User Instruction

mA output PID control setup

Configure the mA output PID controller

Make sure that a 4-20 mA output module is installed in the SC4500[1] controller. Refer to the documentation supplied with the module. Make sure that all of the necessary electrical connections are complete before the 4-20 mA output is configured.

1. Identify the relation between the input current and calculated value as follows:
   - Identify which analog output range uses the connected device (0-20 mA or 4-20 mA).
   - Identify the maximum value that is equal to the 20 mA on the analog output.
   - Identify the minimum value that is equal to the 0 or 4 mA on the analog output.
2. Push the main menu icon, then select Outputs > mA outputs > System setup.
   The available channels based on the installed expansion modules show.
3. Enter the settings for each channel.

Option	Description
Source	Selects the analog output to configure. For the selected device, select the parameter that set the measurement options.
Parameter	Changes the parameter selected on the source option.
Data view	Sets the measured value that shows on the display and saves to the data log. Options: Input value (default) or Current.
Function	Sets the output function. Setup options change based on the selected function. • Linear control—Signal is linearly dependent on the process value. Refer to the SC4500 User Manual. • PID control—Signal works as a PID (Proportional, Integral or Derivative) controller.
Transfer	Sets the transfer value shown on the analog output when the selected source reports an internal error, is disconnected from the system or its output mode is set to Transfer. Default: 10 mA
Current	Shows the calculated output current (in mA).
Data logger interval	Sets the interval at which the shown value is saved to the data logger. Options: OFF (default), 5 minutes, 10 minutes, 15 minutes, 20 minutes or 30 minutes

4. Complete the settings based on the Function setting.

PID control function

Option	Description
Error mode	Sets the analog output on hold or to the transfer value when an internal error occurs. Options: Hold or Transfer
Mode	Sets the output condition when the process value is out of the controlled band[2]. • Direct control— mA output will decrease as the process variable increases • Reverse— mA output will increase as the process variable increases
Mode	Automatic—The output works as a PID controller. SC4500 Controller looks at the process variable and adjusts the 0-20 mA automatically. Manual—The PID is disabled. The output is fixed as set in Manual output.
Manual output	Additionally the output current value can be set (condition: Mode is set to Manual). The output current value must be within the values set in the Minimum and Maximum menus.

[1] SC200 controller has different PID settings.
[2] This behavior is different from common PID management and SC200 controller.

Option	Description
Minimum	Sets the lower limit for the output current. Default: 0.0 mA
Maximum	Sets an upper limit for the possible output current value. Default: 20.0 mA
Relay setpoint	The desired process value. The PID controller tries to adjust to this process value.
Dead zone	The dead zone is a band around the setpoint. In this band the PID controller does not change the output signal. This band is determined as setpoint ± dead zone. The dead zone stabilizes the PID controlled system, which have a tendency to oscillate. It is recommended to set the part to 0 (default).
Proportional	Sets the proportional part of the PID controller. The proportional part of the controller generates an output signal which is linearly dependent to the control deviation. A higher proportional part reacts very quickly on any changes at the input but starts to oscillate easily if the value is set to high. The proportional part cannot completely compensate disturbances. Example: An error term (difference between setpoint and process value) is 2 and the proportional gain is 5, then the output current value is 10 mA.
Integral	Sets the integration part of the PID controller. The integral part of the controller generates an output signal that increases linearly when the control deviation is constant. The integral part responds slower than the proportional part and can completely compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set to low, it starts to oscillate. For the SC4500 PID implementation, do not set the integration part to 0. The recommended integration part setting is 10 minutes.
Derivative	Sets the derivative part of the PID controller. The derivative part of the PID controller generates an output signal which depends on the control deviation changes. The faster the control deviation changes, the higher the output signal gets. The derivative part creates an output signal as long as the control deviation changes. If there is no knowledge about the controlled process behavior, it is recommended to set this part to “0”, because this part tends to oscillate strongly.
Snap shot	Shows the current input value of the PID (process value).
Current	Shows the current output value of the PID.

5. Push the main menu icon, then select Outputs > mA outputs > Test/Maintenance.

The Test/Maintenance menu lets the user do a test of the internal plug in the expansion cards.

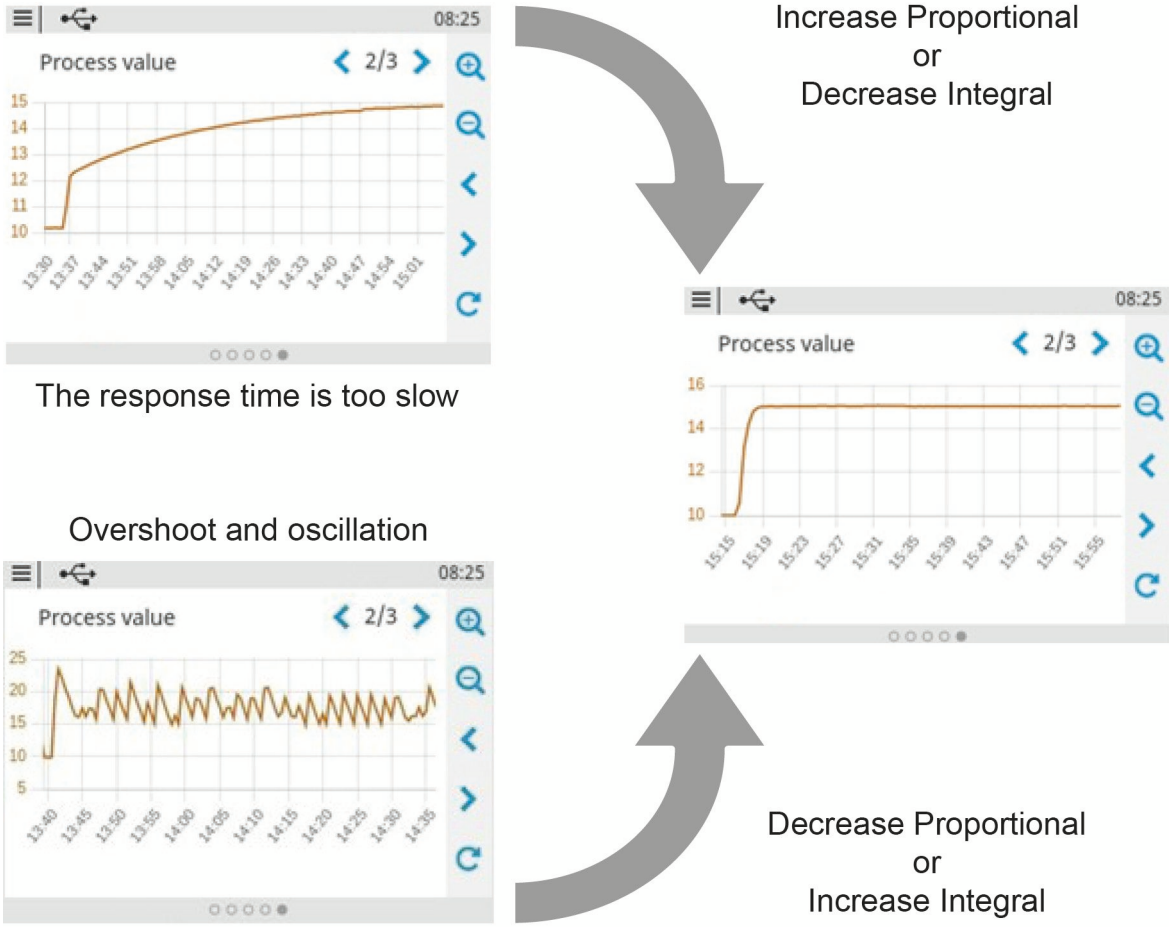
6. Select an option.

Option	Description
Function test	Does a test on the outputs on the selected module.
Output status	Shows the condition of the outputs on the selected module.

PID tuning

- Enter a setpoint, the mode and the proportional part.
- Set the integration part to 10 minutes and the derivative part to 0.
- Monitor the process value and identify how much time and how near the SC4500 Controller can get the process to the setpoint.
- When the user knows how the SC4500 Controller reacts to changes in the process, update the integration part and identify how the process reacts.
- To get a faster reaction from the process, increase the proportional part and/or decrease the integration part.
- When the output changes between 4 mA and 20 mA, the process oscillates. The process must react more slowly. Decrease the proportional part and/or increase the integration part to prevent oscillation.
- It is recommended to make one change at a time, then monitor how the process reacts to each change.

Figure 1 PID tuning with a setpoint at 15



HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info-de@hach.com
www.de.hach.com

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

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