



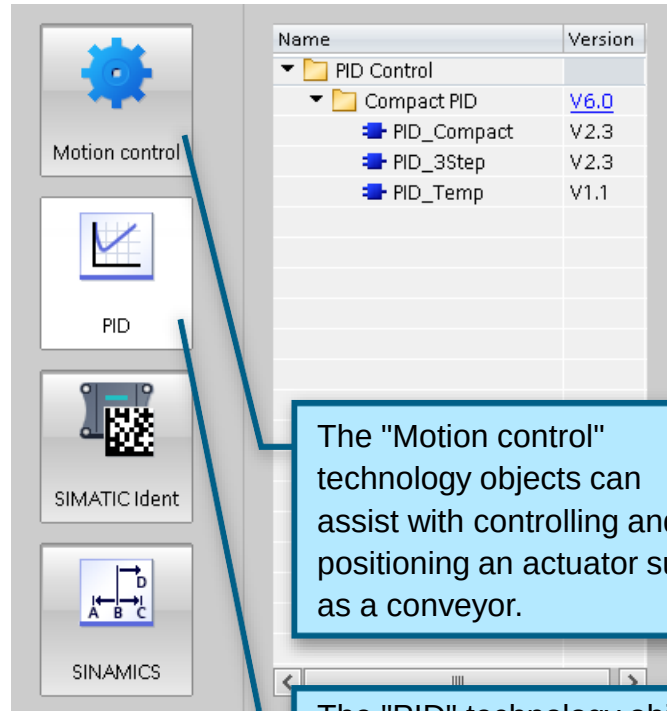
S7-1200: Basic Controller with Advanced Functions

Technology Functions

Technology Functions

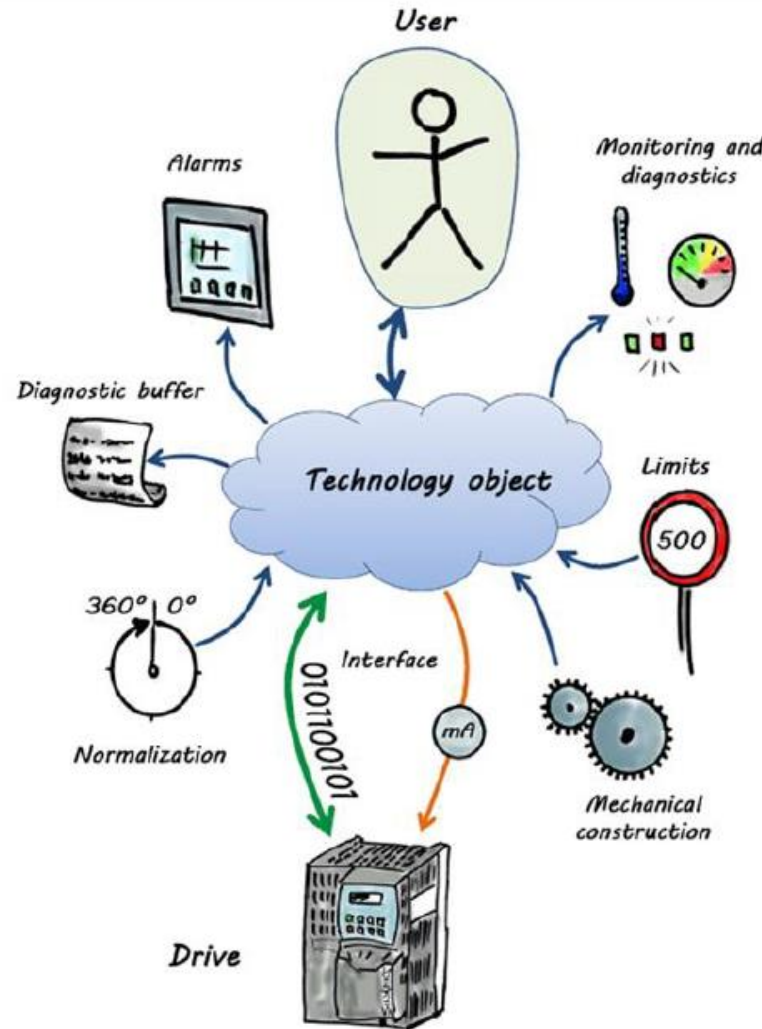
Basics of Technology Objects

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The "Motion control" technology objects can assist with controlling and positioning an actuator such as a conveyor.

The "PID" technology object can help regulate physical characteristics such as temperature or fan speed – maintaining these at a specified value.



Counting, measurement, controlling and moving are all things you have to do in your plant. In the past, mapping up these tasks required a lot of effort. Now in the TIA Portal these standard tasks are completed simply using "technology objects".

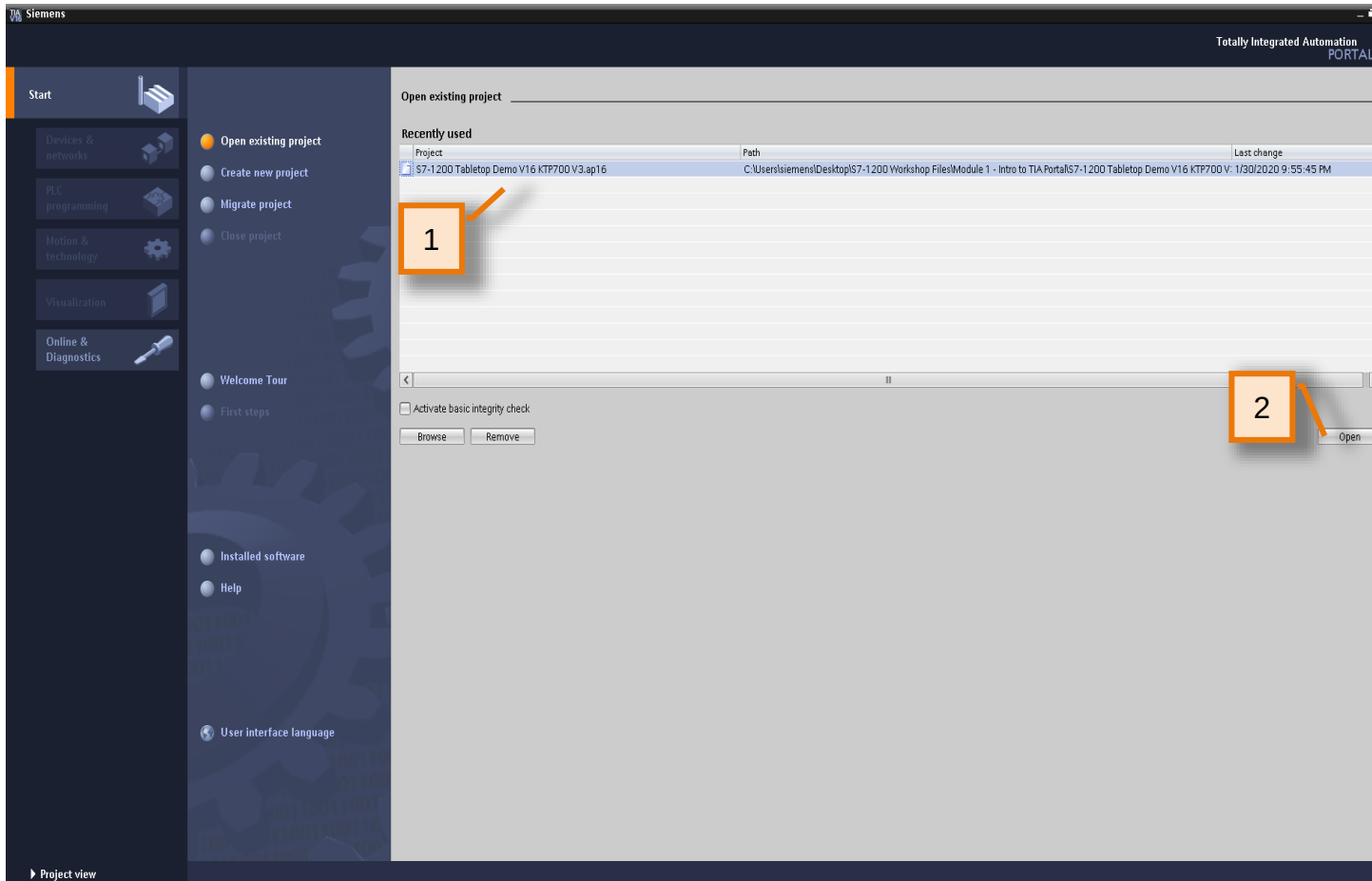
Technology objects are controlled in the user program via the corresponding commands, for example the standard "PLCopen" blocks.

The TIA Portal guides you through configuring, commissioning and programming the technology objects.

In this module, we will explore some of the integrated technology functions of the S7-1200 CPU and some of the commissioning interfaces of the technology objects representing our PID controller and our conveyor motion axis.



Technology Functions



1. Go to Portal view and open the project called 'S7-1200 Tabletop Demo KTP700 V3.ap16' by double clicking on it on the "recent projects" list.

If the project does not appear in the list, press Browse and navigate to the "`\\Desktop\\S7-1200 Event\\S7-1200 Tabletop Demo V16 KTP700 V3.ap16`"

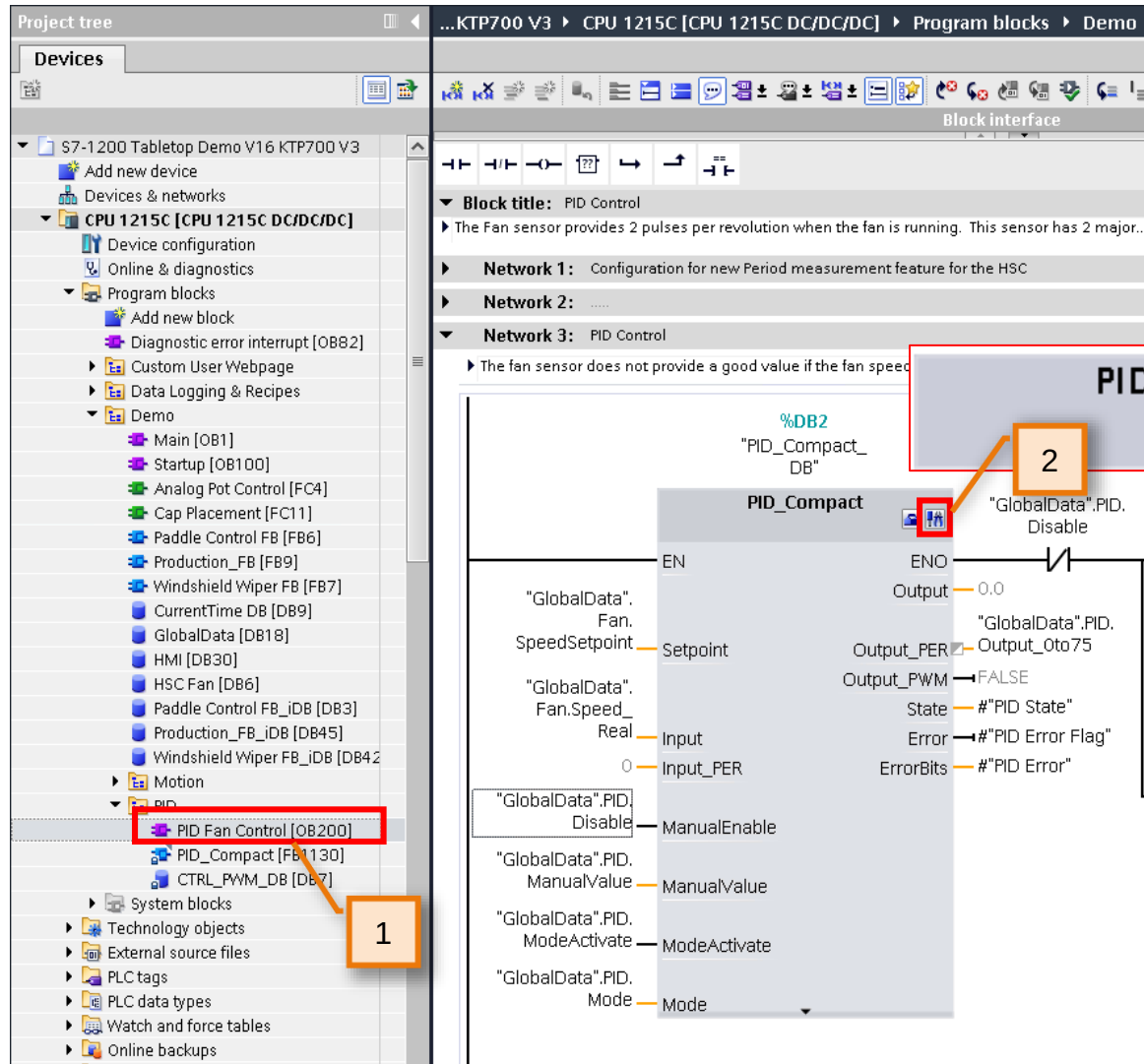
2. Click the "Open" Button.



Technology Functions – PID Control

Technology Functions

PID – Commissioning & Tuning

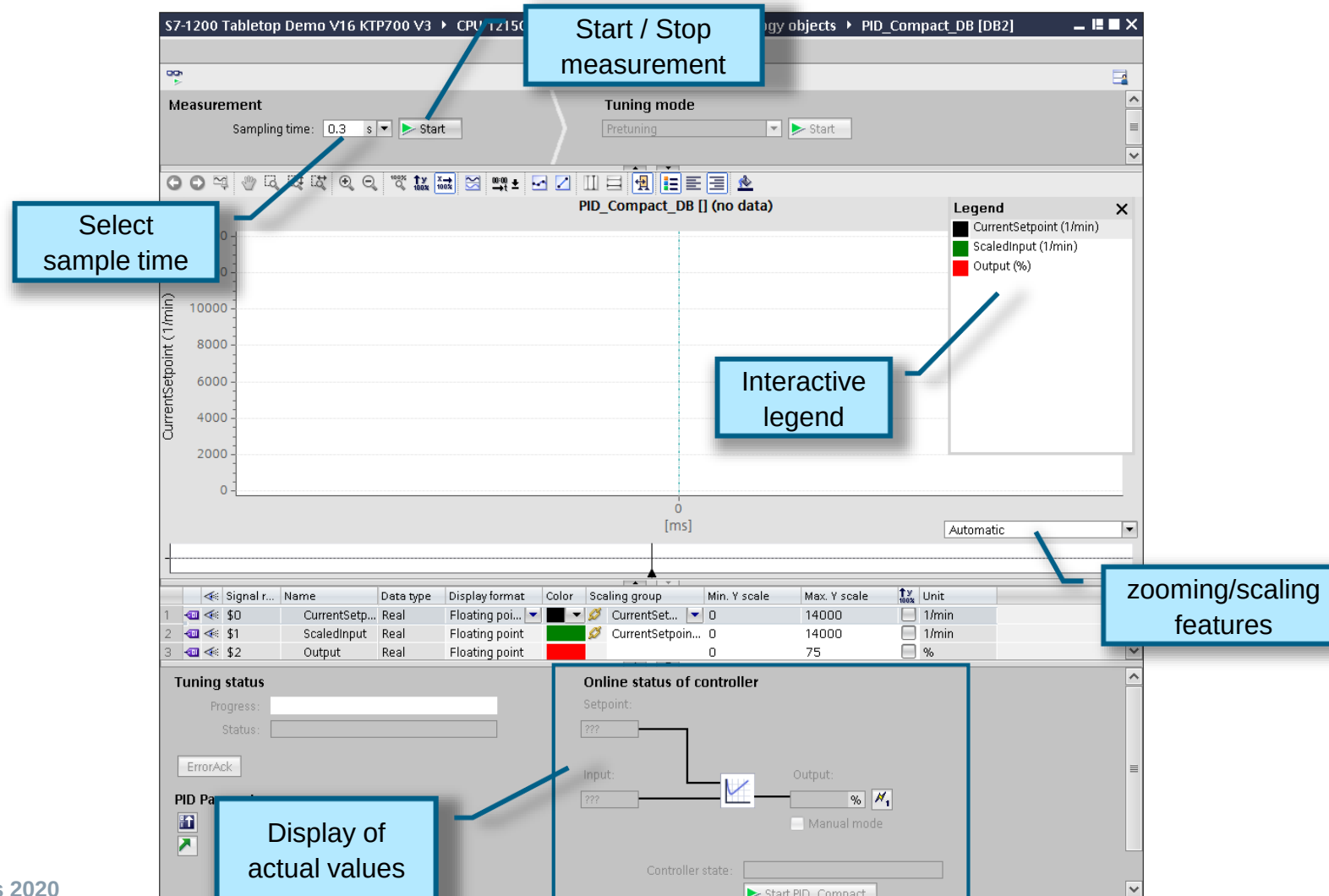


1. From the project tree, navigate and open the "PID Fan Control" block using the selections as shown.
2. Click on the commissioning icon from the "PID_Compact" block in network 3 as shown.



Technology Functions

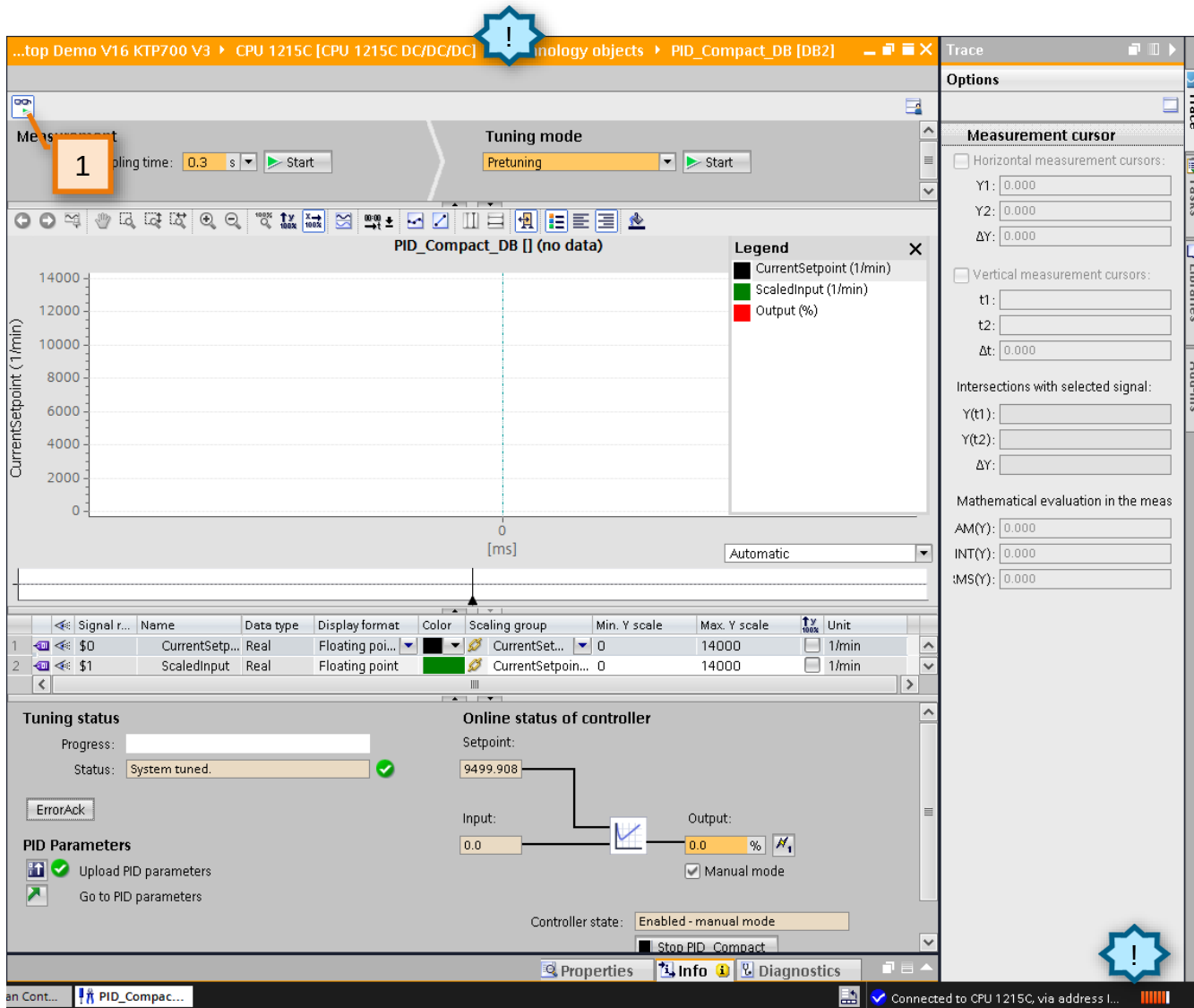
PID – Commissioning & Tuning Window



Technology Functions

PID – Commissioning & Tuning Window (online)

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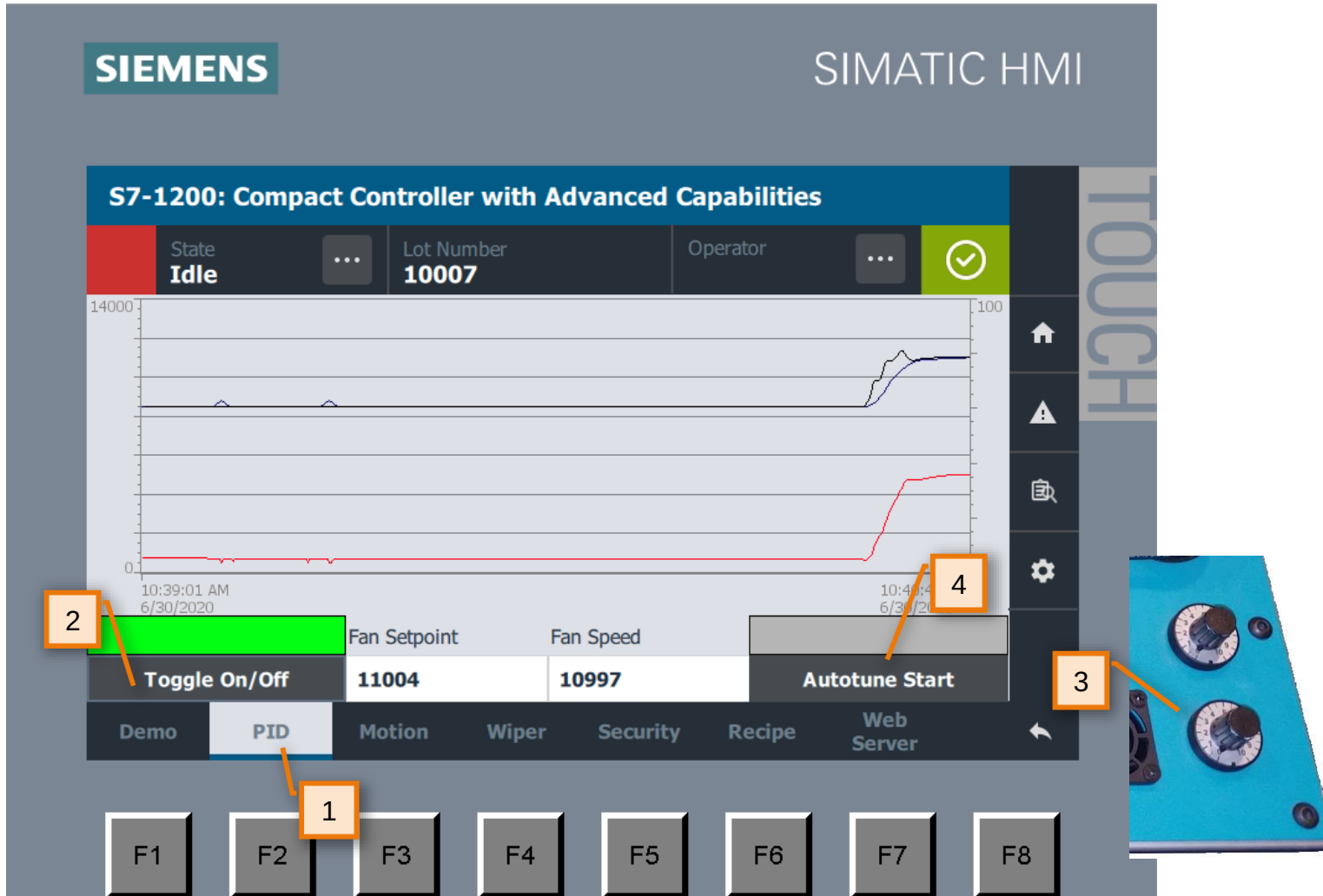


1. Go online by clicking the 'monitor all' icon above the measurement window.
- The title bar of the active window will appear orange colored indicating online status.
- You will also see an online status bar at the bottom-right of the project view. 'Online status' is covered more in the next module.



Technology Functions

PID – Autotuning

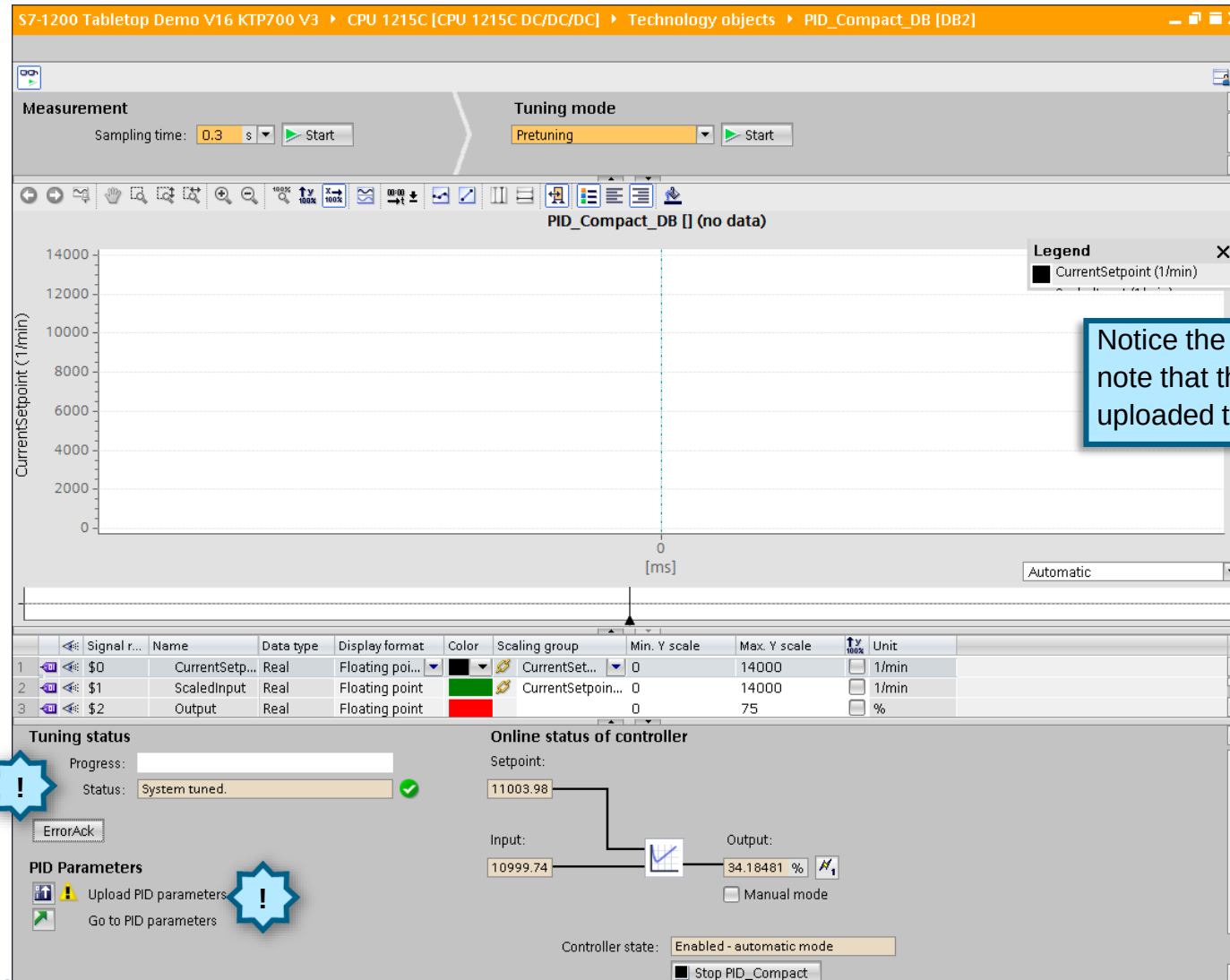


1. On the HMI screen on the demo kit, select “PID” from the bottom of the HMI screen.
Now the PID menu is open. Here the Autotune can be activated.
2. Toggle the PID On
3. Use the bottom knob on the demo kit to adjust the Fan Setpoint to around 11000. This allows the output to change values during the autotune process with in the full range of the application.
4. Press “Autotune Start” on the HMI to tune the PID.
The autotune process will begin. This may take several minutes.
5. Direct your attention back to the commissioning screen of the PID in TIA Portal.



Technology Functions

PID – Autotuning



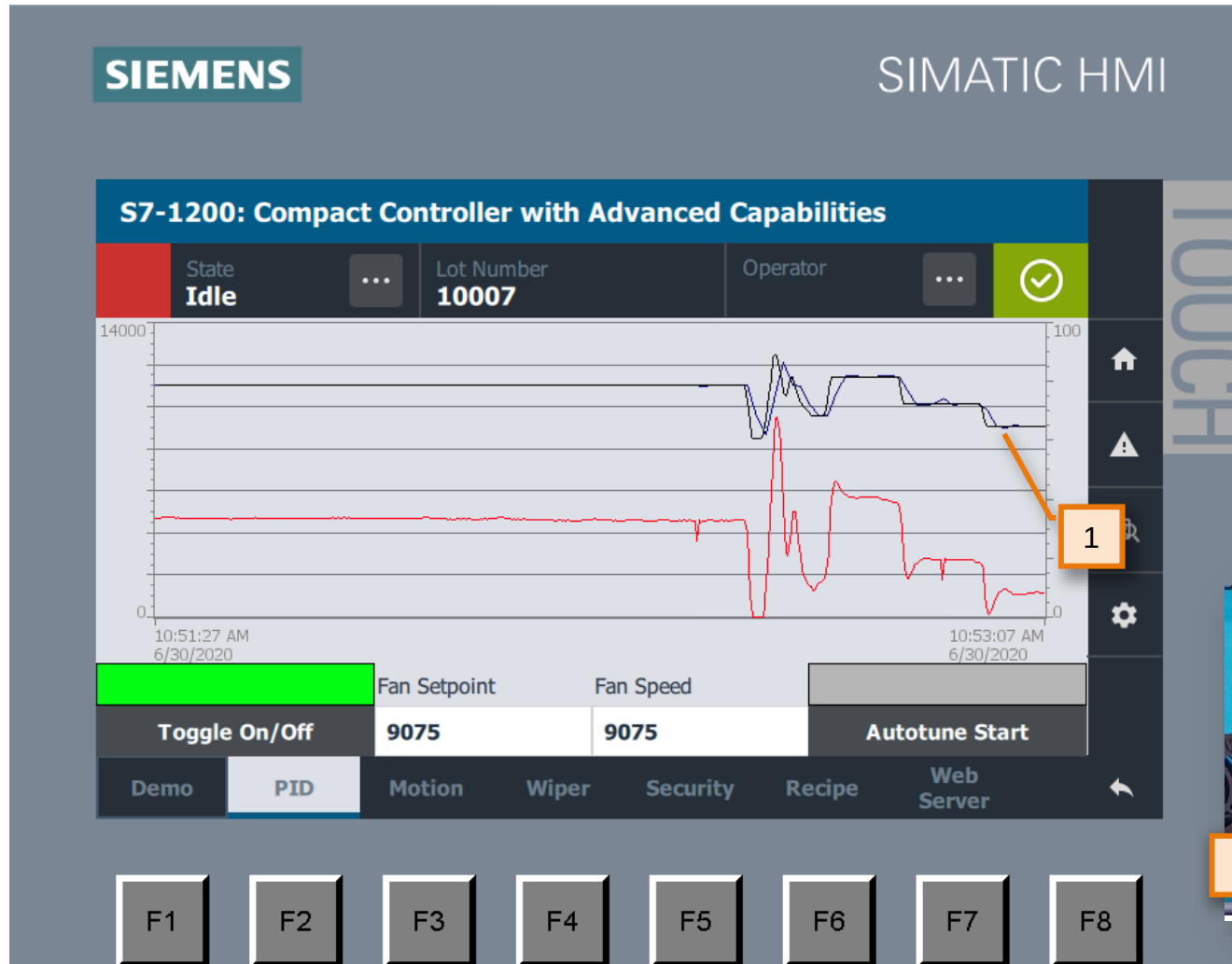
Notice the tuning status of the PID. Also note that the PID parameters have been uploaded to the hardware.



Technology Functions

PID – Autotuning

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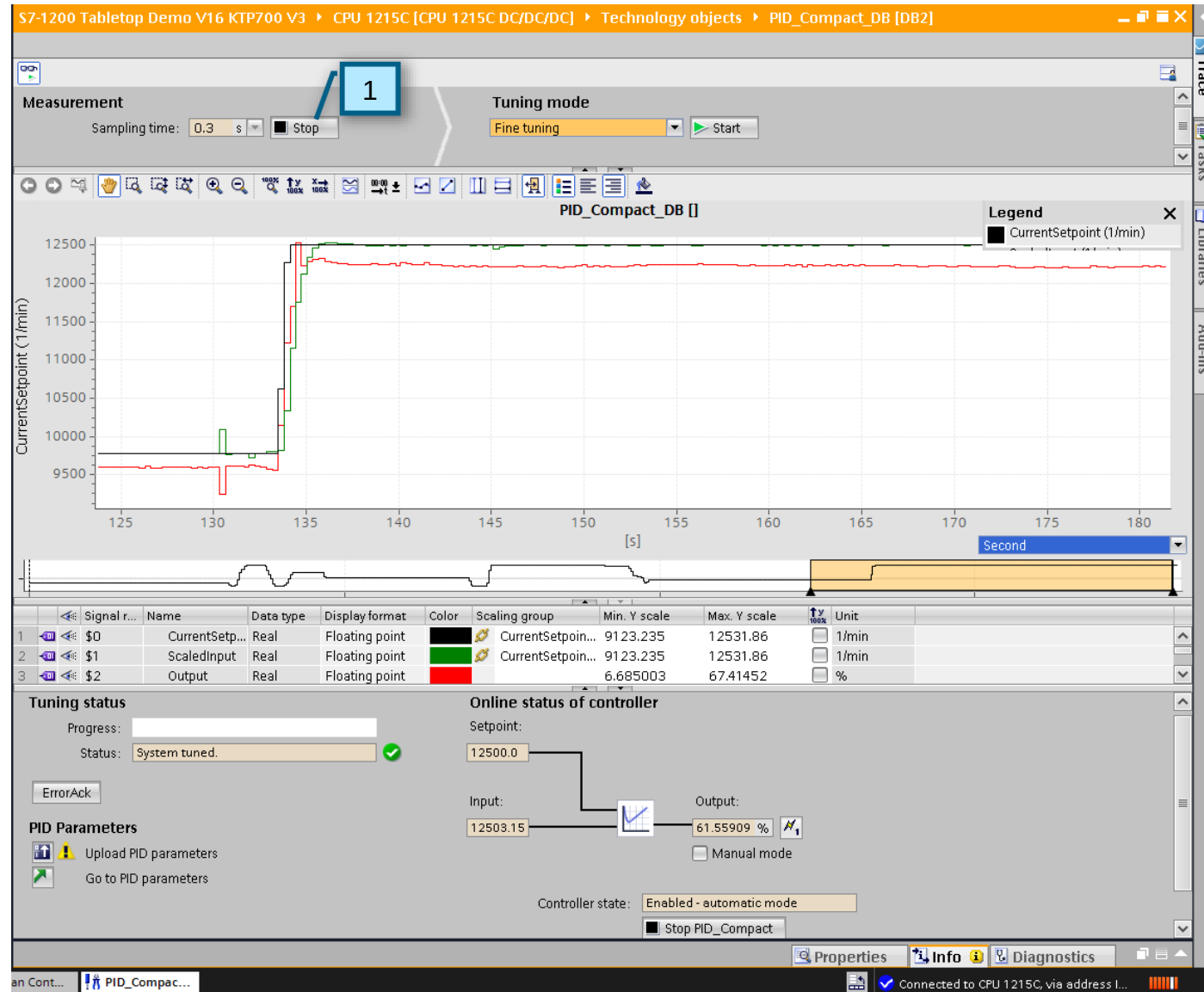
1. Once autotuning is complete, notice the responsiveness of the PID controller has improved.
2. Use the bottom knob to adjust the setpoint for speed of the fan. See the Process Variable (PV) track the setpoint on the PID screen of the HMI.



Technology Functions

PID – Commissioning via TIA Portal

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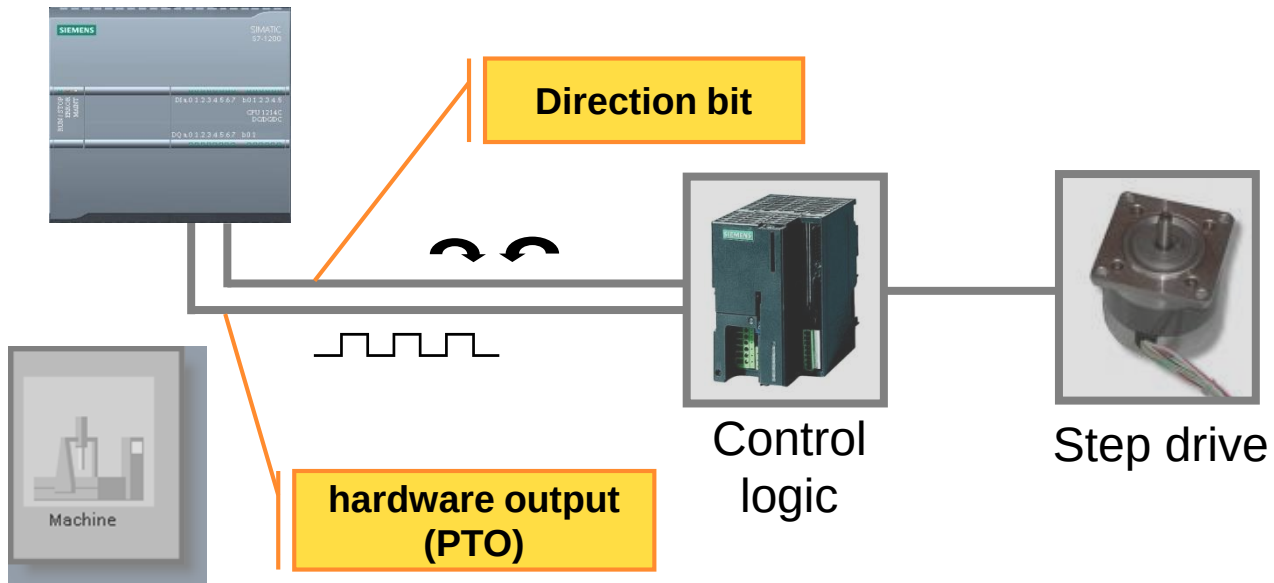
1. You can also monitor the same values in Portal by clicking the "start measurement" button  commissioning toolbar.



Technology Functions – Motion Control

Technology Functions

Motion



The following slides shows the integrated motion functionality of the S7-1200 controller.



Technology Functions

Motion – Demo Overview

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Dynamics Settings:

Max Velocity = 5 in/s

Acceleration = 4.9 in/s²

Home
switch

Load 5.5
inch/rev

End of travel low
limit switch

End of travel
high limit switch

Stepper
Motor 1600
pulse/rev

Pot used for jog
speed setpoint



Technology Functions

Motion – Axis Control via TIA Portal

Project tree

S7-1200 Tabletop Demo V16 KTP700 V3 ▶ CPU 1215C [CPU 1215C DC/DC/DC] ▶ Technology objects ▶ Conveyor [DB1]

Devices

S7-1200 Tabletop Demo V16 KTP700 V3

Add new device

Devices & networks

CPU 1215C [CPU 1215C DC/DC/DC]

Device configuration

Online & diagnostics

Program blocks

Technology objects

Add new object

Conveyor [DB1]

Configuration

Commissioning

Diagnostics

PID_Compact_DB [DB2]

External source files

PLC tags

PLC data types

Watch and force tables

Online backups

Traces

OPC UA communication

Device proxy data

Program info

PLC alarm text lists

Local modules

HMI KTP700 [KTP700 Basic PN]

Ungrouped devices

Security settings

Cross-device functions

Common data

Documentation settings

Languages & resources

Version control interface

Master control: Activate Deactivate Axis: Enable Disable

Axis control panel

Command: Jog

Velocity: 0.5 in/s

Acceleration / deceleration: 2.0 in/s²

Enable jerk limit

Jerk: 192.0 in/s³

Backward Forward

Stop

Current values

Position: 0.0

Velocity: 0.0

Axis status

Enabled

Homed

Ready

Drive error

Axis error

Restart required

Info message

Confirm

Error message

OK

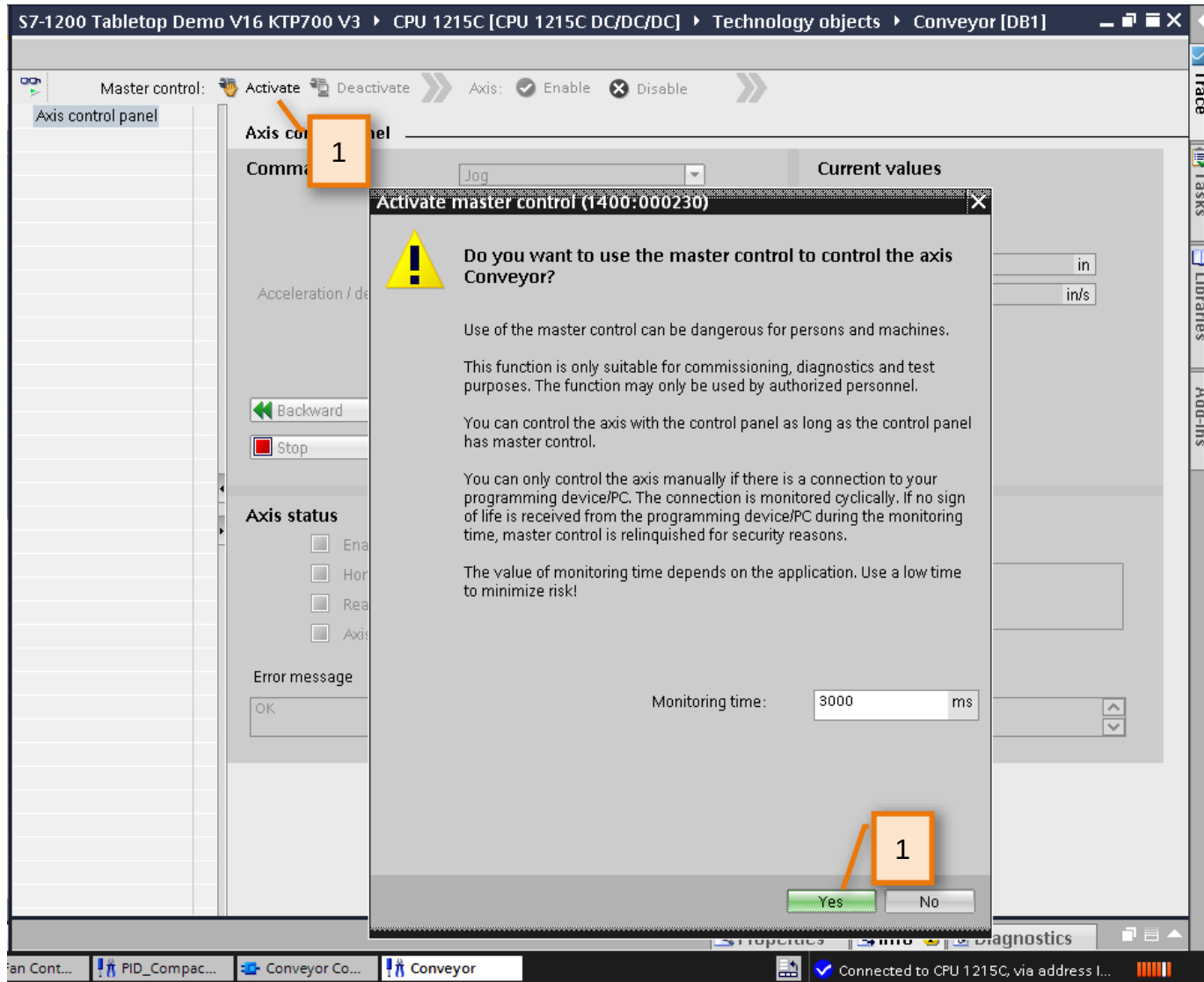
1. Under the PLC menu, double-click on the 'commissioning' screen under the "Conveyor [DB1]" technology object as shown.

*Project tree → "Technology objects" →
"Conveyor [DB1]" → "Commissioning"*



Technology Functions

Motion – Axis Control via TIA Portal

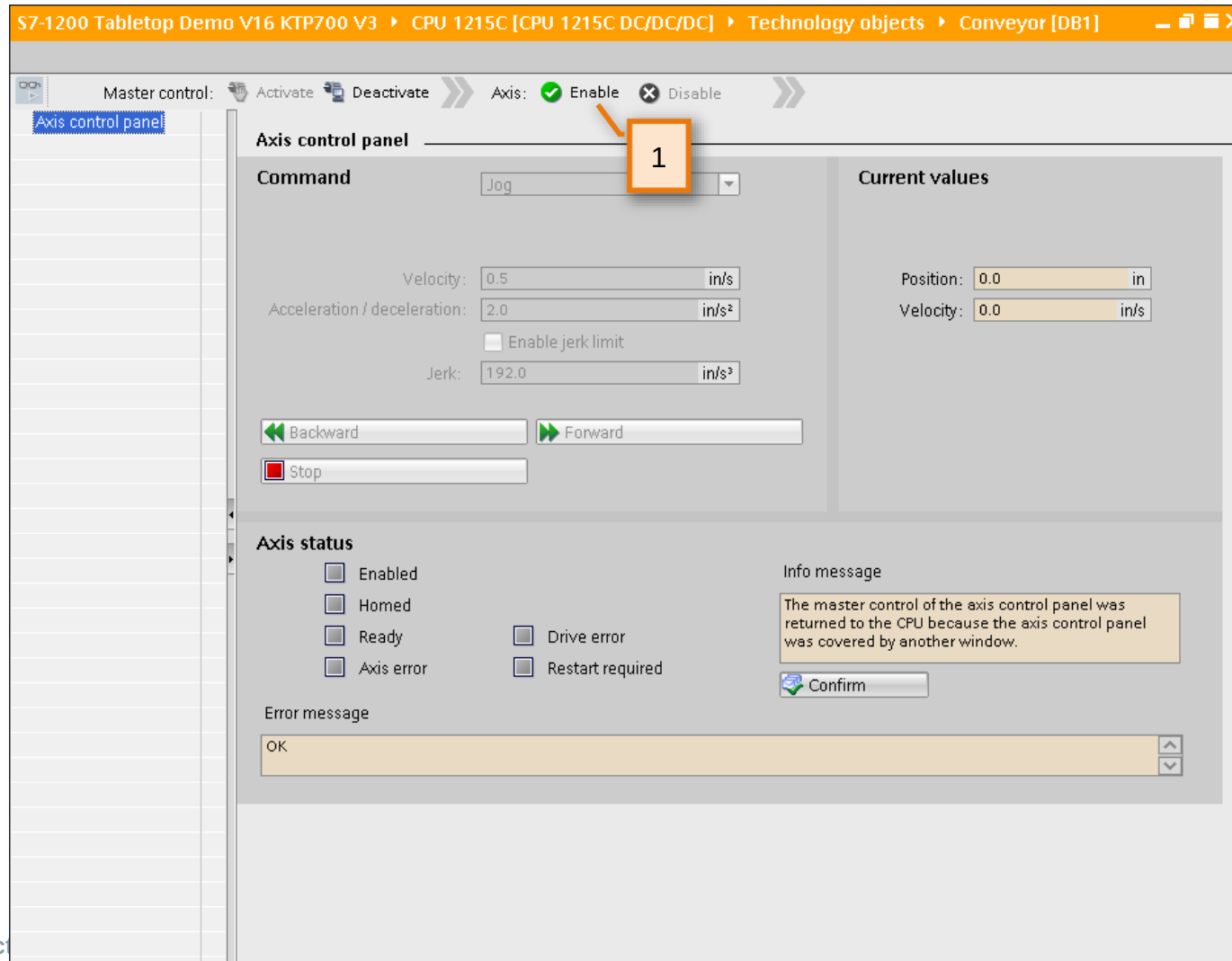


1. Click the “Activate” button to activate the axis control panel.
2. Select “Yes” in the window that pops up.

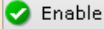


Technology Functions

Motion – Axis Control via TIA Portal



The axis control panel now appears.

1. Click on  **Enable** to activate the conveyor.



Technology Functions

Motion – 'Jog' Axis Control via TIA Portal

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The screenshot shows the 'Axis control panel' in the TIA Portal. The 'Command' dropdown is set to 'Jog'. The 'Current values' section shows Position: 36.95313 in and Velocity: 0.0 in/s. The 'Axis status' section shows 'Enabled' and 'Ready' as active. An error message at the bottom states: 'Value at "Velocity" parameter of motion control instruction is invalid. (Value is greater than configured maximum velocity)'. A blue starburst icon with an exclamation mark is next to the Velocity input field (6.0 in/s).

Axis control panel

Command: Jog

Current values

Position: 36.95313 in
Velocity: 0.0 in/s

Axis status

- ☒ Enabled
- ☐ Homed
- ☒ Ready
- ☐ Axis error
- ☐ Drive error
- ☐ Restart required

Info message: Axis is at standstill

Error message: Value at "Velocity" parameter of motion control instruction is invalid. (Value is greater than configured maximum velocity)

Jogging Mode

Axis Status

Actual Values

The 'Jog' function allows you to manually move the axis to a position with an appropriate value for velocity and acceleration.

Try different values and try to exceed the limits.

Configured Dynamics Settings:

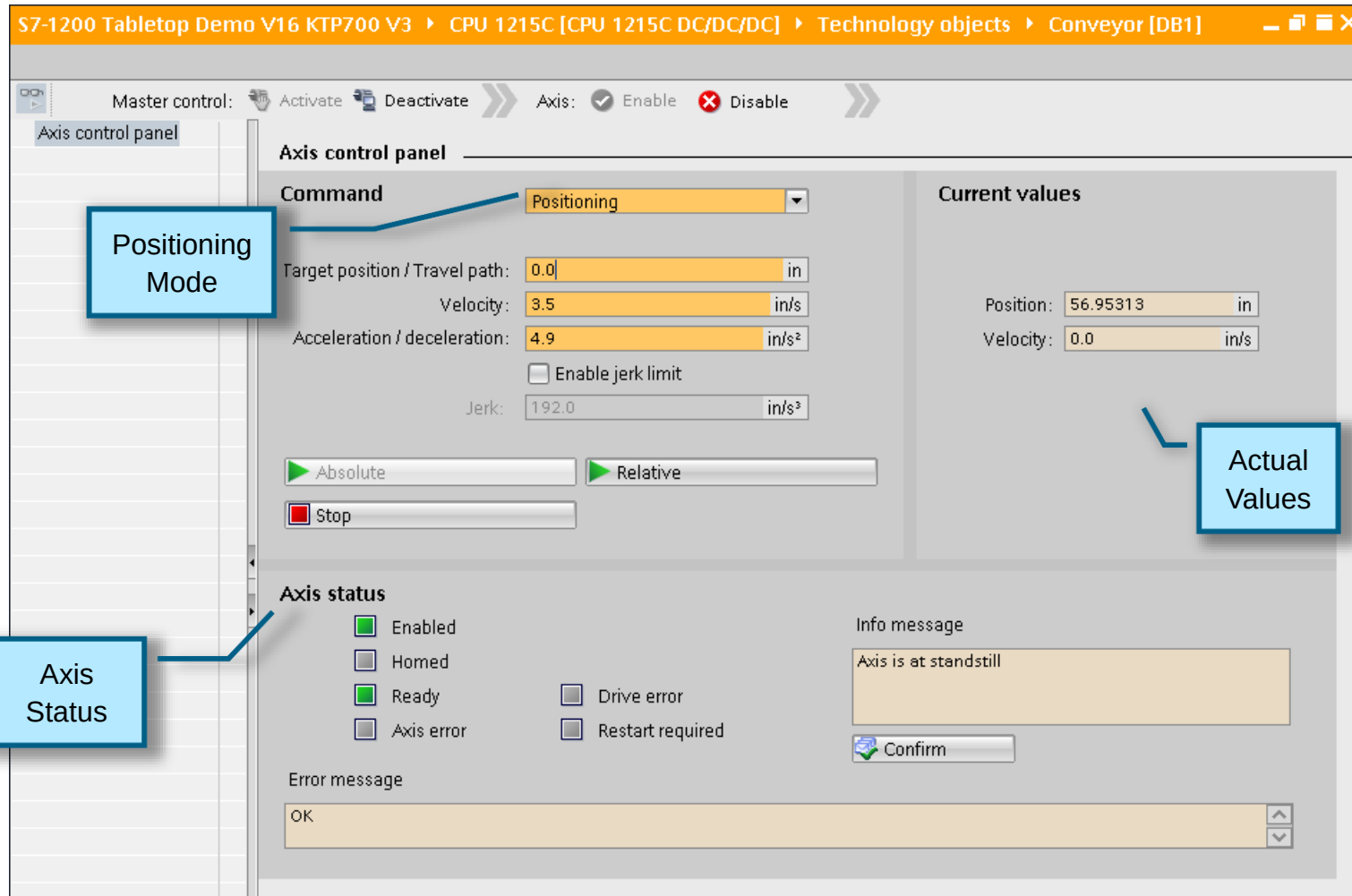
Max Velocity = 5 in/s

Acceleration = 4.9 in/s²



Technology Functions

Motion – 'Position' Axis Control via TIA Portal



The 'positioning' function allows you to move the conveyor to a specific distance with an appropriate value for velocity and acceleration.

Try different values and watch the actual values on the right

Configured Dynamics Settings:

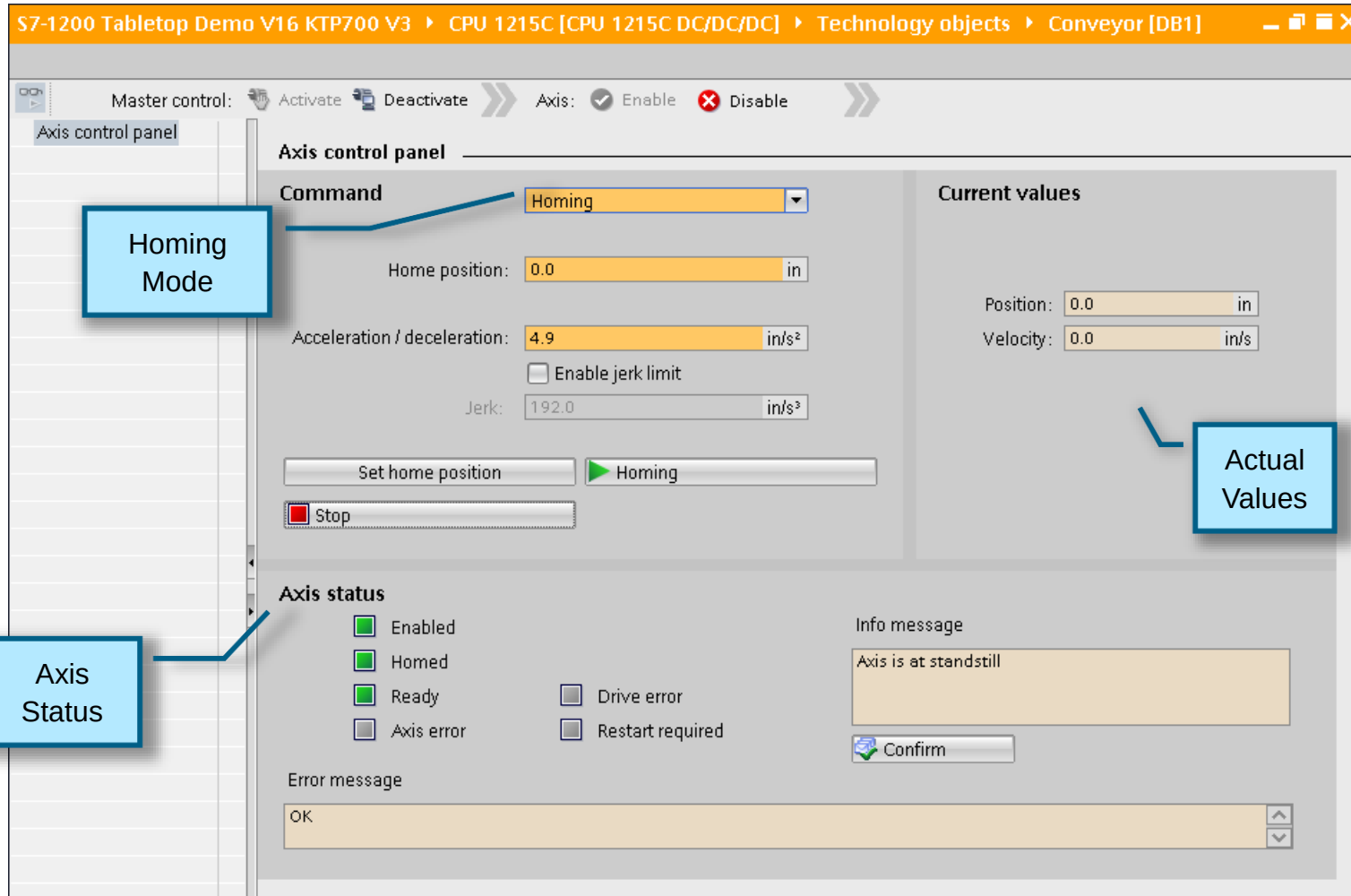
Max Velocity = 5 in/s

Acceleration = 4.9 in/s²



Technology Functions

Motion – 'Homing' Axis Control via TIA Portal



The 'homing' function allows you to define the initial/home position of the conveyor or trigger the homing command.

Actual Values

Homing Mode

Axis Status



Technology Functions

Motion – Axis Diagnostics via TIA Portal

The screenshot displays the Siemens TIA Portal interface. The left sidebar shows the 'Project tree' with the following structure:

- S7-1200 Tabletop Demo V16 KTP700 V3
 - Devices
 - ▼ S7-1200 Tabletop Demo V16 KTP700 V3
 - Add new device
 - Devices & networks
 - ▼ CPU 1215C [CPU 1215C DC/DC/DC]
 - Device configuration
 - Online & diagnostics
 - Program blocks
 - Technology objects
 - Add new object
 - ▼ Conveyor [DB1]
 - Configuration
 - Commissioning
 - Diagnostics

The 'Diagnostics' menu item under 'Conveyor [DB1]' is highlighted with a red box and the number '1'. The main window shows the 'Status and error bits' for the 'Conveyor' axis. The 'Diagnostics' menu is expanded, showing the following options:

- Status and error bits
- Motion status
- Dynamics settings

The 'Status and error bits' section is active, displaying the following status messages:

- Axis
 - Enabled
 - Homed
 - Axis error
 - Control panel active
 - Restart required
- Drive
 - Ready
 - Drive error
- Motion
 - Standstill
 - Acceleration
 - Constant velocity
 - Deceleration
- Type of motion
 - Positioning
 - Move at predefined velocity
- Limit switch status messages
 - Low SW limit switch has been approached
 - High SW limit switch has been approached
 - Low HW limit switch has been approached
 - High HW limit switch has been approached
- Error messages
 - SW limit switch has been approached
 - HW limit switch has been approached
 - Invalid direction of movement
 - PTO already in use
 - Configuration error
 - Internal error

An 'OK' button is visible at the bottom right of the status messages area.

1. Double-click on "Diagnostics" in the "Technology objects" menu.



Technology Functions

Motion – Axis Diagnostics via TIA Portal

S7-1200 Tabletop Demo V16 KTP700 V3 ▶ CPU 1215C [CPU 1215C DC/DC/DC] ▶ Technology objects ▶ Conveyor [DB1]

▼ Diagnostics

- Status and error bits
- Motion status
- Dynamics settings

Status and error bits

Axis: **Conveyor**

	Status messages	Limit switch status messages	Error messages
Axis	☐ Enabled ☐ Homed ☐ Axis error ☒ Control panel active ☐ Restart required	☐ Low SW limit switch has been approached ☐ High SW limit switch has been approached ☐ Low HW limit switch has been approached ☐ High HW limit switch has been approached	
Drive	☐ Ready ☐ Drive error		
Motion	☐ Standstill ☐ Acceleration ☐ Constant velocity ☐ Deceleration		
Type of motion	☐ Positioning ☐ Move at predefined velocity ☐ Homing active ☐ Command table active		

OK

Status Bits

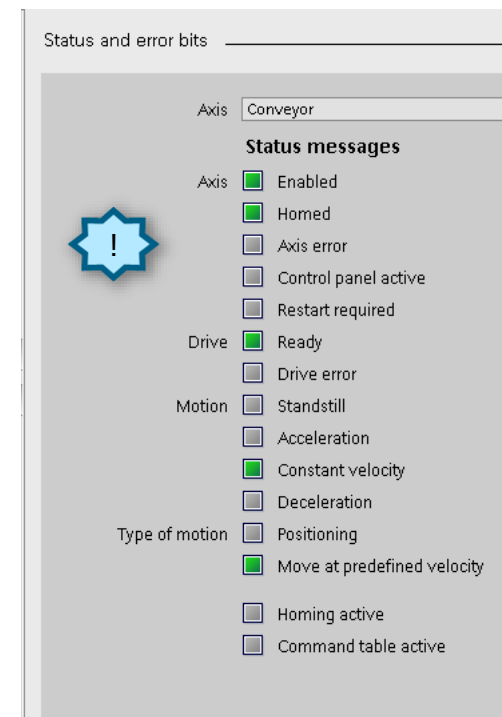
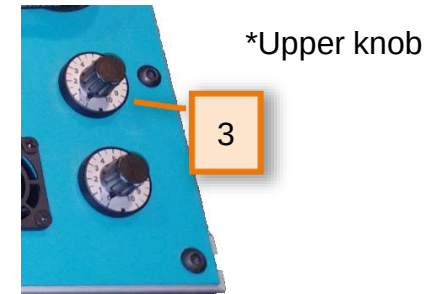
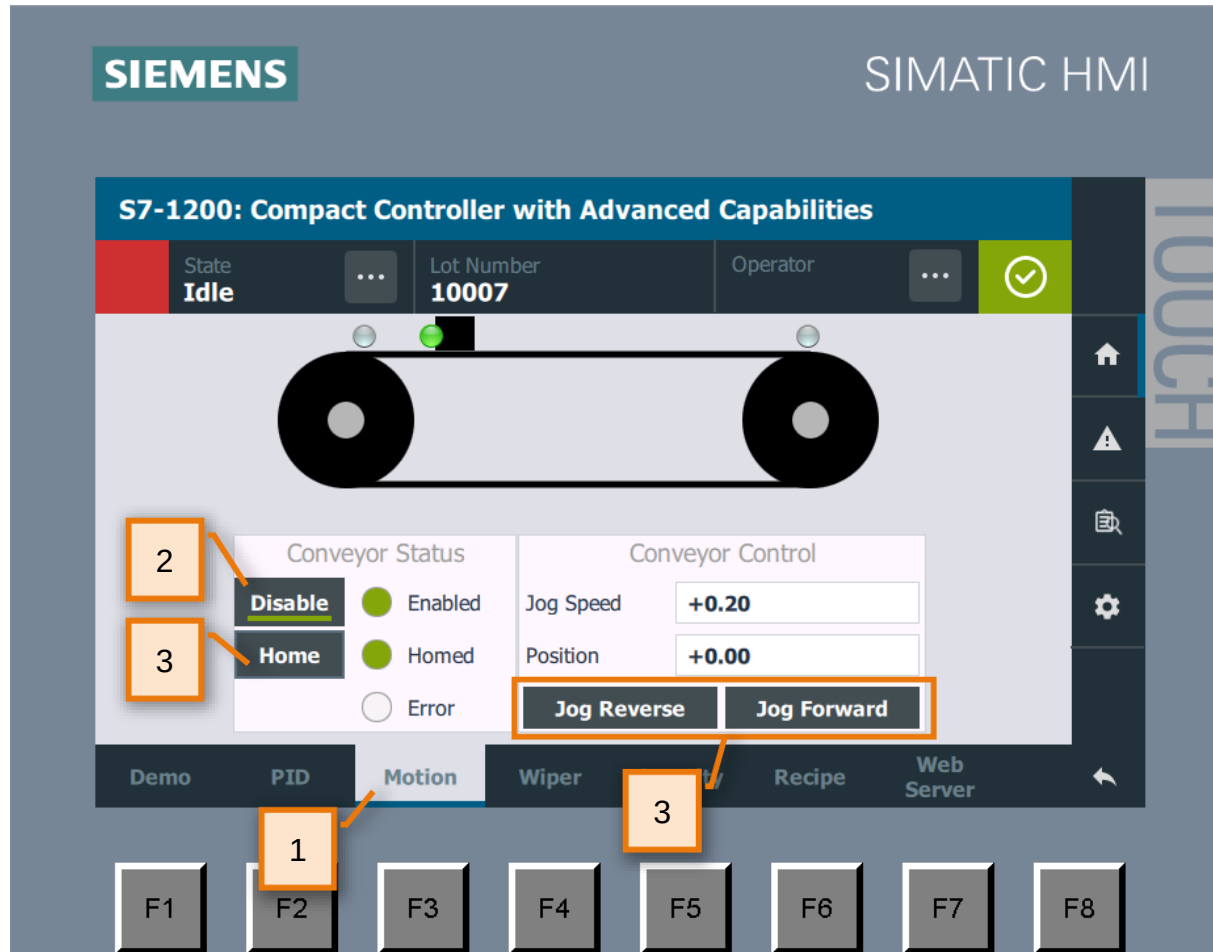
Different status and error bits from the axis interface allows for easy investigation of the status of the motion.

Error Bits



Technology Functions

Motion – Axis Diagnostics via TIA Portal



We will now control the axis using the HMI. Meanwhile, observing the status changing in the TIA Portal Diagnostic Screen between each step.

1. Open the "Motion" screen on the HMI
2. Enable the axis
3. Home the axis
4. Jog the axis

note: jog speed is adjusted using the upper pot.

! Notice the changes of the status in the TIA Portal Diagnostic screen as you go through the steps.



End of 'Technology Functions'



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