



UDC 3500 Application Note

Setpoint Rate/Ramp/Program Overview

Introduction

The Setpoint Ramp configuration group lets you enable and configure any of the following:

- **SP RATE** – a specific rate of change for any local setpoint change.
- **SP RAMP** – a single setpoint ramp that occurs between the current local setpoint and a final local setpoint over a time interval of 1 to 255 minutes.
- **SP PROG** – a ramp/soak profile in a 20-segment program.

This section explains the operation of each selection and configuration reference where necessary.

PV Hot Start

This is a standard feature. At power-up, the setpoint is set to the current PV value and the Rate or Ramp or Program then starts from this value.

RUN/HOLD key

You can start or stop the Ramp or Program using the RUN/HOLD key.

Setpoint Rate

Introduction

When you have configured a SETPOINT RATE, it will apply immediately to local setpoint change.

Configuration check

Make sure:

- SPRATE is enabled
- A Rate Up (EUHRUP) or Rate Down (EUHRDN) value has been configured in Engineering units per hour.

ATTENTION

A value of 0 will imply an immediate change in setpoint, that is, NO RATE applies. See *Subsection– Configuration group “SPRAMP” for details.*

Operation

When a change to local setpoint is made, this controller will ramp from the original setpoint to the “target” setpoint at the rate specified.

The current setpoint value is shown as **SPn XXXX** on the lower display while the “target” setpoint is shown as **SP XXXX** on the lower display.



UDC 3500 Application Note

Power outages

If power is lost before the “target” setpoint is reached, upon power recovery, the controller powers up with Sn = Current PV value and it automatically “Restarts” from Sn = current PV value up to the original “target” setpoint.

Setpoint Ramp

Introduction

When you have configured a SETPOINT RAMP, the ramp will occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

Configuration Check






Make sure

- SPRAMP is enabled
- SP RATE and SPPROG are not running.
- A Ramp Time (TIMIN) in minutes has been configured
- A final setpoint value (FINLSP) has been configured. See Subsection – Configuration group “SPRAMP” for details.

Operation

Running a Setpoint Ramp includes starting, holding, viewing the ramp, ending the ramp and disabling it. See Table -1.

Table -1 Running A Setpoint Ramp

Step	Operation	Press	Result
1	Select Automatic Mode		“A” indicator is on. <i>Upper Display</i> = “H” and PV value <i>Lower Display</i> = SP and Present value
2	Set Start Setpoint		Until start SP value is in lower display <i>Upper Display</i> = “H” and PV value <i>Lower Display</i> = SP and start SP value
3	Start the Ramp		You will see <i>Upper Display</i> = “R” and a changing PV value <i>Lower Display</i> = SP and a changing SP value increasing or decreasing toward the final SP value
4	Hold/Run the Ramp		This holds the ramp at the current setpoint value. Press again to continue.
5	View the remaining ramp time		Until you see <i>Upper Display</i> = PV value <i>Lower Display</i> = RAMPXXXM (time remaining in minutes)



UDC 3500 Application Note

Step	Operation	Press	Result
6	End the Ramp		When the final setpoint is reached, “R” changes to “H” in the upper display and the controller operates at the new final setpoint.
7	Disable SPRAMP		See Section Error! Reference source not found. – Configuration group “SPRAMP” for details.

Power Outage

If power is lost during a ramp, upon power-up the controller will be in HOLD and the setpoint value will be the setpoint value prior to the beginning of the setpoint ramp.

The ramp is placed in hold at the beginning.

Configure the mode at Set Up Group “CONTROL”, function prompt “PWR MODE”.

Setpoint Ramp/Soak Programming

Introduction

The term “programming” is used here to identify the process for selecting and entering the individual ramp and soak segment data needed to generate the required setpoint versus time profile (also called a program).

There are new features in this group that do not appear in previous NGC products:

- 20 segments instead of 12
- 10 Guaranteed Soak Settings (one for each Soak Segment)
- PID Set selection for each Segment

A segment is a ramp or soak function which together makes up a setpoint program. Setpoint Ramp/Soak Programming lets you configure 10 ramp and 10 soak segments to be stored for use as one program or several small programs. You designate the beginning and end segments to determine where the program is to start and stop.

Review program data and configuration

While the procedure for programming is straightforward, and aided by prompts, we suggest you read “Program Contents”. Table 2 lists the program contents and an explanation of each to aid you in configuration. Then refer to Subsection– Configuration to do the setpoint program.

Make sure SPRAMP is disabled.

Fill out the worksheet

Refer to the example in Figure 1 and draw a Ramp/Soak Profile on the worksheet provided (Figure 2) and fill in the information for each segment. This will give you a record of how the program was developed.



UDC 3500 Application Note

Operation

Refer to Table 3 Run/Monitor the program.

Program Contents

Table -2 lists all the program contents and a description of each.

Table -2 Program Contents

Associated Prompts	Contents	Definition
STRT SEG	Start segment number	The start segment number designates the number of the first segment. Range = 1 to 19
END SEG	End segment number	The end segment number designates the number of the last segment, it must be a soak segment (even number). Range = 2 to 20
RECYCLES	Recycle number	The recycle number allows the program to recycle a specified number of times from beginning to end. Range = 0 to 99
STATE	Program state	The program state selection determines the program state after completion. The selections are: <ul style="list-style-type: none"> • DISABLE = program is disabled (so program value changed to DISABLE) • HOLD = program on hold
PROG END	Program termination state	The program termination state function determines the status of the controller upon completion of the program. The selections are: <ul style="list-style-type: none"> • LAST = controls to last setpoint • FAILSAFE = manual mode and failsafe output.
POWER OUT	Program state after a power outage	This configuration determines what the Program will do in the case of a power outage during the Program. This prompt only appears on those instruments that have the Real Time Clock option. The selections are: <ul style="list-style-type: none"> • ABORT = Program terminated on power up. Instrument controls per the PROG END configuration. • RESUME = Continue at the same point in segment and cycle where power was lost. • RESTART = Restart program at the beginning of the first program segment in the same cycle where power was lost.
KEYRESET (ToBEGIN)	Reset Program to Beginning	When enabled, this selection allows you to reset via the keyboard to the beginning of the program and resets the Recycle value to 0. The program mode is placed in HOLD. If the current Local Setpoint 1 value is at any value other than that Setpoint value used in the first Soak segment in the program, then the program will restart at the current Local



UDC 3500 Application Note

Associated Prompts	Contents	Definition
		<p>Setpoint 1 value and at the beginning of the first Ramp segment in the program.</p> <p>If the current Local Setpoint 1 value is at the same Setpoint value as that used for the first Soak segment in the program, then the first Ramp segment is skipped and the program will restart at the beginning of the first Soak segment in the program.</p>
KEYRESET (RERUN)	Rerun current cycle	RERUN CURRENT CYCLE —When enabled, this selection allows you to reset the program via the keyboard to the beginning of the current cycle. The Recycle value is not affected. The program mode (RUN or HOLD) is not affected.
HOTSTART	Hot Start	<p>This function determines whether LSP1 or PV is used as the setpoint when the program is initially changed from HOLD to RUN. The selections are:</p> <p>DISABLE = When the program is initially changed from HOLD to RUN the present LSP1 value is captured as the default setpoint. If the program is terminated or the power cycled before the program has completed, the LSP1 is used as the control setpoint. The beginning segment uses this value as the initial ramp setpoint.</p> <p>ENABLE = When the program is initially changed from HOLD to RUN the present PV value is captured and used as the beginning setpoint value for the ramp segment. If the program is terminated before completion, the setpoint value will revert back to the PV value captured at the initial HOLD to RUN transition. If the power is cycled before program completion, upon power-up the setpoint is set to the PV value at power-up and when the program is restarted that setpoint value is used initially.</p>
RAMPUNIT SEGxRAMP or SEGxRATE	Ramp time or rate segments	<p>A ramp segment is the time it will take to change the setpoint to the next setpoint value in the program.</p> <p>Ramps are odd number segments (1, 3, . . . 19). Segment #1 will be the initial ramp time.</p> <p>Ramp time is determined in either:</p> <p style="padding-left: 40px;">TIME - Hours.Minutes Range = 0-99hr.59 min.</p> <p style="text-align: center;">or</p> <p style="padding-left: 40px;">RATE - EU/MIN or EU/HR Range = 0 to 999</p> <p>This selection of time or rate is made at prompt “RAMPUNIT”. Set this prompt before entering any Ramp values.</p> <p>ATTENTION Entering “0” implies an immediate step change in setpoint to the next soak.</p>
SEGx SP	Soak segments	A soak segment is a combination of soak setpoint (value) and



UDC 3500 Application Note

Associated Prompts	Contents	Definition
SEGxTIME		<p>a soak duration (time).</p> <ul style="list-style-type: none"> • Soaks are even number segments (2, 4, . . . 20). • Segment 2 will be the initial soak value and soak time. • The soak setpoint range value must be within the setpoint high and low range limits in engineering units. • Soak time is the duration of the soak and is determined in: TIME – Hours:Minutes Range = 0-99 hr:59 min.
SEGX PID	PID Set	<p>These prompts will appear only when the number of PID sets selected in the Control or Control 2 Setup Group is set to 4KEYBD. Each Ramp and Soak segment may select a specific PID set. A Setpoint Program enabled only for Loop 1 will use Loop 1 PID Sets. A Setpoint Program enabled only for Loop 2 will use Loop 2 PID Sets. A Setpoint Program enabled for both Loop 1 and Loop 2 will use Loop 1 PID Sets.</p> <p>Range: PID Set 1 to 4</p>
SOAK2DEV <i>through</i> SOAK20DEV	Guaranteed Soak Deviation Value	<p>Each individual soak segment can have a unique guaranteed deviation value of from 0.000 to ± 99.99 in engineering units.</p> <p>Guaranteed Soak deviation values greater than zero ensure that the soak segment's process variable is within the \pm deviation value for the configured soak time. Whenever the \pm deviation value is exceeded, the soak timer stops until the process variable gets within the \pm deviation value. While the soak timer is halted, "R" and "H" will alternate in the upper display. When the PV gets within the \pm deviation value, the timer will resume and a steady "R" will appear in the upper display.</p> <p>There are no guaranteed soaks whenever the deviation value is configured to 0.00 (that is, soak segments start timing soak duration as soon as the soak setpoint is first reached, regardless of where the process variable remains relative to the soak segment).</p> <p>The decimal location used here corresponds decimal configuration chosen in the Display Set up group.</p>



UDC 3500 Application Note

Ramp/soak profile example

Before you perform the actual configuration, we recommend that you draw a Ramp/Soak profile in the space provided on the “*Program Record Sheet*” and fill in the associated information. An example of a Ramp-Soak Profile is shown in Figure -1. Start setpoint is at 200 degrees F.

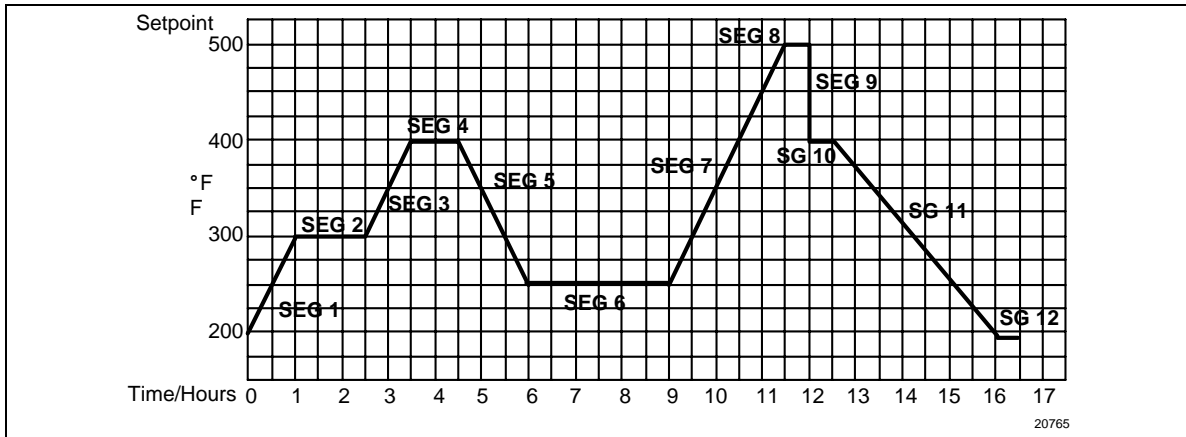


Figure -2 Ramp/Soak Profile Example
Ramp/Soak Profile Example (Using 12 Segments)

Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.		1	SEG4 SP	Soak SP	4	400
END SEG	End Seg.		12	SEG4TIME	Soak Time	4	1 hr.
RAMP UNIT	Engr. Unit for Ramp		TIME	SEG5RAMP	Ramp Time	5	1 hr:30 min.
RECYCLES	Number of Recycles		2	SEG6 SP	Soak SP	6	250
SOAK DEV	Deviation Value		0	SEG6TIME	Soak Time	6	3 hr:0 min.
PROG END	Controller Status		LAST SP	SEG7RAMP	Ramp Time	7	2 hr:30 min.
STATE	Controller State at end		HOLD	SEG8 SP	Soak SP	8	500
KEYRESET	Reset SP Program		DISABLE	SEG8TIME	Soak Time	8	0 hr:30 min.
POWER UP	Program Status at Power up		ABORT	SEG9RAMP	Ramp Time	9	0
HOTSTART	PV Hot Start		DISABLE	SG10 SP	Soak SP	10	400
SEG1RAMP	Ramp Time	1	1 hr.	SG10 TIME	Soak Time	10	0 hr:30 min.
SEG2 SP	Soak SP	2	300	SG11RAMP	Ramp Time	11	3 hr:30 min.
SEG2TIME	Soak Time	2	1 hr:30 min.	SG12 SP	Soak SP	12	200



UDC 3500 Application Note

SEG3RAM P	Ramp Time	3	1 hr.	SG12TIME	Soak Time	12	0 hr:30 min.
---------------------	-----------	---	-------	-----------------	-----------	----	--------------

Program record sheet

Draw your ramp/soak profile on the record sheet shown in Figure 2 and fill in the associated information in the blocks provided. This will give you a permanent record of your program and will assist you when entering the Setpoint data.

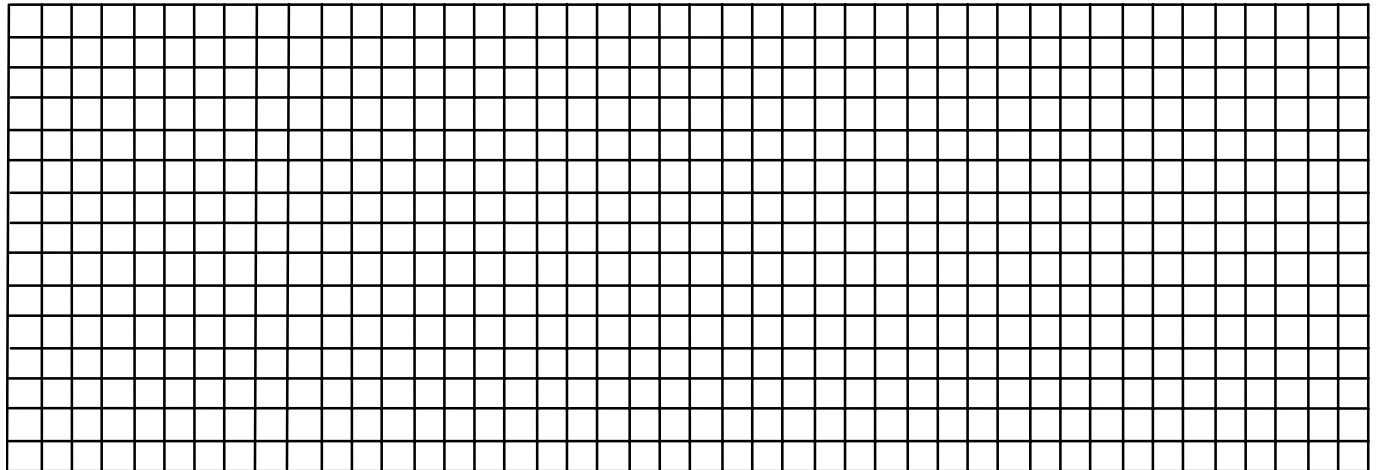


Figure -3 Program Record Sheet

Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg.			SEG3RAMP	Ramp Time	3	
END SEG	End Seg.			SEG3 PID	PID Set	3	
RAMPUNIT	Engr. Unit for Ramp			SEG4 SP	Soak SP	4	
RECYCLES	Number of Recycles			SEG4TIME	Soak Time	4	
PROG END	Controller Status			SOAK4DEV	Guar. Soak	4	
STATE	Controller State at end			SEG4 PID	PID Set	4	
POWER UP	Program Status at Power up			SEG5RAMP	Ramp Time	5	
KEYRESET	Reset SP Program			SEG5 PID	PID Set	5	
HOT START	PV Hot Start Program			SEG6 SP	Soak SP	6	
SEG1RAMP	Ramp Time	1		SEG6TIME	Soak Time	6	
SEG1 PID	PID Set	1		SOAK6DEV	Guar. Soak	6	
SEG2 SP	Soak SP	2		SEG6 PID	PID Set	6	



UDC 3500 Application Note

Prompt	Function	Segment	Value
SEG2TIME	Soak Time	2	
SOAK2DEV	Guar. Soak	2	
SEG2 PID	PID Set	2	
SEG8 SP	Soak SP	8	
SEG8TIME	Soak Time	8	
SOAK8DEV	Guar. Soak	8	
SEG8 PID	PID Set	8	
SEG9RAMP	Ramp Time	9	
SEG9 PID	PID Set	9	
SG10 SP	Soak SP	10	
SG10 TIME	Soak Time	10	
SOAK10DEV	Guar. Soak	10	
SG10 PID	PID Set	10	
SG11RAMP	Ramp Time	11	
SG11 PID	PID Set	11	
SG12 SP	Soak SP	12	
SG12TIME	Soak Time	12	
SOAK12DEV	Guar. Soak	12	
SG12 PID	PID Set	12	
SG13RAMP	Ramp Time	13	
SG13 PID	PID Set	13	
SEG14 SP	Soak SP	14	
SG14TIME	Soak Time	14	
SOAK14DEV	Guar. Soak	14	
SG14 PID	PID Set	14	

Prompt	Function	Segment	Value
SEG7RAMP	Ramp Time	7	
SEG7 PID	PID Set	7	

SG15RAMP	Ramp Time	15	
SG15 PID	PID Set	15	
SEG16 SP	Soak SP	16	
SG16TIME	Soak Time	16	
SOAK16DEV	Guar. Soak	16	
SG16 PID	PID Set	16	
SG17RAMP	Ramp Time	17	
SG17 PID	PID Set	17	
SEG18 SP	Soak SP	18	
SG18TIME	Soak Time	18	
SOAK18DEV	Guar. Soak	18	
SG18 PID	PID Set	18	
SG19RAMP	Ramp Time	19	
SG19 PID	PID Set	19	
SEG20 SP	Soak SP	20	
SG20TIME	Soak Time	20	
SOAK20DEV	Guar. Soak	20	
SG20 PID	PID Set	20	

Run/Monitor the program

Prior to running the program, make sure all the “SP PROG” function prompts under the Set Up group “SP RAMP” have been configured with the required data.

“H” appears in the upper display indicating that the program is in the HOLD state.

ATTENTION SP Program parameter *cannot* be changed during RUN state; the unit must be in the HOLD state in order to change parameters.

Run/Monitor functions






Table 3 lists all the functions required to run and monitor the program.

Table 3 Run/Monitor Functions

Function	Press	Result
----------	-------	--------



UDC 3500 Application Note

Function	Press	Result
Set the Local Setpoint		<i>Upper Display = PV value</i> <i>Lower Display = SP</i>
	▲ or ▼	To set the Local Setpoint value to where you want the program to start out.
Run State		Initiates the setpoint program. "R" appears in the upper display indicating that the program is running.
Hold State		Holds the setpoint program. "H" appears in the upper display indicating that the program is in the HOLD state. The setpoint holds at the current setpoint.
External Hold		If one of the Digital Inputs is programmed for the HOLD function, then contact closure places the controller in the HOLD state, if the setpoint program is running. The upper display will periodically show "H" while the switch is closed. ATTENTION The keyboard takes priority over the external switch for the RUN/HOLD function. Reopening the HOLD switch runs the program.
Viewing the present ramp or soak segment number and time	 until you see	<i>Upper Display = PV value</i> <i>Lower Display = XXRAHH.MM for Ramps or = XXSKHH.MM for Soaks</i> Time remaining in the SEGMENT in hours and minutes. XX = The segment number, 1 to 12.
Viewing the number of cycles left in the program	 until you see	<i>Upper Display = PV value</i> <i>Lower Display = RECYC XX</i> Number of cycles remaining in the setpoint program. X = 0 to 99
End Program		When the final segment is completed, the "R" in the upper display either changes to "H" (if configured for HOLD state), or disappears (if configured for disable of setpoint programming). <ul style="list-style-type: none"> The controller then either operates at the last setpoint in the program or goes into manual mode/failsafe output, depending upon the "LAST" configuration.

Continued



UDC 3500 Application Note

Function	Press	Result
Disable Program		See Configuration Group “SP PROG” for details.

Power outage

ATTENTION If power is lost during a program, upon power-up the controller will be in hold and the setpoint value will be the setpoint value prior to the beginning of the setpoint program. The program is placed in hold at the beginning. The mode will be as configured under “PWR UP” in the “CONTROL” group.

Digital Input (remote switch) operation

Program can be placed in RUN, HOLD, RERUN, or BEGIN state through a remote dry contact connected to optional digital input terminals, as follows:

RUN—contact closure places Program in RUN state, OR

HOLD—contact closure places Program in HOLD state

RERUN—contact closure allows the Setpoint Programmer to be reset to the initial segment of its current cycle, unit stays in previous mode.

Opening the contact will cause the Controller to revert to its original state.

BEGIN— Contact closure resets SP Program back to the beginning of the first segment in the program and place the program in the HOLD mode. Program cycle number is not affected. Reopening switch has no effect.

Opening the contact will cause the Controller to revert to its original state.