
17	tunE7	Motor poles set-up incorrectly (see 05.12)
18	tunE	Auto-tune stopped before completion (see 05.12)
19	It.br	I^2t on braking resistor (see 10.31)
20	It.AC	I^2t on drive output current (see 04.15)
21	O.ht1	Drive over-heat (IGBT junctions) based on thermal model (see 05.18)
22	O.ht2	Drive over-heat based on heatsink temperature (see 07.04)
23	O.CtL	Drive over-heat based on control board temperature (see 07.05)
24	th	Motor thermistor trip (see 07.11)
25	thS	Motor thermistor short circuit (see 07.11)
26	O.Ld1	Digital output overload
27	O.ht3	Drive over-heat based on thermal model (see 07.35). The drive will attempt to stop the motor before tripping. If the motor does not stop in 10seconds the drive trips immediately
28	cL2	Analogue input 2 current mode: current loss (see 07.11)
29	cL3	Analogue input 3 current mode: current loss (see 07.11)
30	SCL	Serial comms timeout with remote keypad on drive 485 comms port
31	EEF	Internal drive EEPROM failure. The Drive mode becomes Open-loop and all the parameters are set to default. The trip can only be removed by entering a load default command (i.e. 1233, 1244, etc.) into parameter x.00 before reseting the drive
32	PH	High input voltage phase imbalance or input phase loss. Normally a motor load of between 50 and 100% or drive rating is required to trigger the trip. The drive will attempt to stop the motor before tripping except in Regen mode
33	rS	Failure to measure resistance during auto-tune or when starting in open-loop voltage modes 0 or 3. This is either because the resistance exceeds the maximum measurable value or the drive was not enabled (see 05.12, 05.14, 05.17)
34	PAd	If an LED or LCD keypad are fitted directly to the drive, and the drive is in keypad reference mode, and the keypad is removed the drive produces this trip
35	CL.bit	Trip initiated from the control word (parameter 06.42)
36-38	t036 - t038	User trips
39	L.SYNC	Drive failed to synchronise to the supply voltage in Regen mode (see 03.08)
40-89	t040 - t089	User trips
90	UP div0	User Program: attempted divide by zero
91	UP PAr	User Program: attempted access to a non-existent parameter
92	UP ro	User Program: attempted write to a read only parameter

93	UP So	User Program: attempted read of a write only parameter. (This trip should never occur as there are no write only parameters in the drive.)
94	UP ovr	User Program: attempted out-of-range parameter write
95	UP vAr	User program: Variables and function block calls using more than the allowed RAM space (stack overflow)
96	UP uSEr	User program: program requested a trip
97	UP udf	User program: undefined trip
98 - 99	t098 - t99	User trips
100		Drive reset (see 10.38)
101-108	1.PH - 8.PH	Multi-module drive system: high imbalance or phase loss detected by one module. The number indicates the module that initiated the trip. Modules are numbered starting at the one nearest the control module
109-110	t109 - t110	User trips
111-118	1.OIAC - 8.OIAC	Multi-module drive system: instantaneous over-current detected by one module
119-120	t119 - t120	User trips
121-128	1.Oht2 - 8.Oht2	Multi-module drive system: heatsink over temperature detected by one module
129-130	t129 - t130	User trips
131-138	1.PS - 8.PS	Multi-module drive system: internal power supply trip
139-140	t139 - t140	User trips
141-148	1.OIBr-8.OI.Br	Multi-module drive system: braking IGBT over-current
149-150	t149 - t150	User trips
151-158	1.OV - 8.OV	Multi-module drive system: over voltage trip
159-160	t159 - t160	User trips
161-168	t161 - t168	User trips
169-170	t169 - t170	User trips

171	UFLt	Multi-module drive system: unidentified fault. The common trip line has been activated, but no module shows a fault. This trip is normally caused by electrical noise problems
172-175	t172 - t175	User trips
176	EnP.Er	Data error from electronic nameplate data stored in selected position feedback device
177-178	t177 - t178	User trips
179	C.Chg	Data block exists already: An attempt has been made to store a data block where a data block with the same number on the card already exists
180	C.Optn	Option module categories different between source and destination drives
181	C.RdO	Read-only: An attempt has been made to transfer parameters to a read only smart card or to erase a read-only smart card. A smart card is read-only if the read-only flag has been set. Data block numbers 500 to 999 are always read-only whatever the state of the read-only flag. Writing to these blocks always causes this trip
182	C.Err	Card data error: The file access is corrupted. 11.42 is set to 3 or 4 and a parameter is changed in menu 0 before reset is activated
182	C.Err	Card data error: The file access is corrupted. 11.42 is set to 3 or 4 and a parameter is changed in menu 0 before reset is activated
183	C.dat	Data does not exist: An attempt has been made to transfer data from a blank card or data block that does not exist
184	C.FULL	Card full: An attempt was made to store a parameter set in a smart card which does not have enough space to store the data. The data was not transferred to the card
185	C.Acc	Card read/write fail: The drive cannot communicate with the card either because it is faulty or is not fitted in the drive. Removing a card during an access will cause this trip
186	C.rtg	Rating change: The parameters loaded to the drive from a card are for a drive of a different voltage or current rating. No rating dependent parameters have been transferred
187	C.Typ	Card data type error: One of the following has been attempted and is not allowed - An attempt has been made to load a parameter set that is not allowed because the hardware will not support the type. A change of drive mode is required in Boot mode (see parameter 11.42)
188	C.cpr	A compare has been carried out between the data in a smart card and the parameters in the drive and they are not the same
189	EnC1	Drive encoder trip: power supply short overload
190	EnC2	Drive encoder trip: wire break
191	EnC3	Drive encoder trip: UVW phase angle incorrect whilst running (servo mode only) or SINOS phase error
192	EnC4	Drive encoder trip: Comms failure (timeout)
193	EnC5	Drive encoder trip: Checksum or CRC error

194	EnC6	Drive encoder trip: Encoder has indicated an error
195	EnC7	Drive encoder trip: Initialisation failed
196	EnC8	Auto-configuration has been requested and failed
197	EnC9	Position feedback selected is not valid (i.e. not from a position feedback option module)
198	t198	User trip
199	dESt	Destination parameter clash
200	SL1.HF	Option module in slot 1: hardware fault. This could occur because the module cannot be identified, or the module has not indicated it is running within 5s of drive power-up, or an internal hardware fault has occurred in the module. If the module is removed after power-up the drive also produces this trip
201	SL1.tO	Option module in slot 1: watchdog timeout. The module has started the watchdog system, but has not subsequently serviced the watchdog within the timeout period
202	SL1.Er	Option module in slot 1: error. The module has detected an error and tripped the drive. [For example, the intelligent position feedback module has detected an encoder error and the drive trip on error bit (parameter x.16) is set. The reason for the error is stored in parameter x.15.]
203	SL1.nF	Option module in slot 1: not fitted. The option module is identified by the drive by an option code. The drive stores the codes of the modules fitted when the drive parameters are saved. The stored codes are compared with the codes from the option modules at power-up. If a module is not present, but a code is stored in drive EEPROM to indicate that it should be fitted the drive trips
204	SL1.dF	Option module in slot 1: different fitted. The option module is identified by the drive by an option code. The drive stores the codes of the modules fitted when the drive parameters are saved. The stored codes are compared with the codes from the option modules at power-up. If a module is different to the code stored in drive EEPROM the drive trips
205	SL2.HF	Option module in slot 2: Hardware fault
206	SL2.tO	Option module in slot 2: watchdog timeout
207	SL2.Er	Option module in slot 2: error
208	SL2.nF	Option module in slot 2: not fitted
209	SL2.dF	Option module in slot 2: different fitted
210	SL3.HF	Option module in slot 3: hardware fault
211	SL3.tO	Option module in slot 3: watchdog timeout
212	SL3.Er	Option module in slot 3: error
213	SL3.nF	Option module in slot 2: not fitted
214	SL3.dF	Option module in slot 3: different fitted
215	SL.rtd	Option module route disable fail on drive mode change
216-219	t216-219	User trips
220-230	HF20 - HF30	Hardware faults

Trips can be grouped into the following categories:

Category	Trips	Comments
Hardware faults	HF01 to HF19	These indicate fatal problems and cannot be reset. The drive is inactive after one of these trips and the display shows HFxx
Self reseting trips	UU	Under voltage trip cannot be reset by the user, but is automatically reset by the drive when the supply voltage is with specification*
Non-resetable trips	HF20 to HF30, SL1.HF, SL2.HF, SL3.HF	Cannot be reset
EEF trip	EEF	Cannot be reset unless a code to load defaults is first entered in parameter x.00 or parameter 11.43
Normal trips	All other trips	Can be reset after 1.0s
Normal trips with extended reset	OI.AC, OI.Br, x.OIAC, x.OIBr	Can be reset after 10.0s
Non-important trips	Old1, cL2, cL3, SCL	If parameter 10.37 is 1 or 3 the drive will stop before tripping
Phase loss	PH	The drive stops before tripping provided the drive motoring power is suitably reduced after 500ms of detecting phase loss

*Under voltage trip and restart levels are as follows:

Drive voltage rating	UU trip level	UU restart level
200	175	215
400	330	425
575	435	590
690	435	590

HF fault code	Reason for trip
01	CPU address error
02	DMAC address error
03	Illegal instruction
04	Illegal slot instruction
05	Undefined exception
06	Reserved exception
07	Watchdog failure
08	Level 4 crash
09	Heap overflow
10	Router error
11	Access to the EEPROM failed
12-19	Not used
20	Power stage - code error
21	Power stage - unrecognised frame size
22	Power stage - multi-module frame size mismatch
23	Power stage - multi-module voltage rating mismatch
24	Power stage - unrecognised drive size
25	Current feedback offset error
26	Soft start relay failed to close, or soft start monitor failed, or braking IGBT short circuit at power-up
27	Power stage thermistor 1 fault
28	Power stage thermistor 2 fault / Internal fan fault for some drive sizes
29	Control board thermistor fault
30	Not used

The braking IGBT continues to operate even when the drive is not enabled, but is only disabled if any of the following trips occurs or would occur if another trip had not already become active: OI.Br, PS, or It.Br.

It should be noted that although the UU trip operates in a similar way to all other trips. All drive functions can still operate, but the drive cannot be enabled. Parameter values are only loaded from EEPROM if the supply voltage is low enough for the switch mode power supply in the drive to shut down and then it is increased to restart the drive power supplies. The only differences between UU and other trips are as follows:

1. Power down save user parameters are saved when UU trip is activated except when the 48V supply is active (parameter 06.44=1).
2. The UU trip is self-reseting when the d.c. link voltage rises above the drive restart voltage level.
3. The drive can change between using the main high voltage supply and 48V supply only when the UU trip is active.
4. When the drive is first powered up a UU trip is initiated if the supply voltage is below the restart voltage level. This does not save power down save parameters. If another trip occurs during power-up it is the active trip in preference to the UU trip. If this trip is cleared and the supply voltage is still below the restart voltage threshold a UU trip is then initiated.

10.30	Full power braking time															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.00 to 400.00s							
Default	Open-loop, Closed-loop vector, Servo								See below							
Update rate	Background read															

The default value is either 0.0, or a suitable value for standard braking resistors that can be mounted within the drive heatsink as given in the table below.

Drive rating	Parameter default
200V Size 1 and 2	0.02s
400V Size 1 and 2	0.09s
All other ratings	0.00s

This parameter defines the time period that the braking resistor fitted can stand full braking volts without damage. The setting of this parameter is used in determining the braking overload time.

Drive voltage rating	Full braking volts
200V	390V
400V	780V
575V	930V
690V	1120V

10.37	Action on trip detection															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 3							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

	Braking IGBT trip mode	Stop on non-important trips
0	Trip	No
1	Trip	Yes
2	Disable	No
3	Disable	Yes

For details of braking IGBT trip mode see Pr 10.31. If stop on non-important trips is selected the drive will stop before tripping except in Regen mode where the drive trips immediately. Non-important trips are: th, ths, Old1, cL2, cL3, SCL.

10.41	Trip 0 time: years.days															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3	1		1		1			1	1
Range	Open-loop, Closed-loop vector, Servo								0.000 to 9.365 Years.Days							
Update rate	Background write															

10.42	Trip 0 time: hours.minutes															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
		1					2	1		1		1			1	1
Range	Open-loop, Closed-loop vector, Servo								00.00 to 23.59 Hours.Minutes							
Update rate	Background write															

10.43 - 10.51	Trip 1 - Trip 9 time															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
		1					2	1		1		1			1	1
Range	Open-loop, Closed-loop vector, Servo								0 to 600.00 Hours.Minutes							
Update rate	Background write															

When a trip occurs the reason for the trip is put into the top location in the trip log (parameter 10.20). At the same time either the time from the powered-up clock (if 06.28 = 0) or from the run time clock (if 06.28=1) is put into Trip 0 time (parameters 10.41 and 10.42). The times for earlier trips (Trip 1 to 9) are moved to the next parameter in the same way that trips move down the trip log. The time for Trips 1 to 9 are stored as the time difference between when Trip 0 occurred and the relevant trip in hours and minutes. The maximum time difference that can be stored is 600 hours. If this time is exceeded the value stored is 600.00.

If the powered-up clock is used as the source for this function all the times in the log are reset to zero at power-up because they were related to the time since the drive was powered-up last time. If the runtime clock is used the times are saved at power-down and then retained when the drive powers up again. If parameter 06.28, which defines the clock source, is changed by the user the whole trip and trip time logs are cleared. It should be noted that the powered-up time can be modified by the user at any time. If this is done the values in the trip time log remain unchanged until a trip occurs. The new values put in the log for earlier trips (Trip 1 to 9) will become the time difference between the value of the power-up clock when the trip occurred and the value of the powered-up clock when the latest trip occurred. It is possible that this time difference may be negative, in which case the value will be zero.

Menu 11: General Drive set-up

There are a number of parameters in menu 11 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
11.27		Not Used in Unidrive SP
11.28		Not Used in Unidrive SP
11.31	Drive operating mode	Unidrive SP uses same operating modes as Unidrive1, however, now represented as 1-4 instead of 0-3 as in Unidrive 1, details overleaf
11.32	Drive Heavy duty current rating	Represents maximum current available with Heavy duty overload (150/175%/200%), details overleaf, previously Drive rated current (FLC) in Unidrive 1, details overleaf
11.36	SMARTCARD data previously loaded	Previously Drive fitted with low speed fans in Unidrive 1, details overleaf
11.37	SMARTCARD data number	Previously Macro number in Unidrive 1
11.38	SMARTCARD data type / mode	Previously Clone module parameter set in Unidrive 1, details overleaf
11.39	SMARTCARD data version	Previously Clone module parameter set drive type in Unidrive 1, details overleaf
11.40	SMARTCARD data checksum	Previously Clone module parameter checksum in Unidrive 1, details overleaf
11.41	Status mode timeout	New parameter with Unidrive SP details overleaf
11.42	Parameter cloning	New parameter with Unidrive SP details overleaf
11.43	Load defaults	New parameter with Unidrive SP details overleaf
11.44	Security status	New parameter with Unidrive SP details overleaf
11.45	Select motor 2 parameters	New parameter with Unidrive SP details overleaf
11.46	Defaults previously loaded	New parameter with Unidrive SP details overleaf
11.47	Ladder program enable	New parameter with Unidrive SP details overleaf
11.48	Drive user program status	New parameter with Unidrive SP details overleaf
11.49	Drive user programming events	New parameter with Unidrive SP details overleaf
11.50	User program max scan time	New parameter with Unidrive SP details overleaf
11.51	Drive user program first run	New parameter with Unidrive SP details overleaf

11.31	User drive mode														
Drive modes	Open-loop, Closed-loop vector, Servo														
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1			1		1		1		1	1	
Range	Open-loop, Closed-loop vector, Servo								1 to 4							
Default	Open-loop Closed-loop vector Servo								1 2 3							
Update rate	Background read															

This parameter defines the drive mode. If this parameter is changed from the current drive mode, parameter x.00 is set to 1253, 1254, 1255 or 1256, and then the drive is reset the drive mode is changed to the mode defined by this parameter. After the mode change the default settings of all parameters will be set according to drive mode. The Drive mode will not be changed if the drive is running. If the parameter value is changed and a reset is initiated, but parameter x.00 is not equal to 1253, 1254, 1255 or 1256, or the drive is running this parameter is set back to the value for the current drive mode and the drive mode is not changed.

Parameter value	String	Drive mode
1	OPEn LP	Open-loop
2	CL VECt	Closed-loop vector
3	SErVO	Servo

11.32	Maximum heavy duty current rating															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0.00 to 9999.99A							
Update rate	Write at power-up															

This parameter indicates the continuous current rating of the drive for heavy duty operation. See menu 4 for more details.

11.36	SMARTCARD parameter data previously loaded															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1		1	1		1	
Range	Open-loop, Closed-loop vector, Servo								0 to 999							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background write															

This parameter shows the number of the data block last transferred from a SMARTCARD to the drive.

11.37	SMARTCARD data number															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 1000							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Data blocks are stored on a SMARTCARD with header information which includes a number which identifies the block. The header information also includes the type of data stored in the block, the drive mode if the data is parameter data, the version number and a checksum. This data can be viewed through Pr 11.38 to Pr 11.40 by increasing or decreasing Pr 11.37. This parameter jumps between the data numbers of the data blocks present on the card inserted into the drive. If this parameter is set to 1000 the checksum parameter shows the number of bytes left on the card. If there is no data on the card Pr 11.37 can only have values of 0 or 1000.

The actions of erasing a card, erasing a file, changing a menu 0 parameter, or inserting a new card will effectively set Pr 11.37 to 0 or the lowest file number in the card.

Data transfer and erasing can be performed by entering a code in Pr x.00 and then resetting the drive as shown in the table below.

Code	Action
3yyy	Transfer drive EEPROM data to a SMARTCARD block number yyy
4yyy	Transfer drive data as difference from defaults to SMARTCARD block number yyy
5yyy	Transfer drive ladder program to SMARTCARD block number yyy
6yyy	Transfer SMARTCARD data block yyy to the drive
7yyy	Erase SMARTCARD data block
8yyy	Compare drive parameters with block yyy
9999	Erase SMARTCARD
9888	Set SMARTCARD read-only flag
9777	Clear SMARTCARD read-only flag

Data blocks with numbers from 1 to 499 can be created or erased by the user. Data block with numbers 500 and above are read only and cannot be created or erased by the user. The whole card may be protected from writing or erasing by setting the read-only flag (i.e if the flag is set then only codes 6yyy or 9777 are effective).

If the destination drive has a different drive mode to the parameters on the card, the drive mode will be changed by the action of transferring parameters from the card to the drive.

After an attempt to read, write or erase a trip may occur, see Pr 10.20 for details. If the card is removed during data transfer from the card for a file that was saved with code 3yyy the drive EEPROM checksum will be set up to be incorrect and an EEF trip will be initiated. If the card is removed during data transfer from the card for a file that was saved with code 4yyy then no data will be saved to EEPROM and a C.Acc trip will be initiated. It should be noted that in both cases the parameters held in drive parameter RAM are likely to be incorrect.

During smart card or EEPROM data transfer the user will not be able to exit keypad edit mode when the current parameter is in menu 0.

Parameter data block when 3yyy is used to transfer data to a card

The data blocks contain the complete data from the drive EEPROM, i.e. all user save (US) except the parameters with the NC coding bit set. Power-down save (PS) are not saved to the smart card. A smart card can hold up to 4 data blocks of this type.

When the data is transferred back to a drive, using 6yyy in Pr x.00, it is transferred to the drive RAM and drive EEPROM. A parameter save is not required to retain the data after power-down. (When parameters are copied to the drive RAM this action is performed twice to prevent interdependent parameters from being copied incorrectly.) Before the data is taken from the card, defaults are loaded in the destination drive using the same default code as was last used in the source drive.

The categories of modules fitted to the card data source drive are stored on the card. If these are different from the destination drive, the menus for the slots where the option module categories are different are not modified and so they will contain their defaults values, and the drive will produce a C.Optn trip. If the data is transferred to a drive of a different voltage or current rating from the source drive all parameters with the RA coding bit set are not modified and a C.rtg trip occurs.

Pr No.	Function
02.08	Standard ramp voltage
03.05	Regen unit voltage setpoint
04.05-04.07, 21.27-21.29	Current limits
05.07, 21.07	Motor rated current
05.09, 21.09	Motor rated voltage
05.17, 21.12	Stator resistance
05.18	Switching frequency
05.23, 21.13	Voltage offset
05.24, 21.14	Transient inductance
05.25, 21.24	Stator inductance
06.06	D.C. injection braking current

A compare action on this file type, setting 8yyy in Pr x.00, will compare the smart card file with the data in the EEPROM. If the compare is successful Pr x.00 is simply set to 0. If the compare fails a C.cpr trip is initiated.

Parameter data block when 4yyy is used to transfer data to a card

The only parameter data stored on the smart card is the number for the last set of defaults loaded and the differences from the last defaults loaded. This requires six bytes for each parameter difference. The data density is not as high as when using the data format described in the previous section, but in most cases the number of differences from default is small and the data blocks are therefore smaller. This method can be used for creating drive macros. Parameters that are not transferred when using 3yyy are also not transferred with this method. Parameter RAM is used as the source of this information.

When the data is transferred back to a drive, using 6yyy in Pr x.00, it is transferred to the drive RAM and the drive EEPROM. A parameter save is not required to retain the data after power-down. (When parameters are copied to the drive RAM this action is performed twice to prevent interdependent parameters from not being set correctly.) The categories of modules fitted to the card data source drive are stored on the card. If these are different from the destination drive, the menus for the slots where the option module categories are different are not modified and will contain their default values, and the drive will produce a C.Optn trip if any of the parameters from the card are in the option menus. If the data is transferred to a drive of a different voltage or current rating from the source drive then parameters with the RA coding bit set (see table above) will not be written to the drive and these parameters will contain their default values. The drive will produce a C.rtg trip whether any of the parameters from the card are parameters with the RA coding bit set or not if the current or voltage ratings are different.

A compare action on this file type, setting 8yyy in Pr x.00, will compare the smart card file with the data in the drive RAM. If the compare is successful Pr x.00 is simply set to 0. If the compare fails a C.cpr trip is initiated.

Ladder program data blocks(Available 2003)

The internal ladder program from a drive may be transferred to/from internal flash memory from/to a smart card. If the ladder program is transferred from a drive with no ladder program loaded the block is still created on the card, but contains no data. If this is then transferred to a drive the drive will then have no ladder program. A smart card has a capacity of 4K bytes and each block of this type can take up to 4K bytes.

SMARTCARD compare function

If 8yyy is entered in Pr x.00 and the drive is reset data block yyy on the SMARTCARD is compared with the relevant parameters in the drive. If the compare is successful Pr x.00 is simply set to 0. If the compare fails a C.cpr trip is initiated.

11.38	SMARTCARD data type/mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1			1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 17							
Update rate	Background write															

Gives the type/mode of the data block selected with Pr 11.37 as shown below.

Pr 11.38	String	Type/mode	Data stored
0	FrEE	Value when Pr 11.37 = 0	
2	3OpEn.LP	Open-loop mode parameters	Data from EEPROM
3	3CL.VECt	Closed-loop vector mode parameters	Data from EEPROM
4	3SErVO	Servo mode parameters	Data from EEPROM
5	3REGEn	Regen mode parameters	Data from EEPROM
6 - 8	3Un	Unused	
10	4OpEn.LP	Open-loop mode parameters	Defaults last loaded and differences
11	4CL.VECt	Closed-loop vector mode parameters	Defaults last loaded and differences
12	4SErVO	Servo mode parameters	Defaults last loaded and differences
13	4REGEn	Regen mode parameters	Defaults last loaded and differences
14 - 16	4Un	Unused	
17	LAddEr	First part of a ladder program	
18	Option	A option module file	

11.39	SMARTCARD data version															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 9999							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read/write															

Gives the version number of the data block. This is intended to be used when data blocks are used as drive macros. If a version number is to be stored with a data block this parameter should be set to the required version number before the data is transferred. Each time Pr 11.37 is changed by the user the drive puts the version number of the currently viewed data block in this parameter.

11.40	SMARTCARD data checksum															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65335							
Update rate	Background write															

Gives the checksum of the data block.

11.41	Status mode timeout															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 250s							
Default	Open-loop, Closed-loop vector, Servo								240							
Update rate	Background read															

Set the timeout for the drive display to revert to status mode from edit mode following no key presses. Although this parameter can be set to less than 2s, the minimum timeout is 2s.

11.42	Parameter cloning															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1					1			*	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 4							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

* Modes 1 and 2 are not user saved, mode 3 and 4 are user saved.

Reading (Setting Pr 11.42 to 1)

Setting Pr 11.42 to 1 and resetting the drive will load the parameters from the card into the drive parameter set and the drive EEPROM. All SMARTCARD trips apply. When the action is complete this parameter is automatically reset to zero. Parameters are saved to drive EEPROM after this action is complete. Note: this operation is only performed if block 1 on the card is a complete copy of the EEPROM (i.e. types 1 to 5) and not a difference from default file. If block 1 does not exist or the type is incorrect a C.dat trip occurs.

NOTE When Pr 11.42 is 1 the value is NOT saved to EEPROM or card.

Programming (Setting Pr 11.42 to 2)

Setting Pr 11.42 to 2 and resetting the drive will save the parameters in the drive EEPROM to a card, i.e. equivalent to writing 3001 to Pr x.00. All SMARTCARD trips apply except C.Chg. If the data block already exists it is automatically over-written. When the action is complete this parameter is automatically reset to zero.

NOTE When Pr 11.42 is 2 the value is NOT saved to EEPROM or card.

Auto (Setting Pr 11.42 to 3)

Changing Pr 11.42 to 3 and resetting the drive will save the complete parameter set from the EEPROM to the card. All SMARTCARD trips apply, except C.Chg. If the data block already exists it is automatically overwritten.

If the card is removed when Pr 11.42 is set to 3 Pr 11.42 will be set to 0. If a card with a file 1 is inserted into a drive the drive must overwrite the file to ensure that the data is correct. The action of setting Pr 11.42 to 0 when a card is removed will force the user to change Pr 11.42 if auto mode is still required. Therefore the user will need to set Pr 11.42 to 3 and press reset to write the complete parameter set to the new card. (When a parameter in menu zero is changed, and a card is fitted, a save to EEPROM, is initiated. Only the new value of the modified parameter is written to the EEPROM and card. If Pr 11.42 were not cleared automatically when a card is remove then when a new card is inserted that contains data block 1 the modified parameter would be written to the existing data block 1 on the new card. The rest of the parameters in this data block may not be the same as those in the drive.)

When Pr 11.42 is equal to 3 and the parameters in the drive are saved, the card is also updated, therefore the card becomes a copy of the drives stored configuration.

At power up, if Pr 11.42 is set to 3, the drive will save the complete parameter set to the card. This is done to ensure that if a user puts a new card in during power down the new card will have the correct data.

NOTE When Pr 11.42 is 3 the value is saved to EEPROM but NOT the card.

Boot (Setting Pr 11.42 to 4)

When Pr 11.42 is set 4 the drive operates the same as Auto mode except when the drive is powered-up. At power up provided a card is inserted in the drive and parameter data block 1 exists, it is type 1 to 5, with Pr 11.42 on the card set to 4, the parameters are automatically transferred to the drive. If the drive mode is different from that on the card the drive gives a C.Typ trip and the data is not transferred.

If the 'boot' mode is stored in the cloning card this makes the cloning the master device This provides a very fast and efficient way of re-programming a number of drives.

NOTE If the card and drive have Pr 11.42 set to 4 the card will be the master. Boot mode is saved to the card but when the card is read the drive value of Pr 11.42 is not transferred to the drive.

11.43	Load defaults															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1					1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Setting this parameter to a non-zero value and resetting the drive loads defaults as follows. This parameter is automatically reset to zero when the action is complete.

Pr 11.43	Pr 11.43 Equivalent Value	Defaults Loaded
1 (Eur)	1233	Normal defaults
2 (USA)	1244	US defaults
3 (br.Eu)	1266	Normal defaults with braking macro
4 (br.US)	1277	US defaults with braking macro

11.44	Security status															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1			1				1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

This parameter controls the access via the drive LED keypad as follows:

Pr Value	Pr String	Action (Unidrive)
0	L1	Only menu 0 can be accessed
1	L2	All menus can be accessed
2	Loc	Lock user security when drive is reset. (This parameter is set to L1 after reset.)

The LED keypad can adjust this parameter even when user security is set.

11.45	Select motor 2 parameters															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

When this bit is set to one the motor 2 parameters in menu 21 become active instead of the equivalent parameters in other menus. Changes will only be implemented when the drive is disabled. When the motor 2 parameters are active the decimal point that is second from the right on the 1st row of the display is on. If this parameter is one when an auto-tune is carried out (05.12=1), the results of the auto-tune are written to the equivalent second motor parameters instead of the normal parameters. Each time this parameter is changed the accumulator for motor thermal protection is reset to zero.

11.46	Defaults previously loaded															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1		1	1		1	
Range	Open-loop, Closed-loop vector, Servo								0 to 2000							
Default	Open-loop, Closed-loop vector, Servo								Number of defaults loaded, i.e. 1233, etc							
Update rate	Background write															

Displays the number of the last set of defaults loaded, i.e. 1233, 1244, etc.

11.47	Drive User Program Enable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								2							
Default	Open-loop, Closed-loop vector, Servo								0 to 2							
Update rate	Background read															

The Drive User Program Enable parameter is used to start and stop the drive user program.

Value	Description
0	Halt the Drive User Program
1	Run the drive User Program (if fitted). Any out-of-range parameter writes attempted will be clipped to the maximum / minimum values valid for that parameter before being written
2	Run the drive User Program (if fitted). Any out-of-range parameter writes attempted will cause a drive trip

11.48	Drive User Program Status															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-128 to +127							
Update rate	Background write															

The Drive User Program Status parameter indicates to the user the actual state of the drive User Program. (not fitted / running / stopped / tripped.)

Value	Description
-n	User Program caused a drive trip due to an error condition while running rung n. Note that the rung number is shown on the display as a negative number
0	User Program is Not Fitted
1	User Program is fitted but stopped
2	User Program is fitted and running

11.49	Drive User Programming															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1			1	1
Range	Open-loop, Closed-loop vector, Servo								0 to 65535							
Update rate	Background write															

The Drive User Programming Events parameter holds the number of times a user program download has taken place and is 0 on dispatch from the factory. If the Drive User Programming Events are greater than the maximum value, which may be represented by this parameter, the value will be clipped to the maximum value. This parameter is not altered when defaults are loaded.

11.50	User Program Maximum Scan Time															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1			1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65535 milliseconds							
Update rate	User program execution period															

The User Program Maximum Scan Time parameter gives the longest scan time within the last ten scans of the drive User Program. If the scan time is greater than the maximum value which may be represented by this parameter the value will be clipped to the maximum value.

11.51	Drive User Program First Run															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Range	Open-loop, Closed-loop vector, Servo								0 or 1							
Update rate	User program execution period															

The Drive User Program First Run parameter is set for the duration of the first ladder diagram scan from the ladder diagram stopped state. This enables the user to perform any required initialisation every time the ladder diagram is run. This parameter is set every time the ladder is stopped.

Menu 12: Threshold Detectors and Variable selectors

There are a number of parameters in menu 12 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
12.04	Threshold Detector	1threshold levels Parameter resolution increased from 0.0 - 100.0 to 0.00 to 100.00, details overleaf
12.05	Threshold Detector 1& 2 hysteresis	Parameter resolution increased from 0.0 - 25.0 to 0.00 to 25.00, details overleaf
12.08	Variable selector 1 source 1	New parameter introduced with Unidrive SP, details overleaf
12.09	Variable selector 1 source 2	New parameter introduced with Unidrive SP, details overleaf
12.10	Variable selector 1 mode	New parameter introduced with Unidrive SP, details overleaf
12.11	Variable selector 1 destination	New parameter introduced with Unidrive SP, details overleaf
12.12	Variable selector 1 output	New parameter introduced with Unidrive SP, details overleaf
12.13	Variable selector 1 source 1 scaling	Previously Threshold detector 2 input source in Unidrive 1, details overleaf
12.14	Variable selector 1 source 2 scaling	Previously Threshold detector 2 threshold level in Unidrive 1, details overleaf
12.15	Variable selector 1 control	Previously Threshold detector 2 hysterpsis level in Unidrive 1, details overleaf
12.23	Threshold Detector 2 source	Parameter moved from Pr 12.13 in Unidrive 1, details overleaf
12.24	Threshold Detector 2 threshold levels	Parameter resolution increased from 0.0 - 100.0 to 0.00 to 100.00 details overleaf.
12.25	Threshold Detector 2 hysteresis	Parameter resolution increased from 0.0 - 25.0 to 0.00 to 25.00, details overleaf
12.28	Variable selector 2 source 1	New parameter with Unidrive SP details overleaf
12.29	Variable selector 2 source 2	New parameter with Unidrive SP details overleaf
12.30	Variable selector 2 mode	New parameter with Unidrive SP details overleaf
12.31	Variable selector 2 destination	New parameter with Unidrive SP details overleaf
12.32	Variable selector 2 output	New parameter with Unidrive SP details overleaf
12.33	Variable selector 2 source 1 scaling	New parameter with Unidrive SP details overleaf
12.34	Variable selector 2 source 2 scaling	New parameter with Unidrive SP details overleaf
12.35	Variable selector 2 control	New parameter with Unidrive SP details overleaf

12.04, 12.24	Threshold detector 1,2 level															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.00 to 100.00%							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms x number of menu 9 or 12 functions active read															

12.05, 12.25	Threshold detector 1,2 hysteresis															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.00 to 25.00%							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	4ms x number of menu 9 or 12 functions active read															

12.08, 12.28	Variable selector 1,2 source 1															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2					1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Default	Open-loop, Closed-loop vector, Servo								00.00							
Update rate	Read on reset															

12.09, 12.29	Variable selector 1,2 source 2															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2					1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Default	Open-loop, Closed-loop vector, Servo								00.00							
Update rate	Read on reset															

Menu 12: Threshold Detectors and Variable selectors

12.10, 12.30	Variable selector 1,2 mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 8							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms x number of menu 9 or 12 functions active read															

12.11, 12.31	Variable selector 1,2 destination															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
				1			2					1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Default	Open-loop, Closed-loop vector, Servo								00.00							
Update rate	Read on reset															

12.12, 12.32	Variable selector 1,2 output															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2	1		1	1	1				
Range	Open-loop, Closed-loop vector, Servo								-100.00 to 100.00%							
Update rate	4ms x number of menu 9 or 12 functions active write															

12.13, 12.33	Variable selector 1,2 source 1 scaling															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1		
Range	Open-loop, Closed-loop vector, Servo								-4.000 to 4.000							
Default	Open-loop, Closed-loop vector, Servo								1.000							
Update rate	4ms x number of menu 9 or 12 functions active read															

12.14, 12.34	Variable selector 1,2 source 2 scaling															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1		
Range	Open-loop, Closed-loop vector, Servo								-4.000 to 4.000							
Default	Open-loop, Closed-loop vector, Servo								1.000							

12.23	Threshold detector 1,2 source															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2					1	1	1	1	
Range	Open-loop, Closed-loop vector, Servo								00.00 to 21.51							
Default	Open-loop, Closed-loop vector, Servo								00.00							
Update rate	Read on reset															

Menu 13: Position control

There are a number of parameters in menu 13 of the Unidrive SP which have changed from Unidrive 1, basic change information is shown below, detail explanation of the changes are shown overleaf.

Parameter	Function	Details
13.01	Position loop error - Revolutions	Position Error in Unidrive SP is split into:- No of Revolutions
13.02	Position loop error - Position	Position within one revolution
13.03	Position loop error - Fine Position	Fine position error
13.04	Position controller reference source	With Unidrive SP, Position controller can select reference source as:- Drive, Slots 1-3 or Local Reference
13.05	Position controller feedback source	With Unidrive SP, Position controller can select feedback source as drive or slots 1-3
13.06	Position reference invert	Invert position reference, was Pr 13.19 (**Reference encoder invert**) in Unidrive 1
13.07	Ratio numerator	In Unidrive SP, Ratio Numerator (in conjunction with Pr 13.08 **Ratio Denominator**) form Reference ratio, was Reference encoder ratio (Pr13.07) in Unidrive 1
13.08	Ratio denominator	
13.09	Position controller P gain	Gain Applied to position error, was Pr13.09 in Unidrive 1
13.10	Position controller mode	Position controller mode, was Pr 13.08 in Unidrive 1
13.11	Absolute mode enable	See details overleaf
13.12	Position controller speed clamp	Limits velocity correction term, was Pr 13.10 in Unidrive 1
13.13	Orientation position reference	As Pr13.11 in Unidrive 1
13.14	Orientation acceptance window	As Pr13.12 in Unidrive 1
13.15	Orientation position complete	As Pr13.18 in Unidrive 1
13.16	Position error reset	See details overleaf
13.17	Relative jog reference	Relative jog reference, was controlled via menu 6 in Unidrive 1
13.18	Relative jog enable	Relative jog enable, was controlled via menu 6 in Unidrive 1
13.19	Relative jog reverse	Relative jog reverse select, was controlled via menu 6 in Unidrive 1
13.20	Local reference - Turns	Optional Local reference source in Unidrive SP is split into:- *No of Turns*
13.21	Local reference - Position	*Position within one revolution*
13.22	Local reference - Fine position	*Fine position error*
13.23	Local reference disable	Enable optional Local reference source (Pr 13.20~13.22)

Menu 13: Position control

13.01	Revolutions error															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-32768 to 32767							
Update rate	4ms write															

13.02	Position error															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-32768 to 32767							
Update rate	4ms write															

13.03	Fine position error															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
								1		1		1				
Range	Open-loop, Closed-loop vector, Servo								-32768 to 32767							
Update rate	4ms write															

For normal position control the position changes from the reference and the feedback are accumulated in an integrator during each sample. The integrator is large enough the guarantee that the position controller will operate with a position error within the range -32768 revolutions to +32767 revolutions before rolling over. The position error is displayed in parameters 13.01, 13.02 and 13.03. Parameter 13.01 shows the turns error, parameter 13.02 shows the error within a revolution in 1/216 counts per revolution units and parameter 13.03 shows the fine position error in 1/232 counts per revolution units. These values are signed and so they can be used to show the following error with different levels of resolution.

For orientation mode the error between the orientation position and the position feedback source is shown in parameter 13.02.

13.04	Position controller reference source															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 4							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Menu 13: Position control

13.05	Position controller reference source															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 3							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Source param	Source
0 (drv)	Drive encoder
1 (slot1)	Slot 1
2 (slot2)	Slot 2
3 (slot3)	Slot 3
4 (locAl)	Local reference

The reference and feedback positions can be taken from the drive encoder or a position feedback option module in one of the option slots. The reference can also be taken from the local reference parameters. If the reference and feedback sources are the same the position controller cannot be enabled. If an option slot is selected as a source, but the module is not a position feedback category option module the position controller cannot be enabled. Orientation mode can always be enabled in closed-loop modes.

13.06	Position reference invert															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

13.07	Ratio numerator															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.000 to 4.000							
Default	Open-loop, Closed-loop vector, Servo								1.000							
Update rate	Background read															

13.08	Ratio denominator															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.001 to 1.000							
Default	Open-loop, Closed-loop vector, Servo								1.000							
Update rate	Background read															

An exact ratio can be applied to the position reference with these two parameters. The ratio cannot be changed when the drive is enabled without causing abrupt changes of position. Although it is possible to set up ratios with a high gain, the drive limits the resultant gain of the ratio block to 4.000.

13.09	Position controller P gain															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.00 to 100.00 rads^{-1}/rad							
Default	Open-loop, Closed-loop vector, Servo								25.00							
Update rate	Background read															

The gain of the position controller is controlled with this parameter. The standard units within the drive for position are in 2^32 counts per revolution and the standard units for speed are 0.1rpm, however the position controller gain is given in rads-1/rad. These units are consistent with units such as mms-1/mm or ms-1/m often used for linear control applications. An error of 1 radian (10430 counts in the position error (13.02)) gives a speed reference of 1rads-1 (9.5rpm) when this gain is 1.00.

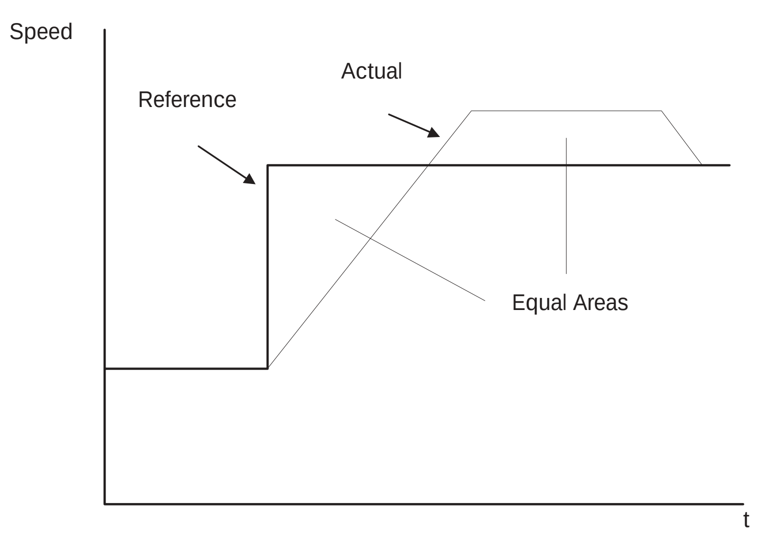
13.10	Position controller mode															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop Closed-loop vector, Servo								0 to 2 0 to 6							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

This parameter is used to set the position controller mode as shown in the table below.

Parameter value	Mode	Feed forward active
0	Position controller disabled	
1	Rigid position control	√
2	Rigid position control	
3	Non-rigid position control	√
4	Non-rigid position control	
5	Orientation on stop	
6	Orientation on stop and when drive enabled	

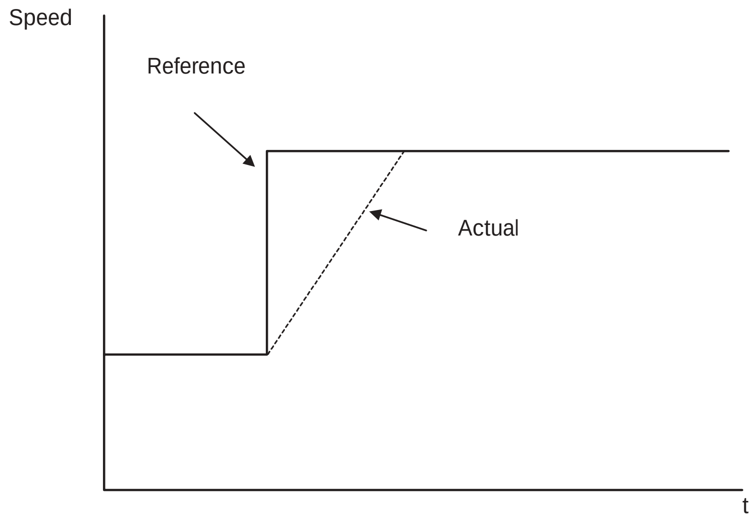
Rigid position control

In rigid position control the position error is always accumulated. This means that, if for example, the slave shaft is slowed down due to excessive load, the target position will eventually be recovered by running at a higher speed when the load is removed.



Non-rigid position control

In non-rigid position control the position loop is only active when the 'At Speed' condition is met (see parameter (03.06). This allows slippage to occur while the speed error is high.



Velocity feed forward

The position controller can generate a velocity feed forwards value from the speed of the reference encoder. The feed forward value is passed to Menu 1, and so ramps may be included if required. Because the position controller only has a proportional gain, it is necessary to use velocity feed forwards to prevent a constant position error that would be proportional to the speed of the reference position.

If for any reason the user wishes to provide the velocity feed forward from a source other than the reference position, the feed forward system can be made inactive, i.e. parameter 13.10 = 2 or 4. The external feed forward can be provided via Menu 1 from any of the frequency/speed references. However, if the feed forward level is not correct a constant position error will exist.

Relative jogging

If relative jogging is enabled the feedback position can be made to move relative the reference position at the speed defined by parameter 13.17.

Orientation

If parameter 13.10 is 5 the drive orientates the motor following a stop command. If hold zero speed is enabled (parameter 06.08 = 1) the drive remains in position control when orientation is complete and hold the orientation position. If hold zero speed is not enabled the drive is disabled when orientation is complete.

If parameter 13.10 is 6 the drive orientates the motor following a stop command and whenever the drive is enabled provided that hold zero speed is enabled (parameter 06.08 = 1). This ensures that the spindle is always in the same position following the drive being enabled.

When orientating from a stop command the drive goes through the following sequence:

1. The motor is decelerated or accelerated to the speed limit programmed in parameter 13.12, using ramps if these are enabled, in the direction the motor was previously running.
2. When the ramp output reaches the speed set in parameter 13.12, ramps are disabled and the motor continues to rotate until the position is found to be close to the target position (i.e. within 1/32 of a revolution). At this point the speed demand is set to 0 and the position loop is closed.
3. When the position is within the window defined by parameter 13.14, the orientation complete indication is given in parameter 13.15.

The stop mode selected by parameter 06.01 has no effect if orientation is enabled.

13.11	Absolute mode enable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1												1	1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

When this parameter is set to one and the position controller mode (13.10) is 1 or 2, the position error integrator is loaded with the absolute position error defined by the position sources when the position controller is disabled. (The position controller is disabled under the following conditions: when the drive is in the inhibit, ready or tripped states; either the reference or feedback position sources from an option modules are invalid; the position feedback is not correctly initialised (03.48=0); the position control mode (13.10) is changed; this parameter (13.11) is changed; or the position error reset (13.16) is set to one.) Therefore when this parameter is one the position controller operates on the absolute position from the reference and feedback. If the feedback device is not absolute then the absolute position is the change of position since the drive was powered-up.

When this parameter is zero or the position control mode is not 1 or 2 the error integrator is loaded with zero when the position controller is disabled therefore the position controller operates on the relative position changes of the reference and feedback from the point when the position controller is re-enabled.

It should be noted that the value of this parameter does not affect the operation of the marker reset for any position source. If the marker position reset disable (03.31 for the drive encoder, or similar for option modules) is zero, the position controller takes the position source including the effect of the marker. When a marker event occurs the position and fine position are reset to zero, but the turns are not affected. If the marker position reset disable is one then the marker events have no effect on the position source used by the position controller.

13.12	Position controller speed clamp															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 250							
Default	Open-loop, Closed-loop vector, Servo								150							
Update rate	Background read															

This parameter limits the velocity correction applied by the position controller. In Closed-loop and Servo modes this value is also used as the reference during orientation.

13.13	Orientation position reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65535							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

13.14	Orientation acceptance window															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 4096							
Default	Open-loop, Closed-loop vector, Servo								256							
Update rate	Background read															

13.15	Orientation position complete															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Update rate	4ms write															

Parameter 13.13 defines the position as a 1/216 of a revolution for orientation. Parameter 13.14 defines the position acceptance window either side of the position reference for orientation in 1/216 of a revolution. The window is within Parameter 13.15 indicates orientation is complete, i.e. the position is within the acceptance window defined by parameter 13.14.

13.16	Position error reset															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

The position error integrator is preset to the absolute error (parameter 13.10 is 1 or 2, and parameter 13.11 is one) otherwise it is set to zero when this parameter is set to one.

The position controller is disabled and the error integrator is also reset under the following conditions:

1. If the drive is disabled (i.e. inhibited, ready or tripped)
2. If the position controller mode (13.10) is changed. The position controller is disabled transiently to reset the error integrator.
3. The absolute mode parameter (13.11) is changed. . The position controller is disabled transiently to reset the error integrator.
4. One of the position sources is invalid.
5. The position feedback initialised parameter (03.48) is zero.

13.17	Relative jog reference															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.0 to 4000.0rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Update rate	Background read															

13.18	Relative jog enable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

13.19	Relative jog reverse															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	Background read															

Relative jog can be used to move the feedback position relative to the reference position at a speed defined by parameter 13.17.

13.20	Local reference turns															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65536							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

13.21	Local reference position															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65536							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

13.22	Local reference fine position															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 65536							
Default	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

13.23	Local reference disable															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1									1				1		
Range	Open-loop, Closed-loop vector, Servo								0							
Update rate	4ms read															

The local reference can be used to control the position of the motor shaft. If the local reference disable parameter is one the previously written value is used. This allows all three parts of the local reference position to be changed without data skew problems. The local reference position is sampled within 250µs of the level 2 task beginning that initiates the level 4 (4ms) task that operates the position controller. Therefore the reference may be written synchronously from an application category module provided it is not written within 250µs of a level 2 task RMINT transition that will initiate a level 4 task.

Menu 14: User PID controller

There are a number of parameters in menu 14 of the Unidrive SP, which have changes from Unidrive 1, as following...

Parameter	Function	Details
14.01	PID output	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
14.13	PID output high limit	Parameter resolution increased from 0 - 100.0% to 0 - 100.00% with Unidrive SP
14.14	PID output low limit	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
14.19	PID main reference	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
14.20	PID reference	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
14.21	PID feedback	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP
14.22	PID error	Parameter resolution increased from +100.0% to +100.00% with Unidrive SP

Menu 15: Solution module set-up, Slot 1

In Unidrive SP, menu 15 is the configuration menu for the solutions module in slot 1, this was previously the REGEn mode configuration menu in Unidrive1 (configuration of Unidrive SP in REGEn mode is carried out via menu 3).

With Unidrive SP, solutions modules can be fitted in slots 1~3 and configured via their individual menu(s) 15,16 & 17. The function and value of parameters in menu 15 of the Unidrive SP depend on the solutions module fitted in slot 1.

The full parameters of menu 15 are only visible in a Unidrive SP, if a solutions option is fitted in slot 1, with no solution module fitted only parameters 00 and 01 are visible.

For more information on the Unidrive SP solutions modules, see the Unidrive SP User guide.

Menu 16: Solution module set-up, Slot 2

In Unidrive SP, menu 16 is the configuration menu for the solutions module in slot 2, this was previously the small option module menu in Unidrive 1.

The single small option module no longer exists in Unidrive SP, there being no differentiation between slot types on Unidrive SP.

With Unidrive SP, solutions modules can be fitted in slots 1~3 and configured via their individual menu(s) 15,16 & 17. The function and value of parameters in menu 16 of the Unidrive SP depend on the solutions module fitted in slot 2.

The full parameters of menu 17 are only visible in a Unidrive SP if a solutions option is fitted in slot 2, with no solution module fitted only parameters 00 and 01 are visible.

For more information on the Unidrive SP solutions modules, see the Unidrive SP User guide.

Menu 17: Solution module set-up, Slot 3

In Unidrive SP, menu 17 is the configuration menu for the solutions module in slot 3, this was previously the Large option module menu in Unidrive 1.

The single large option module no longer exists in Unidrive SP, there being no differentiation between slot types on Unidrive SP.

With Unidrive SP, solutions modules can be fitted in slots 1~3 and configured via their individual menu(s) 15,16 & 17. The function and value of parameters in menu 17 of the Unidrive SP depend on the solutions module fitted in slot 3.

The full parameters of menu 17 are only visible in a Unidrive SP if a solutions option is fitted in slot 3, with no solution module fitted only parameters 00 and 01 are visible.

For more information on the Unidrive SP solutions modules, see the Unidrive SP User guide.

Menu 18: Application menu 1

There are a number of parameters in menu 18 of the Unidrive SP, which have changes from Unidrive 1, as following:

Parameter	Function	Details
18.01	Application menu 1 power-down saved R/W integer	Parameter range changed from +32,000 to -32,768 to +37,767 with Unidrive SP
18.02 - 18.10	Application menu 1 RO integers	
18.11 - 18.30	Application menu 1 R/W integers	

Menu 19: Application menu 2

There are a number of parameters in menu 19 of the Unidrive SP, which have changes from Unidrive 1, as following:

Parameter	Function	Details
19.01	Application menu 2 power-down saved R/W integer	Parameter range changed from +32,000 to -32,768 to +37,767 with Unidrive SP
19.02 - 19.10	Application menu 2 RO integers	
19.11 - 19.30	Application menu 2 R/W integers	

Menu 20: Application menu 3

In Unidrive SP menu 20 is always present, with Unidrive 1, Menu 20 was only available with a UD70 Large option module fitted.

Menu 20 parameters are now stored in the drive memory with Unidrive SP, previously stored in the UD70 Large option memory with Unidrive 1.

There are a number of parameters in menu 20 of the Unidrive SP, which have changes from Unidrive 1, as following:

Parameter	Function	Details
20.01 - 20.20	Application menu 3 R/W integers	Parameter functions previously involved with Fieldbus operation. Function, default value and range dependant on fieldbus used. Parameter range for increased from +32,000 to -32,768 to +37,767 with Unidrive SP
20.21 - 20.40	Application menu 3 R/W long integers	Parameter range for increased from +32,000 to -231 to 231-1 with Unidrive SP
20.41 - 20.49	Application menu 1 R/W variables	Not available with Unidrive SP
20.50	Reserved status communications parameter	Not available with Unidrive SP

Menu 21: Second Motor Parameters

Menu 21 contains second motor map information similar to Commander SE, this menu did not exist in Undrive 1.

The following parameters are used instead of the normal motor set-up parameters when Pr 11.45 is set to a one.

New Parameter functions are as follows:

21.01	Maximum reference clamp															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
	Closed-loop vector and servo = VM															
Range	Open-loop Closed-loop vector and Servo								0 to 3000.0Hz Speed-Limit_Max rpm							
Default	Open-loop Closed-loop vector Servo								50.0 1500.0 3000.0							
Drive modes	Open-loop, Closed-loop vector, Servo															
Normal Parameter	Open-loop, Closed-loop vector, Servo								1.06							
Update rate	Background read															

21.02	Minimum reference clamp															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1					1	1	1		
	Closed-loop vector and servo = VM															
Range	Open-loop Closed-loop vector and Servo								-3000.0Hz to 3000.0Hz ±Speed_Limit_Max rpm							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Drive modes	Open-loop, Closed-loop vector, Servo															
Normal Parameter	Open-loop, Closed-loop vector, Servo								1.07							
Update rate	Background read															

21.03	Reference selector															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 5							
Default	Open-loop, Closed-loop vector, Servo								0 (A1.A2)							
Normal Parameter	Open-loop, Closed-loop vector, Servo								1.14							
Update rate	4ms read															

Unlike the motor 1 Pr 1.14 this parameter is not used for F5 and F6 digital input auto-selection, see Pr 8.39.

21.04	Acceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								5.0 2.000 0.200							
Normal Parameter	Open-loop, Closed-loop vector, Servo								2.11							
Update rate	Background read															

21.05	Deceleration rate															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
	Closed-loop vector and servo DP = 3															
Range	Open-loop Closed-loop vector and Servo								0.0 to 3200.0 s/100Hz 0.000 to 3200.000 s/1000rpm							
Default	Open-loop Closed-loop vector Servo								5.0 2.000 0.200							
Normal Parameter	Open-loop, Closed-loop vector, Servo								2.21							
Update rate	Background read															

Menu 21: Second Motor Parameters

21.06	Rated frequency															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop Closed-loop vector								0 to 3000.0Hz 0 to 1250.0Hz							
Default	Open-loop, Closed-loop vector								50.0Hz							
Normal Parameter	Open-loop, Closed-loop vector								5.06							
Update rate	Background read															

21.07	Rated current															
Drive modes	Open-loop, Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1						1	1	1	
Range	Open-loop, Closed-loop, Servo								0 to Rated_Current_Max A							
Default	Open-loop, Closed-loop vector, Servo								Drive rated current, Pr 11.32							
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.07							
Update rate	Background read															

21.08	Rated load rpm															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
	Closed-loop vector DP=2															
Range	Open-loop, Closed-loop								0 to 180,000rpm 0.00 to 40,000.00rpm							
Default	Open-loop, Closed-loop vector								1500 1450.00							
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.08							
Update rate	Background read															

21.09	Rated voltage															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1			1				1	1	1	
Range	Open-loop, Closed-loop, Servo								0 to AC_Voltage_Set_Max V							
Default	Open-loop, Closed-loop vector, Servo								200V rating drive: 230V 400V rating drive: 400V 575V rating drive: 575V 690V rating drive: 690V							
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.09							
Update rate	Level 4 read															

21.10	Rated power factor															
Drive modes	Open-loop, Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3						1	1	1	
Range	Open-loop, Closed-loop								0.000 to 1.000							
Default	Open-loop, Closed-loop vector								0.85							
Normal Parameter	Open-loop, Closed-loop vector								5.10							
Update rate	Background read															

21.11	Number of motor poles															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 60 (Auto to 120 Pole							
Default	Open-loop, Closed-loop vector Servo								0 (Auto) 3 (Auto)							
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.11							
Update rate	Background read															

21.12	Stator resistance															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.0 to 30.000 Ohms							
Default	Open-loop, Closed-loop vector, Servo								0.0							
Drive modes	Open-loop, Closed-loop vector, Servo															
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.17							
Update rate	Background read															

21.13	Voltage offset															
Drive modes	Open-loop															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1		1				1	1	1	
Range	Open-loop								0.0 to 25.0 V							
Default	Open-loop								0.0							
Normal Parameter	Open-loop								5.23							
Update rate	Background read															

21.14	Transient inductance (σL_S)															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							3		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.000 to 500.000 mH							
Default	Open-loop, Closed-loop vector, Servo								0.000							
Normal Parameter	Open-loop, Closed-loop vector, Servo								5.24							
Update rate	Background read															

21.15	Motor 2 active															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
	1							1		1		1				
Default	Open-loop, Closed-loop vector, Servo								1							
Normal motor Parameter	Open-loop, Closed-loop vector, Servo								21.15							
Update rate	Background write															

Pr 21.15 does not have an equivalent normal motor parameter, but shows when motor 2 is active.

21.16	Thermal time constant															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0.0 to 400.0							
Default	Open-loop, Closed-loop vector Servo Regen								89.0 20.0 89.0							
Normal motor Parameter	Open-loop, Closed-loop vector, Servo								4.15							
Update rate	Background read															

21.17	Speed controller Kp gain															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Closed-loop vector, Servo								0.00 to 653.35(1/ rad/s)							
Default	Closed-loop vector, Servo								1.00							
Normal motor Parameter	Closed-loop vector, Servo								3.10							
Update rate	Background read															

21.18	Speed controller Ki gain															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2						1	1	1	
Range	Closed-loop vector, Servo								0.00 to 653.35(1/ rad)							
Default	Closed-loop vector, Servo								1.00							
Normal motor Parameter	Closed-loop vector, Servo								3.11							
Update rate	Background read															

21.19	Speed controller Kd gain															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							5						1	1	1	
Range	Closed-loop vector, Servo								0.00000 to 0.65336(s / (rad/s))							
Default	Closed-loop vector, Servo								0.00000							
Normal motor Parameter	Closed-loop vector, Servo								3.12							
Update rate	Background read															

When the second motor is selected the gains defined in Pr 21.17 to Pr 21.19 are used directly by the speed controller. The speed controller set-up method defined by Pr 3.13 is ignored.

21.20	Encoder phase angle															
Drive modes	Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							1	1		1				1	1	1
Range	Servo								0.0 to 359.9deg electrical							
Default	Servo								0.0							
Normal motor Parameter	Servo								3.25							
Update rate	Background read															

21.21	Speed feedback selector															
Drive modes	Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
					1								1	1	1	
Range	Closed-loop vector, Servo								0 to 3							
Default	Closed-loop vector, Servo								0							
Normal motor Parameter	Closed-loop vector, Servo								3.26							
Update rate	Background read															

21.22	Current controller Kp gain															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Commander SE, Open-loop, Closed-loop vector, Servo								0 to 30000							
Default	Drive voltage rating : Open-loop, Closed-loop vector, Servo Regen								200V 20 75 45	400V 20 150 90	575V 20 180 110	690V 20 215 130				
Normal Parameter	Closed-loop vector, Servo								4.13							
Update rate	Background read															

21.23	Current controller Ki gain															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to 30000							
Default	Drive voltage rating : Open-loop, Closed-loop vector, Servo Regen								200V 40 1000 1000	400V 40 2000 2000	575V 40 3000 3000	690V 40 3450 3450				
Normal Parameter	Closed-loop vector, Servo								4.14							
Update rate	Background read															

Menu 21: Second Motor Parameters

21.24	Stator inductance (Ls)															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
							2		1				1	1	1	
Range	Closed-loop vector								0.00 to 5000.00 mH							
Default	Closed-loop vector								0.00							
Normal Parameter	Closed-loop vector								5.25							
Update rate	Background read															

21.25	Motor saturation breakpoint 1															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector								0 to 100% of rated flux							
Default	Closed-loop vector								50							
Normal Parameter	Closed-loop vector								5.29							
Update rate	Background read															

21.26	Motor saturation breakpoint 2															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Closed-loop vector								0 to 100% of rated flux							
Default	Closed-loop vector								75							
Normal Parameter	Closed-loop vector								5.30							
Update rate	Background read															

Menu 21: Second Motor Parameters

21.27	Motoring current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to Motor2_Current_Limit_Max %							
Default	Open-loop, Closed-loop vector, Servo								165.0 175.0							
Normal Parameter	Open-loop, Closed-loop vector, Servo								4.05							
Update rate	Background read															

21.28	Regen current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to Motor2_Current_Limit_Max %							
Default	Open-loop, Closed-loop vector, Servo								165.0 175.0							
Normal Parameter	Open-loop, Closed-loop vector, Servo								4.06							
Update rate	Background read															

21.29	Symmetrical current limit															
Drive modes	Open-loop, Closed-loop vector, Servo															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
						1	1		1				1	1	1	
Range	Open-loop, Closed-loop vector, Servo								0 to Motor2_Current_Limit_Max %							
Default	Open-loop, Closed-loop vector, Servo								165.0 175.0							
Normal Parameter	Open-loop, Closed-loop vector, Servo								4.07							
Update rate	Background read															

21.30	Motor volts per 1000rpm															
Drive modes	Closed-loop vector															
Coding	Bit	SP	FI	DE	Txt	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
													1	1	1	
Range	Servo								0 to 10000							
Default	Servo								98							
Normal Parameter	Servo								5.33							
Update rate	Background read															