EWELLIX

MAKERS IN MOTION

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

LIFTKIT-0S

Contents

⚠ WARNING

Please read this manual before installing, operating or maintaining this lifting column. Failure to follow safety precautions and instructions could cause lifting column failure and result in serious injury, death or property damage.
Keep this manual nearby for future reference.

1.0 General information

1.1 Information in this manual

This manual provides important information on how to work with the actuator (also called device or drive) safely and efficiently.

The manual is part of the device, must always be kept in the device's direct proximity and should be available for personnel to read at any time . All personnel working with the device must read and understand this manual before starting any work. Strict compliance with all specified safety notes and instructions is a basic requirement for safety at work.

Moreover, the accident prevention guidelines and general safety regulations applicable at the place of use of the device must also be complied with.

For a better representation of the circumstance of use, the illustrations used are not necessarily to scale and may vary from the actual design of the device.

1.2 Explanation of symbols and signal words

Safety precautions

Safety precautions are identified by symbols and signal words as shown to the right . The signal words indicate the severity of the hazard and the chance it could occur.

Follow these safety precautions and act cautiously in order to avoid accidents, personal injury and damage to property.

These installation instructions describe the setup and operation of LIFTKIT, a vertical lifting axis for collaborative robots.

Warning label

The box contains hazardous voltage. Disconnect the power before opening the box.

Do not touch or change any wiring inside the box, except it is stated in this manual.LIFTKIT designations

⚠ DANGER

Indicates a dangerous situation, which will lead to death or serious personal injury, if the precautionary measures are ignored.

⚠ WARNING

Indicates a dangerous situation, which can lead to minor or moderate injury or property damage, if the precautionary measures are ignored.

⚠ CAUTION

Indicates a dangerous situation, which can lead to minor or moderate injury the precautionary measures are ignored.

NOTICE

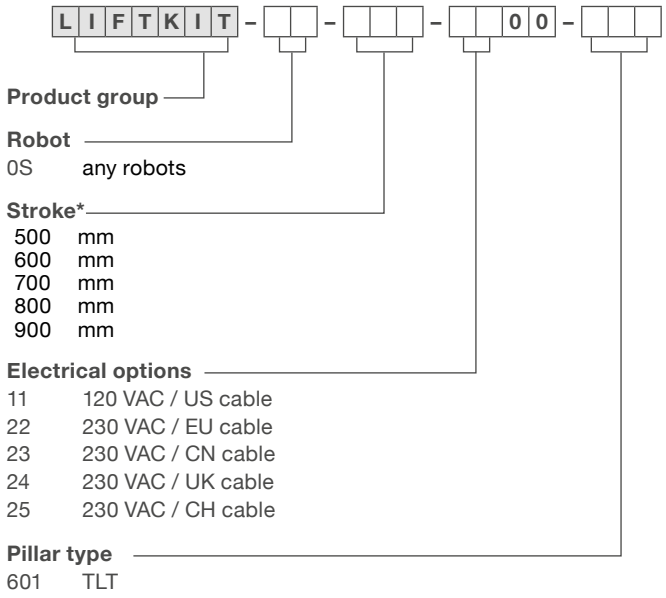
Indicates information considered important, but not hazard-related (e.g. messages relating to property damage).

NOTE

Emphasizes useful hints and recommendations as well as information for efficient and trouble-free operation.

1.3 LIFTKIT designations

LIFTKIT contains a telescopic pillar, a controller and additional accessories enabling easy integration with a collaborative robot. Depending on LIFTKIT typekey chosen, different configurations of these included products are possible.



* Longer stroke up to 1 400 mm available on request

1.4 Related documents

This instruction manual does not replace the operating manuals of the included products, but adds additional instructions relevant to the setup and operation of the LIFTKIT's system related to collaborative robots.

For general information and safety instructions please refer to installation, operation and maintenance manuals available at www.ewellix.com.

- TC-08023-EN THG-TLG-TLT operating manual
- TC-08005-EN SCU operating manual

1.5 Target audience

This manual is intended for qualified technical personnel who install and use LIFTKIT in their application. This manual and the corresponding operating manuals should be kept available for reference at all times.

Qualified personnel is able to carry out assigned work and to recognize and prevent possible dangers self-reliantly due to its professional training, knowledge and experience as well as profound knowledge of applicable regulations.

2.0 Safety

This section provides safety aspects supplementary to the safety aspects described in the relevant operating manuals of the included devices. Failure to comply with the guidelines and safety instructions contained in this manual may result in serious hazards that could cause possible serious injury or death, or damage to the device or equipment.

The listed safety aspects must be reviewed and taken into account in the final application risk assessment prior to the use of LIFTKIT.

2.1 Intended use

LIFTKIT has been designed and built for the intended use as described in the operating manual of the pillar, with additional intended use defined as

- Lifting of a robot to extend its operating range.

Any use that extends beyond the intended use or a use different than the one described above is deemed misuse.

Any type of claims resulting from damage caused by misuse are excluded.

2.2 Safety elements

The LIFTKIT has a range of safety elements built in to allow its integration into a robot application, including safety relay certified according ISO 13849-1, allowing STO up to PLe, Cat. 4

2.3 Application notes

- Integration with an emergency-stop is required for its intended use.
- Install emergency stop functions for the pillar and integrate them into the safety chain of the complete system prior to operating LIFTKIT.
- The emergency stop function has to be connected in such a way that a disruption of the power supply or the activation of the power supply after a power disruption cannot cause a hazardous situation for persons and objects.
- The emergency-stop systems must always be freely accessible.

2.4 Potential risks

The following risks during LIFTKIT operation have to be considered in an application specific risk assessment

- The pillar does not detect an impact automatically and does not stop movement upon impact. This can lead to:
  - Crushing of a person or an object in the path of the pillar, causing serious injury or death or property damage.
  - Dynamic impact to a person or an object causing serious injury or death or property damage.
- It is possible that the pillar movement does not stop at the desired position
  - Movement of the robot can occur at a different position than intended, causing significant serious injury or death or property damage.

2.5 E-Stop setup and behavior

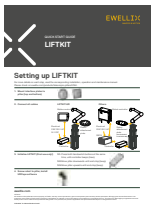
The LIFTKIT has two e-stop mechanisms. One is integrated into the SBOX, the other directly into the SCU. The SCU mechanism is software controlled and is much faster, but only the SBOX mechanism guarantees an STO up to PLe, Cat.4. It is recommended to integrate both mechanism into the safety system. See the following table for comparison:

E-Stop mechanism	Performance level ISO 13489-1	Stop distance	Stop time
SCU	Not rated	18 mm	200 ms
SBOX	Up to PLe, Cat. 4	28 mm	750 ms

3.0 LIFTKIT components

3.1 Scope of delivery

- 1 Lifting column TLT
- 1 Control unit SCU16/56/96
- 1 SBOX power cable EU/US/CH/CN
- 1 RS232 interface cable M/0133976
- 1 Controller I/O cable M/0133975
- 1 EHA3A operating handswitch
- 1 bottom mounting plate
- 8 M10x40 screws for mounting plates
- 4 screws M6x20
- 2 pins ⌀ 8x20 to align robot
- Quick start guide
- 1 SBOX
- 1 SBOX key
- 1 SBOX I/O cable
- 1 SBOX to controller power cable
- 1 Ethernet cable
- SBOX mounting attachments



Quick start guide


Control unit SCU16/56/96


SBOX


Lifting column TLT


Bottom mounting plate


EHA3A operating handswitch


Screws for mounting plates


SBOX Key


SBOX I/O cable


SBOX power cable


SBOX to controller power cable


Controller I/O cable


RS232 interface cable


Ethernet cable

4.0 Mechanical installation

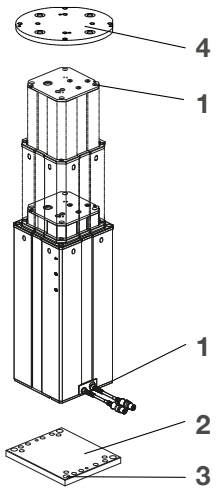
4.1 Tools required

- Hex key size 5 and 6
- Screw driver 2 mm

4.2 Robot installation on the telescopic pillar

Refer to the numbers in 3.1 Scope of delivery, and in the figure below.

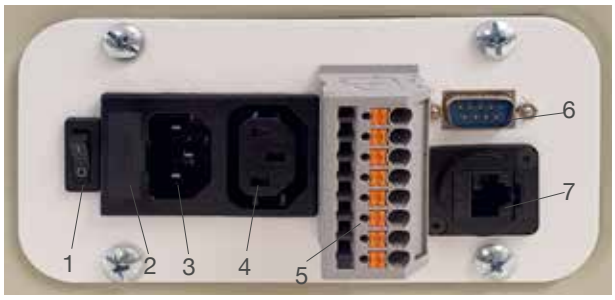
1. Take the telescopic pillar out of the box
2. Loosen and remove 4 transport screws at the bottom (**1**)
3. Attach the bottom mounting plate (**2**) using 4 M10x40 screws (screw 10) on the outer guiding tube
   a. Ensure tightening torque 40 Nm on these screws
4. Fix the bottom plate securely to the ground or a frame using at least four attachment holes on the plate (**3**)
   a. Alternatively, if mounting to a SLIDEKIT, attach the bottom plate with 8x M6 screws to the LIFTKIT's attachment plate.
5. Loosen and remove 4 transport screws at the top (**1**)
6. Attach the top attachment plate (**4**) using 4 M10x40 screws (screw 10) on the inner guiding tube.
   a. Ensure tightening torque 40 Nm on these screws
7. If required, insert the 2 alignment pins on the top plate and press them in (or use a plastic hammer)
8. Align the robot with the alignment pins and fix the robot base with the four screws provided (M6x20 (screw 11))



1. Transport screws
2. Bottom mounting plate
3. Ground fixations holes
4. Top mounting plate

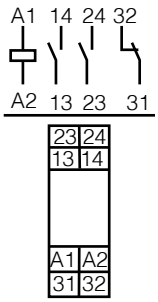
5.0 Hardware connection SBOX

5.1 Hardware connection SBOX



1. On/Off Switch
2. Fuse
3. Power In
4. Power Out
5. I/O Conenctor
6. RS232 Connector
7. Ethernet Connector

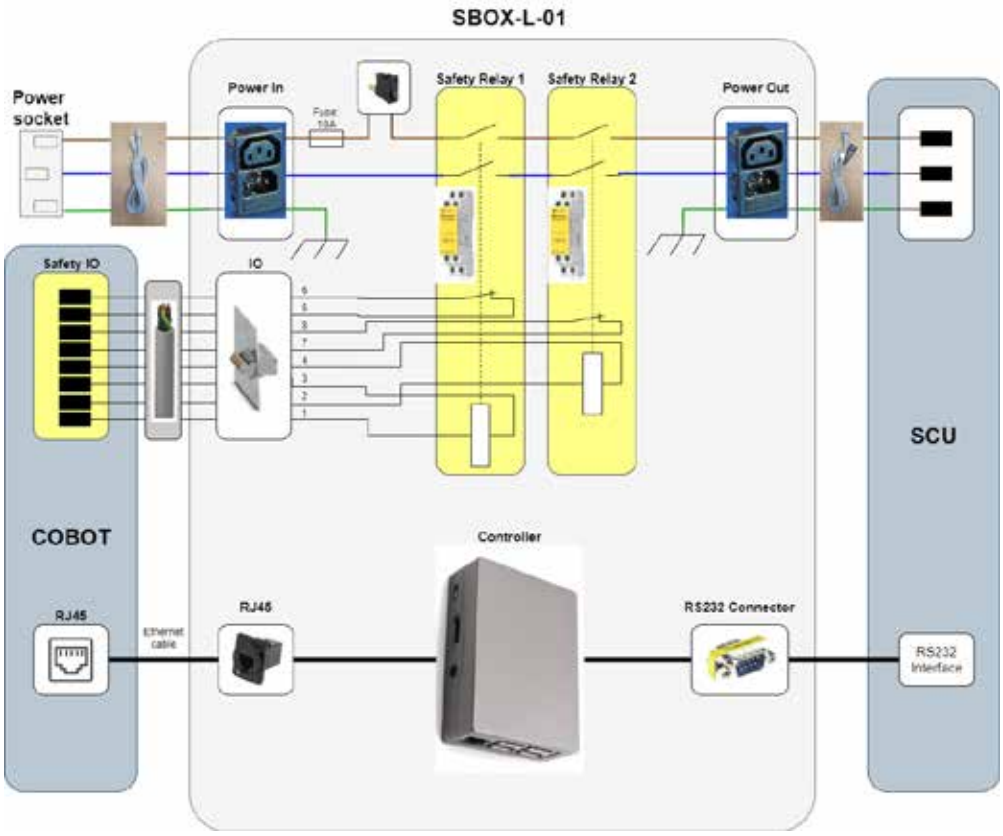
8. K1.A1
9. K2.A1
10. K1.A2
11. K2.A2
12. K1.31
13. K1.32
14. K2.31
15. K2.32



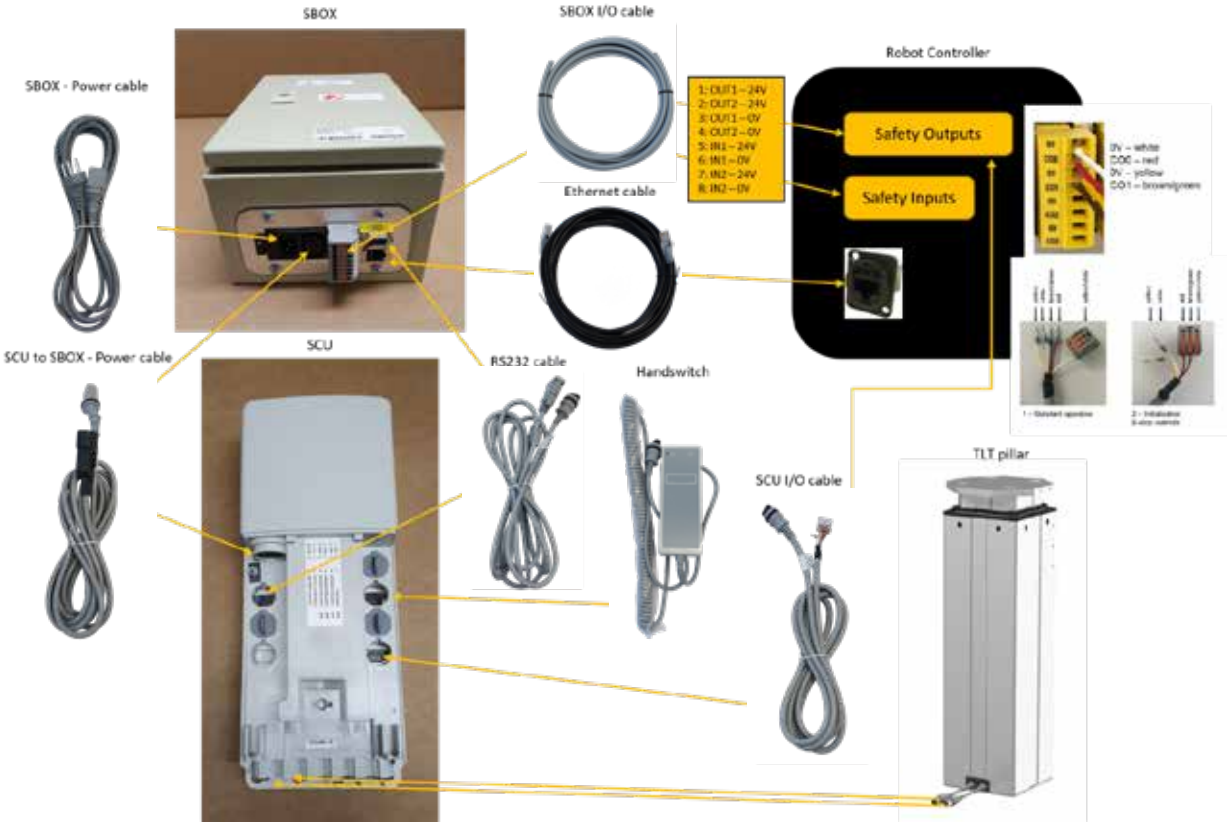
5.2 Safety connection

The SBOX-L-01 has two integrated safety relay with forcibly guided contacts. Their coil and feedback contacts are wired directly to the I/O connector.

5.3 Schematic SBOX



5.4 LIFTKIT connection setup

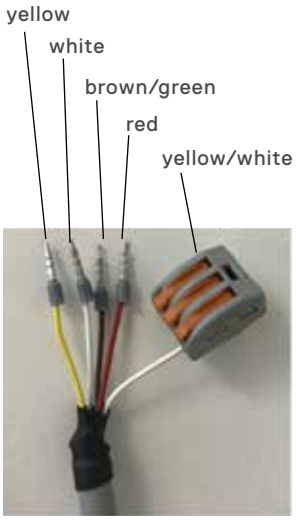


6.0 Initialization of LIFTKIT before connection to robot controller

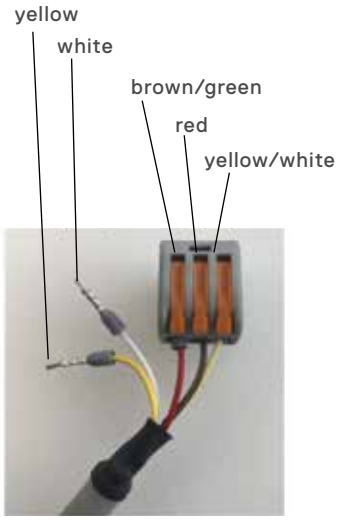
LIFTKIT has to be initialized before its first operation. For this step, the handset included has to be connected to the LIFTKIT's SCU controller. Follow the steps below:

1. Follow the LIFTKIT connection setup
2. If the SCU I/Os are not integrated into the emergency stop system, an override of the emergency stop has to be activated. Short-circuit the three wires with provided clamp as shown in **figure 2**.
3. Press both handswitch buttons simultaneously for about 5 seconds, until the SCU rattles and beeps. Now the pillar will run at 50% speed and force.
4. Move the pillar downwards until it hits the end position. The SCU controller beeps.
5. Move the pillar upwards to the top position until it hits the end position. The SCU controller beeps.
6. Now the end positions have been identified and virtual limits have been set to always stop the pillar using soft ramps.
7. The pillar should move without beeping at its full speed. If it does not reach its full stroke, or it continues to beep, repeat the initialization procedure.

Fig. 2



1 - Standard operation



2- Initialization
E-stop override

7.0 Software operation

7.1 Software connection

The SBOX-L-01 is controlled by using string-based TCP/IP commands. It can be controlled by connecting it to a PLC, a robot or a PC using telnet communication with port 50001. The default IP address is 192.168.1.100.

7.2 Messages

Client message

Command	Parameter 1	Parameter 2	Line feed

Server message

Received Command	Acknowledge	Parameter 1	Parameter 2	Parameter 3	Parameter 3	Line feed

Separator and End of line character

As a separator, a comma is used. At the end of a message, a line feed (\n) is used as an end of line character.

Parameters

Parameters are defined for each command. They must be in the right order.

Decimals

All float values are sent with one decimal place. More decimals will be cut out.

Acknowledge

	Acknowledge	Parameter 1	Parameter 2	Parameter 3	Description
Command ok	OK				Everything is fine
Command not found	NF				Command is not valid
Command not allowed	NA	*see status	*see status	*see status	Command is valid, but not allowed in the current state
Wrong nbr of parameters	WNP	Nbr of min needed parameters	Nbr of max possible parameters		Wrong number of parameters used in the command
Out of range	OOR	Index of parameter	Min	Max	At least one parameter is out of range
Value Error	VE	Index of parameter	Data type		Wrong data type for parameter is used
Execution Error	EF	Error reason			Command and parameters are valid, but execution of the command failed

7.3 Commands

Several commands can be used to communicate with the SBOX-L-01. Consider, that they only work in the allowed state.

Command	Allowed state
moveTo_absolutePosition	Ready
stop_moving	Moving
get_position	Connected, Ready, Moving, Error
get_stroke	Connected, Ready, Moving, Error
get_status	Initialized, Connected, Ready, Moving, Error
set_virtualLimits	Connected, Ready
get_virtualLimits	Connected, Ready, Moving, Error
set_type*	Initialized, Connected, Ready, Error
get_type	Initialized, Connected, Ready, Moving, Error
get_typesAvailable	Initialized, Connected, Ready, Moving, Error

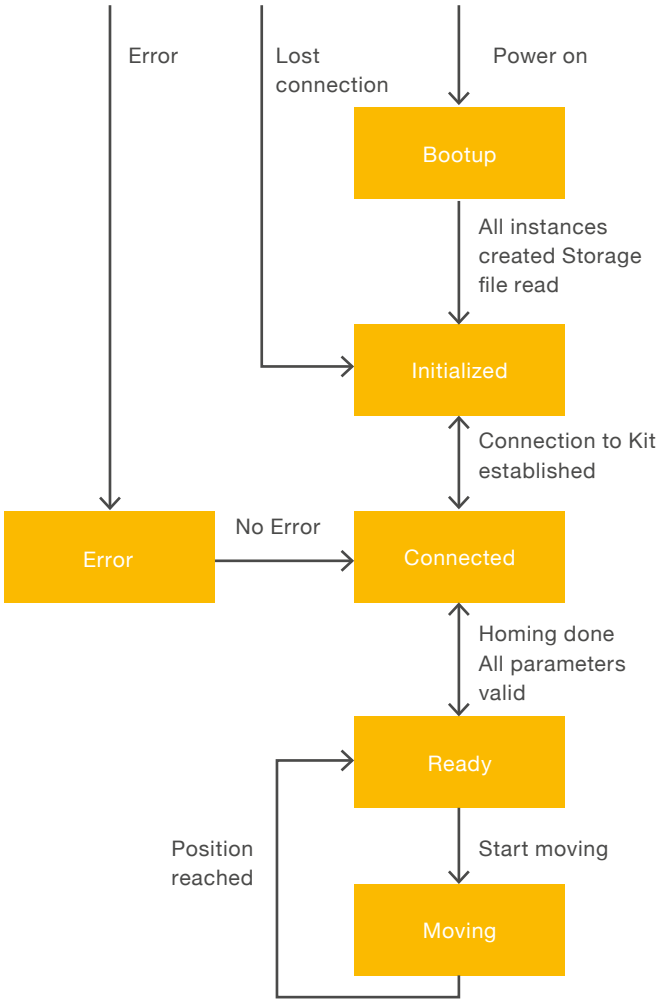
* Require restart. Virtual limits must be set again after changing the type.

Get status

For getting the actual status from the SBOX-L-01 send: “get_status\n”

As a return you get the actual status in parameter one and a cause in parameter two, if the state is not READY or MOVING.

There are six states, the SBOX-L-01 can be in:



Parameter 1	Parameter 2	Description
INITIALIZED	Cause	Liftkit is not connected to the SBOX-L-01 or no connection is established
CONNECTED	Cause	Liftkit is connected, but no homing is performed, or Pillar is not valid
READY		Liftkit is ready to use, but no movement is performed
MOVING		Liftkit is moving to the desired position
ERROR	Cause	An error appeared

NOTE: After using the STO safety function while the Liftkit is not moving, the SBOX-L-01 will stand in READY state for a few seconds, because of the capacitors in the Liftkit controller.

Get stroke

For getting the stroke of the Liftkit send: "*get_stroke\n*"

It returns the max. stroke in [mm] of the Liftkit as a float number with one decimal place.

E.g.: "*get_stroke,OK,600.0*"

Get position

For getting the position of the Liftkit send: "*get_position\n*"

It returns the max. stroke in [mm] of the Liftkit as a float number with one decimal place.

E.g.: "*get_position,OK,250.2*"

Get virtual limits

For getting the virtual limits of the Liftkit send: "*get_virtualLimits\n*"

It returns the minimum and maximum virtual Limit in [mm] of the Liftkit as float numbers with one decimal place.

E.g.: "*get_ virtualLimits,OK,0.0,600.0*"

Set virtual limits

For getting the virtual limits of the Liftkit send: "*set_virtualLimits,[min],[max]\n*"

The limits are in [mm] as a float number with maximum of one decimal place.

E.g.: "*set_ virtualLimits,50.5,450.0*" or "*set_ virtualLimits,40,500*"

If everything is correct, it returns "*set_virtualLimits,OK*"

Move to absolute position

For moving to an absolute position of the Liftkit send: "*moveTo_absolutePosition,[position]\n*"

The position is in [mm] as a float number with one decimal place.

E.g.: "*moveTo_absolutePosition,120.5"* or *"moveTo_absolutePosition,140*"

If everything is correct, it returns "*moveTo_absolutePosition,OK*"

NOTE: This is an asynchronous command. The response indicates that the movement is started. To know when the desired position is reached or if the pillar really moves, the commands get_position and get_status needs to be used.

Stop moving

For stopping the movement of the Liftkit send: "*stop_moving\n*"

If everything is correct, it returns "*stop_moving,OK*"

Get type

For getting the actual selected type of the Liftkit send: "*get_type\n*"

It returns the actual type of the Liftkit.

E.g.: "*get_type,OK,LIFTKIT-601*"

Get types available

For getting all available types of the Liftkit send: "*get_typesAvailable\n*"

It returns all available types of the Liftkit. These are LIFTKIT-601 and LIFTKIT-00 for the TLT and LIFTKIT-602 for the CPMT. More types could be followed in the future.

E.g.: "*get_typesAvailable,OK,LIFTKIT-601,LIFTKIT-602,LIFTKIT-00*"

Set type

For setting the type of the Liftkit send: "*set_type,[type] \n*"

E.g.: "*set_type,LIFTKIT-601*"

If everything is correct, it returns "*set_type,OK*"

NOTE: After setting a new type, the SBOX-L-01 needs to be restarted and the virtual limits must set again.

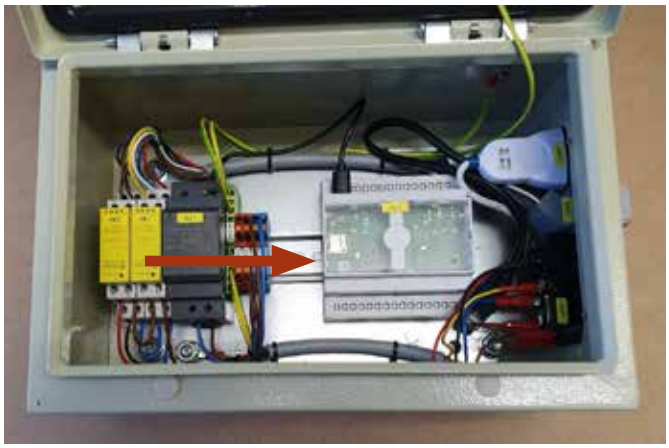
7.4 Software update SBOX

Software updates can be done by flashing a new image to the controller SD card.

1. Remove all cables attached to the SBOX

2. Unplug the USB and the ethernet connector from the controller:

3. Move controller to the front plate:



4. Remove the SD card using a small tool like a pliers

5. Download and install one of these tools:
   - Raspberry imager, from https://www.raspberrypi.org/downloads/
   - balenaEtcher, from https://www.balena.io/etcher/
6. Copy Image on SD card:
   - **6.1.** Place SD card into your laptop
   - **6.2.** Do not format SD card
   - **6.3.** Start Raspberry imager or balenaEtcher
   - **6.4.** Choose Image
   - **6.5.** Select SD Card
   - **6.6.** Start writing process
7. Put SD card back into Controller following the steps 1 – 4 in reverse.

7.5 IP address

The SBOX-L-01 uses a static IP address. The default address is 192.168.1.100.

Changing the IP address

1. Create a file called “ip_changer.conf” on your PC
2. Insert the following content:

   static ip_address=192.168.1.100/24

   static routers=192.168.1.1

   static domain_name_servers=192.168.1.1
3. Change the IP addresses to your needs. Make sure that the “/24” stays behind the static IP address.
4. Put the file on an USB Stick.
5. Remove all cables from the SBOX-L-01
6. Open the Box
7. Insert USB Stick into the controller

8. Close the Box
9. Plug in the power cable into the SBOX-L-01
10. Switch on the SBOX-L-01
11. Wait 5 Minutes
12. Switch off the SBOX-L-01
13. Remove all cables from the SBOX-L-01
14. Open the Box
15. Remove USB Stick
16. Close Box
17. Connect all cables again
18. If everything worked, the USB Stick has the following empty file on it:

    update_ip_address_successfull_from_”Name of the USB Stick”

8.0 Specifications

Operating range extension

- Vertical lifting of the cobot by up to 900 mm (1 400 mm on request) with compact retracted height
- Robust pillar design for industrial use, vibration free motion and virtually maintenance free

Plug-and-play solution

- Hardware interface compatible with any robots
- LIFTKIT control through TCP/IP

Cost savings and higher productivity

Cobots combined with Ewellix LIFTKIT provide a cost-effective solution to upgrade an existing assembly shop, moving from a manual handled to a fully automatized line.

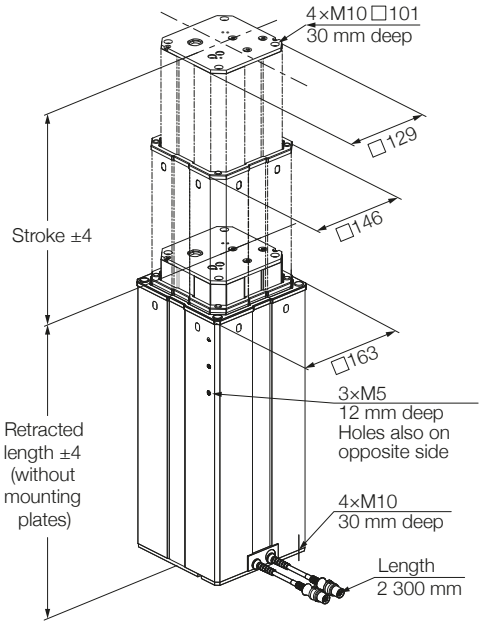
Technical data

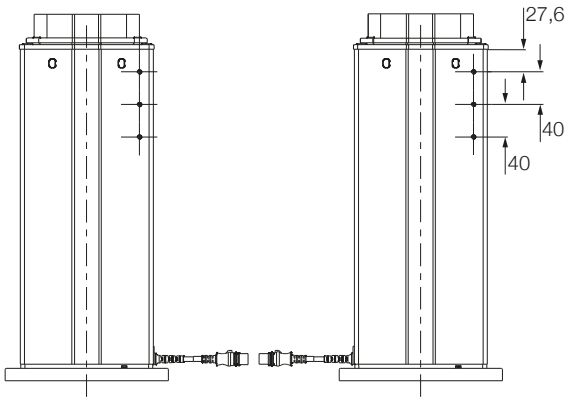
	Unit	LIFTKIT-0S-601
Pillar type	-	TLT
Performance Data		
Max. Push load	N	1 500
Max. Pull load	N	0
Max. dynamic moment	Nm	210
Max. static moment	Nm	3 000
Max. linear speed	mm/s	80
Duty cycle	-	10% (20% at 500N)
Mechanical Data		
Screw type	-	Acme screw
Stroke range	mm	500 - 900
Retracted length (software controlled)	mm	Stroke/2 + 275
Weight @ 0 mm stroke	kg	21
Δ weight per 500 mm stroke	kg	1,7
Robots compatibility	-	Any
Cable management	-	Threads on pillar and interface
	-	plate to attach cable management
Electrical		
Input Voltage/Current	-	120 VAC / 6,5 A 230 VAC / 3,3 A
Input frequency	Hz	50-60
Input Fuse	A	10
I/O voltage	-	24 VDC
I/O current	-	max. 10 A not protected
Emergency stop	-	STO up to PLe, Cat.4
Communication		
Control interface	-	TCP/IP
Positioning, repeatability	mm	± 1
Accessible positions	-	any
Feedback	-	Position & Status
Soft start and stop	-	Implemented for smooth operation
Environment		
Type of protection	-	IP40 in operational state
Ambient temperature	°C	+10 to +40
Max. humidity	%	85
Altitude	m	2 000
Vibration	-	Stationary industrial environment

Dimensional drawing

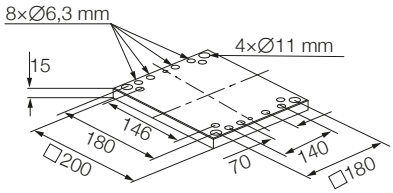
TLT telescopic pillar

TLT Pillar

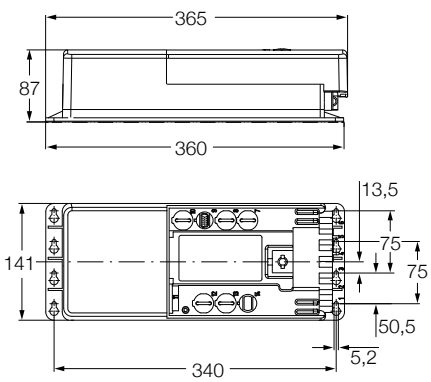




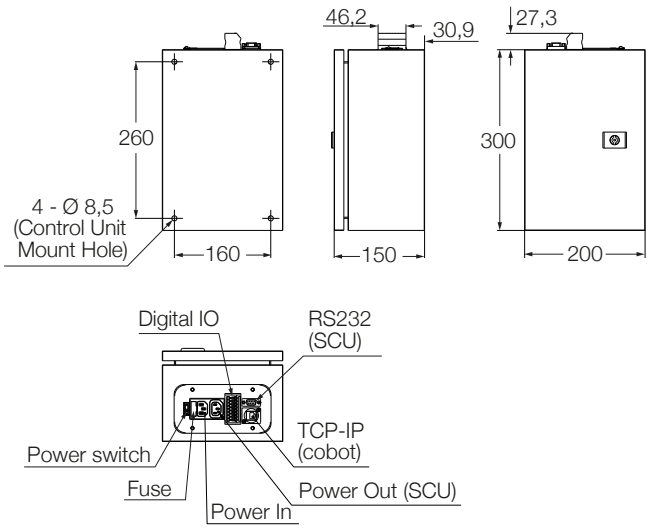
Bottom fixation plate



Controller



SBOX



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