

RDE and flowpack OBs

This first exercise is meant to start using RDE environment with Robox synchronous OB library (flowpack OB). This is an easy workspace to test entry level commands and start getting familiar with some OBs. You can see the attached video (explained in chapter 6) to better understand the system.

1. Synchronous machine structure

In this exercise we start introducing a flowpack machine, which is a system able to put some products inside bags and then seal the bags to close them. A flowpack works in a cyclic way, always repeating a predefined cycle in which every axis is performing its motion. In this first exercise the machine structure is simple and not coming from a real situation, but just a demo. A structure scheme is shown in **figure 1**, as follows:

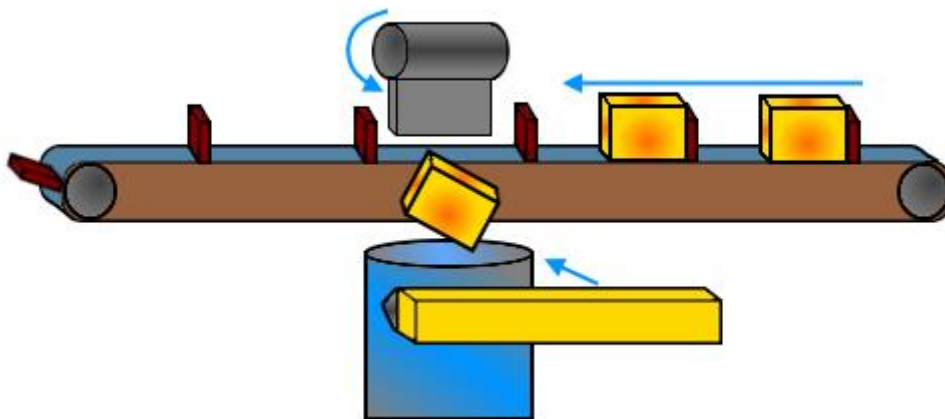


figure 1 - Machine scheme

This flowpack machine has a **chain** axis (brown and blue) bringing products and a **loader** axis (gray), rotating at 90 degrees over the chain, to push products inside bags (light blue). After a bag is full, a sealer and cutter (yellow bar) is pushed to cut the bag and close it with a hot seal. The hot seal has no motor, it's just a pneumatic moved by a relay controlled by a digital output.

In this machine we can identify two axes: a chain and a loader. These axes must work with precise positions, in a synchronous way, otherwise they may hit each other. Therefore, they both work in function of machine speed and controlled by a master axis reference position. This means that chain and loader are slave of a master (virtual). The sealer is controlled in cam too, but just in a binary way (true/false) to enable/disable the bar pusher pneumatics.

1.1 Chain

The rod chain is an axis bringing products. This axis has a phase relative to the master of 30 degrees and moves without any cam, just at linear speed. Each cycle is 400 mm long and fast stop time is 0,25 s. Other parameters are listed as follows:

	Speed [cycle/s]	Acc [cycle/s ²]	Jerk [cycle/s ³]
Jog	0,5	5	25
Reach master	0,2	6	30
Master lock	3	6	30

1.2 Loader

This axis rotates at 90 degrees with respect to the chain, in order to push products out by chain's side and make them fall into the bag. Since the product is delicate, the loader has to perform a slowdown during its approach and push, therefore it has a cam which makes it slower for 30 degrees (± 15 deg centered at zero) where the speed is 0.5 as normal. Other parameters are the same as chain axis.

1.3 Sealer

The sealer is just performing a digital output, enabled only if its master speed is moving. If the master stops when the sealer is pushing, it must be released. According to chain cycle, the sealer has to seal starting at 120 deg until 270 deg.

2. Create a new project to control 2 axes

Create a new RDE project.

Create 2 axes and a power set to handle them.

Write task and rule to control the system. RP1 or RP2 controllers should be used.

Program this synchronous machine using Robox library Flowpack OBs.

3. Write rule and task file in R3 language to control the machine

Prepare to handle these operative modes:

- Power off
- Fast stop
- Idle
- Zero cycle
- Manual

- Posit
- Auto

Remember that task is used to make FSM and switch among operative modes (SELECT command), together with OB parameters update. Rules are used to control the motion. Zero cycle can be omitted in this sample, just set zero done to emulated axes.

Rule posit is to be used to move axis in the correct place before starting AUTO. This is done thanks to “reach_master” OB mode. Each time start button is pressed, system must check all axes positions and move them to avoid position steps or jumps.

If stop button is pressed during automatic, the machine must perform a phase stop at 230 deg of master cycle. Standard machine speed is 0,3 cycle/s, but it can be modified runtime at any value up to 1 cycle/s. Other parameters are listed as follows:

	Speed [cycle/s]	Acc [cycle/s ²]	Jerk [cycle/s ³]
Jog	0,4	3	15
Move (auto)	0,3 – 1	0,4	2

4. Input and outputs

Following I/O have to be handled by controller:

- Inp_alm_reset inp_w(10).0
- Inp_start_button inp_w(10).1
- Inp_stop_button inp_w(10).2

- out_green_lamp out_w(10).0
- out_yellow_lamp out_w(10).1
- out_red_lamp out_w(10).2

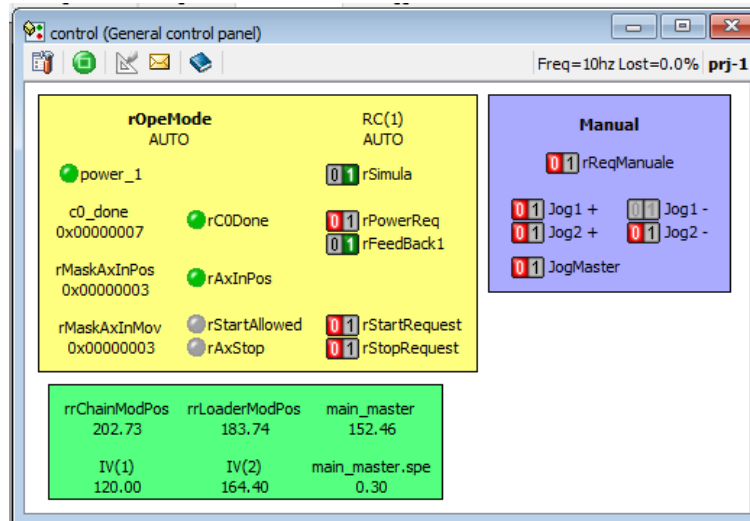
In order to switch on the lamps, there are two signals that you must create: fast frequency at 2 Hz and slow frequency at 1 Hz.

- out_green_lamp is switched on in the auto mode and blinks slowly in manual.
- out_yellow_lamp is on if idle mode, blinks slowly in zero cycle and blinks quickly in posit.
- out_red_lamp is on in power off, blinks quickly in fast stop mode and blinks slowly if any alarm is present.

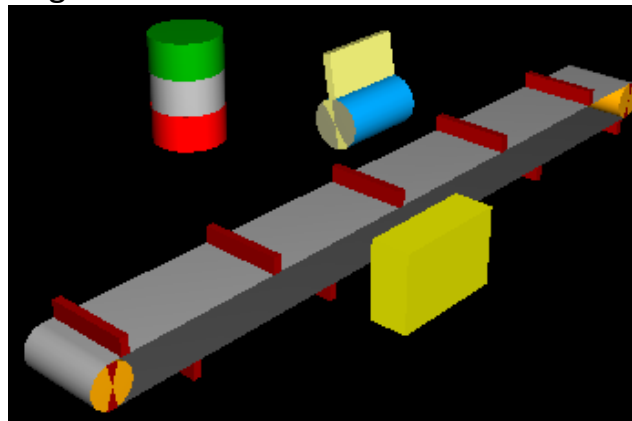
Other controls and commands may be done as you prefer, with inputs or registers.

5. Debug

Switch on the system and make it work. On RDE make a control panel with related control buttons to be able to handle all machine behaviors. Inputs can be forced by buttons. You will see out_w(10).0 as first output of RP1 onboard led. If you use a different Robox controller you will need to put a led in the panel.



An oscilloscope to show all axes' modulated positions and IV is required. A 3D panel to see moving pieces and output lights should be made as exercise.



6. Video

You can see attached video to well understand the system and how it has to work: at begin of the video, the machine is switched on, then moved in jog to test axes; after zero cycle and positioning, machine starts its production in auto mode, at a speed of 0,3 cycle/s. The user then, reaches 0,8 cycles/s and finally 1 cycle/s. After a machine phase stop and restart, the speed is lowered again to 0,3 cycle/s and again stopped in phase at 230 deg.