

The Application Note is pertinent to the Unidrive Family

Setting Current Loop Gains for Undrive in Closed Loop and Servo Modes.

Introduction:

Low inductance vector or servo motors may cause instability of the current loop at certain speeds which can result in instantaneous over current (OI.AC) trips. This can usually be corrected by correct setting of the current loop gain parameters #4.13 and #4.14.

Data required to calculate Unidrive current loop gains:

The current loop gains may be calculated using the formulae below, or by using the Wizard provided in the current version (3.4.3) of UniSoft. The formulae require that the user first obtains the following input data:

1. Per phase leakage inductance of the motor (**L**) in millihenries. This should be obtained from the motor manufacturer, or in the case of a servo motor is half the phase to phase value normally published in the motor data sheet.
2. Per phase dc resistance of the motor (**R**), this is half the phase to phase resistance given in a servo motor data sheet.
3. Drive rated current tabulated at appendix A of this document (**I_r**). Note that this changes according to the selected switching frequency.

Calculations:

Proportional gain (#4.13). = Integer $(1.8 \times L \times I_r)$

Integral gain (#4.14). = Integer $(44 \times (\#4.13) \times (R/L))$.

Example:

This example is based on a real application using a special MTS servo motor wound for 7000 rpm rated speed. The drive used was a UNI2203LV rated at 25A. The MTS data sheet for the motor gives the phase to phase inductance as 0.726 mH (per phase inductance = $0.726/2 = 0.363$) and the phase to phase resistance as 0.11Ω (per phase = $0.11/2 = 0.055$). Running the motor with the default current loop gains (#4.13 =130 and #4.14 = 1200) resulted in an OIAC trip at about 3800 rpm. The problem was resolved by recalculating the gains using the formulae above:

P gain (**#4.13**) = Integer $(1.8 \times 0.363 \times 25) = 16$

I gain (**#4.14**) = Integer $(44 \times 16 \times (0.055 / 0.363)) = 107$

Important note: The Unidrive Advanced User guide provides similar formulae for calculating the gains but the inductance used is expressed in Henries.

Effect Of Switching Frequency:

There have been a number of instances of OIAC trips occurring with Unidrive and servo motors which are not particularly low inductance. These were found to occur when the drive switching frequency selected was below 6 KHz. It is strongly recommended that 6 KHz should be the minimum switching frequency used with the drive in servo mode. Control Techniques sales literature uses Unidrive current ratings at 6 KHz switching frequency in its matched motor drive combination performance data.

Questions? Ask the Author:

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Appendix A Undrive Rated Currents.

The tables below are for Unidrive and Unidrive LV at an ambient temperature of 40°C (104 F).

Unidrive (480V)

Switching Frequency	3 KHz	4.5 KHz	6 KHz	9 KHz	12 KHz
Unidrive Model	Rated Current				
UNI 1401	2.1A	2.1A	2.1A	2.1A	2.1A
UNI 1402	2.8A	2.8A	2.8A	2.8A	2.8A
UNI 1403	3.8A	3.8A	3.8A	3.8A	3.8A
UNI 1404	5.6A	5.6A	5.6A	5.6A	4.5A
UNI 1405	9.5A	9.5A	8.5A	7.0A	5.5A
UNI 2401	12.0A	12.0A	12.0A	12.0A	11.7A
UNI 2402	16.0A	16.0A	16.0A	14.2A	11.7A
UNI 2403	25.0A	21.7A	18.2A	14.2A	11.7A
UNI 3401	34.0A	34.0A	34.0A	28.0A	23.0A
UNI 3402	40.0A	40.0A	37.0A	28.0A	23.0A
UNI 3403	46.0A	46.0A	40.0A	32.0A	26.6A
UNI 3404	60.0A	47.0A	40.0A	32.0A	26.7A
UNI 3405	70.0A	56.0A	46.0A	35.0A	28.0A
UNI 4401	96.0A	96.0A	88.0A	70.0A	N/A
UNI 4402	124.0A	104.0A	88.0A	70.0A	N/A
UNI 4403	156.0A	124.0A	105.0A	80.0A	N/A
UNI 4404	180.0A	175.0A	145.0A	110.0A	N/A
UNI 4405	202.0A	175.0A	145.0A	110.0A	N/A

Unidrive LV (230V)

Switching Frequency	3 KHz	4.5 KHz	6 KHz	9 KHz	12 KHz
Unidrive Model	Rated Current				
UNI 1201 LV	2.1A	2.1A	2.1A	2.1A	2.1A
UNI 1202 LV	2.8A	2.8A	2.8A	2.8A	2.8A
UNI 1203 LV	3.8A	3.8A	3.8A	3.8A	3.8A
UNI 1204 LV	5.6A	5.6A	5.6A	5.6A	4.5A
UNI 1205 LV	9.5A	9.5A	8.5A	7.0A	5.5A
UNI 2201 LV	12.0A	12.0A	12.0A	12.0A	11.7A
UNI 2202 LV	16.0A	16.0A	16.0A	14.2A	11.7A
UNI 2203 LV	25.0A	21.7A	18.2A	14.2A	11.7A
UNI 3201 LV	34.0A	34.0A	34.0A	28.0A	23.0A
UNI 3202 LV	46.0A	46.0A	40.0A	32.0A	26.6A
UNI 3203 LV	60.0A	47.0A	40.0A	32.0A	26.7A
UNI 3204 LV	74.0A	56.0A	46.0A	35.0A	28.0A



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