Asycube

User Guide

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Table of Contents

1. Introduction

1.1.   Generalities

The following document is the property of Asyril S.A. and may not be copied or circulated without permission. The information contained in this document is subject to change without notice for the purpose of product improvement. Before operating your product, please read this document in order to ensure a correct use of the product. Nevertheless, if you meet difficulties during the operation or the maintenance, please, feel free to contact Asyril customer service.

In this manual, the safety precautions that you must respect are classified as: "Danger", "Warning" and "Note"; the following symbols are used:

DANGER!

Failure to observe the instruction may result in death or serious injury.

DANGER!

Failure to observe the instruction may result in electrocution or serious injury due to electric shock

WARNING!

Failure to observe the instruction may result in injury or property damage.

NOTE :

The user should read carefully this information to ensure the correct use of the product, although failure to do so would not result in injury.

Refer to …

For more information on a specific subject, the reader should read other manual, or refer to other paragraph.

WARNING!

Asyril shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in "Safety Precautions" of the OPERATING MANUAL. The customer is responsible to provide the necessary instruction to the persons concerned.

NOTE :

All dimensions in this document are expressed in millimeters

1.2. Related manuals

As shown in Table 1-1 below, this manual is an integral part of the Asycube documentation set.

Manual Title	Manual reference	Description of the content
Asycube Unpacking Instructions	ACUBE-240_Unpacking_Instructions	Describes how to unpack your Asycube.
Asycube Operating Manual	Asyril_ASYCUBE-50_80_Operating_Manual Asyril_ASYCUBE-240_Operating_Manual	Technical description, safety precautions, installation, maintenance and reparation information
HMI User Guide	Asyril_HMI_User_Guide	Describes how to use the HMI (simply move the parts, and configure the Asycube's vibrations …)
Asycube Programming guide	Asyril_ASYCUBE-50_80_Programming_Guide Asyril_ASYCUBE-240_Programming_Guide	Describes how to integrate and program the Asycube
Asycube User Guide	Asyril_ASYCUBE_User_Guide	Describes how to use the Asycube products (tuning of the different vibration parameters, creating a sequence …)
Asycube Plugin .NET	ACUBE_PLUGIN_.NET_Integration_Guide	Describes the Asycube dll's that are High-level libraries, which help to integrate Asycubes using .Net 3.5 environment.

Table 1-1: Overview Manuals

2. User Guide Introduction

This chapter presents a brief introduction on the general functioning of the Asycube and an overview of the procedure for setting up the Asycube for your application, followed by a definition of the expressions used throughout this and the other Asyril documentation. The following chapters detail how to use the Asycube and at end, to conclude this document, a step-by-step example is given.

The Asycube is a flexible feeding system, which spreads the parts on the picking surface using smart vibrations. The displacements in all directions as well as more advanced trajectories are the result of the sum of the excitations of the different actuators. The role of the Asycube is to:

- Distribute and flip the components over the picking surface
- Manage the feeding from the hopper in order to have enough components on the picking surface
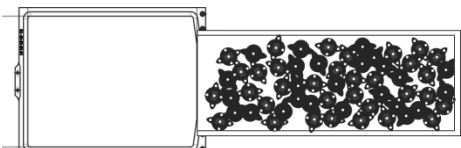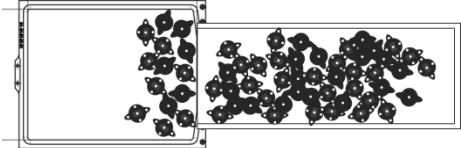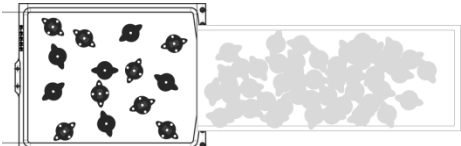
2.1. General Functioning

The table below shows the general way of use of the Asycube with interaction of a vision system and a robot, starting from an initial empty platform.

#AllParts = number of parts detected on the picking surface

Threshold = upper limit of parts on the platform for vibration

GoodParts = parts well oriented and ready to be picked by a robot

Initial state		#AllParts < Threshold ⇨ Feed
Asycube feeds from the hopper		#AllParts < Threshold ⇨ Feeding + spreading
Asycube spreads components with smart vibration		
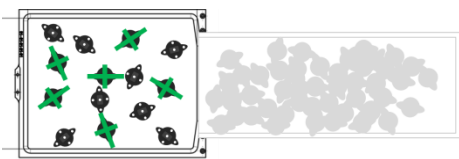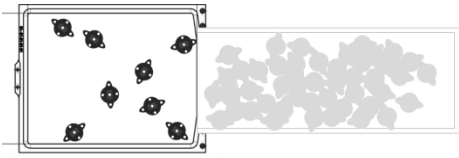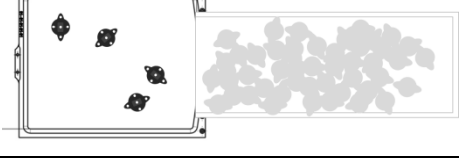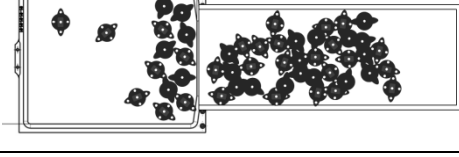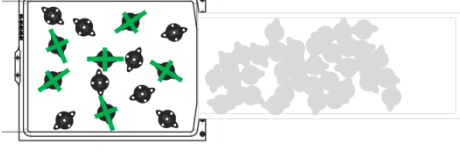
A **vision system** detects which parts are ready to be taken		Get the lists of AllParts & GoodParts Positions
A **robot** picks up the good parts		
Asycube spreads components with smart vibration		#AllParts > Threshold ⇨ Spreding
A **vision system** detects which parts are ready to be taken		Get the lists of AllParts & GoodParts Positions
A **robot** picks up the good parts		
Asycube feeds from the hopper		#AllParts < Threshold ⇨ Feeding + spreading
Asycube spreads components with smart vibration		
A **vision system** detects which parts are ready to be taken and a robot picks up the good parts		…

Table 2-1: Sequence of Use of a Flexible Feeder

2.2.   Overview General Procedure

The table below presents the general procedure to set up your Asycube for your specific application. The next chapters of this document follow the order of the general procedure and at the end of this document, a step-by-step example recapitulates the different aspects approached.

Steps		
1. Install and configure the Asyril HMI	3. Asyril HMI Installation	*page 12*
2. Adjust *Platform* and *Hopper Vibrations / Output Activations*	4. Hopper Vibration / Output Activation	*page 15*
a. for part family 1 (Vibration Set 1)	5. Platform Vibration	*page 18*
b. for part family 2 (Vibration Set 2)	9. Example	*page 35*
c. for part family 3 (Vibration Set 3)		
d. etc.		
3. Adjust Sequences	6. Sequence	*page 24*
a. for scenario 1, flat platform,… (Sequence 1)	9. Example	*page 35*
b. for scenario 2, structured platform, … (Sequence 2)		
c. for scenario 3, flat platform, … (Sequence 3)		
d. etc.		
4. Save all the parameters in the Asycube	7. Saving	*page 31*
5. Configure the backlight	8. Backlight	*page 33*
6. Execute commands from PLC (Programmable Logic Controller)	9. Example	*page 35*
a. Select a Vibration Set		
b. Execute a Sequence		
c. Activate the backlight		
d. etc.		

Table 2-2: Overview General Procedure

2.3. Definitions

Platform Vibration:

A *Platform Vibration* is defined as the combination of the excitation of each actuator in order to obtain the desired trajectory of parts on the platform. 26 *Platform Vibrations* (A – Z) are available, each of them is composed of several parameters for each actuator (e.g. amplitude, frequency etc.) as well as the vibration duration.

Please refer to chapter 5 on page 18 of this document for more information on Platform Vibrations.

Hopper Vibration / Output Activation:

Depending on the Asycube, a hopper is integrated (Asycube 50 and 80) or not (Asycube 240). The expression *Hopper Vibration* is used in the case of an integrated hopper and *Output Activation* is used for the Asycube 240.

- Asycube 50/80 (integrated hopper): a *Hopper Vibration* corresponds to the excitation of the actuator in order to obtain the desired trajectory of parts on the hopper. 26 *Hopper Vibrations* (A – Z) are available, each of them is composed of several parameters (e.g. amplitude, frequency, vibration duration etc.).

- Asycube 240: The Asycube 240 is equipped with two outputs, which can be used to drive one, two hoppers or whatever is connected to these outputs. The Asycube 240 contains 26 *Output Activations* (A – Z); each of them can be configured in order to activate or not an output, to select an analog output value, to set the duration of the signal etc.

Please refer to chapter 4 on page 15 of this document for more information on Hopper Vibrations / Output Activations.

Standard Vibration:

To simplify the configuration of parameters, some *Platform Vibrations* and *Hopper Vibrations/Output Activations* are pre-defined vibrations called *Standard Vibration*. In the case of the Asycube 50 and 80, there are nine *Standard Platform Vibrations* (A – I) such as for example 'Forward', 'Forward left', 'Right', 'Backward' etc. In the case of the Asycube 240, there are two additional *Standard Platform Vibrations* (J and K), which correspond to short and long axis centering vibrations. *Hopper Vibrations / Output Activations* present a similar structure.

Custom Vibration:

The non-*Standard Vibrations* are called *Custom Vibrations* and can be used for further customization.

Vibration Set:

26 *Vibration Sets* are contained in the Asycube and are identified by means of its ID. One *Vibration Set* contains 26 *Platform Vibrations* and 26 *Hopper Vibrations/Output Activations* (See Figure 2-1). Note that the *Vibration Set* 26 is not modifiable by the user as it corresponds to default parameters already adjusted in order to obtain a good behavior of a standard part on your Asycube.

Smart Vibration:

A *Smart Vibration* is based on the input of a vision system in order for the Asycube to adapt to the current situation. In addition of the input of a vision system, it uses the parameters tuned in the *Vibration Set*. Thus, its effectiveness depends strongly on well-adjusted vibrations. There are two types of *Smart Vibrations*:

- **Vibration type 'Centering'**: This vibration type is used to center parts on the platform. It computes based on the detected position of the parts (center of mass) the direction and duration of the vibration.

- **Duration mode 'Quantity Adjusted'**: This duration mode is used to adapt the feeding duration of new parts onto the picking surface based on the number of parts detected on the surface. The more parts are on the surface, the less new parts are fed.

Please refer to section 6.3 on page 27 of this document for more information on Smart Vibrations.

Sequence:

26 Sequences are available, each of them composed of seven *Actions*. An *Action* could be a *Hopper* or *Platform Vibration*, a certain waiting duration for part stabilization, the *Smart Vibration* 'Centering' that adapts the direction and vibration duration depending on the part location etc.

Please refer to chapter 6 on page 24 of this document for more information on Sequences.

Vibration Sets

ID 1

Standard Vibrations

Platform Vibration		Hopper Vibration	
A	Forward	A	Forward
B	Forward left	B	Custom
C	Forward right	C	Custom
D	Left	D	Custom
E	Right	E	Custom
F	Backward	F	Custom
G	Backward left	G	Custom
H	Backward right	H	Custom
I	Flip	I	Custom
J	**Custom**	J	**Custom**
K	Custom	K	Custom
L	Custom	L	Custom
M	Custom	M	Custom
N	Custom	N	Custom
O	Custom	O	Custom
P	Custom	P	Custom
Q	Custom	Q	Custom
R	Custom	R	Custom
S	Custom	S	Custom
T	Custom	T	Custom
U	Custom	U	Custom
V	Custom	V	Custom
W	Custom	W	Custom
X	Custom	X	Custom
Y	Custom	Y	Custom
Z	Custom	Z	Custom

Standard Vibration

1 to 26

ID 26

Platform Vibration		Hopper Vibration	
A	Forward	A	Forward
B	Forward left	B	Custom
C	Forward right	C	Custom
D	Left	D	Custom
E	Right	E	Custom
F	Backward	F	Custom
G	Backward left	G	Custom
H	Backward right	H	Custom
I	Flip	I	Custom
J	**Custom**	J	**Custom**
K	Custom	K	Custom
L	Custom	L	Custom
M	Custom	M	Custom
N	Custom	N	Custom
O	Custom	O	Custom
P	Custom	P	Custom
Q	Custom	Q	Custom
R	Custom	R	Custom
S	Custom	S	Custom
T	Custom	T	Custom
U	Custom	U	Custom
V	Custom	V	Custom
W	Custom	W	Custom
X	Custom	X	Custom
Y	Custom	Y	Custom
Z	Custom	Z	Custom

Figure 2-1: Description of Vibration Sets Asycube 50 & 80

Sequences

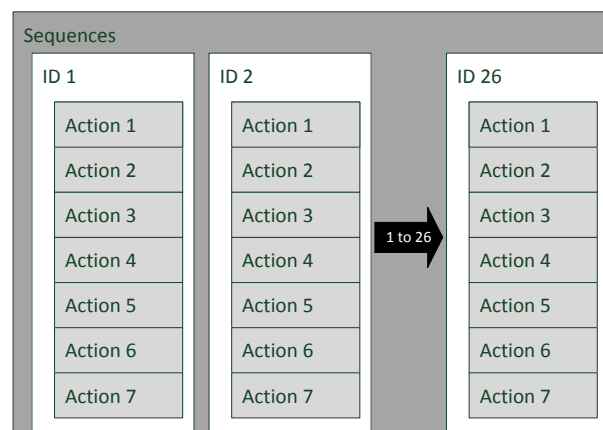| ID 1	ID 2	1 to 26	ID 26
Action 1	Action 1		Action 1
Action 2	Action 2		Action 2
Action 3	Action 3		Action 3
Action 4	Action 4		Action 4
Action 5	Action 5		Action 5
Action 6	Action 6		Action 6
Action 7	Action 7		Action 7

Figure 2-2: Description of Sequences

3. Asyril HMI Installation

NOTE:

If a computer is included in your product, the "HMI" software is already installed.

This chapter explains how to install the HMI on your own computer if needed.

3.1.   Prerequisite

To install and execute the HMI you need following elements:

- Computer with windows 7 (or 8) 64bits (a 32 bits version of HMI can be delivered on request)
- .Net 4.0 minimum installed.
- User access defined such as to be able to install and execute software.

NOTE:

Check that your version of the ".net framework" is up to date. You can download this version from the Microsoft website: http://www.microsoft.com/download/

3.2.   Installing the HMI software on a specific computer

3.2.1. Pre-installing

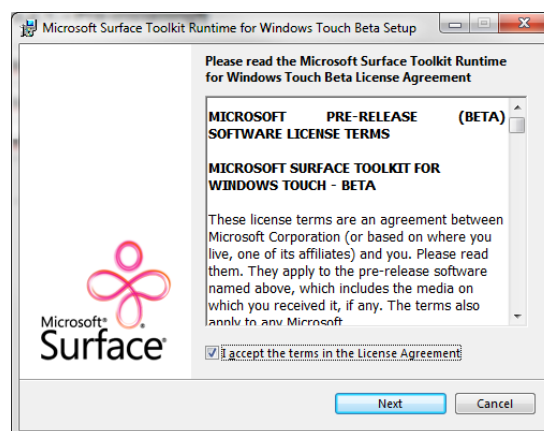| Step 1	Insert the USB key into the computer on which the HMI should be installed
Step 2	Double-click on the SurfaceToolkitRuntime.msi executable file to launch the installation procedure
Step 3	Accept the license agreement and follow the instructions provided by the wizard

Figure 3-1: HMI Setup Wizard

Step 4	When installation is complete, click on "Finish" to close the wizard

3.2.2. Installing

Step 1	Insert the USB key into the computer on which the HMI should be installed
Step 2	Double-click on the setup.exe executable file to launch the installation procedure

Figure 3-2: HMI Setup Wizard

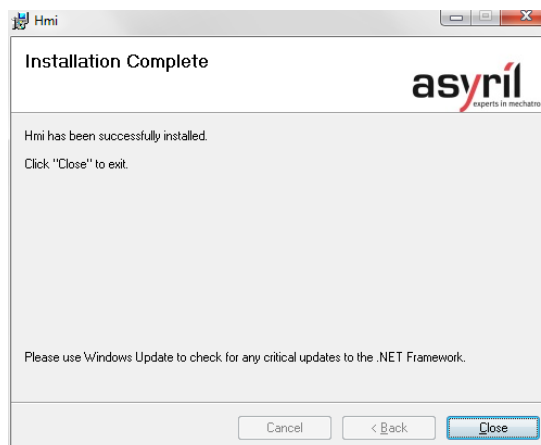| Step 3	Follow the instructions provided by the wizard
Step 4	When installation is complete, click on "close" to close the wizard

Figure 3-3: Installation Complete

3.2.3. Starting HMI

Step 1	Click on the shortcut created on the desktop
Step 2	Configure the HMI (see next section)

3.2.4. Configuring HMI

On the first start, HMI contains no product. You have to add your product in the configuration page to be able to work with it.

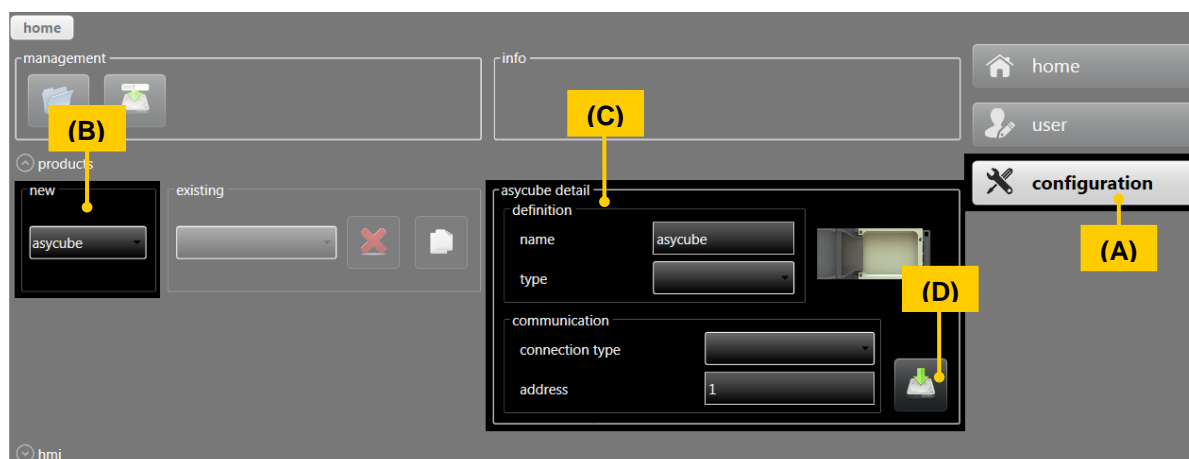The following explanation shows you how to do so:

Figure 3-4: HMI Configuration Page

Ref.	Designation	Description
(A)	*Configuration" button*	Press this button to display the Configuration screen.
(B)	*"New product" list*	Select in this list the product you want to add (an Asycube in this example).
(C)	*"Asycube parameters" window*	Fill all parameters of the product you choose.
(D)	*"Save" button*	Use this button to save the configuration changes. Then you need to restart HMI to apply your modifications.

Table 3-1 : HMI Configuration Page Description

For more explanations, see HMI documentation.

3.2.5. Troubleshooting

Ref.	Problem	Solution
1	*HMI crashes on starting*	Try to start HMI with administrator access (right-click on shortcut, Properties/Compatibility, select "Run this program as an administrator").
2	*HMI starts but no buttons are displayed*	The SurfaceToolKit is missing or improperly installed.

Table 3-2 : Troubleshooting Listing

4. Hopper Vibration / Output Activation

Depending on the Asycube, a hopper is integrated (Asycube 50 and 80) or not (Asycube 240). Therefore, there are some little differences but the general structure is similar. The following sections describe the organization of the parameters as well as the optimal configuration for *Standard Hopper Vibrations / Output Activations*.

4.1. Asycube 50 & 80

The Asycubes 50 and 80 have an integrated hopper to feed the necessary number of parts onto the platform in order to obtain at each cycle an acceptable number of parts available for picking. Table 4-1 below lists the parameters that are used to adjust the behavior of the hopper.

Parameter Name	Explanation	Effect	Unit	Range
Amplitude	Amplitude of the signal sent to the actuator and defined as the percentage of the maximum amplitude	Augmenting the amplitude makes the parts jump more.	[%]	0 to 100 %
Frequency	The frequency of the signal sent to the actuator	Parts react more at a certain frequency depending on different factors (mass/ geometry/ rigidity).	[Hz]	10 to 250 Hz typically 60-80 Hz
Waveform	Is defined as the shape of the signal	A ramp up form makes parts move more hectically (typical for the hopper), whereas a sinus waveform corresponds to smoother part movement.	[-]	0=no signal 1=sinus 2=ramp up 3= ramp down
Duration	Amount of time the signal (i.e. vibration) lasts	Augmenting the duration makes the part travel a longer distance on the hopper (i.e. feeding more parts). Choosing a value of 0ms corresponds to continuous vibration (until the stop button is pushed).	[ms]	0 ms 1 to 32'767 ms

Table 4-1: Asycube 50 & 80 - Hopper Parameters

For more information on the different commands, please refer to the Programming Guide of your Asycube.

4.2. Asycube 240

The Asycube 240 is equipped with two outputs, which are commonly used to drive one or two hoppers in order to feed the necessary number of parts onto the platform as to obtain at each cycle an acceptable number of parts available for picking.

Obviously, the configuration of the outputs depends on what is actually connected to the outputs. However, to simplify the feeding operation, *26 Output Activations* are available in order to customize the behavior of a hopper or whatever is connected to the outputs. These 26 *Output Activations* (A – Z) are contained in one *Vibration Set*.

For more information on the electrical interface and connector reference, please refer to the Operating Manual.

Each of the *Output Activations* contains five adjustable parameters listed in Table 4-2. These parameters are used to choose which outputs are activated, to select the voltage of a specific output as well as the duration of the execution of an *Output Activation*. Note that when executing an *Output Activation*, the two outputs may be active and have a different output value, but their duration is identical.

Parameter Name	Effect	Unit	Range
Toggle output 1	Defines if the output 1 is active (1) or not (0) during the execution of an *Output Activation*.	[-]	0 or 1
Analog output 1 value	Gives the target value of analog output 1 applied during the execution of an *Output Activation*: 100% corresponds to 10V output.	[%]	0 to 100 %
Toggle output 2	Defines if the output 2 is active (1) or not (0) during the execution of an *Output Activation*.	[-]	0 or 1
Analog output 2 value	Gives the target value of analog output 2 applied during the execution of an *Output Activation*: 100% corresponds to 10V output.	[%]	0 to 100 %
Duration	Duration of the *Output Activation*. The two outputs may be active and have a different output value, but the activation duration is identical. If the value chosen is 0ms, outputs will be active until the stop button is pressed.	[ms]	0 ms 1 to 32'767 ms

Table 4-2: Asycube 240 - Output Activation Parameters

NOTE :

Two Standard Vibrations are available: The first, 'Output 1' (A) activates by default the output 1. The second, 'Output 2' (B) activates output 2.

For more information on the different commands, please refer to the Programming Guide of your Asycube.

5. Platform Vibration

A good vibration behavior is achieved when:

- the parts slide on the surface and are able to cross the platform in all directions
- the parts jump only when using the vibration 'Flip'

The movement of the parts on the platform depends on the combination of the different actuator excitations of the Asycube. Each actuator can be adjusted individually using the four parameters amplitude, frequency, phase and waveform in order to obtain the desired part-movement. In addition, the vibration duration has to be adjusted and is identical for all actuators. The result is called a *Platform Vibration*. See Table 5-1 for the detailed explanation of parameters.

ℹ **IMPORTANT NOTE:**

*It is **IMPORTANT** to set the **vibration duration** as the time the parts need to **completely cross the platform** in a given direction. The effectiveness of the 'Centering' Smart Vibration and duration mode 'Vibration Ratio' depends on well-adjusted parameters.*

Parameter Name	Explanation	Effect	Unit	Range
Amplitude	Amplitude of the signal sent to each actuator and defined as the percentage of the maximum amplitude	Augmenting the amplitude makes the parts jump more.	[%]	0 to 100 %
Frequency	The frequency of the signal sent to actuators	Parts react more at a certain frequency depending on different factors (mass/ geometry/ rigidity). Use the same frequency for all actuators when tuning a *Platform Vibration*.	[Hz]	10 to 250 Hz
Phase	Phase shift with the first actuator signal (which corresponds to the reference signal)	Actuator excitations combined differently. Using a phase shift of 180° normally inverts the movement of parts on the platform.	[°]	0 to 360°
Waveform	Is defined as the shape of the signal	A sinus waveform form corresponds to smoother part movement, whereas with a ramp form the parts move more hectically.	[-]	0=no signal 1=sinus 2=ramp up 3= ramp down

Duration	Amount of time the signal (i.e. the vibration) lasts	Augmenting the duration makes the parts travel a longer distance on the platform. Set the duration such as the parts completely cross the platform. Choosing the value 0ms corresponds to continuous vibration (until stop button is pushed).	[ms]	0 ms 1 to 32'767 ms

Table 5-1: Platform Vibration Parameters

The Asycube 50 and 80 work with three actuators opposed to four actuators for the Asycube 240. Therefore, the behavior is a little different. The following sections present more in detail the behavior of your Asycube and give some general advice on how to tune the parameters.

NOTE :

The Vibration Set 26 is defined as being the default Vibration Set (not modifiable by the user): The parameters are already adjusted in order to obtain a good behavior of standard parts on your Asycube. It is strongly recommended to use the default Vibration Set as starting point for the tuning of your parameters.

5.1. Asycube 50 & 80

The Asycube 50 and 80 work with three actuators: two in-plane actuators (Figure 5-1: Act.1 and Act.2) and a vertical one (Act.3). Below, some hints that are useful to adjust the vibrations:

- Use a small vertical vibration (non-zero amplitude for Act.3) for smooth displacement of parts on the platform. Use a stronger vertical vibration (larger amplitude for Act.3) for the 'Flip' vibration.

- For all *Platform Vibrations* but 'Flip', the frequency is usually identical, meaning that once a suitable frequency is found for the displacement of the parts on the platform, the same frequency can be used for other types of displacement.

- The direction of the movement of the parts on the platform is a result of the combination of the two in-plane actuator vibrations (Act. 1 and Act.2). Switching the phase from 0° to 180° the direction of the displacement is inverted (Figure 5-1). The amplitude of the Act. 3. may be different from one direction to the other.
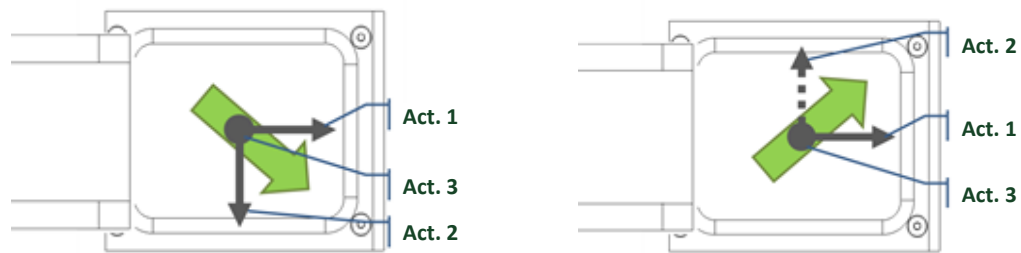
Figure 5-1: Asycube 50 & 80 – Actuator Disposition and Example
(green arrow) (solid line: 0° phase, dashed line: 180° phase)

- If the parts do not move exactly towards the desired target, one can adjust the amplitude of the two in-plane actuators (Act.1 and Act.2) in order to correct the displacement direction of the parts.

NOTE :

The presented hints are general and may not be perfectly suited to your Asycube. We recommend to use the default Vibration Set 26 as a starting point, since it is adjusted and tested for a standard part on your product.

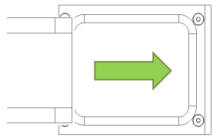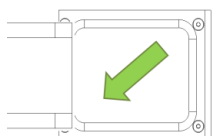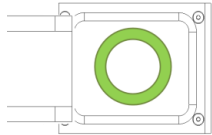Table 5-2 below summarizes the range frequency typically used for the *Standard Platform Vibrations.*

Direction		Vibration		Frequency range
Forward	(A)		A	
Forward Left	(B)			
Forward Right	(C)			
Left	(D)	…		~ 90 Hz
Right	(E)			
Backward	(F)		H	
Backward Left	(G)			
Backward Right	(H)			
Flip	(I)		I	~ 90 Hz

Table 5-2: Asycube 50 & 80 – Standard Platform Vibrations

5.2.   Asycube 240

The Asycube 240 has four actuators, one in each corner of the platform. Below, some hints that are useful to adjust the vibrations:

- The direction of the movement of the parts on the platform is the result of the combination of the excitation of actuators on the opposite side of the targeted end position of parts.

  Figure 5-2: Activating both actuators Act.3 and Act.4 makes the parts move away from them, resulting in this case in a forward vibration. When choosing an amplitude that is larger for the actuator Act.1 than for the two neighboring actuators Act.2 and Act.3, we obtain a diagonal movement of parts (backward left vibration).

- For all the *Platform Vibrations* but the 'Flip', 'Short'- and 'Long axis centering', the frequency is usually the same. Once a good frequency is found for the displacement of the parts on the platform, it generally suits well for the other displacements, too.

- If the parts do not move exactly towards the desired target, one can adjust the amplitude of neighboring actuators in order to correct the displacement direction of the parts.
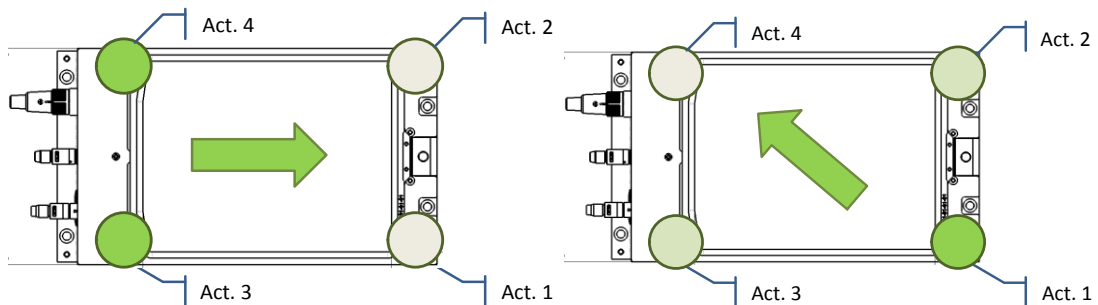

Figure 5-2 : Asycube 50 & 80 – Actuator Disposition and Example

(green: activated, grey: off)

NOTE :

The presented hints are general and may not be perfectly suited to your Asycube. We recommend to use the default Vibration Set 26 as a starting point, since it is adjusted and tested for a standard part on your product.

An "Easy-Tuning" method is available through the Asyril HMI and is presented in section 5.3 on page 22 of this document.

Table 5-3 below summarizes the range frequency typically used for the *Standard Platform Vibrations.*
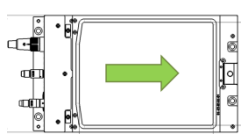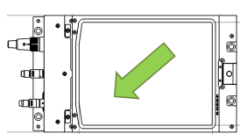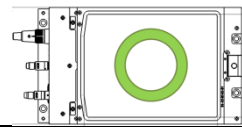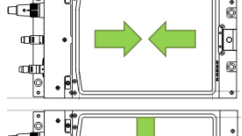
Direction		Vibration		Frequency range
Forward	(A)		A	
Forward Left	(B)			
Forward Right	(C)			
Left	(D)	…		~ 55 Hz
Right	(E)			
Backward	(F)		H	
Backward Left	(G)			
Backward Right	(H)			
Flip	(I)		I	~ 45 Hz
Short axis centering	(J)		J	~ 50 Hz
Long axis centering	(K)		K	

Table 5-3: Asycube 240 – Standard Platform Vibrations

5.3.   Asycube 240 Easy-Tuning Method

To simplify the tuning of the vibration parameters of all vibrations, an *Easy-Tuning* method is available for the Asycube 240 and is detailed in this section. This method involves only the 11 *Standard Vibrations* (A – K).

For each vibration, the tunable parameters are reduced to the following five:

- 1 main amplitude (corresponds to the actuator(s) opposed to the target direction)
- 1 unique frequency (same for all actuators)
- 1 duration
- 2 balances to adjust the direction of displacement (fine adjustment of amplitude of all actuators)

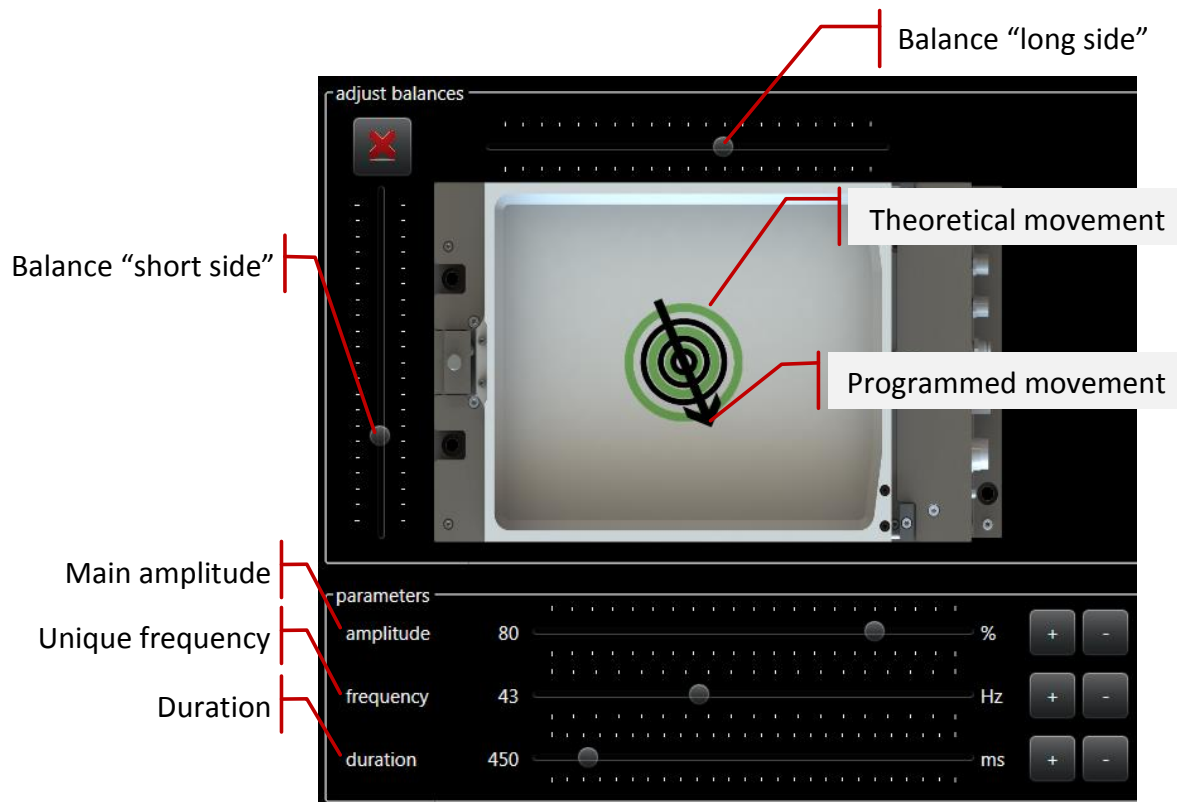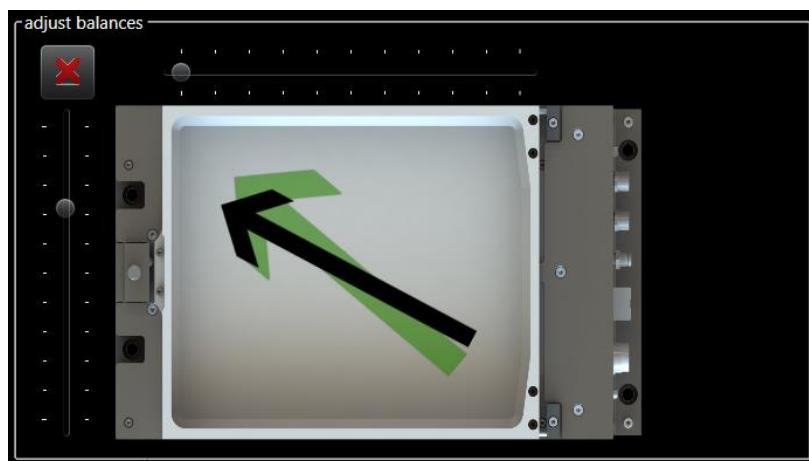**Figure 5-3: Asycube 240 HMI Easy-Tuning**

Figure 5-4: Example – Adjusting Balance to Correct a Trajectory

NOTE :

Adjusting parameters in the Easy-Tune mode modifies the parameters in the 'Platform' and 'Outputs' tab. In certain cases, when the parameters are adjusted in the two latter tabs that are not conform to the Easy-Tune mode (e.g. different frequencies for actuators), a warning appears.

6. Sequence

A *Sequence* contains the different types of vibrations in order to feed, distribute, flip and orient the components optimally on the picking surface. The *Sequence* may vary depending on the number of parts and their location on the platform in order to obtain an optimal behavior. This is the reason why the system may need the input from the vision system such as the number of parts on the platform (for feeding new parts onto the platform), their location (for centering) and well-adjusted parameters of the *Vibration Sets.*

There are 26 *Sequences* available and each of them is composed of up to seven *Actions*. The 26 *Vibration Sets* are composed of the combination of the 26 *Platform Vibrations* and the 26 *Hopper Vibrations / Output Activations*. Any of the 26 *Sequences* can be executed in combination with any of the 26 *Vibration Sets*. This is useful in the case of different types of parts (i.e. *Vibration Sets*) combined with various scenarios (i.e. *Sequences*).

Please, refer to the Programming Guide for more information on how to execute a Sequence using a certain Vibration Set.

Table 6-1 below summarizes the configuration options that are available to adjust a Sequence and are detailed in the following sections.

Action Type	Vibration	Duration Mode	Value Unit
Hopper / Output	*Hopper Vibration / Output Activation* (A – Z)	Fixed Quantity Adjusted Vibration Ratio	[ms] [ms] [%]
Platform	*Platform Vibration* (A – Z)	Fixed Quantity Adjusted Vibration Ratio	[ms] [ms] [%]
	Smart Vibration 'Centering'	Maximum Limit	[ms]
Wait	-	Fixed	[ms]
None	-	-	-

Table 6-1: Summary Sequence Options

6.1. Actions

Four types of actions exist; actions either concern the hopper / output, the platform or none of the latter.

6.1.1. Hopper / Output

Any of the 26 *Hopper Vibrations / Output Activations* (A – Z) of a *Vibration Set* can be selected in order to feed parts onto the platform. By choosing between the three duration modes 'Fixed', 'Quantity Adjusted' and 'Vibration Ratio', the user can adjust the vibration duration of the hopper in order to obtain different types of behavior (see *6.2 Duration Mode* on page 26).

6.1.2. Platform

Any of the 26 *Platform Vibrations* (A – Z) of a *Vibration Set* can be selected in order to obtain the desired part movement on the platform. By choosing between the three duration modes 'Fixed', 'Quantity Adjusted' and 'Vibration Ratio', the user can adjust the vibration duration of the platform in order to obtain different types of behavior (see *6.2 Duration Mode* on page 26).

Other than the *Platform Vibrations*, the user may select the *Smart Vibration* 'Centering', which centers parts no matter where they are located.

For the complete explanation on the Smart Vibration 'Centering', please refer to section 6.3.1 *on page 27 of this document.*

6.1.3. Wait

This action corresponds to a fixed waiting time given in ms. It is principally used between the end of a vibration and before the image acquisition in order to wait for the parts to stabilize on the platform (i.e. to stop rolling/moving).

6.1.4. None

'None' corresponds to an empty action. It is used in the case that a Sequences does not need all the seven available actions.

6.2.   Duration Modes

When using an action related to a *Hopper Vibration* / *Output Activation* or a *Platform Vibration*, the user may choose between three duration modes: 'Fixed', 'Quantity Adjusted' or 'Vibration Ratio' and hence adapt the behavior of the system depending on the application.

6.2.1. 'Fixed' [ms]

Duration mode 'Fixed' corresponds to the simplest configuration; the duration of the vibration will always take the same amount of time, namely the value entered in the box (in ms).
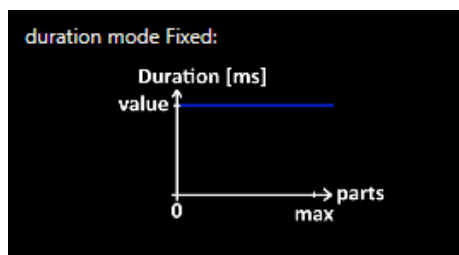
Figure 6-1: Duration Mode 'Fixed' [ms]

6.2.2. 'Quantity Adjusted' [ms]

The duration mode 'Quantity Adjusted' is mainly used to fulfill the function on feeding new parts on the picking zone. In addition, it is considered a *Smart Vibration*, since its behavior adapts to the situation and hence depends on the input of a vision system.

Figure 6-2: Duration Mode 'Quantity Adjusted' [ms]

For the additional explanation on the Smart Vibration 'Quantity Adjusted', please refer to section 6.3.1 on page 28 of this document.

6.2.3. 'Vibration Ratio' [%]

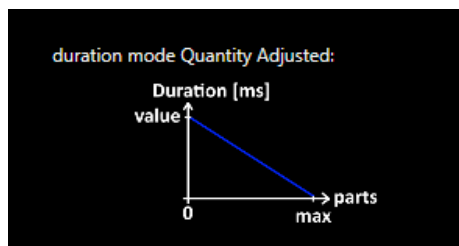The duration mode 'Vibration Ratio' links the vibration duration to use in the *Sequence* with the duration tuned in the *Vibration Set*. Entering the value 100% corresponds to the vibration duration entered in the *Vibration Set* and therefore, if correctly adjusted, to the time needed for the parts to fully cross the platform. Choosing 50% represents a part-displacement of half the platform length. This considerably simplifies the computations for the user. The other advantage is that the user does not need to re-adjust the vibration durations in the *Sequence* when changing *Vibration Set*.
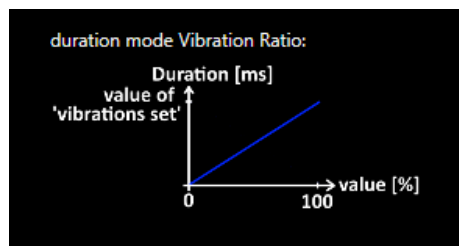

Figure 6-3: Duration Mode 'Vibration Ratio' [%]

![info icon] **IMPORTANT NOTE:**

*It is **IMPORTANT** to set the **vibration duration** as the time the parts need to **completely cross the platform** in a given direction. The effectiveness of the 'Centering' Smart Vibration and duration mode 'Vibration Ratio' depend on well-adjusted parameters.*

6.3.   Smart Vibrations

A *Smart Vibration* adapts the vibration parameters depending on the situation. To do so it needs the input of a vision system. Following sections detail the two possible *Smart Vibrations*: 'Centering' and 'Quantity Adjusted'.

6.3.1. 'Centering'

In a Sequence, the user may choose the action type platform in combination with a *Platform Vibration* (A – Z) or with the *Smart Vibration* 'Centering'. The latter determines the optimal vibration direction and computes the vibration duration based on the input of a vision system. The location of parts on the platform (center of mass) is used to define the direction and the distance to the center. Once these two characteristics are determined, the 'Centering' Vibration chooses:

- the adapted *Standard Platform Vibration*
- the adapted vibration duration based on the given durations indicated in the *Vibration Set* (i.e. the duration adjusted such that parts fully cross the platform)

The duration mode of 'Centering' is called 'Maximum Limit' and corresponds to the upper limit of the vibration duration in this mode. Hence, the user limits the computed vibration duration by entering a value in ms in the box. This is useful if your application engages a time constraint that must be respected. If there is no special constraint, keep the default value of 10 seconds.

> **ℹ️ IMPORTANT NOTE:**
>
> *It is **IMPORTANT** to set the **vibration duration** as the time the parts need to **completely cross the platform** in a given direction. The effectiveness of the 'Centering' Smart Vibration and duration mode 'Vibration Ratio' depend on well-adjusted parameters.*

6.3.2. 'Quantity Adjusted'

The duration mode 'Quantity Adjusted' can be combined with *Hopper Vibrations / Output Activations* or *Platform Vibrations*. It is mainly used in the case of feeding new parts on the picking zone. As the other *Smart Vibration,* the duration mode 'Quantity Adjusted' is based on the input of a vision system (number of parts detected on the picking zone).

The value entered in the box (in ms) corresponds to the duration of vibration when there are no parts on the platform. The more parts are detected, the less time the vibration takes and when the upper limit of parts on the platform is reached, the vibration duration decreases to zero. In between, the vibration duration is linearly interpolated. Note the user has to indicate the upper limit of parts through the box that appears when using 'Quantity Adjusted' situated after the seventh action.

Example:

Let us assume the upper limit of parts on the platform for vibration is defined as 40 and the vibration duration entered in the box is 1000ms. First, no parts are located on the platform, the effective vibration duration will be 1000ms. In a second case where 20 parts are detected on the platform, the effective vibration duration will be 500ms. In the case where 30 parts are detected, the effective vibration duration will decease to 250ms and so on. When 40 or more parts are detected, there will be no further vibration.
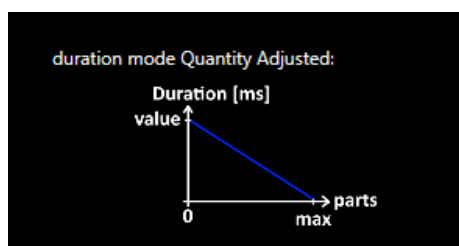

Figure 6-4: Duration Mode 'Quantity Adjusted' [ms]

6.4. HMI Simulation: Test Sequence

In the Asyril HMI, it is possible to test a sequence, even without the input of a vision system (number of parts on the platform and their location). The three general situations are presented in this section, the fourth is a mix between others.

6.4.1. Case 1: No Smart Vibration

No action of the *Sequence* uses a *Smart Vibration* (i.e. no vision system). To execute the simulation, simply press the large button representing the vibrating platform. Note that the currently active *Vibration Set* is indicated in the upper left corner. To switch to the desired Vibration Set, simply change its ID in the tab 'Platform' or 'Hopper'/'Outputs'.
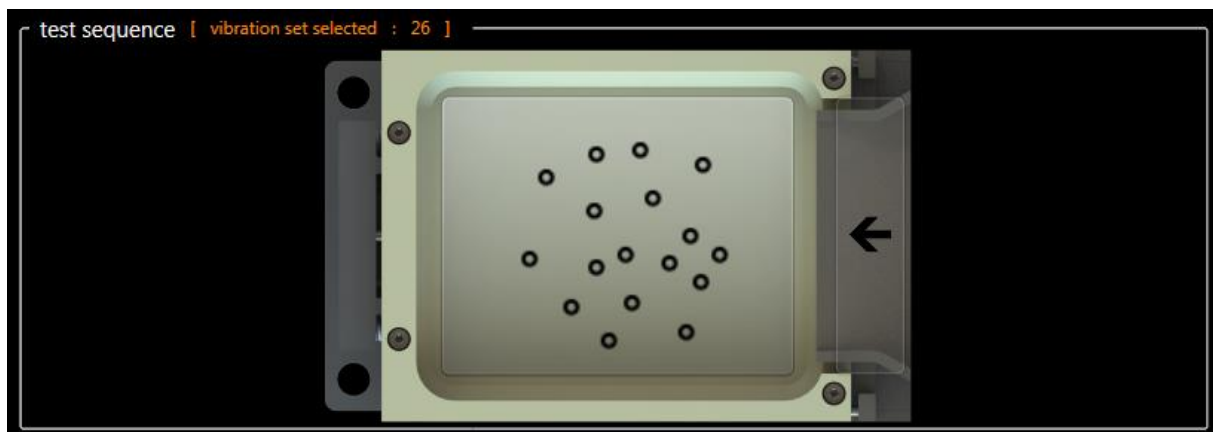
Figure 6-5: HMI Simulation Case 1 – No Smart Vibration

6.4.2. Case 2: 'Quantity Adjusted'

The duration mode 'Quantity Adjusted' adapts the vibration duration depending on the number of parts detected on the picking zone. Besides indicating the vibration duration when no parts are detected as well as the upper limit of parts when no new parts are to be fed, the user has to additionally simulate a vision system by manually entering the number of parts located in the picking zone in the simulation panel. Pushing the large button representing the platform executes the test sequence.

Figure 6-6: HMI Simulation Case 2 – 'Quantity Adjusted'

6.4.3. Case 3: 'Centering'
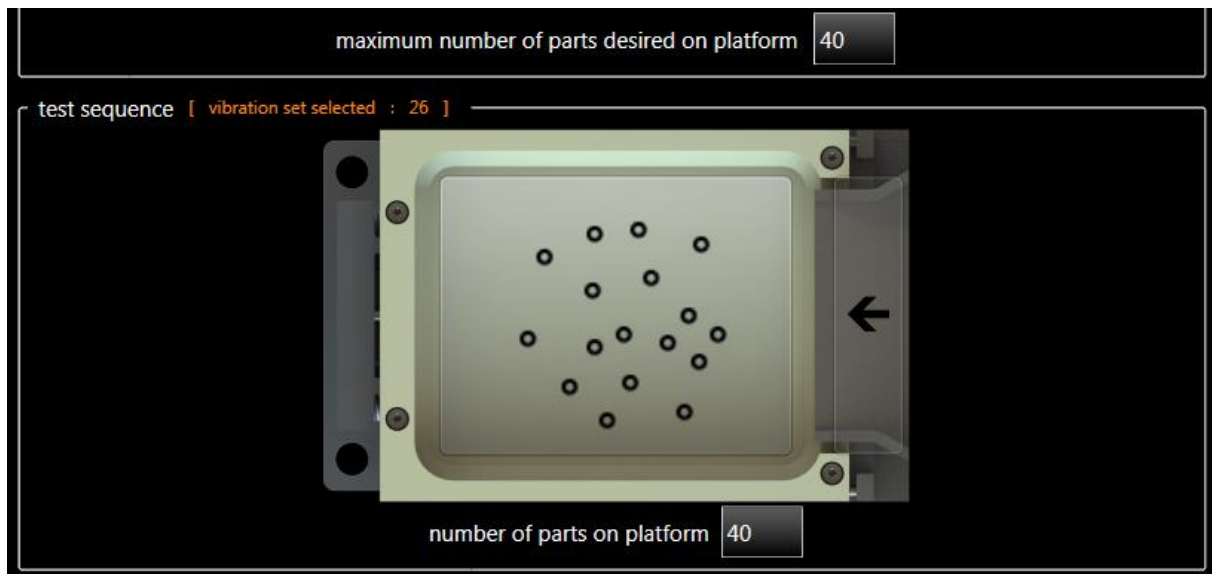
The 'Centering' *Smart Vibration* needs the input of a vision system to center the parts on the platform. For the simulation, the user indicates the approximate location of the parts using one of the nine buttons representing a zone on the platform. Pushing one of the nine buttons executes the test sequence.

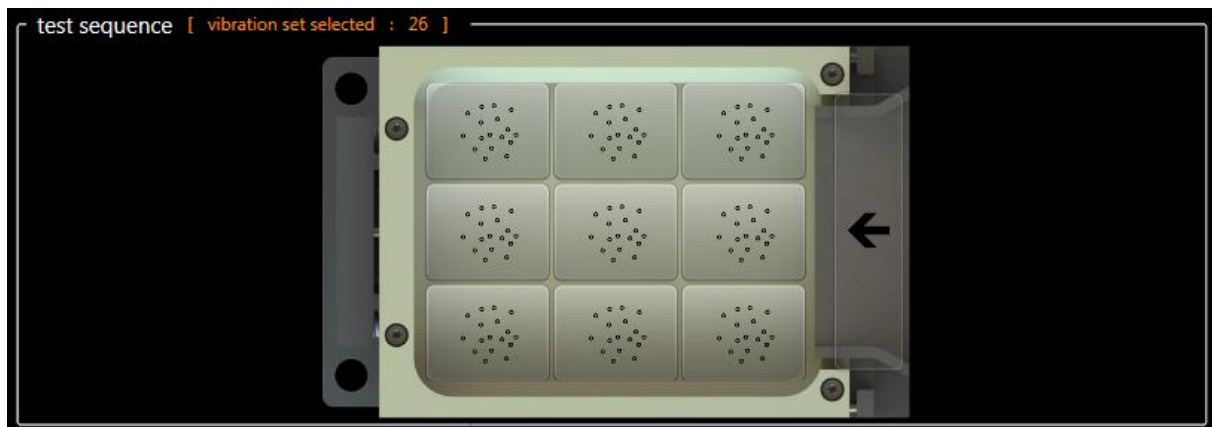**Figure 6-7: HMI Simulation Case 3 – 'Centering'**

6.4.4. Case 4: Mixed Smart Vibrations

Most situations require the combination of both *Smart Vibrations*: a feeding vibration (*Hopper Vibration / Output Activation*) in duration mode 'Quantity Adjusted' combined with 'Centering'. In this mixed case, the simulation interface is the combination of the ones presented previously (Figure 6-6 and Figure 6-7).

7. Saving

One of the 26 *Vibration Sets* can be active at a time. Before switching *Vibration Set* in the 'Platform' tab or the 'Hopper'/'Outputs' tab, the user has to either "flash" the current modifications, meaning the parameters are saved in the Asycube memory, or discard them (see Figure 7-1). Also, note that flashing the parameters from the 'Platform' tab automatically flashes all the parameters of the selected *Vibration Set* (i.e. including the parameters in the 'Hopper'/'Outputs' tab) and likewise when flashing from the 'Hopper'/'Outputs' tab.

Figure 7-1: Vibration Set ID

Switching between *Sequences* does not require flashing the parameters beforehand, you may freely jump from a *Sequence* to another and modify parameters. Also, note that a copy/paste function is available not only to copy a whole Sequence but also in the context of vibration tuning.

Figure 7-2: Sequence ID and Copy/Paste Function

Flashing the parameters, whether parameters of the *Vibration Sets* or the *Sequences*, saves them inside the Asycube and do not need loading from an extern file. Nevertheless, you can import/export xml files from the HMI (see Table 7-1).
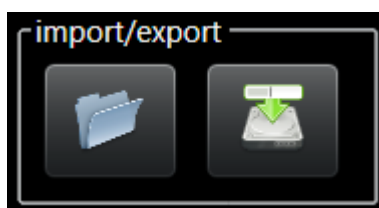
Figure 7-3: Import/Export xml file

Label	Content	Saving
.Fconf	*Vibration Set* parameters such as amplitude, frequency, duration etc.	One *Vibration Set* can be saved in a .Fconf file at a time.
.Fseq	*Sequence* parameters such as actions, vibrations, duration values etc.	Either a Sequence can be saved individually, or all 26 *Sequences* at a time. Note that when saving all the Sequences, the Sequence ID is recorded.

Table 7-1: File Formats

For more information on loading, saving and related commands please refer to the Programming Guide of your Asycube.

8. Backlight

An adapted lighting is very important in order to detect parts on the platform and their orientation. All the Asycubes can be equipped with an integrated backlight. This chapter summarizes the different possibilities to activate the backlight as well as how to configure its intensity.

NOTE :

The backlight is an option and has to be ordered with your Asycube, as well as its color.

8.1. Activation

There are two ways to activate the backlight illumination and to synchronize it with the image acquisition (see Table 8-1).

	Description

Method 1	Software commands:
	    a.) Command to switch ON and then command to switch OFF
	    b.) Flashing-mode

Method 2 (recommended)	Hardware connection: Using the backlight synchronization input. The illumination time corresponds to the impulse length.

Table 8-1: Backlight Activation Methods

When using both activation methods, the backlight will be ON if the command OR the signal is activated.

Note that using a camera that is able to drive the backlight of the Asycube (Method 2 – Hardware connection) is more reliable in terms of timing than using software commands to the Asycube and then commands to a camera for the image acquisition.

For more information on the commands related to the activation of the backlight, please refer to the Programming Guide of your Asycube.

For more information on the electrical interface and connector reference of the backlight synchronization, please refer to the Operating Manual of your Asycube.

8.2.   Intensity

The intensity of illumination can be adjusted from 20% to 100% using the slider in the backlight tab of the HMI. There is no need to flash this parameter manually as it is automatically saved when modified. Also, note that this illumination level is applied for both methods of backlight activation described in Table 8-1.

9. Example

This chapter presents a step-by-step example on how to get started with the Asycube and resumes the notions presented in the previous chapters. The order of the sections respects the order of the general procedure presented in section *2.2 Overview General Procedure* on page 8 of this document.

9.1.   Install and configure the Asyril HMI

Please refer to chapter 3 on page 12 of this document for the detailed and illustrated procedure of installing the software.

9.2.   Adjust Platform and Hopper Vibrations

For each new part, follow the steps presented below. Note that usually, there is no need to re-configure a completely new *Vibration Set* for each new part as one may reuse existing *Vibration Sets*. Therefore, a *Vibration Set* is usually connected to a family of parts rather than a single version of a part. Also, the *Vibration Set* 26 is a non-modifiable set of default vibration parameters adjusted by Asyril specifically for a standard part to work optimally on your Asycube.

Please, refer to chapter 4 on page 15 and chapter 5 on page 18 of this document for the detailed explanation of the tunable parameters and general tuning hints.

9.2.1. Platform Vibrations

Step 1	Place some parts on the Asycube platform, ideally the number of parts that seem to be adequate (enough to be representative, not too many such to minimize overlapping parts).
Step 2	Test the behavior of your parts on the Asycube either using the *Vibration Set* number 26, which contains the default parameters for a standard part (not modifiable by the user) or by using one of your own parametrized *Vibration Set*. → *If no adjusting is needed, you may skip the Step 3 and 4.*

Step 3	There are different ways to start adjusting the parameters: • **Import already parametrized *Vibration Set*** *(strongly encouraged)* Export a Vibration Set (for example Vibration Set 26) as .Fconf file and import it in the Vibration Set you assigned to your part type. • **Copy/paste a *Platform Vibration*** Mostly used during the fine-tuning of the parameters of a Vibration Set. Copy/paste option for one vibration at a time. • **Start tuning from zero** *(not recommended)* Some indications are given for the frequency range (references below).

Step 4	Adjust the parameters in order to obtain rapid and smooth part movement on the platform and parts that jump only during the 'Flip' Vibration. For <u>coarse-tuning</u>, you may take advantage of the continuous mode, which enables you to change parameters such as frequency, amplitude etc. while the platform vibrates continuously. For <u>fine-tuning</u> one obtains better results when the vibration duration corresponds approx. to the real situation.
	
	• **Part displacement Vibrations (A – H):**
	Use the sinus waveform.
	    1. Find an adequate frequency. Once the optimal frequency is found, you may reuse the same frequency for tuning the other *Platform Vibrations*.
	    2. Adjust the amplitude of the different actuators.
	    3. Adjust the vibration duration as for the parts to completely cross the platform in a given direction.
	
	• **'Flip' Vibration (I):**
	Use the sinus waveform.
	    1. Find an adequate frequency.
	       (Asycube 50 & 80: see Table 5-2, Asycube 240: see Table 5-3)
	    2. Adjust the amplitude.
	    3. Adjust the vibration duration; short, but enough time in order for the parts to flip.
	
	• **Asycube 240: 'Long'- and 'Short axis centering' (J and K):**
	Use the sinus waveform.
	    1. Find an adequate frequency.
	       (Asycube 240: see Table 5-3)
	    2. Adjust the amplitude.
	    3. Adjust the duration.
	
	Note that the procedure is identical when using Easy-Tuning method, the adjusting interface is simplified as some parameters are regrouped.

Setp 4	**Troubleshooting** : • Trajectory deviation: If parts do not move precisely enough towards the desired target, you may want to correct the trajectory with help of the other actuators. (Asycube 50 & 80: see section 5.1, Asycube 240: see section 5.2 or use the balance slider in the Easy-Tune mode). • Invisible wall or obstacles: For certain parameters, parts seem to encounter an invisible wall/obstacle or their movement differ depending on their position on the platform. Test different phases, it might help to get a more steady movement.
Step 5	Make sure that the vibration duration for the *Standard Platform Vibrations* corresponds to the time the parts need to fully cross the platform. It is important to respect this; the effectiveness of the Asycube depends on well-tuned parameters.

9.2.2. Hopper Vibration / Output Activation

Step 1	Place parts in the hopper (homogenous filling). It is important that when tuning parameters, the conditions are as close as possible to the production situation. Depending if your parts are sticky or present the tendency to bundle, using a dam might be helpful.
Step 2	Adjust depending on your needs: Either you can use a slower part displacement in the hopper in order to obtain a better repeatability on the number of parts fed (for the same vibration duration) or you can use a faster one, if you need a shorter cycle. • **Asycube 50 & 80 (integrated hopper):** Adjust the frequency and amplitude. • **Asycube 240:** Use the outputs to drive a hopper. You can select the output(s) that are active and adjust signal amplitude from 0 to 100% (corresponding to 10V) as well as the duration of the signal. Please refer to the documentation of your specific hopper.

9.3.   Adjust Sequences

A *Sequence* is used to combine different vibrations and usually corresponds to a scenario. You can use different *Vibrations Sets* (i.e. types of parts) in combination with one or more *Sequences.* In this section, three scenarios are discussed:

1. Scenario - Flat platform: feed and distribute parts
2. Scenario - Structured platform: feed and pre-orient parts
3. Scenario - Flat platform: distribute parts (Asycube 240)

These scenarios are examples, you may be confronted with other scenarios and other parameters may work better for your specific application. The goal here is to give you a general idea on what you can do with *Sequences.*

Please, refer to chapter 6 for the explanation on Sequences and more specifically to section 6.4. on page 29 of this document for indications on how to test a Sequence.

9.3.1. Flat Platform: Feed and Distribute Parts

In the case of a flat platform, usually the *Smart Vibration* 'Centering' followed by a 'Flip' is used in order to distribute parts evenly on the platform.

	Type	Vibration	duration mode	value	unit
1	**Hopper/ Output**	**Forward**	**Quantity Adjusted**	500	[ms]
2	**Platform**	**Centering**	**Maximum Limit**	10'000	[ms]
3	**Platform**	**Flip**	**Fixed**	200	[ms]
4	**Wait**	**-**	**Fixed**	300	[ms]

Table 9-1: Example Scenario 1

9.3.2. Structured Platform: Feed and Pre-orient Parts

In the case of a structured platform, the goal is to pre-orient enough parts in grooves, holes etc. such that the desired cycle time is obtained. In this case, the 'Flip' vibration is used before smoother *Platform Vibrations* such as 'Forward' that enables the parts to be swept over the structured platform. These sweeping vibrations may be very short or not even necessary in some cases.

	Type	Vibration	duration mode	value	unit
1	Hopper/ Output	Forward	Quantity Adjusted	500	[ms]
2	Platform	Flip	Fixed	200	[ms]
3	Platform	Forward	Vibration Ratio	100	[%]
4	Platform	Backward	Vibration Ratio	50	[%]
5	Wait	-	Fixed	300	[ms]

Table 9-2: Example Scenario 2

Please, refer to the Operating Manual for more information on structured platforms.

9.3.3. Flat Platform: Distribution of Parts (Asycube 240)

This example shows how to use a very simple Sequence to center parts distribute them on the platform, exclusively for the Asycube 240 due to its two additional *Standard Platform Vibrations*: 'Short axis centering' (J) and 'Long axis centering' (K), which enables the centering of parts on the platform regardless on their position.

	Type	Vibration	duration mode	value	Unit
1	Platform	Long axis centering	Vibration Ratio	100	[%]
2	Platform	Short axis centering	Vibration Ratio	100	[%]
3	Platform	Flip	Fixed	3000	[ms]
4	Wait	-	Fixed	300	[ms]

Table 9-3: Scenario 3 – Example Scenario 3

9.4.   Save all the parameters in the Asycube

If not already done, flash the parameters in the Asycube. If needed, you can export a *Vibration Set* or *Sequences* as xml files.

Please, refer to chapter 7 on page 31 of this document for the detailed explanation on the saving procedures.

9.5.   Configure the backlight

Please, refer to chapter 8 on page 33 of this document for the details on how to activate the backlight and how to adjust its intensity.

NOTE :

For preliminary tests, it is sufficient to use the backlight activation button in the Home tab of the HMI or software commands (see next section).

9.6.   Execute commands from PLC

A console mode is available in the Asyril HMI in order to test the communication with the Asycube as well as the execution of commands as if they were sent from the client's PLC (Programmable Logic Controller).

NOTE :

The console mode can only be accessed with Integrator level access rights. Please, refer to the HMI User Guide for more information on access rights.

Please, refer to the Programming Guide of your Asycube for the full list of commands as well as their detailed explanation.

	Use a Vibration Set			
Step 1	Command	{UV1}	Response	{UV1}
	Select the Vibration Set 1.			

	Execute a Sequence
Step 2	Command {ES:(23;40;-1;1;5)} Response {ES:(23;40;-1;1;5; 1560)} *23 parts were detected on the picking zone, at 40 parts there is no feeding of new parts. The location of the center of mass of parts is located in the back left corner (x = -1, y = 1, see Figure 9-1). The Sequence to use is Sequence 5. As a response, the system returns the exact duration of the Sequence (here 1560ms).*
Step 3	**Backlight** Command {K1} Response {K1} {K0} {K0} *Switching backlight ON (first command), then OFF.*

The positions on the platform are normalized and defined as shown in the Figure 9-1 below.
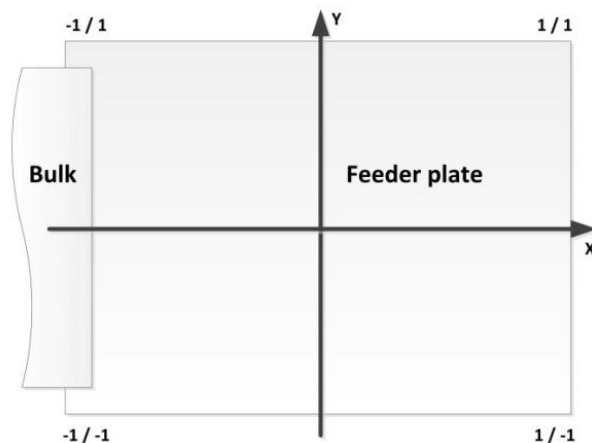

Figure 9-1: Platform Normalized Coordinate System

10. Technical support

10.1. For better service …

You have read the the related manuals without finding answers to your questions? Before calling the support service, note the following information for your system:

- serial number and product key of your material
- software version
- alarm or error message displayed on the screen

10.2. Contact

You can find lot of information on our website: www.asyril.com

You can also contact us by mail or call our support service:

support@asyril.com
+41 26 653 71 90

Review history

Rev.	Date	Author	Comments
A	27.10.2016	PeA	Initial Version
A1	14.12.2016	HsJ	Modify figures and images for translation

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