Asycube

Programming Guide

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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

2. General description of the Asycube

The Asycube contains its own intelligence and memories (one volatile for working and one flash memory for backup).

To use the Asycube, the user has access to vibrations parameters (called “Vibration Sets” and including the parameters of the outputs activations) and sequences. The Asycube has also global parameters which are general parameters adjusted usually by Asyril technician.

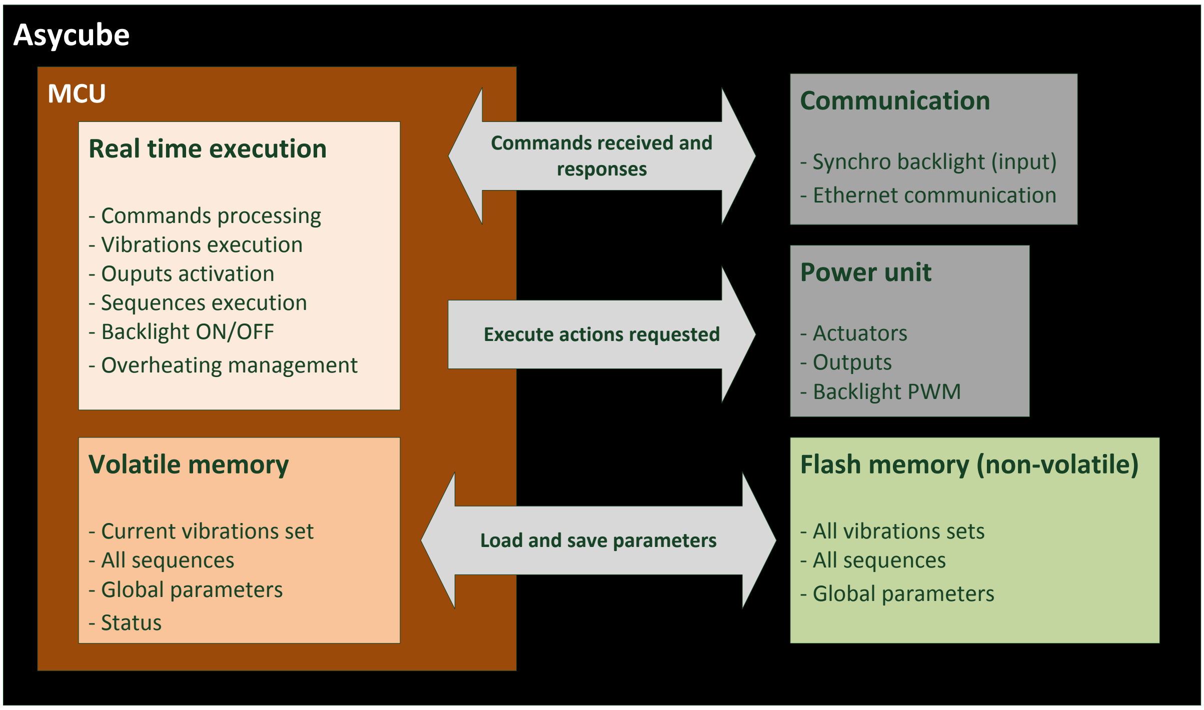


Figure 2-1 : description of Asycube

2.1. Vibration convention

The Asycube has 26 different vibrations, named from ‘A’ to ‘Z’. As a convention, some of the vibrations are set for a given direction while the others can be used for custom vibrations. The Table 2-2 presents the convention used in the Asycubes (please be aware of the differences between the Asycubes models). The Figure 2-3 presents graphically the convention for an Asycube.

Vibration	Number	Platform direction	Hopper direction (only for Asycubes 50 and 80)	Hopper: outputs activation (only for Asycubes 240 and 530)
A	0	Forward	Forward	Output 1
B	1	Forward left		Output 2
C	2	Forward right		
D	3	Left		
E	4	Right		
F	5	Backward		
G	6	Backward left		
H	7	Backward right		
I	8	Flip		
J	9	Long axis centering (only for Asycubes 240 and 530)		
K	10	Short axis centering (only for Asycubes 240 and 530)		

Table 2-2: Vibration direction convention

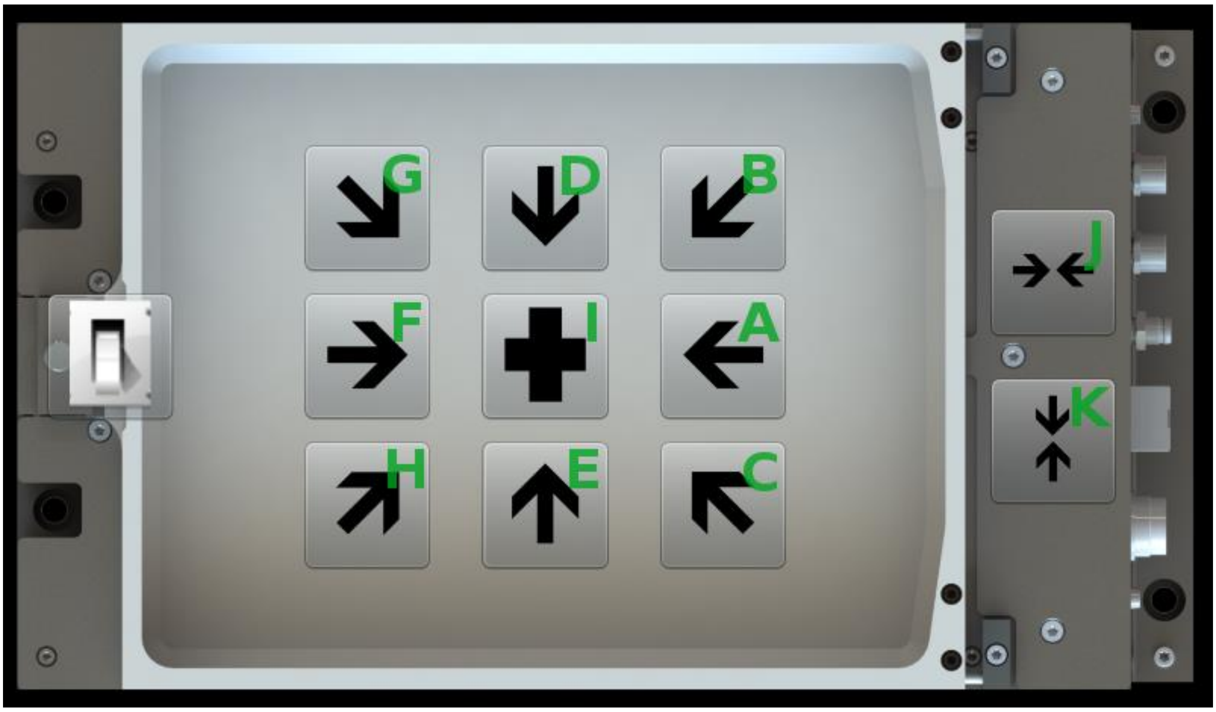


Figure 2-3: Graphical representation of the direction convention for the Asycube 240

2.2. Vibration sets

The vibration parameters are organized in vibration sets. There are 26 different vibration sets (the 26th is reserved for Asyril technician).

Each of the vibration set contains 26 vibrations for the platform identified by letters A to Z and 26 outputs activations (to control two hoppers) identified by other letters A to Z.

For the platform, the 11 first vibrations (A to K) are by convention used for standard vibrations (movements forward, backward, left, right, flip, long axis centering, etc).

For the Asycubes 50 and 80 which have an integrated hopper, the first hopper vibration is by convention used for standard vibration 'Forward'.

The Asycubes 240 and 530 do not have integrated hoppers but outputs that can be activated to control an external hopper. For the outputs activations, the 2 first activations are by convention used for standard activations (A activate the output 1 and B the output 2).

The table below shows the organization of the vibration sets:

Vibration Sets

ID 1 (Standard Vibrations: A to I; Standard Activations: A to B)

Platform Vibration		Output activation	
A	Forward	A	Output 1
B	Forward left	B	Output 2
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

1 to 26

ID 26

Platform Vibration		Output activation	
A	Forward	A	Output 1
B	Forward left	B	Output 2
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 2-4 : description of vibration sets

2.3. Sequences

The Asycube contains 26 different sequences (the 26th is reserved for Asyril technician). Each sequence contains 7 customizable actions. It can be none (no action), platform vibration, output activation or stabilization (a delay).

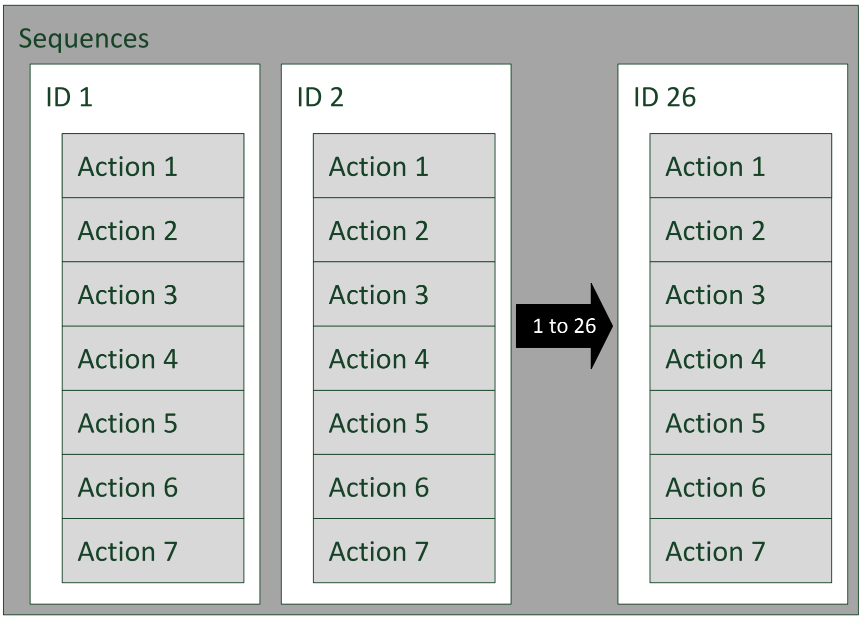


Figure 2-5 : description of sequences

More details in the commands descriptions.

2.4. Load/save in memories

Because of the size of the volatile memory, it can only contain one of the 26 vibration sets. At startup, the Asycube loads from flash memory the last selected vibration set, the 26 sequences and the global parameters.
When the user selects another vibration set, the parameters are loaded from the flash memory and overwrite the previously selected vibration set (all modifications made before selecting another vibration set are lost if the user did not save the vibration set with the command {DV}, which saves the vibration parameters in the flash memory). A status indicates if a value has been modified and can be read with the command {?50}. The time needed to load a new vibration set from the flash memory to the volatile memory is approximatively 0.3 seconds.

Every 20 minutes, the global parameters are automatically saved. If the user tries to save during this ongoing process, his command will be refused until the automatic saving is finished.

3. How to use the Asycube

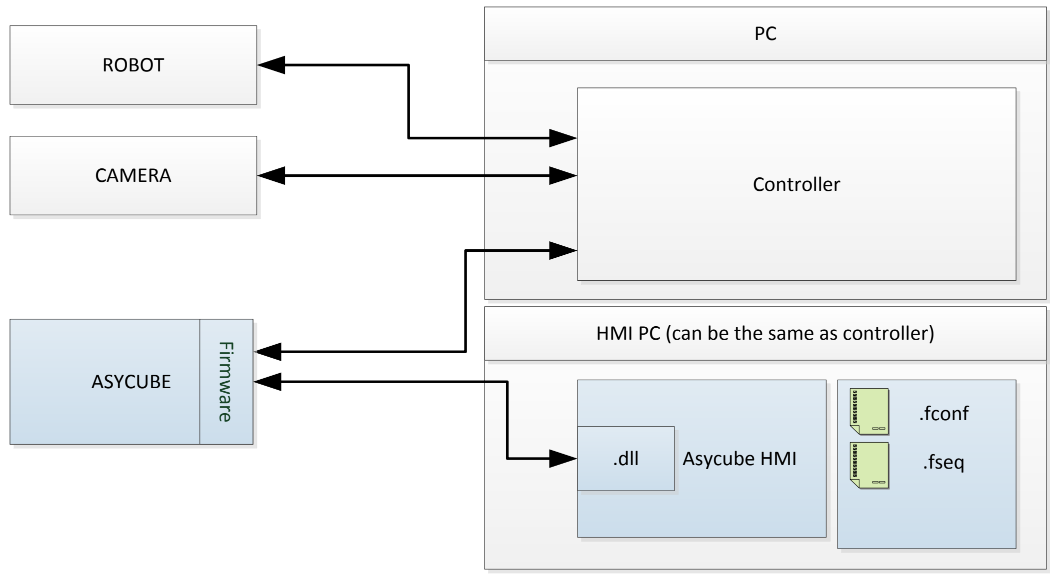
This chapter gives the main information about the use and tuning of the Asycube. It shows general information and behavior, presents the main procedure from setup to running in production with an Asycube and describes then each step. The next chapters will detail the chosen working mode.

3.1. Integration modes

Different ways of integration are available. Here below is a brief description of the main ones. More information is then available in the corresponding section. The main tasks necessary to use, configure and integrate the Asycube are described depending the chosen integration mode. The next tables and figures describe the tasks in charge of the Asycube and the ones due to the integrator. The light blue color represents the levels offered by Asyril, the white one the levels in charge of the integrator.

3.1.1. Direct connection to the Asycube, configuration with Asycube HMI

In this integration mode, the integrator uses the Asycube HMI (installed on a computer, the same as the integrator system or another one) to configure the Asycube, and communicates with the Asycube from his own system in order to execute the vibrations. All the configurations are made with the Asycube HMI and can be exported in different types of files (*.fconf and *.fseqfiles).

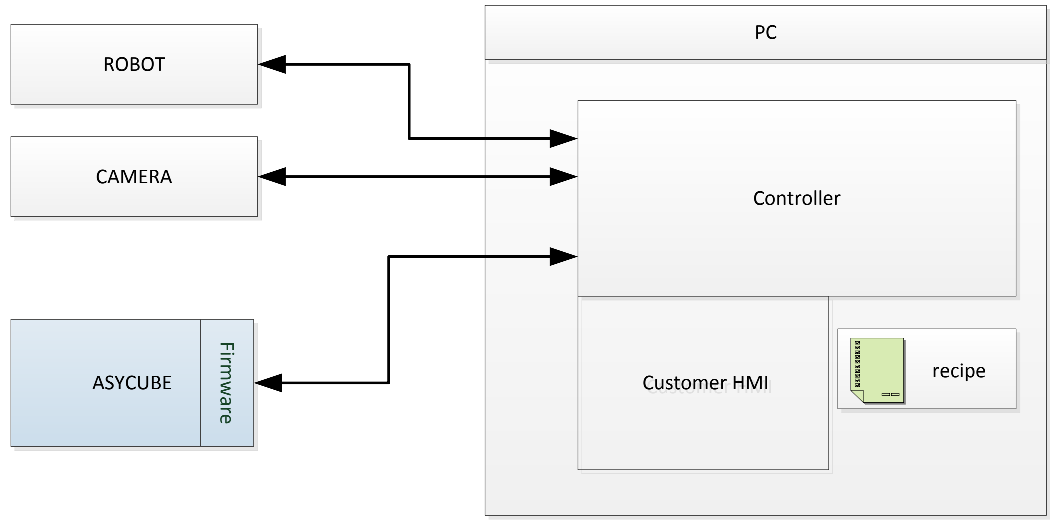


LEVEL	TASKS
Asycube	• Generation and synchronization of the desired vibration • Execute sequences • Save and reload 25 vibration sets (26 for the reload) • Save and reload 25 sequences (26 for the reload) • Activation of the outputs and backlight • Choice/Management of the optimal sequence based on the vision feedback
Asycube HMI	• Configuration and optimization of the feeding (vibration) parameters • Configuration and optimization of the sequences
Integrator	• Communication with the Asycube • Recipe management (memorize vibration set ID and sequence ID for each component). • Synchronization of the feeder and the machine
Optional	• Treatment of the recipe (read/write parameters)

Table 3-1: Integration mode: Asycube only

3.1.2. Direct connection to the Asycube

In this integration mode, the integrator develops his own HMI to configure the Asycube and communicates with the Asycube from his own system in order to execute the vibrations.

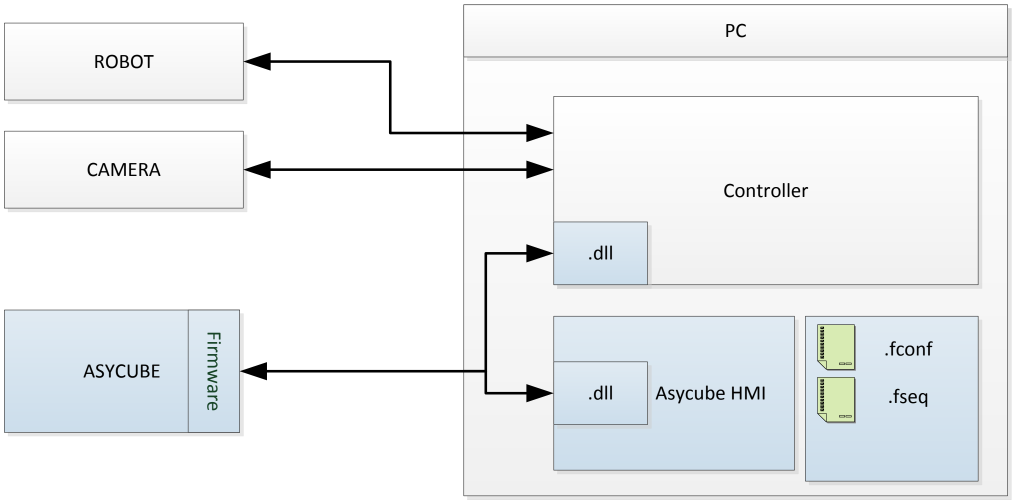


LEVEL	TASKS
Asycube	• Generation and synchronization of the desired vibration • Execute sequences • Save and reload 25 vibration sets (26 for the reload) • Save and reload 25 sequences (26 for the reload) • Activation of the outputs and backlight • Choice/Management of the optimal sequence based on the vision feedback
Integrator	• Communication with the Asycube • Recipe management (memorize vibration set ID and sequence ID for each component). • Configuration and optimization of the feeding (vibration) parameters (customer HMI) • Configuration and optimization of the sequences (customer HMI) • Synchronization of the feeder and the machine
Optional	• Treatment of the recipe (read/write parameters)

Table 3-2: Integration mode: Asycube only

3.1.3. Connection to the Asycube with the Plugin .NET and configuration with Asyril HMI

In this integration mode, the integrator uses the Asycube HMI (installed on a computer, the same as the integrator system or another one) to configure the Asycube and communicates with the Asycube from his own system in order to execute the vibrations by using the Asycube Plugin .NET. This Plugin simplifies the development and allows to export and import the same recipe files as in the Asycube HMI.

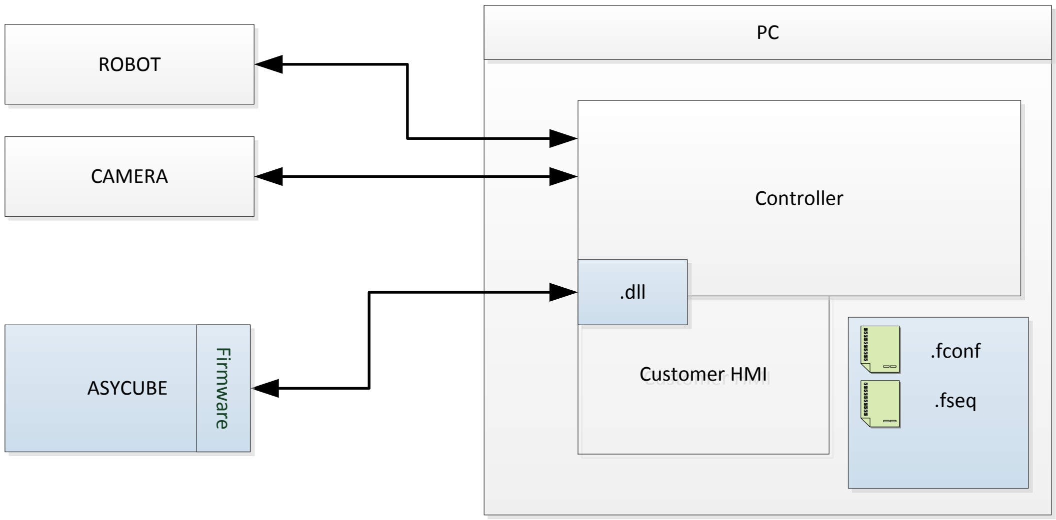


LEVEL	TASKS
Asycube	• Generation and synchronization of the desired vibration • Execute sequences • Save and reload 25 vibration sets (26 for the reload) • Save and reload 25 sequences (26 for the reload) • Activation of the outputs and backlight • Choice/Management of the optimal sequence based on the vision feedback
Asycube Plugin .NET	• Communication with the Asycube (access to the parameters of the vibrations and sequences, vibrations and sequences execution, etc) • Treatment of the recipe (read/write parameters)
Asycube HMI	• Configuration and optimization of the feeding (vibration) parameters • Configuration and optimization of the sequences
Integrator	• Synchronization of the feeder and the machine • Recipe management (memorize vibration set ID and sequence ID for each component).

Table 3-3: Integration mode: Asycube with Plugin .NET and HMI

3.1.4. Connection to the Asycube with the Plugin .NET and configuration with the customer user interface using the Plugin .NET

In this integration mode, the integrator uses the Asycube Plugin .NET to communicate with the Asycube and creates his own HMI to configure the vibrations, the sequences, etc. By choosing this integration mode, the integrator can design his own HMI and benefits from the simplification brought by the Plugin .NET.

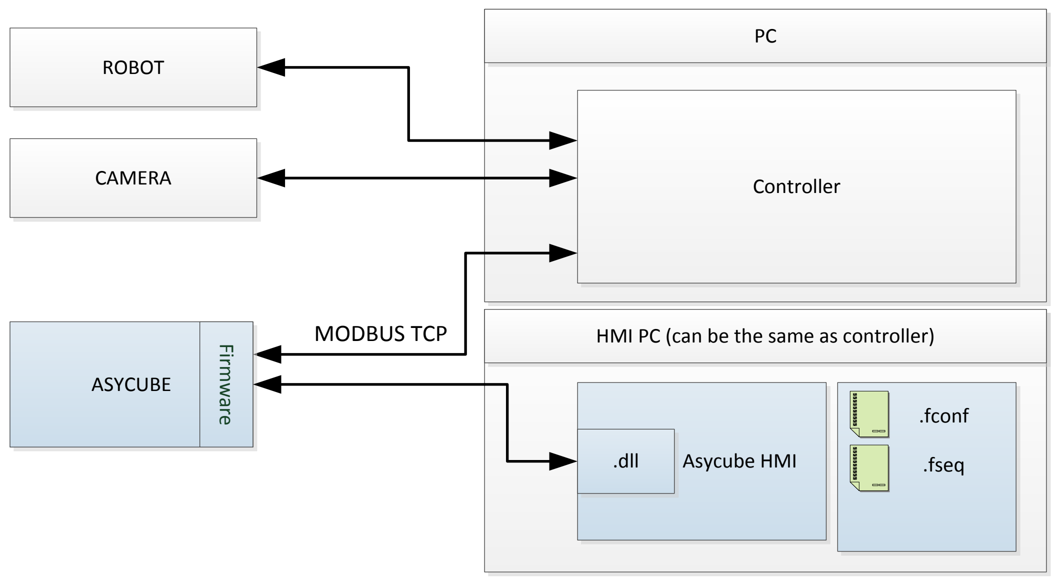


LEVEL	TASKS
Asycube	• Generation and synchronization of the desired vibration • Execute sequences • Save and reload 25 vibration sets (26 for the reload) • Save and reload 25 sequences (26 for the reload) • Activation of the outputs and backlight • Choice/Management of the optimal sequence based on the vision feedback
Asycube Plugin .NET	• Communication with the Asycube (access to the parameters of the vibrations and sequences, vibrations and sequences execution, etc) • Treatment of the recipe (read/write parameters)
Integrator	• Configuration and optimization of the feeding (vibration) parameters (HMI) • Configuration and optimization of the sequences • Synchronization of the feeder and the machine • Recipe management (memorize vibration set ID and sequence ID for each component).

Table 3-4: Integration mode: Asycube Plugin .NET

3.1.5. Modbus TCP connection with the Asycube, configuration with Asycube HMI

In this integration mode, the integrator uses the Asycube HMI to configure the Asycube from an external PC (e.g. Laptop). The integrator communicates with the Asycube from his own system (e.g. PLC) through Modbus TCP in order to execute the vibrations. Please refer to Chapter 6 for more information on Modbus TCP. As an option, a gateway can be used to convert the Asycube Modbus TCP data to industrial fieldbus data for the controller.



LEVEL	TASKS
Asycube	• Generation and synchronization of the desired vibration • Execute sequences • Save and reload 25 vibration sets (26 for the reload) • Save and reload 25 sequences (26 for the reload) • Activation of the outputs and backlight • Choice/Management of the optimal sequence based on the vision feedback
Asycube HMI	• Configuration and optimization of the feeding (vibration) parameters • Configuration and optimization of the sequences
Integrator	• Communication with the Asycube • Recipe management (memorize vibration set ID and sequence ID for each component). • Synchronization of the feeder and the machine
Optional	• Treatment of the recipe (read/write parameters)

Table 3-5: Integration mode: Asycube only

3.2. Production cycle with sequences

Follow this diagram to work with Asycube and sequences in direct communication.

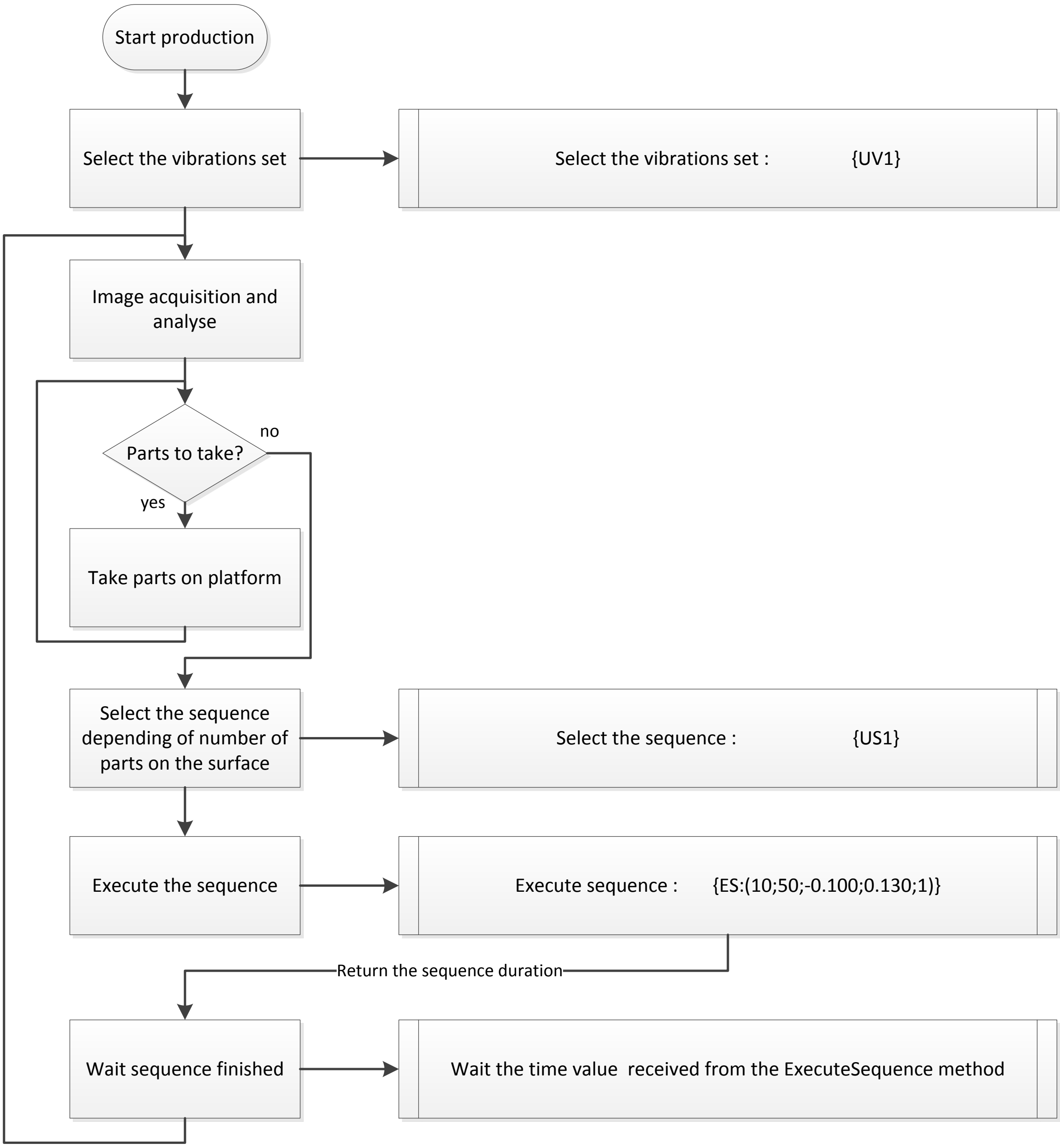


Figure 3-6 : description of sequences

For details of the different parameters, see the complete description of the commands below in this documentation.

3.3. Questions and answers

Here are some recurrent questions and their answers for the integration with TCP/IP communication.

3.3.1. Which vibration set or sequence is currently selected?

To know which vibration set is selected, use the command {UV?}.
For the selected sequence, use the command {US?}.

3.3.2. How do I know if some parameters of the current vibration set have been modified?

To obtain the state of the selected vibration set, use the command {?50}. If the returned value is 1, parameters have been modified.

3.3.3. What is the duration of a specific sequence?

The duration of a sequence (or a centering and feeding) is returned by the execution function. For example, the command {ES:(10;20;-0.1;0.8;1)} will receive as answer the string {ES:(10;20;-0.1;0.8;1;1830)} and 1830 is the duration of the sequence in milliseconds.

3.3.4. How do I know when a vibration or a sequence is finished?

For the vibration, the remaining time of the platform vibration is given by the answer of the command {?42}. For the hopper, use the command {?44} and for the sequence {?46}. The value returned indicates the remaining time in milliseconds.

3.3.5. How do I backup all vibration set on the computer?

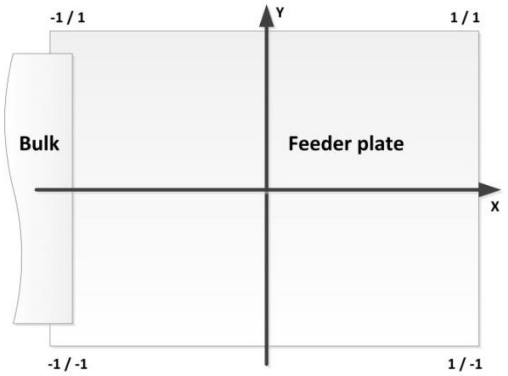
If you do not use the Asycube HMI, you have to read all the vibration parameters vibration by vibration and save the received data in a file. For example, use the command {LCA} for the vibration A. The returned values correspond to the parameters of this vibration (amplitude of actuator 1, frequency of actuator 1, etc)

For the hopper vibration A, the corresponding command is {LBA}.

3.3.6. How is the center of mass of the components on the platform transferred to the command ES ?

The positions on the platform are normalized between -1 and +1 in both directions in order to be independent of the resolution of the camera or of the choice of the camera manufacturer image orientation and origin.

This figure explains the standardized range:



Check in your camera specifications to find the correspondence between the camera positions and the Asycube standardized range.

4. Asycubes Parameters

This chapter presents the Asycube parameters used to configure the settings and to configure the vibrations and sequences. These parameters values can be accessed using the dedicated text commands (Section 5.4.3). Some of these parameters values can be accessed through Modbus TCP (Chapter 6).

NOTE :

Some parameters values have a range of validity. For example, the Amplitude 1 of the Platform vibration "A" (Address 300) ranges from 0 to 100. If you try to set a value out of this range (e.g. 120), it will be limited to its boundary (i.e. 100) without generating an error message. Some of a thresholds may be defined in another parameter. For example, the backlight intensity (Backlight PWM, Address 102) has a minimal value defined in the Backlight minimum PWM threshold parameter (Address 104).

4.1. Configuration

*: integrator write; **: developer write

Address	Parameters	Command	Comment
2	warning	rd & clear	
4	alarm	rd & clear	
6	password	wr	
...			
22	life time [day]	**	if auto-flashing enabled
24	life time [hour]	**	if auto-flashing enabled
26	life time [second]	**	if auto-flashing enabled
28	auto-flashing 20Min.	*	default: enable
30	actuators life time [hour]	**	
32	actuators life time [sec]	**	
34	actuators life time [msec]	**	
36	Actuators number of vibrations [nb] – 0-32767	**	first 2 bytes
38	Actuators number of vibrations [nb] – i*32768	**	bytes 3 and 4
40	IP address first byte	*	default: 192
42	IP address second byte	*	default: 168
44	IP address third byte	*	default: 127
46	IP address fourth byte	*	default: 254
48	IP subnet mask first byte	*	default: 255

Address	Parameters	Command	Comment
50	IP subnet mask second byte	*	default: 255
52	IP subnet mask third byte	*	default: 255
54	IP subnet mask fourth byte	*	default: 0
56	TCP port	*	default: 4001
…			
60	number of flash in ROM [nb] – 0-32767	**	number of flashing data in ROM
62	number of flash in ROM [nb] – i*32768	**	number of flashing data in ROM for more than 32767
64	average number of flash in ROM [nb/day]	**	number of flashing data in ROM per day
…			
72	Synchro backlight logic	*	0 : logic positive / 1 : logic negative
…			
80	DIP switch 1 ON	**	switch state: 1 : IP default value
82	DIP switch 2 ON	**	
84	DIP switch 3 ON	**	
86	DIP switch 4 ON	**	
…			
92	Type 1: Asycube	**	0 : Unknown 1: Asycube 50 2: Asycube 80 3: Asycube 130 4: Asycube 240 5: Asycube 530
94	Type 2: Asycube	**	
96	Color of Backlight	*	0: Green 1: Red 2: Blue 3: IR 4: UV 5: White 99: None
…			
100	Backlight Flash Time		[ms]
102	Backlight PWM		[%]
104	Backlight minimum PWM threshold	**	[%]
106	Frequency minimum threshold	**	[Hz]
108	Frequency maximum threshold	**	[Hz]

Address	Parameters	Command	Comment
110	Vibration Set ID	**	Selected Vibration Set ID [1...26]
112	Sequence ID	**	Selected Sequence ID [1...26]
...			
130	Sequence ID Input 1		Sequence ID [1...26]
132	Sequence ID Input 2		Sequence ID [1...26]
...			
144	UART1 rx timeout Ethernet	*	Default: 1'000 [ms]
148	UART1 tx timeout Ethernet	*	Default: 2 [ms]
...			
152	Backlight timeout	**	0= disable timeout function 30 = 30 sec with PWM 100%, 60 sec with PWM 50%, etc. 0 for Asycubes 240 and 530 backlight because there is no risk to keep it switched on permanently.
...			
158	Gain amplitude actuator 1	*	(int) [2.55]
160	Gain amplitude actuator 2	*	(int) [2.55]
162	Gain amplitude actuator 3	*	(int) [2.55]
164	Gain amplitude actuator 4	*	(int) [2.55]
166	Offset amplitude actuator 1	*	(int) +/- n 1/256
168	Offset amplitude actuator 2	*	(int) +/- n 1/256
170	Offset amplitude actuator 3	*	(int) +/- n 1/256
172	Offset amplitude actuator 4	*	(int) +/- n 1/256
174	Offset frequency actuator 1	*	(int) +/- n 0.25 Hz
176	Offset frequency actuator 2	*	(int) +/- n 0.25 Hz
178	Offset frequency actuator 3	*	(int) +/- n 0.25 Hz
180	Offset frequency actuator 4	*	(int) +/- n 0.25 Hz
182	Gain amplitude output 1	*	(int) [2.55]
184	Gain amplitude output 2	*	(int) [2.55]
186	Offset amplitude output 1	*	(int) +/- n 1/256
188	Offset amplitude output 2	*	(int) +/- n 1/256
190	Output 1 logic	*	0 : logic positive / 1 : logic negative
192	Output 2 logic	*	0 : logic positive / 1 : logic negative
194	Input 1 logic	*	0 : logic positive / 1 : logic negative
196	Input 2 logic	*	0 : logic positive / 1 : logic negative

Table 4-1: configuration parameters

4.2. Platform Vibrations

This section presents the platform vibration parameters. Please note that these parameters are different between the Asycubes 50 and 80 (Section 4.2.1) and the Asycubes 240 and 530 (4.2.2).

4.2.1. For the Asycube 50 and Asycube 80

The Table 4-2 shows the formula to get the addresses of the platform vibrations parameters, while the Table 4-3 presents the specific addresses for the vibrations A and B. These parameters are set from address range 300 to 920 and from 940 to 990.

Address	Parameters	Vibration	Units	Range
300+24*n	Amplitude 1	Platform "n" A: n=0, B: n=1, … Z: n=25	[%]	0 to 100 %
302+24*n	Frequency 1		[Hz]	0 to 250 Hz
304+24*n	Phase 1		[°deg.]	0 to 359 degrees
306+24*n	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
308+24*n	Amplitude 2		[%]	0 to 100 %
310+24*n	Frequency 2		[Hz]	0 to 250 Hz
312+24*n	Phase 2		[°deg.]	0 to 359 degrees
314+24*n	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
316+24*n	Amplitude 3		[%]	0 to 100 %
318+24*n	Frequency 3		[Hz]	0 to 250 Hz
320+24*n	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
940+2*n	Duration		[ms]	0 to 30'000 ms

Table 4-2: Generic addressing of platform vibrations parameters for the Asycube 50 and Asycube 80

Address	Parameters	Vibration	Units	Range
300	Amplitude 1	Platform "A"	[%]	0 to 100 %
302	Frequency 1		[Hz]	0 to 250 Hz
304	Phase 1		[°deg.]	0 to 359 degrees
306	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
308	Amplitude 2		[%]	0 to 100 %
310	Frequency 2		[Hz]	0 to 250 Hz
312	Phase 2		[°deg.]	0 to 359 degrees

Address	Parameters	Vibration	Units	Range
314	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
316	Amplitude 3		[%]	0 to 100 %
318	Frequency 3		[Hz]	0 to 250 Hz
320	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
940	Duration		[ms]	0 to 30'000 ms
324	Amplitude 1	Platform "B"	[%]	0 to 100 %
326	Frequency 1		[Hz]	0 to 250 Hz
328	Phase 1		[°deg.]	0 to 359 degrees
330	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
332	Amplitude 2		[%]	0 to 100 %
334	Frequency 2		[Hz]	0 to 250 Hz
336	Phase 2		[°deg.]	0 to 359 degrees
338	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
340	Amplitude 3		[%]	0 to 100 %
342	Frequency 3		[Hz]	0 to 250 Hz
344	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
942	Duration		[ms]	0 to 30'000 ms

Table 4-3: platform vibrations parameters A and B for the Asycube 50 and Asycube 80

4.2.2. For the Asycube 240 and Asycube 530

The Table 4-4 shows the formula to get the addresses of the platform vibrations parameters, while the Table 3-1 presents the specific addresses for the vibrations A and B. These parameters are set from address range 300 to 1962.

Address	Parameters	Vibration	Units	Range
300+64*n	Amplitude 1	Platform "n" A: n=0, B: n=1, … Z: n=25	[%]	0 to 100 %
302+64*n	Frequency 1		[Hz]	0 to 250 Hz
304+64*n	Phase 1		[°deg.]	0 to 359 degrees
306+64*n	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
310+64*n	Amplitude 2		[%]	0 to 100 %
312+64*n	Frequency 2		[Hz]	0 to 250 Hz
314+64*n	Phase 2		[°deg.]	0 to 359 degrees

Address	Parameters	Vibration	Units	Range
316+64*n	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
320+64*n	Amplitude 3		[%]	0 to 100 %
322+64*n	Frequency 3		[Hz]	0 to 250 Hz
324+64*n	Phase 3		[°deg.]	0 to 359 degrees
326+64*n	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
330+64*n	Amplitude 4		[%]	0 to 100 %
332+64*n	Frequency 4		[Hz]	0 to 250 Hz
334+64*n	Phase 4		[°deg.]	0 to 359 degrees
336+64*n	Waveform 4		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
362+64*n	Duration		[ms]	0 to 30'000 ms

Table 4-4: Generic addressing of the platform vibrations parameters for the Asycube 240 and Asycube 530

Address	Parameters	Vibration	Units	Range
300	Amplitude 1	Platform "A"	[%]	0 to 100 %
302	Frequency 1		[Hz]	0 to 250 Hz
304	Phase 1		[°deg.]	0 to 359 degrees
306	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
310	Amplitude 2		[%]	0 to 100 %
312	Frequency 2		[Hz]	0 to 250 Hz
314	Phase 2		[°deg.]	0 to 359 degrees
316	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
320	Amplitude 3		[%]	0 to 100 %
322	Frequency 3		[Hz]	0 to 250 Hz
324	Phase 3		[°deg.]	0 to 359 degrees
326	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
330	Amplitude 4		[%]	0 to 100 %
332	Frequency 4		[Hz]	0 to 250 Hz
334	Phase 4		[°deg.]	0 to 359 degrees
336	Waveform 4		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
362	Duration		[ms]	0 to 30'000 ms
364	Amplitude 1	Platform "B"	[%]	0 to 100 %
366	Frequency 1		[Hz]	0 to 250 Hz
368	Phase 1		[°deg.]	0 to 359 degrees
370	Waveform 1		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn

Address	Parameters	Vibration	Units	Range
374	Amplitude 2		[%]	0 to 100 %
376	Frequency 2		[Hz]	0 to 250 Hz
378	Phase 2		[°deg.]	0 to 359 degrees
380	Waveform 2		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
384	Amplitude 3		[%]	0 to 100 %
386	Frequency 3		[Hz]	0 to 250 Hz
388	Phase 3		[°deg.]	0 to 359 degrees
390	Waveform 3		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
394	Amplitude 4		[%]	0 to 100 %
396	Frequency 4		[Hz]	0 to 250 Hz
398	Phase 4		[°deg.]	0 to 359 degrees
400	Waveform 4		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
426	Duration		[ms]	0 to 30'000 ms

Table 4-5: platform vibrations parameters A and B for the Asycube 240 and Asycube 530

4.3. Hopper Vibrations or Outputs Activations

This section presents the hopper vibration parameters for the Asycubes 50 and 80 and the output activations parameters for the Asycubes 240 and 530.

4.3.1. Hopper vibrations (Asycube 50 and Asycube 80)

The Table 4-6 shows the formula to get the addresses of the hopper vibrations parameters, while the Table 4-7 presents the specific addresses for the vibrations A and B. These parameters are set from address range 1000 to 1204 and 1240 to 1290.

Address	Parameters	Vibration	Units	Range
1000+8*n	Amplitude	Bulk "n" A: n=0, B: n=1, … Z: n=25	[%]	0 to 100%
1002+8*n	Frequency		[Hz]	0 to 250 Hz
1004+8*n	Figure		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
1240+2*n	Duration		[ms]	0 to 30'000 ms

Table 4-6: Generic addressing of the hopper vibrations parameters for the Asycube 50 and Asycube 80

Address	Parameters	Vibration	Units	Range
1000	Amplitude	Bulk "A"	[%]	0 to 100%
1002	Frequency		[Hz]	0 to 250 Hz
1004	Figure		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
1240	Duration		[ms]	0 to 30'000 ms
1008	Amplitude	Bulk "B"	[%]	0 to 100%
1010	Frequency		[Hz]	0 to 250 Hz
1012	Figure		[0..3]	0=no signal, 1=sinus, 2=rp up, 3= rp dn
1242	Duration		[ms]	0 to 30'000 ms

Table 4-7: hopper vibrations parameters A and B for the Asycube 50 and Asycube 80

4.3.2. Outputs activations (Asycube 240 and Asycube 530)

The Table 4-8 shows the formula to get the addresses of the outputs activations parameters, while the presents the specific addresses for the outputs activations A and B. These parameters are set from address range 2000 to 2414.

Address	Parameters	Activation	Units	Range
2000+16*n	Toggle output 1	Outputs "n" A: n=0, B: n=1, … Z: n=25	[bool]	0=no signal, 1=signal
2002+16*n	Amplitude output 1		[%]	0 to 100% (0 to 10V)
2004+16*n	Toggle output 2		[bool]	0=no signal, 1=signal
2006+16*n	Amplitude output 2		[%]	0 to 100% (0 to 10V)
2014+16*n	Duration		[ms]	0 to 30'000 ms

Table 4-8: Generic addressing of the outputs activations parameters for the Asycube 240 and Asycube 530

Address	Parameters	Activation	Units	Range
2000	Toggle output 1	Outputs "A"	[bool]	0=no signal, 1=signal
2002	Amplitude output 1		[%]	0 to 100% (0 to 10V)
2004	Toggle output 2		[bool]	0=no signal, 1=signal
2006	Amplitude output 2		[%]	0 to 100% (0 to 10V)
2014	Duration		[ms]	0 to 30'000 ms
2016	Toggle output 1	Outputs "B"	[bool]	0=no signal, 1=signal
2018	Amplitude output 1		[%]	0 to 100% (0 to 10V)
2020	Toggle output 2		[bool]	0=no signal, 1=signal
2022	Amplitude output 2		[%]	0 to 100% (0 to 10V)
2030	Duration		[ms]	0 to 30'000 ms

Table 4-9: outputs activations parameters A and B for the Asycube 240 and Asycube 530

4.4. Sequences

This section presents the sequences parameters.

The Table 4-10 shows the formula to get the address of the sequences parameters; please be aware that the base address differs from an Asycube model to the others (baseAddr = 1300 for the Asycubes 50 and 80; baseAddr = 2500 for the Asycubes 240 and 530). The presents the specific addresses of all 7 actions from the sequences 1 and 26. These parameters are set from address range 1300 to 2806 for the Asycubes 50 and 80 while they are set from address range 2500 to 4006 for the Asycube 240 and 530.

Address	Parameters	Action nb	Sequence ID	Range	Comment
baseAddr + 0 + 8*(m-1) + 58*(n-1)	Type	m 1 to 7	n 1 to 25 26**	[0..3]	0=None, 1=Platform 2=Hopper, 3=Stabilisation
baseAddr + 2 + 8*(m-1) + 58*(n-1)	Vibration	m	n	[A..Z + 0]	0 = Centering
baseAddr + 4 + 8*(m-1) + 58*(n-1)	Duration Mode	m	n	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
baseAddr + 6 + 8*(m-1) + 58*(n-1)	Duration Value	m	n	[0..30000ms] [0..100%]	Unit change depending of selected duration mode

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Table 4-10: Generic addressing of the sequences parameters (baseAddr = 1300 for the Asycubes 50 and 80; baseAddr = 2500 for the Asycubes 240 and 530)

Address	Parameters	Action nb	Sequence ID	Range	Comment
2500	Type	1	1	[0..3]	0=None, 1=Platform 2=Hopper, 3=Stabilisation
2502	Vibration			[A..Z + 0]	0 = Centering
2504	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2506	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2508	Type	2	1	[0..3]	0=None, 1=Platform 2=Hopper, 3=Stabilisation

Address	Parameters	Action nb	Sequence ID	Range	Comment
2510	Vibration			[A..Z + 0]	0 = Centering
2512	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2514	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2516	Type	3	1	[0..3]	0=None, 1=Platform 2=Hopper, 3=Stabilisation
2518	Vibration			[A..Z + 0]	0 = Centering
2520	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2522	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2524	Type	4	1	[0..3]	0=None, 1=Platform 2=Hopper, 3=Stabilisation
2526	Vibration			[A..Z + 0]	0 = Centering
2528	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2530	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2532	Type	5	1	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
2534	Vibration			[A..Z + 0]	0 = Centering
2536	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2538	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2540	Type	6	1	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
2542	Vibration			[A..Z + 0]	0 = Centering
2544	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2546	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2548	Type	7	1	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation

Address	Parameters	Action nb	Sequence ID	Range	Comment
2550	Vibration			[A..Z + 0]	0 = Centering
2552	Duration Mode			[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
2554	Duration Value			[0..30000ms] [0..100%]	Unit change depending of selected duration mode
2556	Nb Limit Parts		1	[0..32767]	Nb limit of parts for the QuantityAdjusted vibration.
3950	Type	1	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3952	Vibration		**	[A..Z + 0]	0 = Centering
3954	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
3956	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
3958	Type	2	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3960	Vibration		**	[A..Z + 0]	0 = Centering
3962	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
3964	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
3966	Type	3	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3968	Vibration		**	[A..Z + 0]	0 = Centering
3970	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
3972	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
...					
3974	Type	4	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3976	Vibration		**	[A..Z + 0]	0 = Centering
3978	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio

Address	Parameters	Action nb	Sequence ID	Range	Comment
3980	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
3982	Type	5	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3984	Vibration		**	[A..Z + 0]	0 = Centering
3986	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
3988	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
3990	Type	6	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
3992	Vibration		**	[A..Z + 0]	0 = Centering
3994	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
3996	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
3998	Type	7	26 **	[0..3]	0=None, 1=Platform 2= Hopper, 3=Stabilisation
4000	Vibration		**	[A..Z + 0]	0 = Centering
4002	Duration Mode		**	[0..2]	0=Fixed, 1=QuantityAdjusted, 2=VibrationRatio
4004	Duration Value		**	[0..30000ms] [0..100%]	Unit change depending of selected duration mode
4006	Nb Limit Parts		26 **	[0..32767]	Nb limit of parts for the QuantityAdjusted vibration.

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Table 4-11: sequences parameters 1 and 26

5. TCIP/IP Communication

This chapter presents how to communicate with the Asycube to use the text commands over TCP/IP. The commands are presented in Section 5.4.

The other way to communicate with the Asycube is by using Modbus TCP (Chapter 6).

5.1. Configuration

The host computer communicates with the Asycube using protocol Ethernet TCP/IP. The Asycube is the TCP/IP server and the host computer is the TCP/IP client. The server (the Asycube) sends packets only in response to a client request.

Default TCP/IP parameters are:

IP Address	192.168.127.254
Subnet Mask	255.255.255.0
TCP port	4001

These parameters can be changed in configuration page of the Asyril HMI. If parameters are unknown (connection cannot be established), use the "Recover IP address using default IP address" procedure described in Operating Manual. Using this procedure enables the connection to the Asycube with the default parameters and modification of the lost parameters.

5.2. Asycube communication protocol

The host controller communication protocol uses only ASCII characters and is designed for communication networks. The host computer is always the client. Servers transmit only after receiving a message from the client.

Command / Response Format	Command: Begin, **Command**, End, CRLF Response: Begin, **Response**, End, CRLF
Begin	The ASCII char "{" must be the first character of the packet, which allows detection of a new packet.
Command	This field will contain ASCII letter characters followed by the parameter number. These letters specify the purpose of the message packed (for instance Read or Write Parameter). The available commands are listed in Section 5.4. The Command can contain extra data that will be interpreted in various ways and special delimiter characters.
Response	This field contains a fixed format that specifies the validation of the instruction. The Asycube gives a response message for each corresponding instruction.
End	The ASCII char "}" must be placed just after the Command or Response.
CRLF	The ASCII chars "carriage return 0x0D" (also known as "\r") and "line feed 0x0A" (also known as "\n") are the last two bytes of the packet, for both sending and receiving.

" 0 " to " 9 " " a " to " z ", " A " to " Z "	not case sensitive
" { "	begin of packet
" : "	specifies read operation
" = "	specifies write operation
" } "	end of packet
" (" or ") " or " ; "	special delimiters
CR	0x0D Carriage Return
LF	0x0A Line Feed

Table 5-1: ASCII Character

Examples:

1) In this example we want to know the actual parameter of register 300 (amplitude of first actuator of Platform Vibration A) on the Asycube.

   Command: {**rp300**} CR LF

   Response: {**rp300:00100**} CR LF

2) In this example we want to modify the amplitude of the first actuator (value=90) of the Platform Vibration A (301) from the Asycube.

   Command: {**wp301=90**} CR LF

   Response: {**wp301=00090**} CR LF

3) In this example, we want to start the vibration of the platform, using the Vibration F (Backward direction) for duration of 1000 ms. Please note that the duration in the response may vary from what has been asked in the command.

   Command: {**cf1000**} CR LF

   Response: {**cf1060**} CR LF

5.3. Communication error code (Serial bit)

The serial response gives an error code in the form of an integer value. You have to convert the value to binary to obtain the error bit affected. For example a response {Er00004} means that the system doesn't recognized the first character of the command.

Binary	Error Bit	Message
[00001]	0	Message string syntax error!
[00002]	1	String to integer data convert error! , even/off according to read/write
[00004]	2	Unknown first character of command!
[00008]	3	Unknown second character of command!
[00016]	4	Parameter value error!
[00032]	5	Sequence vibration duration value 0 error !
[00064]	6	Access to the vibration set or sequence ID 26 error!
[00128]	7	*« not used »*
[00256]	8	Receive buffer is full!
[00512]	9	Receive end of message "}" but receive buffer is full!
[01024]	10	Receive end of message "}" but missing begin of message "{"!
[02048]	11	
[04096]	12	Framing error detected!
[08192]	13	Parity error detected!
[16384]	14	Overflow error detected!
[32768]	15	Receive complete message timeout control!

Table 5-2: communication error code

5.4. Commands

All existing TCP/IP commands are described in the overview below.

5.4.1. Description and ranges of parameters

The following table describes the parameters used by the different commands and their ranges.

Parameter	Description	Commands	Range	Unit
Amplitude	Amplitude of the vibration	LC, LB, SC, SB	[0…100]	%
Frequency	Frequency of the vibration	LC, LB, SC, SB	[0…250]	Hz
Waveform	Waveform of the vibration	LC, LB, SC, SB	[0…3]	
Phase	Phase of the vibration	LC, SC	[0…359]	°
Duration	Duration of the vibration or output activation	LC, LB, SC, SB	[0…30000]	ms
Action number	Number of the action in the sequence (7 actions in a sequence)	LS, SS	[1…7]	
Type	Type of action in the sequence (None, Platform, Hopper, Wait)	LS, SS	[0…3]	
Vibration	Vibration used by the action in the sequence (for Platform and Hopper types)	LS, SS	[A…Z] 0 for centering	
Duration Mode	Duration mode of the action in the sequence (Fixed, QuantityAdjusted and VibrationRatio)	LS, SS	[0…2]	
Duration Value	Duration value of the action in the sequence	LS, SS	[0…30000] [1] [0…100] [2]	ms %
Nb Parts on the platform	Number of parts on platform used by the Asycube to execute the sequence	ES, EF	[0…32767]	parts
Nb Limit Parts for Vibration	Limit number of parts on platform in the sequence to have a vibration with QuantityAdjusted duration mode (if the number of parts exceeds this value the hopper will not be vibrated)	LS, SS, ES, EF	[0…32767]	parts
Center of mass	Center of mass of the parts on the platform. This value is used by the Centering vibration.	ES, EC	[-1.000…1.000]	
Sequence ID	ID of the sequence	LS, SS, US	[1…26]	
Vibration Set ID	ID of the vibration set	UV	[1…26]	

[1] For all duration modes except the “vibration ratio”

[2] Only for duration mode “vibration ratio”

Table 5-3: parameters range

5.4.2. Level access

The system has three different levels to access parameters or to execute some commands. The actual selected access level can be obtained using the command {?6}.

Level	Description	Response to query	Select the level
User	User access allows to access simple commands and parameters to use the Asycube.	{?6:00001}	{WP7=0}
Integrator	Integrator access allows changing some special parameters for advanced configuration.	{?6:00002}	{WP7=1234}
Developer	Developer access allows to change all parameters but is exclusively used by Asyril	{?6:00004}	*Reserved for Asyril*

Table 5-4: level access description

5.4.3. Access Single Parameters

Code	Label	Command	Response	Remark
WP	Write Parameter	{WP303=90}	{WP303=90}	
RP	Read Parameter	{RP302}	{RP302:90}	

Table 5-5: read and write commands

NOTE :

The even numbered registers are readable parameters and the odd numbered registers are the writable parameters. E.g. the register 302 and 303 stand for the first actuator frequency of the platform vibration "A". If the frequency of the first actuator signal needs to be changed, register 303 needs to be overwritten. If the information of the frequency of the first actuator signal needs to be returned, register 302 has to be read.

5.4.4. Access to parameters

For all explanations below, the parameters ranges are described in this generic chapter.

5.4.4.1. Platform Vibration Parameters

Code	Label	Command	Response	Remark
SCA..Z	Save Platform Vibration A…Z parameters	{SCA=(p1; p2;etc)}	{SCA=(p1;p2;etc)}	
LCA..Z	Load Platform Vibration A…Z parameters	{LCA}	{LCA:(p1;p2;etc)}	

Table 5-6: platform vibration commands

P1, P2 are parameters given in a specific order and separate with a semicolon. The order of the parameters is as follows:

Amplitude1; Frequency1; Phase1; Waveform1;
Amplitude2; Frequency2; Phase2; Waveform2;
Amplitude3; Frequency3; Phase3; Waveform3;
Amplitude4; Frequency4; Phase4; Waveform4;
Duration

Examples:

- Write platform vibration A:
  - Command : {SCA=(90;70;0;1;88;71;90;2;85;72;180;3;80;73;270;4;1200)}
  - Response: {SCA=(90;70;0;1;88;71;90;2;85;72;180;3;80;73;270;4;1200)}
- Read platform vibration A :
  - Command : {LCA}
  - Response: {LCA :(90;70;0;1;88;71;90;2;85;72;180;3;80;73;270;4;1200)}

NOTE :

To access vibration and activation parameters (platform and outputs), the order of the parameters has to be strictly respected. These commands are useful to access all parameters of a vibration/activation in only one message.

5.4.4.2. *Hopper Vibration Parameters (Asycube 50 and 80)*

Code	Label	Command	Response	Remark
SBA..Z	Save Hopper Vibration A…Z parameters	{SBA=(p1; p2;etc)}	{SBA=(p1;p2;etc)}	
LBA..Z	Load Hopper Vibration A…Z parameters	{LBA}	{LBA:(p1;p2;etc)}	

Table 5-7: hopper vibration commands

P1, P2 are parameters given in a specific order and separate with a semicolon. The order of the parameters is as follows:

Amplitude; Frequency; Waveform; Duration

Examples:

- Write hopper vibration A:
  - Command: {SBA=(80;70;3;1200)}
  - Response: {SBA=(80;70;3;1200)}
- Read hopper vibration A:
  - Command: {LBA}
  - Response: {LBA:(80;70;3;1200)}

5.4.4.3. *Outputs Activation Parameters (Asycubes 240 and 530)*

Code	Label	Command	Response	Remark
SBA..Z	Save Outputs Activation A…Z parameters	{SBA=(p1; p2;etc)}	{SBA=(p1;p2;etc)}	
LBA..Z	Load Outputs Activation A…Z parameters	{LBA}	{LBA:(p1;p2;etc)}	

Table 5-8: outputs activation commands

P1, P2 are parameters given in a specific order and separate with a semicolon. The order of the parameters is as follows:

Toggle_Output1; Amplitude_output1; Toggle_Output2; Amplitude_Output2; Duration

Examples:

- Write outputs activation A:
  - Command: {SBA=(1;100;0;20;1200)}
  - Response: {SBA=(1;100;0;20;1200)}
- Read outputs activation A:
  - Command: {LBA}
  - Response: {LBA :(1;100;0;20;1200)}

NOTE :

To access vibration and activation parameters (platform and outputs), the order of the parameters has to be strictly respected. These commands are useful to access all parameters of a vibration/activation in only one message.

5.4.4.4. Sequence Parameters

Code	Label	Command	Response	Remark
SS	Save a sequence	{SS=(p1; p2;etc)}	{SS=(p1;p2;etc)}	
LS	Load a sequence	{LS=(p1,p2)}	{LS:(p1;p2;etc)}	

Table 5-9: hopper vibration commands

P1, P2 are parameters given in a specific order and separate with a semicolon.

NOTE :

To access sequence parameters, the order of the parameters has to be strictly respected.

5.4.4.4.1. Load

The order of the parameters for the command is as follows:

Action number; Sequence ID

The order of the parameters for the response is as follows:

Action number; Type; Vibration; Duration Mode; Duration Value;
Nb Limit Parts for Vibration; SequenceID

Example:

Command: {LS:(1;1)}

Response: {LS:(1;2;B;1;1000;120;1)}

NOTE :

The sequenceID is optional, if missing, the Asycube will send back parameters for the currently selected sequence (command {US?} allows to ask the selected sequence ID).
If no action is used the "Duration Mode" "QuantityAdjusted", the "Nb Limit Parts for Vibration" value has no impact on the action.

5.4.4.4.2. Save

The order of the parameters for the command and the response is as follows:

Action number; Type; Vibration; Duration Mode; Duration Value;
Nb Limit Parts for Vibration; Sequence ID

Example:

Command: {SS=(1;2;B;1;1000;120;1)}
Response: {SS=(1;2;B;1;1000;120;1)}

NOTE :

The sequenceID is optional, if missing, the Asycube will write parameters on the parameters for the selected sequence (command {US?} allows to ask the selected sequence ID).
The "Nb Limit Parts for Vibration" is optional, if missing, the Asycube will use the value currently in the memory.

5.4.5. Vibration set and sequence selection

Code	Label	Command	Response	Remark
UV#	Use Vibration Set	{UV1}	{UV1}	UV# command select the vibration set to use
US#	Use Sequence	{US1}	{US1}	US# command select the sequence to use
UV?	Get selected Vibration Set	{UV?}	{UV?:1}	UV? asks for the selected vibration set
US?	Get selected Sequence	{US?}	{US?:1}	US? asks for the selected sequence
U??	Get selected Vibration Set and Sequence	{U??}	{U??:01:01}	U?? asks for the selected vibration set and sequence

Table 5-10: Vibration set and sequence selection commands

5.4.6. Backlight

Code	Label	Command	Response	Remark
K1	Backlight On	{K1}	{K1}	After response received, the backlight is considered ON, but you must consider a delay to get the maximal intensity.
K0	Backlight Off	{K0}	{K0}	
K?	Backlight State	{K?}	{K?:0} {K?:1}	0: Backlight is off 1: Backlight is on
KF	Backlight is flashing	{KF}	{KF}	Duration = Parameter 100

Table 5-11: backlight commands

5.4.7. System States

The Asycube has two different working states:

- Service mode is the normal mode, to work with the Asycube.
- Standby mode is a special mode. In this mode the power of vibrations, outputs, backlight, etc. are off. Operator can send commands without any physical action on the Asycube. This mode can be useful for tests and debug.

Code	Label	Command	Response	Remark
HC	Halt Platform Vibrations	{HC}	{HC}	Stop the platform actuators
HB	Halt Hopper vibration / Outputs Activation	{HB}	{HB}	Stop the hopper actuator or the outputs
HS	Halt	{HS}	{HS}	Stop the sequence
H1	System in service	{H1}	{H1}	Set system in service
H0	System in standby	{H0}	{H0}	Set system in standby
H?	System State	{H?}	{H?:0} {H?:1}	0: System in standby 1: System in service

Table 5-12: system states commands

5.4.8. Platform Vibrations (C for Cube)

Code	Label	Command	Response	Remark
CA..Z	Platform vibrate for a time [ms]	{CF100}	{CF100}	Vibration F vibrates for 100ms
CA0..Z0	Platform vibrate forever	{CF0}	{CF0}	Vibration F vibrate forever. Stop vibration with command HC.
CA..Z	Platform vibrate for a pre-defined delay	{CF}	{CF}	Delay depends on selected Vibration. In this case the delay is equal the register 950 value. If value = 0 -> forever
C?	Read selected Platform vibration	{C?}	{C?:F}	Vibration F is selected. The selected vibration is the last vibration executed.
C??	Read selected Platform Vibration and state	{C??}	{C??:F3}	Vibration F is selected and the state is 3. States: 0: Actuator disabled 1: Actuator enable but stopped 3: Vibrating 5: Actuator stopped over temperature !: Undefined actuator state
CA..Z ?	Read Platform Vibration state	{CF?}	{CF:0}	State of Vibration F is 0. States: 0: Actuator disabled 1: Actuator enable but stopped 3: Vibrating 5: Actuator stopped over temperature !: Undefined actuator

Table 5-13: platform vibrations commands

The value sent back indicates the duration of the vibration (communication time is not included).

NOTE :

For the Asycube 50, 80 and 240, the duration answered can change depending of the conditions when the vibration is requested.

- *Due to hardware limitation, the vibration effectively starts 60ms after the command has been received.*
- *If the amplifiers are in the switching OFF process (automatically 5s after the end of the last vibration), the Asycube needs to wait the end of the switching OFF process (max 150ms) before to be able to start a new vibration. Then the time answered to the command will be: the time requested + the 60ms of switching ON amplifiers + max 150ms of switching OFF process. The 150ms is the worst situation, because if the request appears in the middle of the switching OFF process, the delay will be only 75ms.This delay depends of the moment when the request appears during the switching OFF process.*

5.4.9. Hopper vibration or Outputs activation

5.4.9.1. Asycubes 50 and 80: Hopper Vibrations (B for Bulk)

Code	Label	Command	Response	Remark
BA..Z	Hopper vibrate for a time [ms]	{BF100}	{BF100}	Vibration F vibrates for 100ms
BA0..Z0	Hopper vibrate forever	{BF0}	{BF0}	Vibration F vibrates forever. Use the command HB to stop the vibration.
BA..Z	Hopper vibrate for a pre-defined delay	{BF}	{BF}	Delay depends on selected Vibration. In this case the delay is equal the register 1250 value. If value = 0 -> forever
B?	Read selected Hopper vibration	{B?}	{B?:F}	Vibration F is selected. The selected hopper vibration is the last vibration executed.
B??	Read selected Hopper vibration and state	{B??}	{B??:F3}	Vibration F is selected and the state is 3. States: 0: Actuator disabled 1: Actuator enabled but stopped 3: Vibrating 5: Actuator stopped over temperature !: Undefined actuator state
BA..Z ?	Read Hopper vibration state	{BF?}	{BF:0}	State of Vibration F is 0. States: 0: Actuator disabled 1: Actuator enabled but stopped 3: Vibrating 5: Actuator stopped over temperature !: Undefined actuator state

Table 5-14: hopper vibrations commands

The value sent back indicates the duration of the vibration (communication time is not included).

NOTE :

The duration answered can change depending of the conditions when the vibration is requested.

- *If the amplifiers are in the switching OFF process (automatically 5s after the end of the last vibration), the Asycube needs to wait the end of the switching OFF process (max 150ms) before to be able to start a new vibration. Then the time answered to the command will be: the time requested + the 60ms of switching ON amplifiers + max 150ms of switching OFF process. The 150ms is the worst situation, because if the request appears in the middle of the switching OFF process, the delay will be only 75ms.This delay depends of the moment when the request appears during the switching OFF process.*

5.4.9.2. Asycubes 240 and 530: Outputs activation

Code	Label	Command	Response	Remark
BA..Z	Outputs activation for a time [ms]	{BF100}	{BF100}	Activation F activate for 100ms
BA0..Z0	Outputs activation forever	{BF0}	{BF0}	Activation F activate forever. Use the command HB to stop the activation.
BA..Z	Outputs activation for a pre-defined delay	{BF}	{BF}	Delay depends on selected Activation. In this case the delay is equal the register 1250 value. If value = 0 -> forever
B?	Read selected Output activation	{B?}	{B?:F}	Activation F is selected. The selected output activation is the last activation executed.
B??	Read selected Output Activation and state	{B??}	{B??:F3}	Activation F is selected and the state is 3. States: 0: Outputs disabled 1: Outputs enabled but stopped 3: Activating !: Undefined actuator state
BA..Z ?	Read Output Activation state	{BF?}	{BF:0}	State of Activation F is 0. States: 0: Outputs disabled 1: Outputs enabled but stopped 3: Activating !: Undefined actuator

Table 5-15: outputs activation commands

5.4.10. Sequence, centering and feeding execution

Code	Label	Command	Response	Remark
ES	Execute Sequence	{ES:(p1;p2;etc)}	{ES:(p1;p2;etc)}	Execute the sequence depending of given parameters.
EC	Execute Centering	{EC:(p1;p2;etc)}	{EC:(p1;p2;etc)}	Execute centering depending of given parameters.
EF	Execute Feeding	{EF:(p1;p2;etc)}	{EF:(p1;p2;etc)}	Execute feeding depending of given parameters.

Table 5-16: Execute commands

P1, P2 are parameters given in a specific order and separate with a semicolon. The ranges of parameters are described in this generic chapter.

NOTE :

To execute a sequence, a centering or a feeding, the order of the parameters has to be strictly respected.

5.4.10.1. Sequence

The parameter order for the **command** is as follows:

Number of parts on the platform; Nb Limit Parts for Vibration; Center of mass X; Center of mass Y; SequenceID

The parameter order for the **response** is as follows:

Number of parts on the platform; Nb Limit Parts for Vibration;
Center of mass X, Center of mass Y; SequenceID; Duration of the sequence

The duration sent back indicates the duration of the sequence (communication time is not included).

NOTE :

For the Asycube 50, 80 and 240, the duration answered can change depending of the conditions when the vibration is requested.

- *Due to hardware limitation, the vibration effectively starts 60ms after the command has been received.*
- *If the amplifiers are in the switching OFF process (automatically 5s after the end of the last vibration), the Asycube needs to wait the end of the switching OFF process (max 150ms) before to be able to start a new vibration. Then the time answered to the command will be: the time requested + the 60ms of switching ON amplifiers + max 150ms of switching OFF process. The 150ms is the worst situation, because if the request appears in the middle of the switching OFF process, the delay will be only 75ms.This delay depends of the moment when the request appears during the switching OFF process.*

Example:

Command: {ES:(55;100;0.33;-0.33;1)}
Response: {ES:(55;100;0.33;-0.33;1;1560)}

In this example, the sequence will take 1.56 seconds.

NOTE :

- *The 'Sequence ID' is optional, if missing, the Asycube will execute the currently selected sequence (command {US?} allows to ask the selected sequence ID).*
- *The 'center of mass' is optional if the sequence doesn't contain a centering vibration.*
- *The 'number limit of parts for vibration' must have the value 0 to use the value already in the Asycube memory.*

5.4.10.1.1. Various formats of the command ES

Command sent	Command executed	Remark
ES	**ES:(0;nbMax;0;0;ID)**	**nbMax** : value in memory previously given. **ID** : Selected sequence
ES:(nbParts)	**ES:(nbParts;nbMax;0;0;ID)**	**nbParts** : number of parts on the platform given in the command. **nbMax** : value in memory previously given. **ID** : Selected sequence
ES:(nbParts;nbMax)	**ES:(nbParts;nbMax;0;0;ID)**	**nbParts** : number of parts on the platform given in the command. **nbMax** : max number of parts given in the command. **ID** : Selected sequence
ES:(nbParts;nbMax;X)	**ES:(nbParts;nbMax;X;0;ID)**	**nbParts** : number of parts on the platform given in the command. **nbMax** : max number of parts given in the command. **X** : X coordinate of the center of mass given in the command. **ID** : Selected sequence
ES:(nbParts;nbMax;X;Y)	**ES:(nbParts;nbMax;X;Y;ID)**	**nbParts** : number of parts on the platform given in the command. **nbMax** : max number of parts given in the command. **X** : X coordinate of the center of mass given in the command. **Y** : Y coordinate of the center of mass given in the command. **ID** : Selected sequence
ES:(nbParts;nbMax;X;Y;ID)	ES:(**nbParts**;**nbMax**;**X**;**Y**;**ID**)	**nbParts** : number of parts on the platform given in the command. **nbMax** : max number of parts given in the command. **X** : X coordinate of the center of mass given in the command. **Y** : Y coordinate of the center of mass given in the command. **ID** : Sequence ID given in the command.

In green, the values given in the command.

In red, the values used by the Asycube when the value is missing in the command.

Special case for nbMax:		
ES:(nbParts;0;X;Y;ID)	ES:(nbParts;nbMax;X;Y;ID)	nbParts : number of parts on the platform given in the command. nbMax : value in memory previously given. X : X coordinate of the center of mass given in the command. Y : Y coordinate of the center of mass given in the command. ID : Sequence ID given in the command.

NOTE :

If the value 0 is given in the command for the nbMax, the value used for the execution is the value in memory. This use of the 0 value for this parameter can be done in all formats of the command ES.

NOTE :

If the value 0 is given in the command for the ID, the value used for the execution is the value in memory (Selected sequence).

5.4.10.2. Centering

The order of the parameters for the **command** is as follows:

Center of mass X; Center of mass Y

The parameters order for the **response** is the following:

Center of mass X, Center of mass Y; Duration of the centering

The duration sent back indicates the duration of the centering (communication time is not included).

NOTE :

For the Asycube 50, 80 and 240, the duration answered can change depending of the conditions when the vibration is requested.

- *Due to hardware limitation, the vibration effectively starts 60ms after the command has been received.*
- *If the amplifiers are in the switching OFF process (automatically 5s after the end of the last vibration), the Asycube needs to wait the end of the switching OFF process (max 150ms) before to be able to start a new vibration. Then the time answered to the command will be: the time requested + the 60ms of switching ON amplifiers + max 150ms of switching OFF process. The 150ms is the worst situation, because if the request appears in the middle of the switching OFF process, the delay will be only 75ms.This delay depends of the moment when the request appears during the switching OFF process.*

Example :

Command: {EC:(0.33;-0.33)}

Response: {EC:(0.33;-0.33;560)}

In this example, the centering will take 0.56 seconds.

5.4.10.3. Feeding

The parameters order for the **command** is the following:

Vibration; Number of parts on the platform; Nb Limit Parts for Vibration

The parameters order for the **response** is the following:

Vibration; Number of parts on the platform; Nb Limit Parts for Vibration; Duration of the feeding

The duration sent back indicates the duration of the feeding (communication time is not included).

NOTE for the Asycube 50 and 80 :

The duration answered can change depending of the conditions when the vibration is requested.

- *If the amplifiers are in the switching OFF process (automatically 5s after the end of the last vibration), the Asycube needs to wait the end of the switching OFF process (max 150ms) before to be able to start a new vibration. Then the time answered to the command will be: the time requested + the 60ms of switching ON amplifiers + max 150ms of switching OFF process. The 150ms is the worst situation, because if the request appears in the middle of the switching OFF process, the delay will be only 75ms.This delay depends of the moment when the request appears during the switching OFF process.*

Example :

Command: {EF:(A;55;110)}

Response: {EF:(A;55;110;1210)}

In the example, the feeding will take 1.21 seconds.

5.4.11. Flash Operation

Code	Label	Command	Response	Remark
DF	Data Flash All in memory	{DF}	{DF}	100'000 Program Cycles
DG	Data Flash Global Parameters	{DG}	{DG}	
DS	Data Flash Sequences	{DS}	{DS}	
DV	Fata Flash Vibration Set	{DV}	{DV}	Save only the current vibration set
DE	Data Erase Memory	{DE}	{DE}	** only developer (Asyril)
DR	Data Restore Memory	{DR}	{DR}	* only integrator
DY	Restore Data with Factory values	{DY}	{DY}	* only integrator
DP	Restore current vibration set data and all sequences data with Factory values	{DP?}	{DP?:0}	* only integrator
D..?	Data Flash Memory State	{DF?}	{DF?:0}	States: 0: Operation completed 1: Operation in progress 16: Flash operation busy 128: Operation need password

Table 5-17: flash operations commands

When something is saved in the flash memory, the status led flashes quickly during the whole saving process. If the user tries to save in flash during this time, an error answer is sent (error 80).
The duration of the saving process is 8s or 16s alternating.
During the saving process, the user can use the product, but cannot change any value or select another vibration set.

NOTE :
The Asycube saves automatically the global parameters every 20 minutes (equivalent to {DG} command). This automatic saving process has no impact on the functionning of the Asycube.

5.4.12. States

Code	Label	Command	Response	Remark
?2	RS485 Node Info	{?2}	{?2:1}	Return node info
?6	Login State	{?6}	{?6}	State: 1: User 2: Integrator 4: Developer (Asyril)
?8	Soft High Version	{?8}	{?8:2}	Return highest value of the software version.
?10	Soft Middle Version	{?10}	{?10:2}	Return middle value of the software version.
?12	Soft Low Version	{?12}	{?12:0}	Return lowest value of the software version.
?40	Backlight Flash Remain Time	{?40}	{?40:00010}	Answer gives the remaining time until the end of the flash of the backlight. The value is in ms.
?42	Platform Remain Time	{?42}	{?42:00010}	Answer gives the remaining time until the end of the platform vibration. The value is in ms
?44	Outputs Remain Time	{?44}	{?44:00010}	Answer gives the remaining time until the end of the activation of outputs. The value is in ms
?46	Sequence Remain Time	{?46}	{?46:00010}	Answer gives the remaining time until the end of the sequence. This value is in ms.
?50	Vibration Set Changed	{?50}	{?50:00001}	Answer indicates if a parameter of the current selected vibration set has been modified. It is useful for avoiding the loss of modified parameters.

Table 5-18: states commands

5.4.13. General

Code	Label	Command	Response	Remark
V?	Read Software Version	{V?}	{(c) Asycube VX.X.X}	

Table 5-19: general commands

5.4.14. Warnings

To read the warnings, send {rp2} command.

Define	Value	Comment
WARNING_1	0x0001	
WARNING_2	0x0002	
WARNING_3	0x0004	
WARNING_4	0x0008	
WARNING_5	0x0010	
WARNING_6	0x0020	
WARNING_7	0x0040	
WARNING_FLASH	0x0080	Flash operation fail

Table 5-20: warnings list

5.4.15. Alarms

To read the alarms, send {rp4} command.

Define	Value	Comment
ALARM_PLATFORM	0x0001	Above max temperature platform
ALARM_HOPPER	0x0002	Above max temperature hopper (only for Asycubes 50/80)
ALARM_AMPLIFIER	0x0004	Amplifier fault (only for Asycubes 530)
ALARM_4	0x0008	
ALARM_NO_S_POWER	0x0010	No S-Power (only for Asycubes 530)
ALARM_6	0x0020	
ALARM_BACK_LT	0x0040	Backlight timeout reached
ALARM_8	0x0080	

Table 5-21: alarms list

6. Modbus TCP

From firmware version 4.0.0, the Asycube offers a Modbus TCP slave (=server) interface in order to simplify the integration with PLCs and other Modbus TCP masters (=clients) over TCP/IP networks. More information on Modbus can be found in the protocol specification available on http://www.modbus.org.

The Section 6.1 presents all necessary information to communicate with the Asycube through Modbus TCP. The Section 6.2 shows typical performances that can be achieved. The Asycube Modbus Register Table is presented in Section 6.3. The Section 6.4 explains the different types of errors and the way to handle them. Finally, the Section 6.5 gives a few useful examples, such as how to start a platform vibration through Modbus TCP.

6.1. Configuration

Default Modbus TCP parameters for the Asycube are:

IP Address	192.168.127.254
Subnet Mask	255.255.255.0
Modbus port	502
Unit ID	N/A for Modbus TCP

The IP Address and the Subnet Mask are shared with the Ethernet communication (Section5.1) and can be changed in the configuration page of the Asyril HMI unlike the Modbus port, which is fixed to 502.

Out of all Modbus public function codes, the Asycube implements the minimum useful set of functions (Class 0):

- Code 03 (0x03): Read Holding Registers, with 16 bits access
- Code 16 (0x10): Write Multiple Registers, with 16 bits access

6.2. Performance

This section presents the performance and limitations of the Asycube Modbus TCP implementation.

6.2.1. Communication

The Asycube only accepts one Modbus master/client to be connected at a time. However, a TCP/IP connection (See Chapter 5) can be used in parallel with Modbus; this can be useful to use the Asycube HMI to configure the Asycube while a machine PLC controls the Asycube through Modbus.

The Asycube can only handle one read or write request at a time. If two requests are sent simultaneously, the second one will be ignored. It is recommended to alternate between the different read/write requests.

As stated in the Modbus protocol specification, up to 125 registers can be read at once and only up to 123 registers can be written at once. If more registers need to be read (or written), you will have to implement multiple read (or write) requests one after the other.

6.2.2. Timing

The Asycube is able to handle one Modbus read or write request every 4 ms. The timing performance of a Modbus command (e.g. trig the start of a platform vibration) depends on different factors such as the Modbus master implementation or the Ethernet network state. Therefore, it is not possible to guarantee neither real-time behavior nor maximal reaction time. The order of magnitude for the delay between a Modbus command and its effect on the Asycube is 10 ms. The delay between the instant when a register is written and the instant when its updated value is read on Modbus typically lays around 15 ms.

6.3. Asycube Modbus Register Table

Asycube data can be accessed via Modbus TCP through Holding Registers. The Register Table presented in this section describes all the Asycube Holding Registers. All Holding Registers are 2 bytes long. Their type is generally a WORD or an UNSIGNED_INT16. Some of the Holding Registers can have negative values (see Data Range column in the Register Table). In this case, their type is SIGNED_INT16. All registers are either Read-only or Write-only (see Read/Write column in the Register Table). This section presents the Holding Registers, which have been placed in different address zones. The registers addresses are shown with the address offset of the zone and the relative address of the register (e.g. “64+3” means that the register is in the zone starting at address 64).

6.3.1. Control Holding Registers (Write-only zone, offset=0)

The Control Holding Registers presented in Table 6-1 are used to control the Asycube. Examples: start a vibration, start a sequence, clear the errors, …

The Holding Registers highlighted in **bold** are triggers that start an action or change a value.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
0	HR_MODBUS_CONTROL	W	0 to 15	The 4 first bits are used to clear the errors. A rising edge on a bit clears the corresponding error. More information in Section 6.4.
1	**HR_PLATFORM_VIBRATION_TRIG**	W	0 or 1	A rising edge trigs the start of a platform vibration with the parameters values given in HR_PLATFORM_VIBRATION_ID and HR_PLATFORM_VIBRATION_DURATION.
2	HR_PLATFORM_VIBRATION_ID	W	0 to 25	The platform vibration identifier is used when a platform vibration is trigged with HR_PLATFORM_VIBRATION_TRIG. The value 0 corresponds to the vibration ‘A’, the value 1 corresponds to the vibration ‘B’, …, the value 25 corresponds to the vibration ‘Z’. Please refer to Section 2.1 for the conventions of direction.
3	HR_PLATFORM_VIBRATION_DURATION	W	0 to 30000 [ms]	This value lets the user chose the duration of the platform vibration when it is trigged with HR_PLATFORM_VIBRATION_TRIG.
4	**HR_PLATFORM_CENTERING_TRIG**	W	0 or 1	A rising edge (value change from 0 to 1) trigs the start of a platform centering with the parameters values given in HR_PLATFORM_CENTERING_X and HR_PLATFORM_CENTERING_Y. More information in Section 5.4.10.2.
5	HR_PLATFORM_CENTERING_X	W	-100 to 100	The platform centering trigged with HR_PLATFORM_CENTERING_TRIG uses this X position to determine both the vibration direction and the duration. This value is an integer and corresponds to 100x the value described in the

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
				coordinate system (Section 3.3.6); a value of -60 in this Holding Register corresponds to -0.6 in the defined coordinate system.
6	HR_PLATFORM_CENTERING_Y	W	-100 to 100	The platform centering trigged with HR_PLATFORM_CENTERING_TRIG uses this Y position to determine both the vibration direction and the duration. This value is an integer and corresponds to 100x the value described in the coordinate system (Section 3.3.6); a value of -60 in this Holding Register corresponds to -0.6 in the defined coordinate system.
7	**HR_HOPPER_VIBRATION_TRIG**	W	0 or 1	A rising edge trigs the start of a hopper vibration with the parameters values given in HR_HOPPER_VIBRATION_ID and HR_HOPPER_VIBRATION_DURATION.
8	HR_HOPPER_VIBRATION_ID	W	0 to 25	The hopper vibration identifier is used when a hopper vibration is trigged with HR_HOPPER_VIBRATION_TRIG. The value 0 corresponds to the vibration ‘A’, the value 1 corresponds to the vibration ‘B’, …, the value 25 corresponds to the vibration ‘Z’. Please refer to Section 2.1 for the conventions of direction.
9	HR_HOPPER_VIBRATION_DURATION	W	0 to 30000 [ms]	This value lets the user chose the duration of the hopper vibration when it is trigged with HR_PLATFORM_HOPPER_TRIG.
10	**HR_HOPPER_FEEDING_TRIG**	W	0 or 1	A rising edge trigs the start of a hopper feeding with the parameters values given in HR_HOPPER_FEEDING_VIBRATION, HR_HOPPER_FEEDING_NBPARTS and HR_HOPPER_FEEDING_NBMAX. More information in Section 5.4.10.3.
11	HR_HOPPER_FEEDING_VIBRATION	W	0 to 25	The hopper feeding trigged with HR_HOPPER_VIBRATION_TRIG uses this hopper vibration identifier. The value 0 corresponds to the vibration ‘A’, the value 1 corresponds to the vibration ‘B’, …, the value 25 corresponds to the vibration ‘Z’. Please refer to Section 2.1 for the conventions of direction.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
12	HR_HOPPER_FEEDING_NBPARTS	W	0 to 65535	The hopper feeding trigged with HR_HOPPER_VIBRATION_TRIG uses this number of parts. More information in Section 5.4.10.3.
13	HR_HOPPER_FEEDING_NBMAX	W	0 to 65535	The hopper feeding trigged with HR_HOPPER_VIBRATION_TRIG uses this maximum number of parts. More information in Section 5.4.10.3.
14	**HR_SEQUENCE_EXECUTION_TRIG**	W	0 or 1	A rising edge trigs the start of a sequence execution with the parameters values given in HR_SEQUENCE_EXECUTION_NBPARTS, HR_SEQUENCE_EXECUTION_NBMAX, HR_SEQUENCE_EXECUTION_X, HR_SEQUENCE_EXECUTION_Y and HR_SEQUENCE_EXECUTION_SEQUENCEID. More information in Section 5.4.10.1.
15	HR_SEQUENCE_EXECUTION_NBPARTS	W	0 to 65535	The sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG uses this number of parts. More information in Section 5.4.10.1.
16	HR_SEQUENCE_EXECUTION_NBMAX	W	0 to 65535	The sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG uses this maximum number of parts. More information in Section 5.4.10.1.
17	HR_SEQUENCE_EXECUTION_X	W	-100 to 100	The sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG uses this X position to determine both the vibration direction and the duration. This value is an integer and corresponds to 100x the value described in the coordinate system (Section 3.3.6); a value of -60 in this Holding Register corresponds to -0.6 in the defined coordinate system.
18	HR_SEQUENCE_EXECUTION_Y	W	-100 to 100	The sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG uses this Y position to determine both the vibration direction and the duration. This value is an integer and corresponds to 100x the value described in the coordinate system (Section 3.3.6); a value of -60 in this Holding Register

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
				corresponds to -0.6 in the defined coordinate system.
19	HR_SEQUENCE_EXECUTION_SEQUENCEID	W	1 to 26	The sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG uses this sequence ID. More information in Section 5.4.10.1.
20	**HR_SELECT_VIBRATION_SET**	W	1 to 26	A value change of this Holding Register sets the new vibration set to use.
21	**HR_SELECT_SEQUENCE**	W	1 to 26	A value change of this Holding Register sets the new sequence to use.
22	**HR_BACKLIGHT_STATE_CONTROL**	W	0 or 1	A rising edge switches the backlight ON. A falling edge (value change from 1 to 0) switches the backlight OFF.
23	**HR_EXECUTE_BACKLIGHT_FLASH_TRIG**	W	0 or 1	A rising edge trigs a backlight flash. More information in Section 5.4.6.
24	**HR_BACKLIGHT_INTENSITY_TRIG**	W	0 or 1	A rising edge sets the backlight intensity value given in the Holding Register HR_BACKLIGHT_INTENSITY.
25	HR_BACKLIGHT_INTENSITY	W	*min* to 100 [%]	This backlight intensity can be set by trigging the HR_BACKLIGHT_INTENSITY Holding Register. The *min* value corresponds to the minimum intensity settable for the Asycube, which value can be read in the corresponding configuration parameter (Section 4.1).
26	**HR_PLATFORM_HALT**	W	0 or 1	A rising edge halts the platform vibration.
27	**HR_HOPPER_HALT**	W	0 or 1	A rising edge halts the hopper vibration.
28	**HR_SEQUENCE_HALT**	W	0 or 1	A rising edge halts the sequence execution.
29	**HR_READ_WRITE_PARAMETER_TRIG**	W	0 or 1	A rising edge reads or writes an Asycube parameter (Chapter 4) with the address given in the Holding Register HR_READ_WRITE_PARAMETER_ADDRESS. An even address trigs a read where the resulting value can be read in the Holding Register HR_READ_WRITE_PARAMETER_READ_VALUE (Address 64+13). An odd

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
				address trigs a write of the value given in the Holding Register HR_READ_WRITE_PARAMETER_WRITE_VALUE (Address 30). Note: no error occurs when trying to write in a forbidden Asycube register.
30	HR_READ_WRITE_PARAMETER_ADDRESS	W	0 to 65535	The parameter read/write trigged with HR_READ_WRITE_PARAMETER_TRIG needs this parameter address. More information in Chapter 4 and in the row above.
31	HR_READ_WRITE_PARAMETER_WRITE_VALUE	W	0 to 65535	The parameter write trigged with HR_READ_WRITE_PARAMTER_TRIG needs this Holding Register value to be written in the parameter.
32	**HR_FLASH_OPERATIONS**	W	0 to 15	The 4 first bits are used to start flash operations. A rising edge on a bit trigs the corresponding flash operation: 0b0001: Flash All in memory 0b0010: Flash Global Parameters 0b0100: Flash Sequences 0b1000: Flash Vibration Set More information in Section 5.4.11.

Table 6-1: Control Holding Registers, offset=0

6.3.2. Status Holding Registers (Read-only zone, offset=64)

The Status Holding Registers presented in Table 6-2 are used to get information on the Asycube. Examples: remaining vibration time, error state, …

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
64+0	HR_MODBUS_STATUS	R	0 to 15	The 4 first bits represents the errors status: Asycube Modbus errors status, Internal Modbus communication error status, Asycube warnings status and Asycube alarms status. More information in Section 6.4.
64+1	HR_MODBUS_ERROR_CODE	R	0 to 65535	The first byte (mask 0x0F) of this Holding Register contains Asycube Modbus error code, while the second byte (mask 0xF0) contains the Internal Modbus communication error code. More information in Section 6.4.2.
64+2	HR_WARNINGS	R	0 to 255	This Holding Register contains the Asycube warning code. More information in Section 6.4.3 and Section 5.4.14.
64+3	HR_ALARMS	R	0 to 255	This Holding Register contains the Asycube alarm code. More information in Section 6.4.3 and Section 5.4.15.
64+4	HR_MODBUS_PLATFORM_STATUS	R	0: DONE 1: BUSY 2: ERROR	This Holding Register gives the status of either the platform vibration trigged with HR_PLATFORM_VIBRATION_TRIG or the platform centering trigged with HR_PLATFORM_CENTERING_TRIG. The transition DONE->BUSY occurs on the trigger rising edge if the data is correct. The transition DONE->ERROR occurs on the trigger rising edge if the data is incorrect (e.g. index is out of range). The transition BUSY->DONE occurs as soon as the vibration ends. The transition BUSY->ERROR occurs if an Internal Modbus communication error (See Section 6.4.2) before the vibration starts.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
				The transition ERROR->DONE can be controlled by setting both triggers to 0.
64+5	HR_PLATFORM_REMAINING_TIME	R	0 to 32767 [ms]	This Holding Register gives the remaining time of the platform vibration. During a vibration, the value decreases over time until it reaches 0. Note: A value of 32767 means that the remaining time is greater than 32767ms. Note: Just before the vibration starts, during the amplifier start up, the value is different than 0 but can be strange. Similarly, during a continuous vibration, the value stays different than 0 but can be strange.
64+6	HR_MODBUS_HOPPER_STATUS	R	0: DONE 1: BUSY 2: ERROR	This Holding Register gives the status of either the hopper vibration trigged with HR_HOPPER_VIBRATION_TRIG or the hopper feeding trigged with HR_HOPPER_FEEDING_TRIG. The transition DONE->BUSY occurs on the trigger rising edge if the data is correct. The transition DONE->ERROR occurs on the trigger rising edge if the data is incorrect (e.g. index is out of range). The transition BUSY->DONE occurs as soon as the vibration ends. The transition BUSY->ERROR occurs if an Internal Modbus communication error (See Section 6.4.2) before the vibration starts. The transition ERROR->DONE can be controlled by setting both triggers to 0.
64+7	HR_HOPPER_REMAINING_TIME	R	0 to 32767 [ms]	This Holding Register gives the remaining time of the hopper vibration. During a vibration, the value decreases over time until it reaches 0. Note: A value of 32767 means that the remaining time is greater than 32767ms. Note: Just before the vibration starts, during the amplifier start up, the value is different than 0 but can be strange. Similarly, during a continuous vibration, the value stays different than 0 but can be strange.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
64+8	HR_MODBUS_SEQUENCE_STATUS	R	0: DONE 1: BUSY 2: ERROR	This Holding Register gives the status of the sequence execution trigged with HR_SEQUENCE_EXECUTION_TRIG. The transition DONE->BUSY occurs on the trigger rising edge if the data is correct. The transition DONE->ERROR occurs on the trigger rising edge if the data is incorrect (e.g. index is out of range). The transition BUSY->DONE occurs as soon as the sequence ends. The transition BUSY->ERROR occurs if an Internal Modbus communication error (See Section 6.4.2) before the sequence starts. The transition ERROR->DONE can be controlled by setting the trigger to 0.
64+9	HR_SEQUENCE_REMAINING_TIME	R	0 to 32767 [ms]	This Holding Register gives the remaining time of the sequence execution. During a sequence, the value decreases over time until it reaches 0. Note: A value of 32767 means that the remaining time is greater than 32767ms.
64+10	HR_VIBRATION_SET_SELECTED	R	1 to 26	This Holding Register gives the current selected vibration set.
64+11	HR_SEQUENCE_SELECTED	R	1 to 26	This Holding Register gives the current selected sequence.
64+12	HR_BACKLIGHT_STATE_STATUS	R	0: OFF 1: ON	This Holding Register gives the current backlight state
64+13	HR_READ_WRITE_PARAMETER_READ_VALUE	R	0 to 65535	The parameter read trigged with HR_READ_WRITE_PARAMETER_TRIG (Address 29) update this Holding Register value.
64+14	HR_FIRMWARE_VERSION_H	R	0 to 9	This Holding Register gives the first digit of the firmware version.
64+15	HR_FIRMWARE_VERSION_M	R	0 to 9	This Holding Register gives the second digit of the firmware version.
64+16	HR_FIRMWARE_VERSION_L	R	0 to 9	This Holding Register gives the third digit of the firmware version.
64+17	HR_USER_ACCESS_LEVEL	R	0: undefined	This Holding Register gives the current user access level. More information in

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
			1: operator 2: integrator 4: developer	Section 5.4.2.
64+18	HR_FLASH_OPERATIONS_STATUS	R	0: DONE 1: BUSY	This Holding Register gives the status of the flash operation trigged with HR_FLASH_OPERATIONS (Address 32).

Table 6-2: Status Holding Registers, offset=64

6.3.3. Recipe Read Holding Registers (Read-only zone, offset=128)

The Recipe Read Holding Registers presented in Table 6-3 are used to get the configuration values of the Asycube vibrations and sequences. They are directly linked to the values of the corresponding Asycube parameters (Chapter 4). Examples: frequency of the Actuator 2 for the vibration Forward 'A', duration of an action in the sequence 9.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
128+0	HR_PLATFORM_VIBRATION_A_AMPL1	R		Direct read access to corresponding parameter in Section 4.2.
128+1	HR_PLATFORM_VIBRATION_A_FREQ1	R		Direct read access to corresponding parameter in Section 4.2.
128+2	HR_PLATFORM_VIBRATION_A_PHASE1	R		Direct read access to corresponding parameter in Section 4.2.
128+3	HR_PLATFORM_VIBRATION_A_WAVEFORM1	R		Direct read access to corresponding parameter in Section 4.2.
128+4	HR_PLATFORM_VIBRATION_A_AMPL2	R		Direct read access to corresponding parameter in Section 4.2.
128+5	HR_PLATFORM_VIBRATION_A_FREQ2	R		Direct read access to corresponding parameter in Section 4.2.
128+6	HR_PLATFORM_VIBRATION_A_PHASE2	R		Direct read access to corresponding parameter in Section 4.2.
128+7	HR_PLATFORM_VIBRATION_A_WAVEFORM2	R		Direct read access to corresponding parameter in Section 4.2.
128+8	HR_PLATFORM_VIBRATION_A_AMPL3	R		Direct read access to corresponding parameter in Section 4.2.
128+9	HR_PLATFORM_VIBRATION_A_FREQ3	R		Direct read access to corresponding parameter in Section 4.2.
128+10	HR_PLATFORM_VIBRATION_A_PHASE3	R		Direct read access to corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
128+11	HR_PLATFORM_VIBRATION_A_WAVEFORM3	R		Direct read access to corresponding parameter in Section 4.2.
128+12	HR_PLATFORM_VIBRATION_A_AMPL4	R		Direct read access to corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
128+13	HR_PLATFORM_VIBRATION_A_FREQ4	R		Direct read access to corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
128+14	HR_PLATFORM_VIBRATION_A_PHASE4	R		Direct read access to corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
128+15	HR_PLATFORM_VIBRATION_A_WAVEFORM4	R		Direct read access to corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
128+16	HR_PLATFORM_VIBRATION_A_DURATION	R		Direct read access to corresponding parameter in Section 4.2.
128+17 to 128+441	HR_PLATFORM_VIBRATION_B_TO_Z_DATA	R		Direct read access to corresponding parameters in Section 4.2. The address has to be computed based on the 17 previous parameters (Address 128+0 to 128+16) with the following formula: Desired_Address = Address_Of_The_Register_For_Vibration_A + 17 x Vibration_Identifier, where 'A'=0, 'B'=1, … Example: HR_PLATFORM_VIBRATION_**E**_WAVEFORM3 = HR_PLATFORM_VIBRATION_A_WAVEFORM3 + 17 x **E** = 128+11 + 17 x **4** = 128+79
128+442	HR_HOPPER_A_DIGITAL_OUTPUT1	R		Direct read access to corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
128+443	HR_HOPPER_A_ANALOG_OUTPUT1	R		Direct read access to corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
128+444	HR_HOPPER_A_DIGITAL_OUTPUT2	R		Direct read access to corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
128+445	HR_HOPPER_A_ANALOG_OUTPUT2	R		Direct read access to corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
128+446	HR_HOPPER_VIBRATION_A_AMPL	R		Direct read access to corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
128+447	HR_HOPPER_VIBRATION_A_FREQ	R		Direct read access to corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
128+448	HR_HOPPER_VIBRATION_A_WAVEFORM	R		Direct read access to corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
128+449	HR_HOPPER_A_DURATION	R		Direct read access to corresponding parameter in Section 4.3.
128+450 to 128+649	HR_HOPPER_VIBRATION_B_TO_Z	R		Direct read access to corresponding parameters in Section 4.3. The address has to be computed based on the 8 previous parameters (Address 128+442 to 128+449) with the following formula: Desired_Address = Address_Of_The_Register_For_Vibration_A + 8 x Vibration_Identifier, where 'A'=0, 'B'=1, … Example: HR_HOPPER_**R**_ANALOG_OUTPUT1 = HR_HOPPER_A_ANALOG_OUTPUT1 + 8 x **R** = 128+443 + 8 x **17**= 128+579
128+650	HR_SEQUENCE_ID1_ACTION1_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+651	HR_SEQUENCE_ID1_ACTION1_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+652	HR_SEQUENCE_ID1_ACTION1_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+653	HR_SEQUENCE_ID1_ACTION1_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.
128+654	HR_SEQUENCE_ID1_ACTION2_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+655	HR_SEQUENCE_ID1_ACTION2_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+656	HR_SEQUENCE_ID1_ACTION2_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+657	HR_SEQUENCE_ID1_ACTION2_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
128+658	HR_SEQUENCE_ID1_ACTION3_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+659	HR_SEQUENCE_ID1_ACTION3_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+660	HR_SEQUENCE_ID1_ACTION3_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+661	HR_SEQUENCE_ID1_ACTION3_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.
128+662	HR_SEQUENCE_ID1_ACTION4_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+663	HR_SEQUENCE_ID1_ACTION4_VIBRATION	R		Direct read access to corresponding parameter in Section 5.4.10.
128+664	HR_SEQUENCE_ID1_ACTION4_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+665	HR_SEQUENCE_ID1_ACTION4_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.
128+666	HR_SEQUENCE_ID1_ACTION5_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+667	HR_SEQUENCE_ID1_ACTION5_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+668	HR_SEQUENCE_ID1_ACTION5_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+669	HR_SEQUENCE_ID1_ACTION5_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.
128+670	HR_SEQUENCE_ID1_ACTION6_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+671	HR_SEQUENCE_ID1_ACTION6_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+672	HR_SEQUENCE_ID1_ACTION6_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+673	HR_SEQUENCE_ID1_ACTION6_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.
128+674	HR_SEQUENCE_ID1_ACTION7_TYPE	R		Direct read access to corresponding parameter in Section 4.4.
128+675	HR_SEQUENCE_ID1_ACTION7_VIBRATION	R		Direct read access to corresponding parameter in Section 4.4.
128+676	HR_SEQUENCE_ID1_ACTION7_DURATION_MODE	R		Direct read access to corresponding parameter in Section 4.4.
128+677	HR_SEQUENCE_ID1_ACTION7_DURATION_VALUE	R		Direct read access to corresponding parameter in Section 4.4.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
128+678 to 128+1377	HR_SEQUENCE_ID2_TO_26	R		The address has to be computed based on the 28 previous parameters (Address 128+650 to 128+677) with the following formula: Desired_Address = Address_Of_The_Register_For_Sequence 1 + 28 x Sequence_Identifier Example: HR_SEQUENCE_ID26_ACTION7_DURATION_VALUE = HR_SEQUENCE_ID1_ACTION7_DURATION_VALUE + 28 x (**26**-1) = 128+677 + 28 x 25 = 128+1377

Table 6-3: Recipe Read Holding Registers, offset=128

6.3.4. Recipe Write Holding Registers (Write-only zone, offset=1536)

The Recipe Write Holding Registers presented in Table 6-4 are used to set the configuration values of the Asycube vibrations and sequences.

The Holding Registers highlighted in **bold** are triggers that start an action or change a value.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
1536+0	**HR_PLATFORM_PARAMETERS_WRITE_TRIG**	W	0 or 1	A rising edge trigs the write of the platform vibration Holding Registers HR_PLATFORM_VIBRATION_AMPL1 (Address 1536+2) to HR_PLATFORM_VIBRATION_DURATION0 (Address 1536+18) to the vibration parameters (Section 4.2) for the identifier HR_PLATFORM_PARAMETERS_WRITE_ID.
1536+1	HR_PLATFORM_PARAMETERS_WRITE_ID	W	0 to 25	The platform vibration write trigged with HR_PLATFORM_PARAMETERS_WRITE_TRIG uses this Holding Register to save the values at the given identifier, where 0 = ‘A’, 1 = ‘B’, …
1536+2	HR_PLATFORM_VIBRATION_AMPL1	W		This value is written to the corresponding parameter in Section 4.2.
1536+3	HR_PLATFORM_VIBRATION_FREQ1	W		This value is written to the corresponding parameter in Section 4.2.
1536+4	HR_PLATFORM_VIBRATION_PHASE1	W		This value is written to the corresponding parameter in Section 4.2.
1536+5	HR_PLATFORM_VIBRATION_WAVEFORM1	W		This value is written to the corresponding parameter in Section 4.2.
1536+6	HR_PLATFORM_VIBRATION_AMPL2	W		This value is written to the corresponding parameter in Section 4.2.
1536+7	HR_PLATFORM_VIBRATION_FREQ2	W		This value is written to the corresponding parameter in Section 4.2.
1536+8	HR_PLATFORM_VIBRATION_PHASE2	W		This value is written to the corresponding parameter in Section 4.2.
1536+9	HR_PLATFORM_VIBRATION_WAVEFORM2	W		This value is written to the corresponding parameter in Section 4.2.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
1536+10	HR_PLATFORM_VIBRATION_AMPL3	W		This value is written to the corresponding parameter in Section 4.2.
1536+11	HR_PLATFORM_VIBRATION_FREQ3	W		This value is written to the corresponding parameter in Section 4.2.
1536+12	HR_PLATFORM_VIBRATION_PHASE3	W		This value is written to the corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
1536+13	HR_PLATFORM_VIBRATION_WAVEFORM3	W		This value is written to the corresponding parameter in Section 4.2.
1536+14	HR_PLATFORM_VIBRATION_AMPL4	W		This value is written to the corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
1536+15	HR_PLATFORM_VIBRATION_FREQ4	W		This value is written to the corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
1536+16	HR_PLATFORM_VIBRATION_PHASE4	W		This value is written to the corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
1536+17	HR_PLATFORM_VIBRATION_WAVEFORM4	W		This value is written to the corresponding parameter in Section 4.2. N/A for the Asycube 50 and 80.
1536+18	HR_PLATFORM_VIBRATION_DURATION0	W		This value is written to the corresponding parameter in Section 4.2.
1536+19	**HR_HOPPER_PARAMETERS_WRITE_TRIG**	W	0 or 1	A rising edge trigs the write of the hopper vibration Holding Registers HR_HOPPER_DIGITAL_OUTPUT1 (Address 1536+21) to HR_HOPPER_DURATION0 (Address 1536+29) to the vibration parameters (Section 4.3) for the identifier HR_HOPPER_PARAMETERS_WRITE_ID.
1536+20	HR_HOPPER_PARAMETERS_WRITE_ID	W	0 to 25	The hopper vibration write trigged with HR_HOPPER_PARAMETERS_WRITE_TRIG uses this Holding Register to save the values at the given identifier, where 0 = ‘A’, 1 = ‘B’, …
1536+21	HR_HOPPER_DIGITAL_OUTPUT1	W		This value is written to the corresponding parameter in Section 4.3.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
				N/A for the Asycube 50 and 80.
1536+22	HR_HOPPER_ANALOG_OUTPUT1	W		This value is written to the corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
1536+23	HR_HOPPER_DIGITAL_OUTPUT2	W		This value is written to the corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
1536+24	HR_HOPPER_ANALOG_OUTPUT2	W		This value is written to the corresponding parameter in Section 4.3. N/A for the Asycube 50 and 80.
1536+25	HR_HOPPER_VIBRATION_AMPL	W		This value is written to the corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
1536+26	HR_HOPPER_VIBRATION_FREQ	W		This value is written to the corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
1536+27	HR_HOPPER_VIBRATION_WAVEFORM	W		This value is written to the corresponding parameter in Section 4.3. Only applicable for the Asycube 50 and 80.
1536+28	HR_HOPPER_DURATION0	W		This value is written to the corresponding parameter in Section 4.3.
1536+29	**HR_SEQUENCE_PARAMETERS_WRITE_TRIG**	W	0 or 1	A rising edge trigs the write of the hopper vibration Holding Registers HR_SEQUENCE_ACTION1_TYPE (Address 1536+31) to HR_SEQUENCE_ACTION7_DURATION_VALUE (Address 1536+58) to the sequence parameters (Section 4.4) for the identifier H HR_SEQUENCE_PARAMETERS_WRITE_ID
1536+30	HR_SEQUENCE_PARAMETERS_WRITE_ID	W	1 to 25	The sequence write trigged with HR_SEQUENCE_PARAMETERS_WRITE_TRIG uses this Holding Register to save the values at the given identifier. Note: The Sequence ID 26 is protected so read-only.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
1536+31	HR_SEQUENCE_ACTION1_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+32	HR_SEQUENCE_ACTION1_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+33	HR_SEQUENCE_ACTION1_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+34	HR_SEQUENCE_ACTION1_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.
1536+35	HR_SEQUENCE_ACTION2_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+36	HR_SEQUENCE_ACTION2_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+37	HR_SEQUENCE_ACTION2_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+38	HR_SEQUENCE_ACTION2_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.
1536+39	HR_SEQUENCE_ACTION3_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+40	HR_SEQUENCE_ACTION3_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+41	HR_SEQUENCE_ACTION3_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+42	HR_SEQUENCE_ACTION3_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.
1536+43	HR_SEQUENCE_ACTION4_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+44	HR_SEQUENCE_ACTION4_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+45	HR_SEQUENCE_ACTION4_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+46	HR_SEQUENCE_ACTION4_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.
1536+47	HR_SEQUENCE_ACTION5_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+48	HR_SEQUENCE_ACTION5_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+49	HR_SEQUENCE_ACTION5_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+50	HR_SEQUENCE_ACTION5_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.

Address (decimal)	Holding Register name	Read/ Write	Data Range	Comments
1536+51	HR_SEQUENCE_ACTION6_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+52	HR_SEQUENCE_ACTION6_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+53	HR_SEQUENCE_ACTION6_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+54	HR_SEQUENCE_ACTION6_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.
1536+55	HR_SEQUENCE_ACTION7_TYPE	W		This value is written to the corresponding parameter in Section 4.4.
1536+56	HR_SEQUENCE_ACTION7_VIBRATION	W		This value is written to the corresponding parameter in Section 4.4.
1536+57	HR_SEQUENCE_ACTION7_DURATION_MODE	W		This value is written to the corresponding parameter in Section 4.4.
1536+58	HR_SEQUENCE_ACTION7_DURATION_VALUE	W		This value is written to the corresponding parameter in Section 4.4.

Table 6-4: Recipe Write Holding Registers, offset=1536

6.4. Errors

Several types of error can arise in the Asycube used with Modbus TCP. The Holding Register HR_MODBUS_STATUS (Address 64) bits represent the status of these types of error.

Value (binary)	Name	Description
0b0001	Asycube Modbus errors status	If the value is 1, please refer to Section 6.4.2
0b0010	Internal Modbus communication error status	If the value is 1, please refer to Section 6.4.2
0b0100	Asycube warnings status	If the value is 1, please refer to Section 6.4.3
0b1000	Asycube alarms status	If the value is 1, please refer to Section 6.4.3

Table 6-5: Status register.

The error status can be reset by writing the corresponding bit to 1 in the Holding Register HR_MODBUS_CONTROL (Address 0). For example, writing the value 0b0110 (it corresponds to the value '6' in decimal) will reset both the Asycube Modbus errors status and the Asycube warnings status.

6.4.1. Main Modbus exception codes

The Modbus exception codes are defined in the protocol specification (http://www.modbus.org). A subset of these exceptions is implemented in the Asycube (See Table 6-6). The Modbus protocol is responsible to carry the exceptions directly in the Modbus message and are not set in a Holding Register.

Value (decimal)	Name	Description
1	Illegal Function	Function code received in the query is not recognized or allowed by slave
2	Illegal Data Address	Data address of some or all the required entities are not allowed or do not exist in slave
3	Illegal Data Value	Value is not accepted by slave

Table 6-6: Modbus protocol exception codes.

6.4.2. Holding Register: error codes

The HR_MODBUS_ERROR_CODE (Address 65) gives the current Asycube Modbus error.

The first byte (mask 0x00FF) gives the error linked to the Asycube Modbus implementation (See Table 6-7).

Value (hexadecimal)	Name	Description
0x01	Write Access Not Allowed	The data cannot be written because it is forbidden or the index is out of range. An example would be selecting a sequence (HR_SELECT_SEQUENCE) with a value out range such as 27.

Table 6-7: Asycube Modbus error codes.

The second byte (mask 0xFF00) gives the internal Modbus communication error code (See the value Error Bit in Table 5-2). The internal Modbus communication error typically occurs when a vibration is trigged with incorrect parameters values. An example would be trigging a platform centering (HR_PLATFORM_CENTERING_TRIG) while the value of the X position (HR_PLATFORM_CENTERING_X) is out of range, such as 120%.

6.4.3. Asycube warnings and alarms

The Asycube has its own warnings and alarms. They can be read respectively in the Holding Registers HR_WARNINGS (Address 66) and HR_ALARMS (Address 67). Their values are explained in the Table 5-20 and Table 5-21.

6.5. Example of use

This section presents some examples showing how to **control** the Asycube through Modbus TCP in production mode. We highly recommend using the Asycube HMI to **configure** the vibrations parameters as described in the Asycube User Manual.

6.5.1. Set up the Modbus master (e.g. PLC)

- Configure the Modbus master (=client) to communicate with the Asycube based on the Asycube communication parameters (Section 6.1). Don’t forget to change your master network settings (IP address, …).
- Define a memory map of 16bits registers for data to be written in the Asycube. We recommend creating as many registers as contained in the Control Holding Registers (Section 0).
- Define a memory map of 16bits registers for data to be read from the Asycube. We recommend creating as many registers as contained in the Status Holding Registers (Section 0).
- Configure the Modbus master to alternatively write the Control Holding Registers and read the Status Holding Registers, with a cycle time of 10 ms.

6.5.2. Handle the Status and Control Holding Registers

- Program your Modbus master to monitor the Asycube errors state by reading the HR_MODBUS_STATUS register. Analyze the HR_MODBUS_ERROR_CODE, HR_WARNINGS and HR_ALARMS registers if needed.
- Program your Modbus master to be able to clear the errors by writing the HR_MODBUS_CONTROL register.

6.5.3. Vibration, sequence, backlight, read/write parameter

- Start a platform vibration
  - Set the vibration identifier in HR_PLATFORM_VIBRATION_ID, for example 3 for ‘D’, which corresponds to a ‘Left’ direction (according to the convention presented in Section 2.1).
  - Set the vibration duration in HR_PLATFORM_VIBRATION_DURATION, for example 1500 to prepare a vibration of 1.5 s.
  - Start the vibration by changing the value of the trigger HR_PLATFORM_VIBRATION_TRIG from 0 to 1.
- Monitor a platform vibration
  - Read the HR_MODBUS_PLATFORM_STATUS. If the value is ERROR, refer to the HR_MODBUS_STATUS for more information. A BUSY value means that the command has been understood and that the vibration has started.
  - Monitor the HR_MODBUS_PLATFORM_STATUS and wait for its value to get back to DONE, which means that the vibration is completed.
  - Or monitor the HR_PLATFORM_REMAINING_TIME to see the remaining vibration time. The value decreases to 0 when the vibration is completed.
- Start and monitor a sequence
  - Prepare the vibration parameters in HR_SEQUENCE_EXECUTION_NBPARTS, HR_SEQUENCE_EXECUTION_NBMAX, HR_SEQUENCE_EXECUTION_X, HR_SEQUENCE_EXECUTION_Y and HR_SEQUENCE_EXECUTION_SEQUENCEID.
  - Start the sequence by changing the value of the trigger HR_SEQUENCE_EXECUTION_TRIG from 0 to 1.
  - Monitor HR_MODBUS_SEQUENCE_STATUS and HR_SEQUENCE_REMAINING_TIME and act accordingly.
- Stop a sequence currently running
  - Stop the sequence by changing the value of the trigger HR_SEQUENCE_HALT from 0 to 1.
- Switch the backlight ON

    - Change the value of HR_BACKLIGHT_STATE_CONTROL from 0 to 1.
- Read a parameter value
    - Prepare the read action by setting the parameter address in HR_READ_WRITE_PARAMETER_ADDRESS, according to Chapter 4 (make sure to have an even address).
    - Start reading by changing the value of the trigger HR_READ_WRITE_PARAMETER_TRIG from 0 to 1.
    - Read and use the result value in HR_READ_WRITE_PARAMETER_READ_VALUE.
- Write a parameter value
    - Prepare the write action by setting the parameter address in HR_READ_WRITE_PARAMETER_ADDRESS+1, according to Chapter 4 (make sure to have an odd address).
    - Prepare the value to write in HR_READ_WRITE_PARAMETER_WRITE_VALUE.
    - Start writing by changing the value of the trigger HR_READ_WRITE_PARAMETER_TRIG from 0 to 1.

7. Technical support

7.1. For better service …

You have read 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

7.2. 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	14.08.2017	PeD	Initial version got by merging the existing programming guides, by adding the Asycube 530 and the Modbus feature. Other minor improvements on 03.11.2017.
A1	12.12.2017	PeD	Removed the reference to the 220ms delay for the Asycube 530 since it has been avoided in the firmware from version v4.0.3.

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