Supplementary Instruction Manual

For the Ramp/Soak option of SYL-2XXXP series Programmable controller Version 1.5

This is a supplementary manual for the SYL-2XXXP controller. It is only for operating the programmable steps (ramp and soak steps) functions. The main manual for the SYL-2XXXP is the same as the SYL-2XXX. It covers all the regular set up and operation instructions.

SYL-2XXXP series programmable controllers with the ramp/soak option (including SYL-2432P and SYL-2532P) are designed for applications where it is desirable to have the set point automatically adjust itself over time.

1. Features

- 30 steps of program control for ramping and soaking process.
- High flexibility in program and operation. It has programmable/maneuverable commands such as jump (for loops), run, Hold and stop. The program can even be modified while it is running.
- The program can also control the two relays that are used for alarms. This feature can be used to notify the operator of the stage of the operation, or to signal other equipment.
- Measurement start-up function and ready function can make the program run more efficiently.
- 4 power-off/power-on event handing modes can be selected. This can prevent the program control from being adversely affected by unexpected power interruptions.

2. Terms and Functions:

Program StEP: The number of the program StEP can be defined from 1 to 30. The current stEP is the program StEP being executed.

StEP time: the total running time of a program Step. The unit is minute and the available value range from 1 to 9999.

Run time: time that the current StEP has run. As the running time reaches the StEP time, the program will jump to the next StEP automatically.

Jump: The program can jump to any other steps in the range of 1 to 30 automatically as you programmed in the program StEP. It can also be used to perform cycle control. If StEP number is modified, the program also will jump. Furthermore if the program StEP reaches and finished the 30th StEP, the program will jump back to the first StEP and run automatically.

Run/Hold: when the program is in the running status, the timer counts down, and the set point value changes according to the preset curve. When the program is in the holding status, the timer stops, and the set point remains. The holding operation can be programmed into the program StEP. When the program meets with the StEP, the StEP time of that is set to zero, or when a jumping StEP jumps to another jumping StEP, the program will get in Hold status. Hold/Run operation can also be performed manually at any time.

Stop: when the stop operation is activated, the program will stop, the running time will be reset and timer will stop, event output switch is reset and the output control is stopped. If run operation is activated when instrument is in the stop status, the program will start-up and run from the StEP 1. The stop function can be programmed into the program StEP. The running StEP number can be set at the same time. The stop operation can also be performed manually at any time. (After stop operation is done, the StEP number will be set to 1, but user can modify it again).

Power interrupt: means power turned off or unexpected power failure at running status. Altogether 4 handling modes are selectable for user.

Event output: Event output can be programmed in the controller. It can trigger two alarm contacts to make external equipment operate with interlock.

Measurement value start-up: If the difference between PV and SV is larger than the deviation alarm setting at the start-up, the controller will adjust the PV until alarm is off before the timer start

3. Program operation

3.1 Program Setup

Press the (A/M) key to bring the instrument into the program setup mode, and the instrument will display the temperature setpoint of the current StEP (indicated by "C" in the upper display followed by the StEP number). Use the (A/M) key to choose which digit to edit (indicated by the flashing decimal point). After adjusting the temperature set point (–1999 to +9999), press the SET key once again, and the current StEP's run time will be displayed ("t" in the upper display). In each program StEP, the temperature and the time is displayed in turn. Hold down the (A/M) key and press V to go back to the previous parameter. Hold (A/M) and press SET to exit program setup mode. Modifying program steps while a program is running is permitted. See section 4 for a programming example

Note: the above operation is inhibited if the program setup function is locked (refer to the later text for the introduction of the LocK parameter at section 3.9).

3.2 Program Hold

The temperature is still controlled, but the timer is paused so the current set point remains. In order to manually activate hold status, press the V key for about 2 seconds until "HoLd" appears in the lower display window. The A/M LED blinks in this mode

3.3 Program Stop

This operation forces the instrument to stop running. The StEP number is reset to 1, the event output is cleared, and the control output is turned off. In order to manually execute the stop operation, press and hold the Λ key for about 2 seconds until the lower display window displays "StoP". The A/M LED is off in this mode.

3.4 Run Program

In order to continue the program when the controller is in Hold mode (or restart it from Stop mode), press the V key for about 2 seconds until the lower window displays "run". When a program is running, the A/M indicator LED is on.

3.5 Run Time/Command Parameter

tXX=1 to 9999 (min) setting time of StEP number XX

tXX=0 The instrument is put in hold mode on StEP number XX until manually released by the operator.

tXX=-1 to -240 represents an operation command such as run, Hold, stop, jump and event output. The

number is calculated according to the equation $tXX = -(A^*30+B)$. "B" is the number (1 to 30) of the next step for the program to jump to and "A" is the event that is triggered:

- A=0 no effect (for jump function only)
- A=1 switch on AL2
- A=2 switch on AL1
- A=3 switch on AL1 and AL2
- A=4 Stop the instrument (B must be set to 1)
- A=5 switch off AL2
- A=6 switch off AL1
- A=7 switch off AL1 and AL2
- tXX=-240 A pulse of 0.5 second occurs on AL1, and then, the instrument goes on its program. The pulse will be cancelled if AL1 has been switch on (whatever by the event output or by the alarm signal)

Examples:

- Jump from StEP4 to StEP5 and switch on AL2. Time setup is: t04=-(1X30+5)=-35
- Jump from StEP6 to StEP1 and switch off AL2. Time setup is: t06=-(5X30+1)=-151
- Stop program at StEP8
 Time setup is: t08=-(4X30+1)=-121

The program will be held if it jumps from a control section to another control section (a Hold action will be inserted between two control sections). The program must be manually changed from Hold status to Run in order for it to continue. The controller does not let a jump command jump to itself (for example: t06=-6) because the Hold status would never be released.

3.6 Displaying and modifying the running StEP number (StEP) of the program

Sometimes it is convenient to jump directly to a particular StEP and execute from there. If the program is still in the middle of the 4th StEP but you hope to finish it in advance and execute the 5th StEP, the StEP modification feature will meet your need. The SYL series controller can start the program from any one of its 30 steps.

Press the SET key (briefly) to display the StEP number. Press the Λ , V keys to change it. The StEP number increases or decreases automatically as the program executes. If the StEP number is manually changed, the running time will be cleared to 0 and the program will begin with the new StEP. If the StEP number is not changed, pressing the SET key will not affect the operation of the program.

3.7 Multiple Curves

The flexible programming format of the SYL-2XXXP can be used to store and recall multiple programmed curves. If a temperature curve doesn't require all 30 steps, the unused steps can be used to store another program. Several different curves can be stored and executed individually, as long as there are not more than 30 steps total (including necessary controls steps). For example, when a

process curve only needs nine program steps, it is possible to store three such process curves in the instrument. Simply change the StEP number to initiate a different curve. Suppose 8 steps represent three groups of process parameters. They are separately arranged on StEP2-StEP9, StEP10-StEP17, StEP18-StEP25. The step time of step 1 can be set as follows to choose the desired program:

T01=-2 Execute the program of curve 1 (StEP2-StEP9)

T01=-10 Execute the program of curve 2 (StEP10-StEP17)

T01=-18 Execute the program of curve 3 (StEP18-StEP25)

You can also choose the curves by manually setting the value of StEP before the program starts. For example, if curve 2 is needed in the current process, StEP must be set to 10.

3.8 Control Mode Parameter A-M

The function of the A-M parameter is defined differently in the SYL-2XXXP than it is for the controller without the ramp/soak option. Its operation is determined according to the equation

A-M = AX1+BX4 (default setting A-M=2)

Where "A" is used to select one of 3 power outage/startup event handing modes "B" is used to select one of two run/modify event handing modes.

Power Outage/Startup Modes:

A=0: When the instrument is turned on, the program will simultaneously jump to 29th program segment and clear event output status. This mode is suitable for applications in which power failure is not allowed at any time. The user may do error handling in segment 29 such as switching on the event output to trigger an alarm.

A=1: If there is no deviation alarm at power up, the program will continue running from the original break point and the event output state remains. Otherwise, the program will jump to the 29th segment and clear event output status.

A=2: After power is turned on, it will continue the program from the original break point, and the event output state remains. This mode is suitable for the applications in which power failure does not affect production. (default setting)

Run/modify event handling:

B=0: When the controller is put into hold mode, the PV is still maintained at the current SV. (default setting)

B=1: the output of the controller is at OutL when it is on hold.

3.9 Privilege for parameter set LocK

For SYL controller with optional ramp/soak functions, the Lock has slightly different functions.

LocK=0, allowed to modify field parameters, program values (time and temperature) and manually choose the segment StEP number.

LocK=1, allowed to modify field parameters and StEP value, but modification of the actual

program is not allowed.

LocK=2, allowed to modify field parameters, but not allowed to modify the StEP value or program.
LocK=3, only allowed to modify parameter LocK itself. All other parameters including program and StEP value cannot be changed.

LocK=808, allowed set all parameters, including the program and StEP value. (default setting)

4. Programming Example

Programs in the SYL-2XXXP series controller have a uniform format of temperature-time-temperature. The temperature set point of the current step will linearly change to the set point of the next step over the time interval of the current step. The time is in minutes, and temperature is in either °C or °F. Negative values of the time interval represent program commands. The following example includes 6 steps: linear temperature heating, maintaining a constant temperature, linear temperature cooling, jump cycling, ready, hold and event output. In the following example, it is assumed that the deviation high alarm is set to 5 °C.

- StEP1: C01=100, t01=30 Start linear temperature heating up from 100 °C to 400°C, over a time period of 30 minutes (10 °C /minute).
- StEP2: C02=400, t02=60 Maintain 400 °C for 60 minutes.
- StEP3: C03=400, t03=120 Reduce the temperature at a rate of (C04-C03)/t03 = 2 °C /minute for 120 minutes. This will bring it down to 160 °C
- StEP4: C04=160, t04=-65 Alarm 1 is triggered, and the program jumps to StEP5. The command number for turning alarm 1 on is "2". The equation used to get the command number is –(30 * Command# + Next Step) = -(30*2+5) = -65.
- **StEP5: C05=160, t05=0** A time value of zero puts the program in a Hold state. A run operation executed by the user is needed for the program to continue to StEP6.

StEP6: C06=100, t06=-181 Alarm 1 is switched off (unless it is also being triggered by an alarm condition outside the program), and the program jumps to StEP1 to start from the beginning. The command for switching off Alarm 1 is "6", so t06 = (-(30 * 6 + 1) = -181).

StEP1: C01=100, t01=30 Since the temperature is still at 160 °C, the program will pause until the controller can bring the temperature within the alarm range of the new set point. Since the deviation high alarm is set to 5 °C, the program will resume (from the beginning) as soon as the temperature drops below 105°C.

The temperature control block is shown below.



5. Quick list of the New Key Functions for the Ramp/Soak Model

Following are the brief description of the key functions when the controller is in its basic operation mode

1) Mode Key (SET)

When pressed momentarily, PV display shows the current step that the program is processing. When pressed again, the PV display shows the set time length of the current step. The SV display shows how long that current step has run in minutes. Press again, the display return to the basic display mode. The PV shows the process temperature and SV can either show the set temperature or the status of the controller (Stopped, Running, or on Hold).

Press and hold for two seconds will put the controller into parameter setting mode, just like the regular controller without ramp option.

2) Auto/Manual function key (A/M)

Press this key will enter the step setting mode to set the time, temperature and action of each step.

- Decrement key V. Press and hold this key for two seconds will start the processing. A-M LED will light up. Press and hold again will hold the processing. A-M LED will flash.
- 4) Increment key Λ: Press and hold this key for two seconds will stop the cprocessing of the program. A-M LED will be turned off.

To start the processing	Press V for 2 seconds
To stop the processing	Press Λ for 2 seconds
To hold the processing	Press V for 2 seconds
Go to step X	Press SET briefly, Then use V or Λ to go to the step.
To program the steps.	Press A/M key to enter programming mode. Then, SET key to go to
	next step.

6. Auto Tuning of the system to optimize the PID parameter.

The Auto Tuning function of the controller should not be started at the very beginning of the process if the temperature of the system is at or near the room temperature. It should be started when the system is heated up to near critical operating temperature. The user can manually start the Auto Tuning by set At=2 when the temperature is near that temperature.

7. Frequently asked questions

The difference between "Hold" and "Stop". If you Hold it (V key) and start Run (V key) again, it will start from the same step that you put hold. However, if you Stop it (Λ key) and start Run (V key) again, it will start from step 1.

How to run this controller as regular controller without ramp/soak function?

If you didn't use up all the steps for programming, you can use one of the steps for that. For example, assuming step 10 is not used, set C10=100 and t30=9999. This set Step 10 to control the temperature at 100 degree for 9,999 minutes. To start it, start Run (V key), press SET once to display StEP, use Λ to go to StEP 10. Press SET twice. The controller will run just like regular controller with PV displayed on top and SV in the bottom. You don't have to do this every time when powers up the controller (assuming A-M parameter is not changed from default). It will remain running StEP 10 until 9999 minutes (7 days) runs out, or until you reset it for other application.