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Fuji PID Controller

Hans-Petter Halvorsen

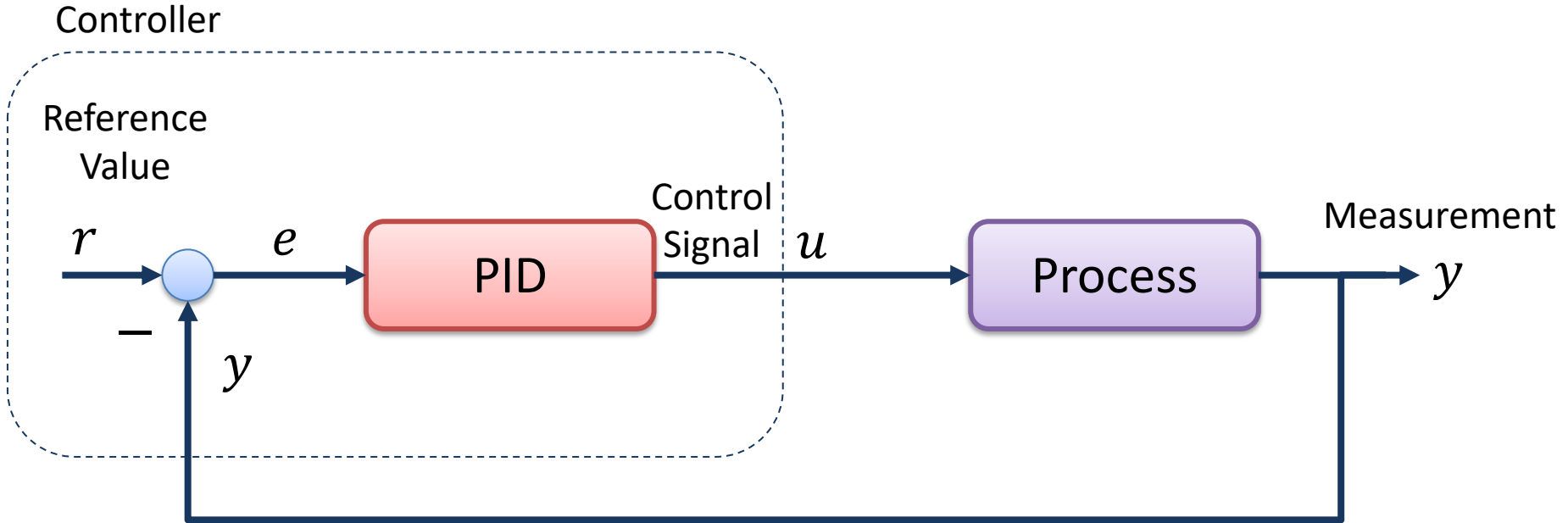
Table of Contents

- Introduction
- Configuration and Settings
- Test Device
- PID Control and Hardware in the Loop Simulations and Testing
- Autotuning



Introduction

Control System



The Controller is typically a PID Controller

Industrial PID Controller

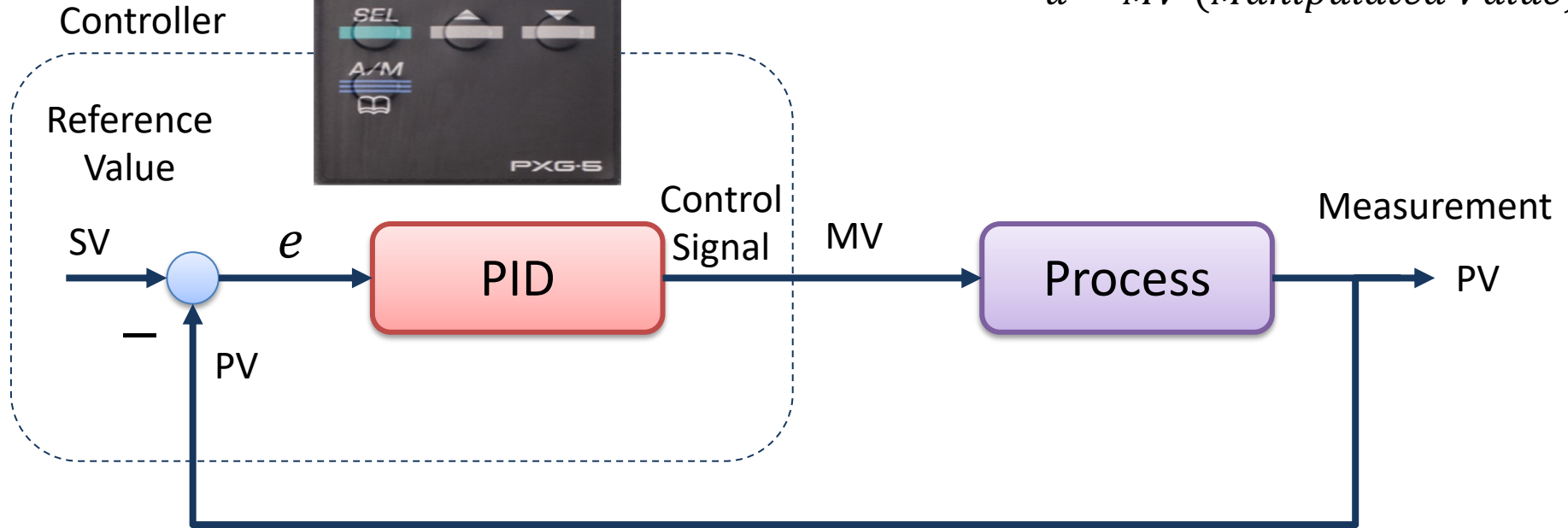


Air Heater Process



Control System

$y = PV$ (Process Value)
 $r = SV$ (Set Value)
 $u = MV$ (Manipulated Value)

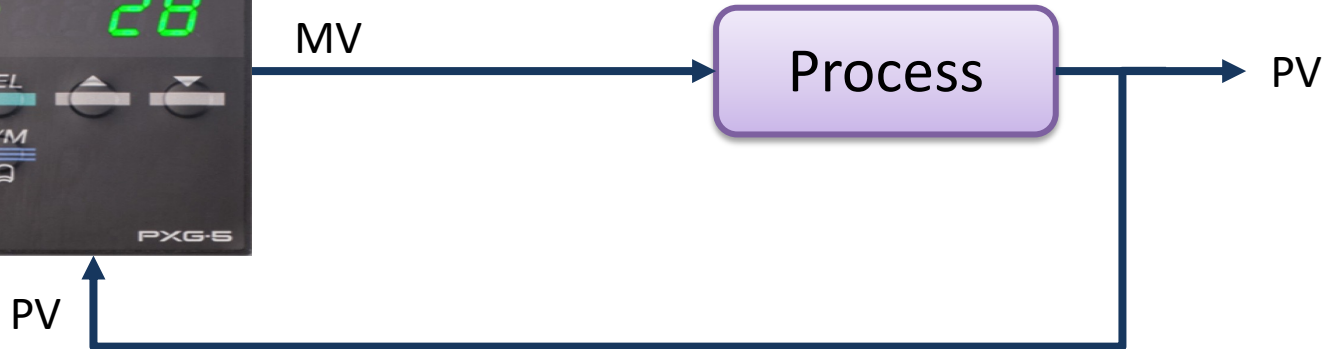


Control System

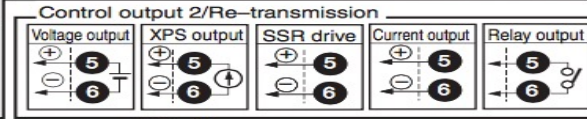
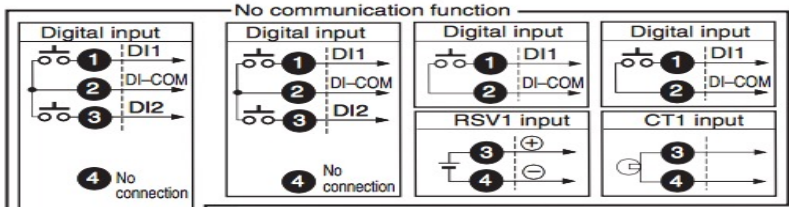
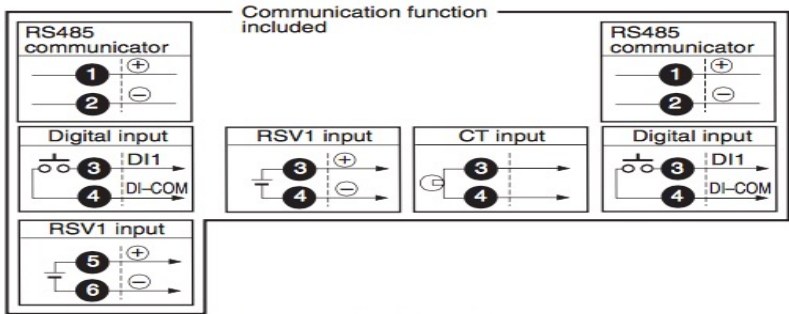
Industrial PID Controller



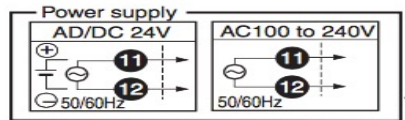
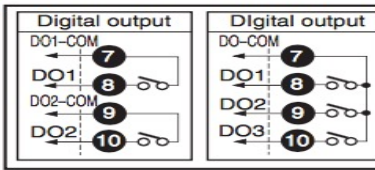
You set PID parameters, SV, etc. on the Controller



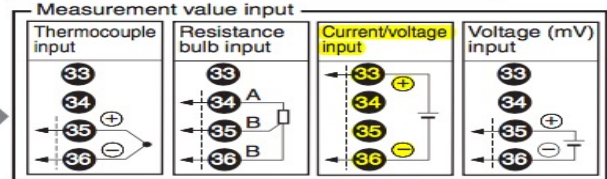
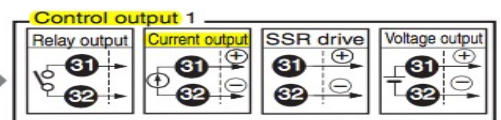
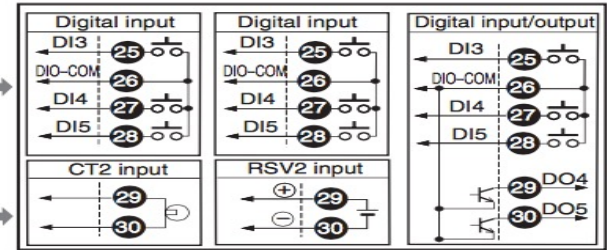
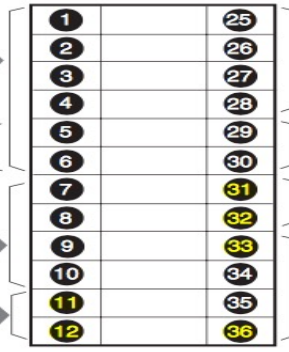
Connections



(Note 3)



(Note 1)



(Note 2)

PV and SV

PV (Process Value)

PC is retrieved from the Process as a Voltage Signal [1-5V] and are converted to Engineering Unit [°C] inside the Fuji PXG5



SV (Set Value)

Adjust SV Up or Down

Fuji PXG5 PID Controller

Demo



Configuration and Settings

Hans-Petter Halvorsen

[Table of Contents](#)

Configuration/Settings

Some recommended Channel Settings:

Channel 1:

MA_n = oFF

rEM = LoCl

AT = oFF

Auto Tuning

Closed-loop Control



Channel 2:

SvL = 20 (Lower SV Limit)

Svh = 50 (Upper SV Limit)

You set SV locally in the Fuji PID



Channel 6:

Pvb = 20 (Lower PV Limit)

PvF = 50 (Upper PV Limit)

Pvd = 0 (or 1) #digits after decimal point

C1r = 0-20mA (Control output range, a 250ohm resistor is used to convert to 0-5V)

Note! The Temperature Range for most of the Air Heaters is 20 – 50°C (1 – 5V) - but some has 0 – 50°C (1 – 5V)

Configuration/Settings



Demo



Test Device

Test Software

Test Communication between PXG5 and DAQ Device.vi Front Panel on HIL Simulation.lvproj/My Computer

File Edit View Project Operate Tools Window Help

15pt Application Font

Search

Analog Out (ao0) [1-5V]

PV

Process Variable (PV) in Voltage [1-5V]. Depending on the settings on the PXG5, you will see Voltage or in Engineering Unit [°C], either 20-50°C or 0-50°C depending on your settings

Analog In (ai0) [0-5V]

MV

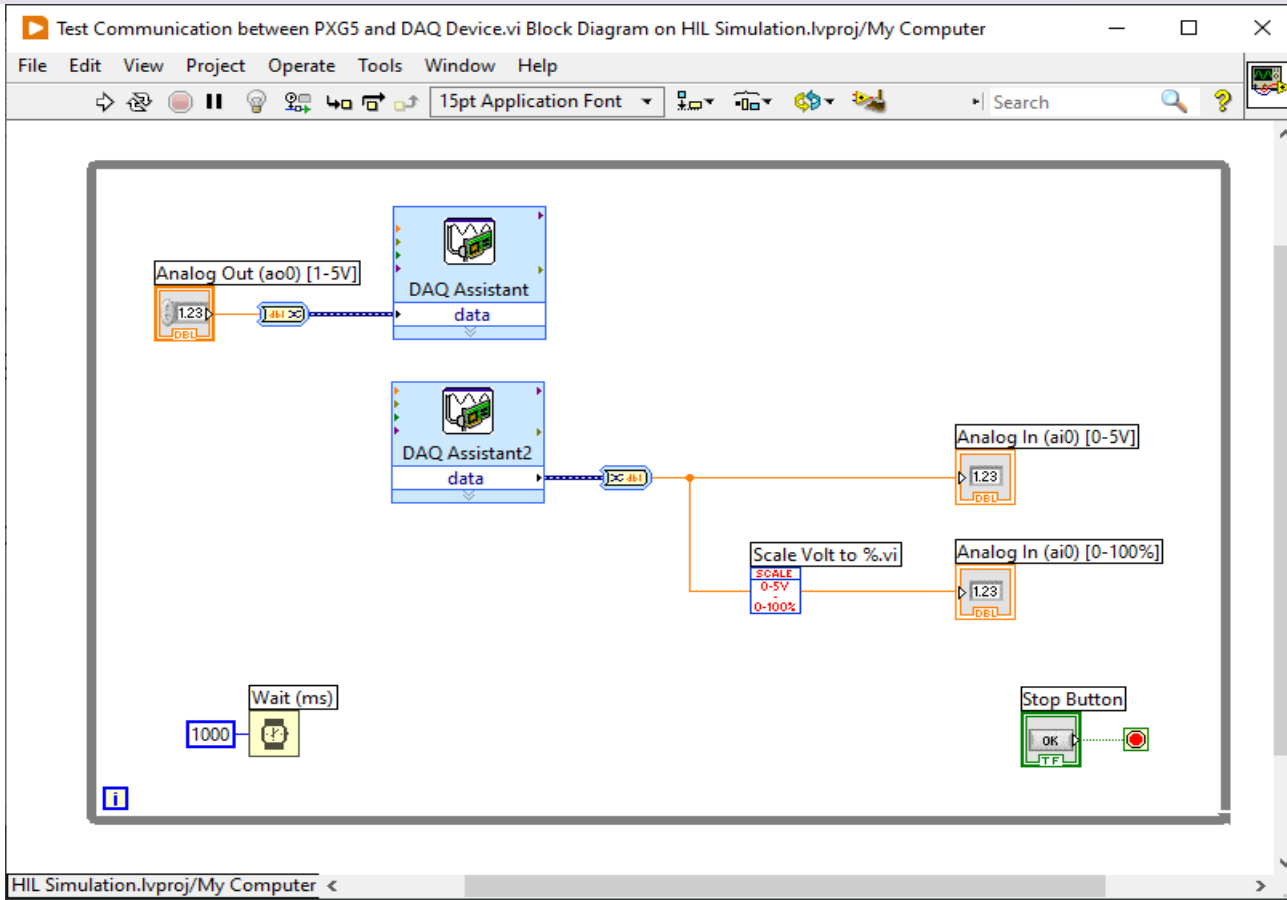
Manipulated Value (MV) in Voltage [0-5V].
On the PXG5, you will set MV between 0-100%

Analog In (ai0) [0-100%]

MV

HIL Simulation.lvproj/My Computer

Test Software



Test Device

Demo



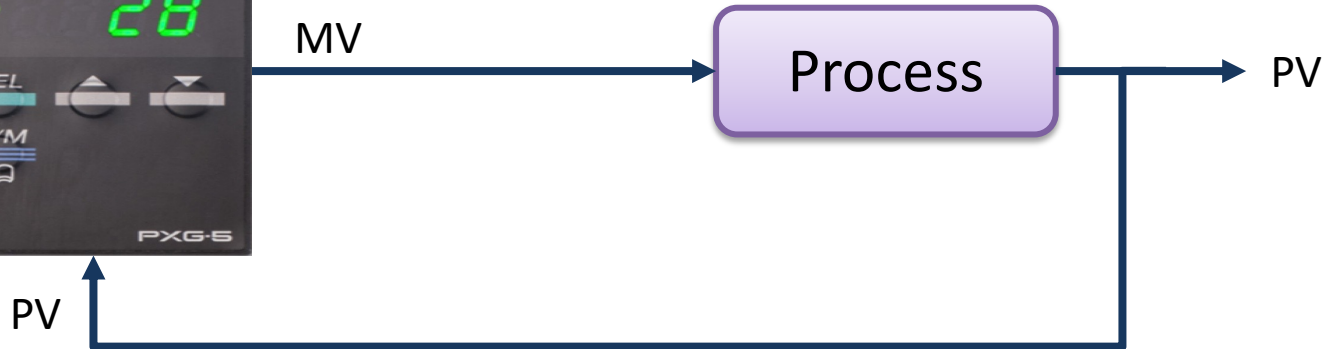
PID Control and Hardware in the Loop Simulations and Testing

Control System

Industrial PID Controller



You set PID parameters, SV, etc. on the Controller



PID Settings

Note! PXG5 uses
Proportional Band

6-2 / PID (Ch2)

Sets parameters for controls such as PID.

Parameter display symbol	Parameter name	Function	Setting range	Initial value	Remarks
"P" (P)	Proportional band	Sets the proportional band of the PID parameter. Setting "0.0" will turn it to an ON/OFF control.	0.0 to 999.9%	5.0%	
"i" (i)	Integration time	Sets the integration time of the PID parameter. Setting "0" will turn off integration.	0 to 3200 sec	240 sec	
"d" (d)	Differential time	Sets the differential time of the PID parameter. Setting "0.0" will turn off derivation.	0.0 to 999.9 sec	60.0 sec	

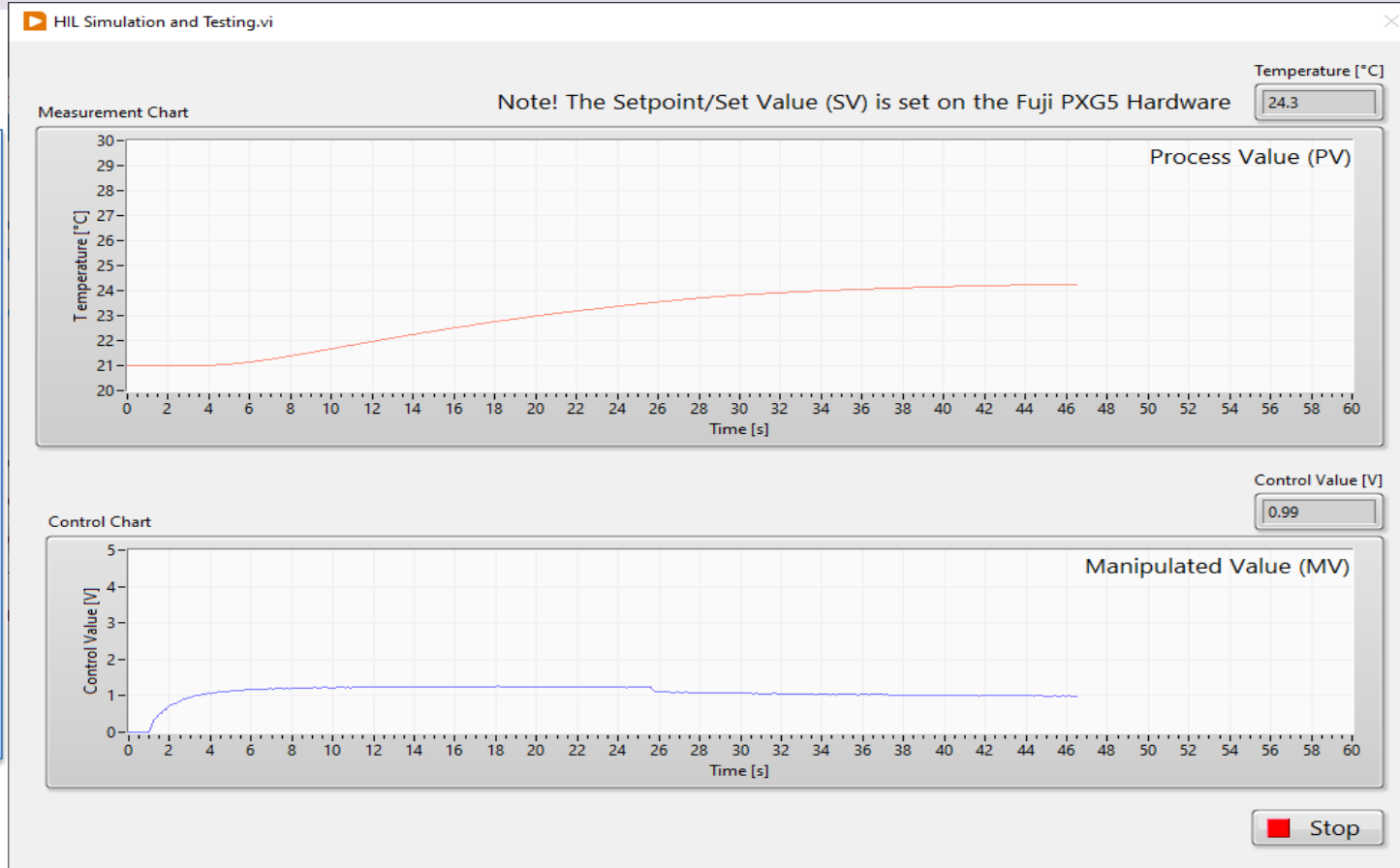
$$PB = \frac{100\%}{K_p} \Leftrightarrow K_p = \frac{100\%}{PB}$$

Example:

$$K_p = 0.8 \rightarrow PB = \frac{100\%}{K_p} = \frac{100\%}{0.8} = 125\%$$

Test Software

I am using the Fuji Controller to control a Process that is running on my computer in form of a Mathematical Model (this is referred to as Hardware in the Loop Simulation and Testing)



HIL Simulation and Testing



Demo



Autotuning

Autotuning

A lamp is blinking when the auto-tuning is running

6-1 / Operation (Ch1)

The following is a menu to operate the controller. Switchover between auto and manual control output, switchover between RUN and standby, and other such functions.

Parameter display symbol	Parameter name	Function	Setting range	Initial value	Remarks
"MAn" (MAn)	Switchover between auto and manual mode	Switchover between auto and manual modes	oFF (auto) / on (manual)	oFF	
"STby" (STby)	Switchover between RUN and standby	Switchover the operation mode between RUN and standby	oFF (RUN) / on (standby)	oFF	
"rEM" (rEM)	Switchover between local and remote SV operation	Switchover between local and remote SV operation	LoCL (local) / rEM (remote)	LoCL	(Note1)
"PrG" (PrG)	Ramp soak control command	Changes ramp soak run states	oFF (stop) rUn (run) hLd (hold)	oFF	Displays End (when ending) or GS (during guaranty soak).
"AT" (AT)	Auto-tuning run command	Runs auto-tuning.	oFF (stop/finish) on (normal type) Lo (low PV type)	oFF	


● Changing MV (control output values)

1

Switch to manual mode.

2

Change the display to PV/MV display (MAN/AT/SELF lamp is lit).

(Pressing the  key in manual mode toggles between PV/SV display and PV/MV display.)

3

Change the MV with the   keys.

(Changes are reflected to the MV as it is changed.)

Autotuning

Demo

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