# In-output dependencies

## Lens lamp of the black white detector

Check if the measured time matches the time it takes from detecting the disc to the lens lamp going on. If this differs half a second or more, this is too much.

## Lens lamp of the position sensor

If the LED state indicator is on and you press the “START/STOP” button, the lens lamp should go on. If the LED state indicator is off and the “START/STOP” or “ABORT” button is pressed the lens lamp should go off.

## Engine of the conveyer belt

If the LED state indicator is on and you press the “START/STOP” button, the engine should turn, resulting in the conveyer belt’s top moving from the storage to the sorter. If the LED state indicator is off and the “START/STOP” is pressed the engine should go off, after the discs on the conveyer belt are processed. If the LED state indicator is off and the “ABORT” is pressed the engine should go off within 50ms.

## Engine of the feeder

To validate the engine of the feeder you can do the same as with the validation of *Engine of the conveyer belt*, but the turning should be clockwise when viewing the machine top down.

## Engine of the sorter

To validate the engine of the sorter you can do the same as with the validation of *Engine of the conveyer belt*, but there are added conditions. The engine moves when it gets a signal from the colour detector, resulting in the sorter arm going down. If the arm is down and the timer signals it’s time to go up, the engine makes sure to do so.

## Display for counting

To check if the counters are correct, we perform a test where the disc are in random order. Then we manually verify if the displayed amount is the same as the actual amount.

Initial state

Safety property 3 can be validated by looking at the UPPAAL model. There are states with incoming and outgoing arrows. However, there are no states with no outgoing arrows present, so that the UPPAAL model will never be in a deadlock. As a result, the assembly program won’t be stuck in a state and won’t stop until the machine is shut down.

From the UPPAAL model, it is also clear that safety property 4 is correct. The outputs of the H-bridge should never be powered on at the same time, otherwise it will create a short circuit and can’t keep on running. In the UPPAAL model, the H-bridge never shows multiple green lights and continues to run. Therefore, the outputs connected to the H-bridge will never be powered on at the same time, and so there will never be a short circuit.

Inputs/outputs Machine Design Software Specification

We see that the inputs and outputs of Software Specification are correct. The inputs of Machine Design should be equal to the outputs of Software Specification, which they are.