

The power system needs to be sequenced such that when the VFD is off, output contactor switches over to excite 1 phase of the motor. Besides needing this external contactor and sequencing logic, mounting/installation costs, the cost of the Motor Winding Heater can be a rather expensive solution.

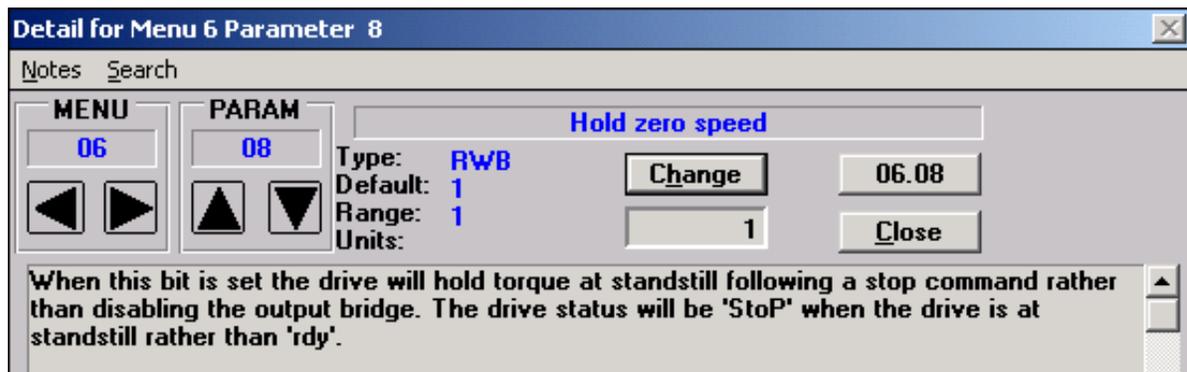
This application note advocates a more elegant solution by accomplishing the same goal but eliminating the need for these costly external power components.

Implementation

Normally when one commands a drive to Stop the drive will decelerate or let the motor coast and then turn off the output transistor stage. Our Unidrive has a built-in feature, Hold Zero Speed, whereby, after a commanded Stop, the output stage can remain active which typically is used to keep the motor shaft from rotating- the display will indicate **StoP**.

Often in the case of cooling tower blowers or similar applications where there are forces that can cause the motor to rotate when the drive is not actively running a commanded speed, this function is available to keep the motor still. However, a side benefit of this feature is that it will keep the motor warm thereby preventing moisture condensation and even ice build up on the motor housing during quiescent periods. The generated output would be exciting all 3 motor phases with a standby current thereby providing a more symmetrical current flow and evenly distributed heating within the motor stator coil versus the external Motor Heater which only excites 1 phase.

In our Unidrive, parameter #6.08, named Hold Zero Speed, is described as follows:



OPEN LOOP MODE

In the Open Loop- V/Hz Mode of operation (applications without encoder – non-Vector applications), this Holding Torque (and Winding Heating amount) can be adjustable by the Voltage Boost parameter #5.15. This parameter can be adjusted to place upto 25% of the motors rated voltage to create the required holdback standstill torque (and/or Winding Heating amount).

The Voltage Boost is typically adjusted to help provide the necessary motor breakaway torque when starting from zero speed when operating in the common V/Hz Open Loop mode. Typically, this amounts to 1-3%. For sufficient Holdback Standstill torque, you may require a little more. This would be too much for normal starting however. So we need a method of switching to a higher Boost amount during the Stop condition but fall back to the normal starting Boost amount when the drive is commanded to run.

The following configuration setup takes advantage of several of the standard built-in features within the Unidrive- specifically one of the 2 programmable logic gates is employed and we will use the free PID loop to accomplish switching the Voltage Boost between 2 levels based on whether we are stopped or not.

Configuration Setup

Open Loop – V/Hz Mode

Parameter	Value	Description
#5.14	Fd - 3	Fixed Boost Mode
#9.04	10.03	At Zero Speed/Frequency Reference
#9.06	1.11	Drive Stop Command
#9.07	1	Invert
#9.08	1	Invert
#9.10	14.05	PID Ref Inverter
#14.03	18.11	Dummy excitation for PID
#14.08	1	Enable PID
#14.10	1	Proportional Gain
#14.11	0	Integral Gain
#14.13	6-10	Holding Torque/Warming Amount - 1.5 - 2.5%
#14.14	2-4	Normal Starting Boost Amount - 0.5% - 1%
#14.16	5.15	Destination – Boost Parameter
#18.11	32000	Full Value
#6.08	1	Activate the Hold Mode

After entering parameters perform a Store.

Boost Settings

Holding Torque/Warming Amount

The Holding Torque/Warming Amount setting #14.13, can be 100 which will demand 25% boost at maximum. This represents 25% motor voltage. So for a boost value of 1.5-2.5% (or approximately 7-12v w/460vac motor) , this would be :

$$1.5/25 = 6\% \text{ of the full boost amount (1.5\%)}$$

$$2.5/25 = 10\% \text{ of the full boost amount (2.5\%)}$$

Keep in mind that on larger motors the stator resistance is quite low. For example, a 100HP (115FLA) motor may have a stator resistance of about 0.25ohms. With 3% boost or 14v, that would cause about 55A which is 50% of the motor current rating. One should start out with #14.13 low and gradually take it up while monitoring the active current (#4.02) and stay below 25-40% current typically while the Drive is Stopped.

Boost Settings con't

Normal Starting Boost

The normal starting boost amount with this configuration is set by parameter #14.14 which should normally be set around 0.5-1%. This would be calculated as follows:

$$\begin{aligned} 0.5/25 &= 2\% \text{ of the full boost amount} &= 0.5\% \\ 1/25 &= 4\% \text{ of the full boost amount} &= 1\% \end{aligned}$$

Lower HP motors can tolerate more boost because their stator resistance is higher.

If #14.14 is set too high, it can result in **OI.AC** trips (overcurrent trips) upon start or can cause stator saturation which can also result in the motor not starting.

Setting Boost Too High

If #14.13 is set too high, besides causing the motor to run warmer during the StoP condition, it can cause **It.AC** trips (I x t or Timed Overcurrent trips), which occur in order to protect the motor from excessive currents. This will be indicated by the display flashing OVLD then eventually the drive will trip indicating **It.AC** . One could start out with #14.13 low and gradually take it up while monitoring one of the output motor leg currents with an AC clamp-on ammeter and stay below 20-30% current typically.

If #14.14 is set too high, it can result in **OI.AC** trips (overcurrent trips) upon start or can cause stator saturation which can also result in the motor not starting.

Note:

When this mode is activated, a warning placard may be warranted at the VFD and motor, that voltage is present when the motor is stopped !

Questions ?? Ask the Author:

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