For the S300 and/or S600 Drives: Brake application note: ADDENDUM

Brake - option - category-1: APPLICATION of Motors

'all motion must stop before the removal of power' !

• Motor Brake FAQs:

1. Please define "normal" usage of the brakes.
   •Brakes supplied with motors (motor options) are static brakes NOT dynamic!
   • The only time this static brake should see a dynamic condition is in the event the plant losses power and the motor axis with a brake is moving at the time of that power loss.

2. What is normal life expectancy of the brakes; if a static brake is only used as a static brake how long will it last?
   •If used properly almost forever - static brake!

3. Are the brakes field-replaceable?
   •No

4. Can I utilize motors with brakes for category-0 ?
   •It is undesirable for most applications because of the lack of control (operator or otherwise) over dynamic utilization of the STATIC brake!

5. What happens if I use my static brake dynamically?
   •Brake pads will ware very quickly causing the compressed high density material to become an un-compressed dust matter expanding throughout the motor cavities (everywhere it can!).

•• Recommend all motors with a brake option and especially all vertical axes be designed, at a minimum, for E-stop/Priority-stop category-1:

'all motion must stop before the removal of power' !

••• For all applications with brake and especially vertical axes:

Category-1 - 'all motion must stop before the removal of power'; 'removal of power' is for the 3-phase going to the drive to develop the DC bus, NOT the 24 VDC logic supply; and make sure:

24 VDC logic supply is maintained

ACTFAULT=1 - if a fault occurs, an Emergency Stop procedure is initiated. (Consult: DECstop).

EMRGTO = x - set x to some minimum time - default [5000mSec] is to long for most applications.

•EMRGTO defines [1] the emergency time out for the ACTFAULT=1 and STOPMODE=1 operations.

Tbrake0 = xx mSec -minimum - default [20mSec]; consult brake specification. Defines drive reaction/response delay; brake must physically disengage before a command variable is acted upon. **NOTE:** If a vertical axis and Tbrake0 time is to long, the axis of motion will drop some before velocity-loop engages, in this case continue to reduce the Tbrake0 time until it does not fall; but do not overdue it, otherwise the motor will drive against the holding brake causing excessive heat, motor loading, and brake ware.

Tbrake= xx mSec - minimum - default [100mSec]; consult brake specification. Defines drive disable delay; brake must physically engage before drive is disabled.

DECDIS= x (mSec) - default [20mSec] - should be set to the minimum time that the axis can be stopped without exceeding the maximum capability of the weakest part in the drive transmission and/or Ipeak for the time available.

MBRAKE=1 - Enables drive brake functions.

VEL0= x - this number should be as low as possible, even 1 rpm, but <u>needs to/should be</u> less than 3% of maximum application speed.

STOPmode =1 - disables the output stage by decelerating the motor to '0rpm' utilizing the defined ramp set by ' DECDIS'; the output stage is disabled after the velocity falls below the absolute value(abs) threshold: 'VEL0'. (consult: DECDIS).

DECStop= x (mSec) - should be set to the minimum time that the axis can be stopped in, without exceeding the maximum capability of the weakest part in the drive transmission and/or Ipeak for the time available. Normally set to the same value as DECDIS.

If for some reason it is undesirable to have an E-Stop wired into the Hardware-Enable, one can notify the drive of an E-Stop condition (that an E-Stop is present) by the utilization of an <u>Input: x</u> with the mode (INxMODE=27) for that specific <u>Input: x</u>.

INxMODE=27 or equivalent - utilize one of the Inputs to change state when the E-stop button is engaged; mode: '27' defines an E-stop button is engaged when a LOW input signal is presented to Input: 'x'.

In addition, an <u>Output: y</u> can be utilized to present a signal back to a controller, operator panel, or other, for the control/disengagement of the 3-phase contactor by setting the mode (**0yMODE**=1) of the specific <u>output: y</u>, that motion has stopped within the speed/velocity set by **0yTRIG** = z.

●●●● 3-phase breaker to disengage:

0yMODE=1 output: 'x' will have a high signal out as long as the motor velocity is below the absolute value(abs) of 01TRIG; output: 'x' will become low again if abs(V) > abs(01TRIG)+(0.01*abs(MSPEED)).

0yTRIG = z - this number should be as low as possible, even 1 rpm, but needs to/should be less than 3% of maximum application speed; set it <= VEL0, or some external time delay requirement to make sure all motion has stopped before the removal of the 3-phase to the drive.

Notations:

1) Customer to first utilize the 'Start with' or Maximum(Max) time provided:

   a) On ENABLE of the axis, if vertical axis falls an unacceptable amount after motor tuning is complete, the time should be reduced for safety reasons;

   b) On ENABLE of the axis, if the axes does not fall at all it is likely the time needs to be increased because this means that the motor could be and/or is driving through a closed brake before it is fully released (if this condition is allowed to continue repeatedly and over many cycles it will have a severe impact on the life of the brake and possibility the motor itself).

   c) There is a two(2) fold purpose here; Maximize Safety for personnel and machine, AND Maximize brake disc life against any improper use.

	Engage-brake [disengage-coil]		dis-engage-brake [engage-coil]		
Motor - Series:	**TBRAKE** - setting	(mSEC)	**TBRAKE0** - setting		(mSEC)
AKM2x.....	.....	18 typical	Start with	50	20 typical
AKM3x.....	.....	10 typical	Start with	50	25 typical
AKM4x.....	.....	15 typical	Start with	70	35 typical
AKM5x.....	.....	15 typical	Start with	120	80 typical
AKM6x.....	.....	20 typical	Start with	140	105 typical
AKM7x.....	.....	35 typical	Start with	160	110 typical
BH/MH-12x.....	.....	100 max	Start with	60	200 max
BH/MH-22x.....	.....	100 max	Start with	100	250 max
BH/MH-42x.....	.....	100 max	Start with	130	250 max
BH/MH-62x.....	.....	100 max	Start with	160	250 max
BH/MH-82x.....	.....	100 max	Start with	160	250 max
MTC-15xx.....	.....	14 max	Start with	28	28 max
MTC-3xx.....	.....	100 max	Start with	120	250 max
MTC-5xx.....	.....	100 max	Start with	140	250 max
MTC-7xx.....	.....	100 max	Start with	160	250 max

- Note: S300/S600 series drives do not utilize a Fly-Back diode; circuits with a Fly-Back

diode will take longer times.

●●●●● These variable settings will cover E-stop, and the removal of the enable line when an axis is moving, and faults within the drive; if the velocity reduction to ~0rpm fails the power stage will be disabled after the set EMRGTO time has lapsed.

The values set above engage the brake after a set time delay after the motor has gone below the value of VEL0 and the 3-phase breaker will disengage power after 0xTRIG.

After an E-Stop/fault one will need to clear faults by an input, or serial communication, or cycle 24VDC logic power.

For time diagrams:
Reference: Stop and Emergency Stop Application Note: Section: III.1 and/or go to the ***Table of contents*** of the appropriate Installation manual (S300, S601-S620, or S640/S670) and refer to the page/pages entitled: *Control for motor-holding brake.*

---

[1] After a ACTFAULT (drive error) or STOPMODE (power stage enable) event, the drive tries to reduce the velocity to zero. If this fails, the power stage will be disabled after the set EMRGTO time has lapsed. This condition may happen in the event of a run away where we no longer have control over the amplifier during the [desired] controlled shut down.

HHG - 09Oct:2005 rev-2.7 [draft]