SCHUNK

Software manual
2D Grasping-Kit
Smart Grasping Native Protocol V3

Original software manual

Hand in hand for tomorrow

Imprint

Technical changes:
We reserve the right to make alterations for the purpose of technical improvement.

Document number: 1591391

Version: 01.00 | 22/04/2024 | en

Dear Customer,

Thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

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Please read the operating manual in full and keep it close to the product.

Table of Contents

1 Native Protocol General

Low-level pipeline interface for robot controllers.

The native protocol is a communication protocol sitting on top of the TCP/IP stack. The protocol design is simple and straightforward, and thus feasible to implement even on the most archaic robots and industrial controllers.

1.1 Conventions

- **Port**: The server listens on tcp-port 42001
- **Endianness**: The order of multi-byte fields is big-endian
- **Floating-point numbers**: Single IEEE-Standard (IEC-60559)
- **Signed integers**: Signed integers are represented in two's complement notation
- **Units of measure**: Unless otherwise specified, lengths are measured in meters [m], and angles are measured in radians [rad]

1.2 Data Types

Following data types are define:

- **signed integers**: int8, int16, int32
- **unsigned integers**: uint8, uint16, uint32
- **floating point numbers**: float32

The number suffix of a data type denotes its size in bits (e. g. int16 is two bytes long).

1.3 Versioning

The server is backwards compatible.

Clients using earlier protocol versions will be served as expected and won't even notice the version mismatch. The server always replies with the same version number in the prefix as the one used in the requests.

However, if a server is outdated such that its protocol version is lower than the client's protocol version, the server will always reply with an empty message. The message prefix will have its length-field set to zero and its version-field set to the server's highest supported protocol version. In this case, clients are advised to alert the user that their server is outdated and incompatible with their current client version.

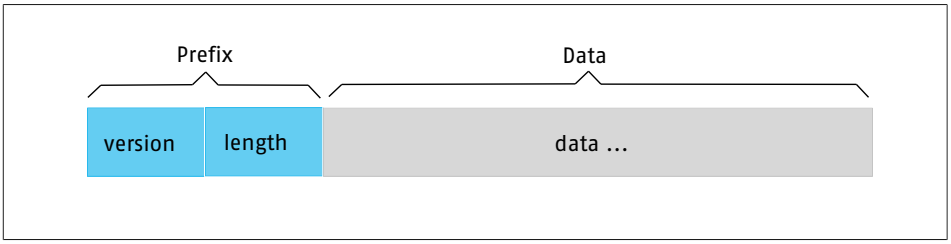
1.4 Layout

Each message frame comprises two parts: an invariant prefix that remains consistent across different protocol versions and a version-specific section. The details of these parts are elaborated in their respective chapters.

2 Native Protocol Prefix

Invariant part of the low-level pipeline interface for robot controllers.

2.1 Layout



2.2 Prefix

All messages start with a *prefix* defining the protocol version and the size of the remaining message.

The prefix is invariant and does not change between different protocol versions.

	Byte offset	Name	Type
Prefix	0	version	uint16
	2	lenght	uint32
Data	6	...	...

- **version**: The protocol version.
- **length**: The size of the remaining message in bytes (max. 4 GB), excluding the *prefix* itself (6B).

2.3 Data

The actual message content. The structure is version-specific and is described in the version chapters.

3 Native Protocol V3

Version 3 of the low-level pipeline interface for robot controllers.

3.1 General

- Message size: Every message is 80 bytes long. Always. Data
- types: Only integers (signed and unsigned). No floats.

3.2 Layout

- Message size: Every message is 80 bytes long. Always. Data
- types: Only integers (signed and unsigned). No floats.

Byte offset	Data
0	Prefix
6	Header
10 – 79	Body

Requests and responses adhere to a consistent layout, which allows a static mapping between fields and their byte indices in a frame. However, depending on the message context, only relevant sections of the body carry meaningful values, while other parts are to be disregarded. The parts to be disregarded are denoted as *offset* or padding.

	Request			Response		
	Byte offset	Data	Type	Byte offset	Data	Type
Prefix	0	version	unit16	0	version	uint16
	2	length	unit32	2	length	uint32
Header	6	comm type	unit8	6	comm type	uint8
	7	reply code	unit8	7	reply code	uint8
	8	reply counter	unit8	8	reply counter	uint8
Body	9	msg type	unit8	9	msg type	uint8
	10	client	unit8	10	version	uint16
	11	grasp mode	unit8	12	state	uint8
	12	object class	uint16	13	grasp mode	uint8
	14	tool	unit8	14	object class	uint16
	15	pose format	unit8	16	object instance	uint16
	16	grasp feedback	unit8	18	stroke	int32
	17	*offset*	–	22	angle offset	int32
	18	robot pose	int32[7]	26	center offset	int32[3]
	46	project index	uint32	38	tool	unit8
	50 – 79	*padding*	–	39	pose format	unit8
				40	grasp pose	int32[7]
				68	object count	unit16
				70	candidate count	unit16
				72 – 79	*padding*	–

3.2.1 Prefix

	version	length
value	3	74

Note: The length field denotes the remaining message size, which is 74 bytes.

Layout see ▶ 2.1 [🗋 6].

3.2.2 Header

The *header* is the part that encodes the message type and its intent.

	Byte offset	Data	Type
Prefix	0	…	…
Header	6	▸ comm type [🗋 9]	uint8
	7	▸ reply code [🗋 9]	uint8
	8	▸ reply counter [🗋 10]	uint8
	9	▸ msg type [🗋 10]	uint8
Body	10 – 79	…	…

3.2.2.1 comm type

value	description
01	request
02	response

3.2.2.2 reply code

The reply code indicates the result status of the processed request.

Clients should always check the reply code in every single response message and only progress if the reply code is set to SUCCESS. If the reply code is not set to SUCCESS, then the rest of the message shall be ignored. However, the reply counter will still be incremented.

value	name	description
General		
1	SUCCESS	The server has handled the request succesfully.
2	ERROR	The server has encountered an error while processing the request.
Message-specific		
3	NO_OBJECT	No object found.
4	NO_GRASP	No grasp found.
5	INVALID_OBJECT_CLASS	Object class is either invalid or does not exist.

NOTE

The reply code is ignored in requests.

3.2.2.3 reply counter

A counter that increments with each reply, resetting to zero when it reaches 256.

NOTE

The reply counter is ignored in requests.

3.2.2.4 msg type

see Chapter ▸ 3.3.1 [🗋 10]

3.3 Messages

3.3.1 Message Types

The following table summarizes all availabe message types.

value	msg type	description
General		
0	reserved/ unused	
1	▸ GET_PROTOCOL_VERSION [🗋 11]	Get the server's protocol version.
2	▸ GET_STATE [🗋 12]	Get the server's current state.
3	▸ REGISTER_CLIENT [🗋 13]	Register the client's robot system to the server.
4	▸ SET_PROJECT [🗋 14]	Set the active project on the server.
Grasping		
16	▸ GET_GRASP [🗋 15]	Get a grasp for the current scene.
17	▸ GRASP_FEEDBACK [🗋 18]	Provide feedback to the server about the last grasp result.
Detection		
32	▸ GET_OBJECT_COUNT [🗋 19]	Get the number of objects in the current scene.
Robot State		
48	▸ ROBOT_POSE [🗋 21]	Notify the server about the current robot pose..

3.3.2 General

3.3.2.1 GET_PROTOCOL_VERSION

Returns the server's highest supported protocol version. This is useful to see if the client's version is outdated or not. If this is the case, the client is advised to inform the user accordingly.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
Header	2	74	uint32
	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	1	uint8
Body	10–79	*padding*	–

Response:

	Byte offset	Data	Type
Prefix	0	3	uint16
Header	2	74	uint32
	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	1	uint8
Body	10	version	uint16
	12–79	*padding*	–

Detail *version*: The server's highest supported protocol version.

3.3.2.2 GET_STATE

Retrieves the server's state.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
Header	2	74	uint32
	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	2	uint8
Body	10–79	*padding*	–

Response:

	Byte offset	Data	Type
Prefix	0	3	uint16
Header	2	74	uint32
	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	2	uint8
Body	10	*offset*	–
	12	state	uint8
	13–79	*padding*	–

Detail *state*:

value	name	description
1	INIT	The server is initializing.
2	OPERATIONAL	The server is operational and ready to serve requests.
3	STOPPED	The server has stopped operating.
4	ERROR	The server has encountered a critical error.

3.3.2.3 REGISTER_CLIENT

Registers the client's robot system (for informational purposes).

This message should be sent right after the connection has been established. However, there are no restrictions on when to send and how often. If the client's robot system is not officially supported (see client table in the request details), then simply ignore this message.

Request:

Contains information about the client's robot system.

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	3	uint8
Body	10	client	uint8
	11 – 79	*padding*	–

Detail *client*:

value	name	vendor
1	UR	Universal Robots
2	Kuka	Kuka
3	Yaskawa	Yaskawa
4	Fanuc	Fanuc
5	ABB	ABB
6	HORST	fruitcore robotics
128	Siemens PLC	Siemens

Response:

The response body is empty.

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	3	uint8
Body	10–79	*padding*	–

3.3.2.4 SET_PROJECT

Sets the active project on the server.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	4	uint8
Body	10	*offfset*	–
	46	project index	uint32
	50 – 79	*padding*	–

Detail *project index*: The index of the project to activate.

Response:

The response body is empty. The reply code indicates whether the operation was successful or not.

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	4	uint8
Body	10 – 79	*padding*	–

3.3.3 Grasping

3.3.3.1 GET_GRASP

Requests a grasp for the current scene.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	16	uint8
Body	10	*offset*	-
	11	grasp mode	uint8
	12	object class	uint16
	14	tool	uint8
	15	pose format	uint8
	16 - 79	*padding*	-

- Detail *grasp mode*:

value	name	description
1	ACTIVE_GRASP	The returned grasp must match the target object's active user-defined grasp definition.
2	ANY_GRASP	The returned grasp must match any of the target object's user-defined grasp definitions.
3	AUTO_GRASP	ANY_GRASP mode with model-free grasp-planning as fallback.

- Detail *object class*: The class id of the target object. If the value is zero, then the class id is ignored and the target object is selected randomly.
- Detail *tool*: The tool to be used for the grasp.

value	name	description
1	EXTERIOR	Exterior two-finger parallel gripper.
2	INTERIOR	Interior two-finger parallel gripper.
3	CONTACT	Suction, magnet or adhesion with a contact area.

- Detail *pose format*: Specifies the pose format to use in the response message. Refer to the Pose Formats section to see all supported formats.

Response:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	16	uint8
Body	10	*offset*	–
	13	grasp mode	uint8
	14	object class	uint16
	16	object instance	uint16
	18	stroke	int32
	22	angle offset	int32
	26	center offset	int32[3]
	38	tool	uint8
	39	pose format	uint8
	40	grasp pose	int32[7]
	68	object count	uint16
	70	candidate count	uint16
	72 – 79	*padding*	–

- Detail *grasp mode*: The used grasp mode, see request details for the enumeration values.

  Note: This grasp mode is not necessarily the same as the requested grasp mode. For example, if an auto grasp is requested, the system will still prefer user-defined grasps and only resort to auto grasps if former either does not exist or is not applicable.
- Detail *object class*: The class id of the target object.
- Detail *object instance*: The instance id of the target object.
- Detail *stroke*: The distance in micrometers between both fingers to set before approaching the object. This field is only relevant for grippers and can be ignored for other types of tools.

Note: The gripper is at position zero when both fingers touch each other.

- Detail *angle offset*: Angular offset in microdegrees between the object model and the robot flange at position zero.

  If an object has to be placed in a pre-defined orientation, align the robot flange by adjusting its position to match the angular offset (after grasping the object). Additionally, apply any custom use-case-specific offset as needed.

  Note: The angular offset is not applicable when dealing with deformable objects or during auto grasps.
- Detail *center offset*: The translational [x,y,z]-offset in micrometers from the object center to the grasp point, expressed in the robot's base coordinate.
- Detail *tool*: The type of tool used in the request (same enumeration value).
- Detail *pose format*: The pose format used for the pose-field. Refer to the Pose Formats section to see all supported formats.
- Detail *grasp pose*: The grasp pose in the robot's base coordinate frame. The type of this field depends on the value in the pose format-field.
- Detail *object count*: The number of all detected objects (including the target object itself).
- Detail *candidate count*: The number of detected objects of the requested class id (including the target object itself).

  Note: If the requested class id was 0 (= random), then all objects are counted.

3.3.3.2 GRASP_FEEDBACK

Provides optional feedback to the server about the last grasp result.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	17	uint8
Body	10	*offset*	–
	16	grasp feedback	uint8
	17 – 79	*padding*	–

- Detail *grasp feedback*: Feedback about the last grasp result.

value	name	description
1	OK	The grasp was OK
2	BAD	The grasp was not OK

Response:

The response body is empty.

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	17	uint8
Body	10 – 79	*padding*	–

3.3.4 Detection

3.3.4.1 GET_OBJECT_COUNT

Requests the number of objects in the current scene.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	32	uint8
Body	10	*offset*	-
	12	object class	uint16
	14 – 79	*padding*	-

- Detail *object class*: The class id of the objects to count. If the value is zero, then all objects of all classes are counted.

Response:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	17	uint8
Body	10	*offset*	–
	14	object class	uint16
	16	*offset*	–
	68	object count	uint16
	70	candidate count	uint16
	72 – 79	*padding*	–

- Detail *object class*: The requested class id of the objects to count. If the value is zero, then all objects of all classes are counted.
- Detail *object count*: The number of detected objects of all classes.
- Detail *candidate count*: The number of detected objects of the requested class.

  Note: If the requested class id was zero, then all objects are counted.

3.3.5 Robot State

3.3.5.1 ROBOT_POSE

Notifies the server about the current pose of the end-effector in the robot's base coordinate frame.

Request:

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	1	uint8
	7	0	uint8
	8	0	uint8
	9	48	uint8
Body	10 – 14	*offset*	–
	15	pose format	uint8
	16	*offset*	–
	18	robot pose	int32[7]
	46 – 79	*padding*	–

- Detail *pose format*: Specifies the format of the robot pose. Refer to the Pose Formats section to see all supported formats.
- Detail *robot pose*: The pose to be transmitted to the server.

  Child frame: end-effector (TCP), parent frame: robot base.

Response:

The response body is empty.

	Byte offset	Data	Type
Prefix	0	3	uint16
	2	74	uint32
Header	6	2	uint8
	7	reply code	uint8
	8	counter	uint8
	9	48	uint8
Body	10 – 79	*padding*	–

4 Visualization

A visualization of the latest detection result is provided as an image resource that can be accessed via HTTP at:

`http://<Server-IP>/monitor/latest_result`

5 Pose Formats

Following pose formats are supported:

value	name	type	layout	description
General formats				
1	Quaternion	int32[7]	position: x, y, z; orientation: qx, qy, qz, qw	Position and unnormalized quaternion. *Note: To normalize the quaternion, divide it by 10^6.* *Units*: Micrometer and radian.
2	Axis-Angle	int32[7]	position: x, y, z; orientation: x, y, z; –	Position and unnormalized rotation vector. *Units*: Micrometer and microradian. *Vendor*: Universal Robots
Vendor-specific formats				
16	WPR	int32[7]	position: x, y, z; orientation: W, P, R; –	Position and orientation WPR with W rotating around the fixed x-axis, then P rotating around the fixed y-axis, then R rotating around the fixed z-axis. *Rotation convention*: x-y-z (extrinsic). *Units*: Micrometer and microdegree. *Vendors*: Fanuc, Yaskawa
17	ABC	int32[7]	position: x, y, z; orientation: A, B, C; –	Position and orientation ABC with A rotating around the z-axis, then B rotating around the y'-axis, then C rotating around the x''-axis. *Rotation convention*: z-y'-x'' (intrinsic). *Units*: Micrometer and microdegree. *Vendor*: Kuka

6 Examples

Lets assume we've set up a TCP connection to the server successfully.

For simple grasping tasks, the most basic sequence of messages is:

1. ▸ GET_PROTOCOL_VERSION [🗋 24]
2. ▸ GET_STATE [🗋 25]
3. ▸ REGISTER_CLIEN [🗋 26]T
4. ▸ SET_PROJECT [🗋 27]
5. ▸ GET_GRASP [🗋 28]

Steps 1 to 4 are performed only once. Step 5 typically iterates in a loop.

6.1 GET_PROTOCOL_VERSION

The first thing to do after setting up a connection is to check the server's highest supported protocol version.

	Request				*Response*			
	Index	**Name**	**Value**	**Type**	**Index**	**Name**	**Value**	**Type**
Prefix	0	version	3	unit16	0	version	3	uint16
	2	length	74	unit32	2	length	74	uint32
Header	6	comm type	1	unit8	6	comm type	2	uint8
	7	reply code	0	unit8	7	reply code	1	uint8
	8	reply counter	0	unit8	8	reply counter	0	uint8
Body	9	msg type	1	unit8	9	msg type	1	uint8
	10 – 79	*padding*	0	–	10	version	3	uint16
					12 – 79	*padding*	0	–
	Data				**Data**			

```
000 003 000 000 000 074 001 000
000 001 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

```
000 003 000 000 000 074 002 001
000 001 000 003 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

In this example, the server answers with version = 3. This means that the client is up-to-date.

6.2 GET_STATE

Before sending further requests to the server, the server's state is to check.

	Request				*Response*			
	Index	**Name**	**Value**	**Type**	**Index**	**Name**	**Value**	**Type**
Prefix	0	version	3	unit16	0	version	3	uint16
	2	length	74	unit32	2	length	74	uint32
Header	6	comm type	1	unit8	6	comm type	2	uint8
	7	reply code	0	unit8	7	reply code	1	uint8
	8	reply counter	0	unit8	8	reply counter	1	uint8
Body	9	msg type	2	unit8	9	msg type	1	uint8
	10 – 79	*padding*	0	–	10	*offset*	0	–
					12	state	2	
					13 – 79	*padding*	0	–
	Data				**Data**			

```
000 003 000 000 000 074 001 000
000 002 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

```
000 003 000 000 000 074 002 001
001 002 000 002 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

In this example, the server answers with state = 2. This means that the server is operational and proceeding is possible.

6.3 REGISTER_CLIENT

Register the client system, which is a Siemens PLC in this example.

		Request				*Response*		
	Index	**Name**	**Value**	**Type**	**Index**	**Name**	**Value**	**Type**
Prefix	0	version	3	unit16	0	version	3	uint16
	2	length	74	unit32	2	length	74	uint32
Header	6	comm type	1	unit8	6	comm type	2	uint8
	7	reply code	0	unit8	7	reply code	1	uint8
	8	reply counter	0	unit8	8	reply counter	2	uint8
Body	9	msg type	3	unit8	9	msg type	3	uint8
	10	client	128	unit8	10 – 79	*padding*	0	–
	11 – 79	*padding*	0	–				
	Data				**Data**			

```
000 003 000 000 000 074 001 000
000 003 128 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

```
000 003 000 000 000 074 002 001
002 003 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

The response body is empty.

6.4 SET_PROJECT

Activate the project with index 5, which contains the objects to be detected and grasped

	Request				*Response*			
	Index	**Name**	**Value**	**Type**	**Index**	**Name**	**Value**	**Type**
Prefix	0	version	3	unit16	0	version	3	uint16
	2	length	74	unit32	2	length	74	uint32
Header	6	comm type	1	unit8	6	comm type	2	uint8
	7	reply code	0	unit8	7	reply code	1	uint8
	8	reply counter	0	unit8	8	reply counter	3	uint8
Body	9	msg type	4	unit8	9	msg type	4	uint8
	10	*offset*	0	–	10 – 79	*padding*	0	uint16
	46	project index	5	unit32				
	50 – 79	*padding*	0	–				
	Data				**Data**			
	000 003 000 000 000 074 001 000 000 004 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 005 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000				000 003 000 000 000 074 002 001 003 004 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000			

In this example activating the project with index 5 was successful.

The response body is empty.

Note: Check the reply code in the response header and proceed only if the reply code is 1 (indicating success).

6.5 GET_GRASP

Requesting an auto grasp with the following parameters: the target object class is random, the tool is an exterior gripper, and the grasp pose shall be returned in quaternion representation.

	Request				*Response*			
	Index	**Name**	**Value**	**Type**	**Index**	**Name**	**Value**	**Type**
Prefix	0	version	3	unit16	0	version	3	uint16
	2	length	74	unit32	2	length	74	uint32
Header	6	comm type	1	unit8	6	comm type	2	uint8
	7	reply code	0	unit8	7	reply code	1	uint8
	8	reply counter	0	unit8	8	reply counter	3	uint8
Body	9	msg type	16	unit8	9	msg type	16	uint8
	10	*offset*	0	–	10	*offset*	0	–
	11	grasp mode	3	unit8	13	grasp mode	2	uint8
	12	object class	0	unit16	14	object class	3	uint16
	14	tool	1	unit8	16	object instance	0	uint8
	15	pose format	1	unit8	18	stroke	86000	int32
	16 – 79	*padding*	0	–	22	angle offset	-25210142	int32
					26	center offset	[-911, -310, 68]	int32[3]
					38	tool	1	uint8
					39	pose format	1	uint8
					40	grasp pose	[853798, 1111998, 502790, 775990, 630744, 0, 0]	int32[7]
					68	object count	2	uint16
					70	candidate count	2	uint16
					72 – 79	*padding*	0	–

Request				Response			
Index	Name	Value	Type	Index	Name	Value	Type
Data				Data			

```
000 003 000 000 000 074 001 000
000 016 000 003 000 000 001 001
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000
```

```
000 003 000 000 000 074 002 001
004 016 000 000 000 002 000 002
000 000 000 001 079 240 254 127
082 226 255 255 252 113 255 255
254 202 000 000 000 068 001 001
000 013 007 038 000 016 247 190
000 007 172 006 000 011 215 054
000 009 159 216 000 000 000 000
000 000 000 000 000 002 000 000
000 000 000 000 000 000 000 000
```

In this example, the returned grasp is a user-defined grasp (grasp mode = 2). The system prioritizes user-defined grasps over auto grasps, and will only use auto grasps if there are no user-defined grasps available or if they are not suitable for the situation. The response indicates that the candidate count is 2, which means that after applying the grasp there will be one candidate object left in the scene.

Note: Requesting a grasp may fail for various reasons, such as an uncalibrated camera, inability to locate the object, or an impractical grasp. It is crucial to verify the reply code in the response header and proceed only if the reply code is 1 (indicating success).

Steps 1 to 4 are performed only once. Step 5 typically iterates in a loop.

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