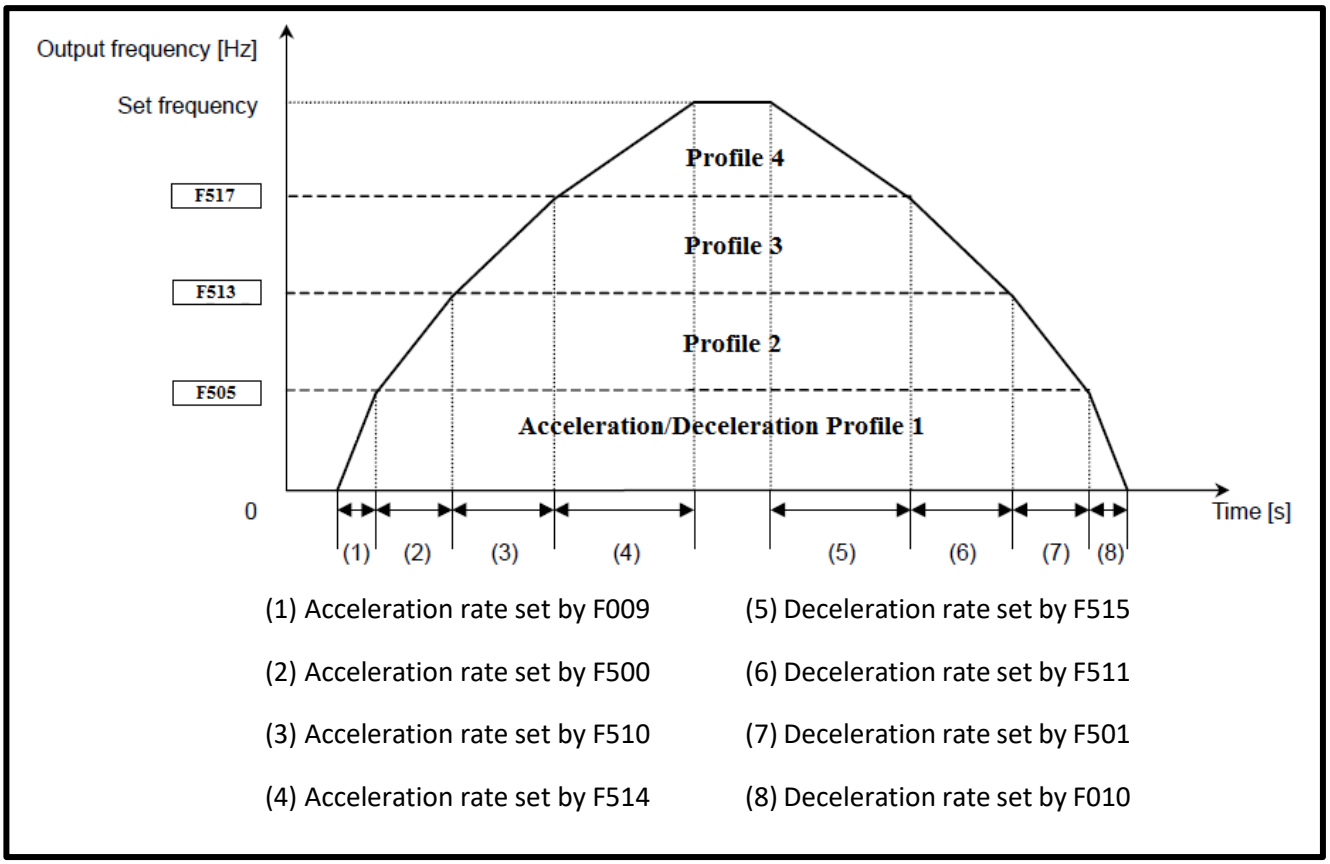
G9/H9 Application Guideline 15.0

Acceleration/Deceleration Time Switching

Introduction

This application note describes how to program a drive to switch acceleration or deceleration rates. There may be applications where you want to accelerate at multiple rates before you reach your desired operating frequency. For example, maybe your system should not be operated for an extended period of time at a low frequency, so you can accelerate quickly when the drive starts and then decrease the acceleration rate when you reach higher frequencies. The same thing can be done for deceleration rates. The 9-series can have up to 4 different accelerating or decelerating rates. The G9/H9 gives you two options on how to change between rates: based on programmed set frequencies or based on switches on digital input terminals.

Diagram



(1) Acceleration rate set by F009

(2) Acceleration rate set by F500

(3) Acceleration rate set by F510

(4) Acceleration rate set by F514

(5) Deceleration rate set by F515

(6) Deceleration rate set by F511

(7) Deceleration rate set by F501

(8) Deceleration rate set by F010

Programming: Option 1

PARAMETER	NAME	MENU PATH	DEFAULT VALUE
F009	Acceleration Time 1	Program→Fundamental→Accel/Decel 1 Settings	10.0 s
F010	Deceleration Time 1	Program→Fundamental→Accel/Decel 1 Settings	10.0 s
F500	Acceleration Time 2	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F501	Deceleration Time 2	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F505	Accel/Decel Switching Frequency 1	Program→Special→Accel/Decel Special	0.00 Hz
F510	Acceleration Time 3	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F511	Deceleration Time 3	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F513	Accel/Decel Switching Frequency 2	Program→Special→Accel/Decel Special	0.00 Hz
F514	Acceleration Time 4	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F515	Deceleration Time 4	Program→Special→Acc/Dec 1-4 Settings	10.0 s
F517	Accel/Decel Switching Frequency 3	Program→Special→Accel/Decel Special	0.00 Hz

Parameter Descriptions

F009: Acceleration rate for profile 1.

F010: Deceleration rate for profile 1.

F500: Acceleration rate for profile 2.

F501: Deceleration rate for profile 2.

F505: Frequency at which the drive switches from profile 1 to profile 2 on acceleration, and from profile 2 to profile 1 on deceleration.

F510: Acceleration rate for profile 3.

F511: Deceleration rate for profile 3.

F513: Frequency at which the drive switches from profile 2 to profile 3 on acceleration, and from profile 3 to profile 2 on deceleration.

F514: Acceleration rate for profile 4.

F515: Deceleration rate for profile 4.

F517: Frequency at which the drive switches from profile 3 to profile 4 on acceleration, and from profile 4 to profile 3 on deceleration.

Note: All acceleration and deceleration rates are based on how long the drive will take to get from 0.0 Hz to Maximum Frequency (F011), or vice versa. In order to get the desired rates, you will need to take this into account.

Programming: Option 2

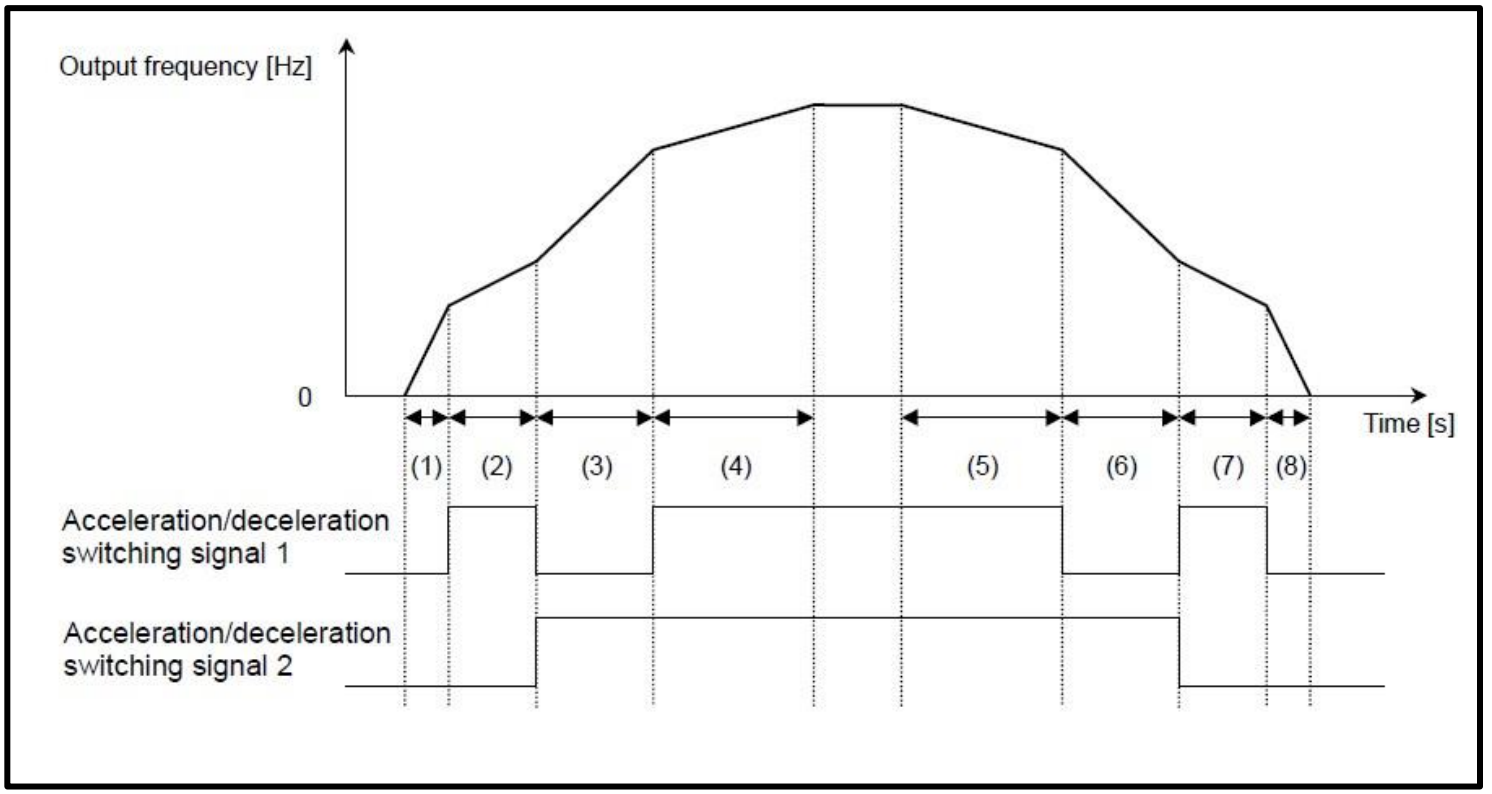
PARAMETER	NAME	MENU PATH	DEFAULT VALUE	NEW VALUE
F116	Input Terminal 6 (S2) Function	Program→Terminal→Input Terminals	12: Preset Speed 2	24: Accel/Decel Switching 1
F117	Input Terminal 7 (S3) Function	Program→Terminal→Input Terminals	14: Preset Speed 3	26: Accel/Decel Switching 2

Parameter Descriptions

By changing these two parameters to Accel/Decel Switching, you can change your acceleration profile from your terminal board instead of a hard set frequency in the drive. Your parameter selections for your different acceleration and deceleration rates will not be any different from the programming discussed previously in option 1. However, make sure that you do not change the parameters that control the frequencies at which the drive will change profiles. These are F505, F513, and F517. You want to leave them at 0.0 Hz so that they are disabled. Below is a chart and graph that illustrate option 2.

Accel/Decel Switch Terminal		Profile #
#1	#2	
0	0	1
1	0	2
0	1	3
1	1	4
1 – Terminal Active		

As you can see from the chart, you would only need to program one terminal to “24: Accel/Decel Switching 1” if you only need to change rates once. You can use any of your discrete input terminals to accomplish this. S2 was just the one we picked to use in our example.



Programming Example

Let's use the application mentioned in the introduction as an example. Suppose our drive is hooked up to a pump, and the pump cannot run for long periods of time under 30 Hz. The customer would prefer the drive to ramp to 30 Hz in 5 seconds, and then go from 30 Hz to 60 Hz in 10 seconds. You can accomplish this with three parameters.

The first parameter that you need to set is **Acceleration Time 1**. We need to take in to account the fact that acceleration and deceleration rates are based on the drive going from 0.0 Hz to Max Frequency. The default value for that frequency on a G9/H9 is 80.0 Hz.

$$\frac{80\ \text{Hz}}{30\ \text{Hz}} = \frac{x}{5\ \text{sec}} .x = \frac{80}{30} * 5 \approx 13.0\ \text{sec}$$

PARAMETER	NAME	MENU PATH	NEW VALUE
F009	Acceleration Time 1	Program→Fundamental→Accel/Decel 1 Settings	13.0 s

The next parameter is **Acceleration Time 2**. This parameter will set the acceleration rate after our switching frequency, which will be our last parameter. Now we want the drive to accelerate from 30.0 Hz to 60 Hz in 10.0 seconds. To find our acceleration rate, we will find the Hz/sec and then multiply by our Maximum Frequency to obtain the total time.

$$\frac{60\ \text{Hz} - 30\ \text{Hz}}{10.0\ \text{sec}} = \frac{3\ \text{Hz}}{1\ \text{sec}}$$

$$\frac{1\ \text{sec}}{3\ \text{Hz}} = \frac{x}{80\ \text{Hz}} \quad .x = \frac{1\ \text{sec}}{3\ \text{Hz}} * 80\ \text{Hz} \approx 26.6\ \text{sec}$$

PARAMETER	NAME	MENU PATH	NEW VALUE
F500	Acceleration Time 2	Program→Special→Acc/Dec 1-4 Settings	26.6 s

The third and final parameter we want to set is **Accel/Decel Switching Frequency 1**. This is the frequency we want the drive to switch from **Acceleration Time 1** to **Acceleration Time 2**. In our application this is 30.0 Hz.

PARAMETER	NAME	MENU PATH	NEW VALUE
F505	Accel/Decel Switching Frequency 1	Program→Special→Accel/Decel Special	30.0 Hz

These parameters can be accessed through their menu paths, or directly by using Direct Access in the Program Menu.

Revision History:

Rev.	Date	Written/Revised By	Approved By	Description
0	11/30/11	Joshua Austin	Eric Houg	Original Document.