

EN

# USER MANUAL

**LINEAR** ACTUATORS  
TECHNOLOGY



**QS 220**



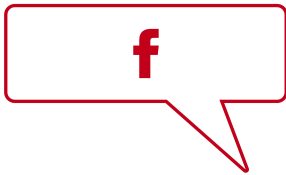
The Motion Systems, manufacturer of Qubic System, would like to thank you for choosing the QS-220, an innovative product that helps you develop highly reliable training and entertainment solutions that reproduce key immersive elements, such as surface textures, acceleration, engine vibrations and vehicle dynamics for multiple types of land, air or sea vehicles. Our motion system has been designed to deliver the most realistic simulation experience. We hope you enjoy your new Qubic System!

Join our sim racing channel at the Qubic System YouTube  
<https://www.youtube.com/c/QubicSystem>



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# 1. SAFETY PRECAUTIONS

**INFO**

Read all safety instructions before installing and using this product. Save this document for future reference. If ownership of this product is transferred, be sure to include this manual.

**WARNING**



The device is intended solely for individuals **OVER THE AGE OF 16**. In case of use by individuals with limited physical, sensory, or mental capabilities, strict supervision is required. Read safety instructions before using the device.

**WARNING**



The device is **NOT** allowed to be used by a pregnant woman.

**WARNING**



**DO NOT** use the device around pets.

**WARNING**



Always ensure that cockpit attachment points can withstand forces generated by the QS-220 (approved construction or tested for expected load). Check the cockpit for loose mounting points.

**WARNING**



To reduce the risk of burns, fire, electrical shock, injury or mechanical damage always **TURN OFF THE POWER SUPPLY** before plugging and unplugging the QS-220. Dangerous voltages level can be present in Power Cabinet for a few minutes after turning off the machine.

---

**WARNING**

**DO NOT** touch the actuators when the power is on.

- Use the QS-220 only for its intended purpose, according to instructions.
- Unplug the QS-220 from the power supply if it is not used for an extended period or when there is a need to perform hardware installation, maintenance, servicing or repairs.
- Turn off the QS-220 when it is not in use.
- The QS-220 was designed for indoor use only - **DO NOT** store or use the product outdoors.
- Keep the QS-220 away from the heat sources, high humidity, water, and other liquids. **DO NOT** store in cold place where water condensation may occur.
- **DO NOT** disassemble the product. Any tampering with or altering the product will void the warranty, poses a serious risk of electric shock, and may irreparably damage the product.
- **DO NOT** cover the ventilation holes in the Power Cabinet.
- Keep the power cord plug and the socket dry, clean and dust-free.
- Protect the power cord from damage caused by being stepped on, rubbed against, or pinched.
- **DO NOT** use the QS-220 if the ambient temperature is below 4° Celsius (39° Fahrenheit) or above 45° Celsius (113° Fahrenheit).
- **DO NOT** use the QS-220 if it has been damaged, or any component is broken or missing. Please contact technical support.
- **DO NOT** use attachments or replacement parts not recommended or approved by the manufacturer. If you must replace a power cord, use only certified products with the same rating as the one being replaced.
- Connect the QS-220 to a properly grounded outlet only. See grounding instructions in section **2.6** on page **18**.
- If you want to increase safety level of the system, you can add external safety devices. For detailed information check section **6** on page **52**.

**WARNING**

Stop using the QS-220 immediately and contact technical support when the machine starts to emit unusual noise, smoke or any other suspicious behaviour indicating the machine is not working properly.

## 1.1. HEALTH AND SAFETY INSTRUCTION

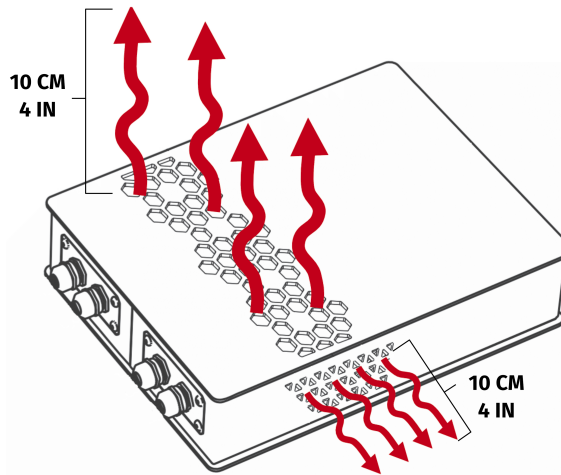
The safety of Qubic System users is top priority. To protect users and bystanders from injuries caused by mechanical parts movement and electric shock, the following instructions **MUST BE** followed.

### WARNING

As with any mechanical device, user is the one responsible for inspecting the condition of the machine before using it and ensuring safe working conditions.

#### What must be checked before turning on the device:

- Ensure that nothing is blocking machine's movements or air vents. The minimum distance between the air vents in the Power Cabinet's and any outside part of the cockpit equipment is 10 cm (4 in).



- Check if cables are mounted correctly – they should **NOT** be stretched or loosely connected to the socket. Place them out of the moving range of the device components.
- Check if all components are correctly mounted.
- Check if there are no sharp edges near the moving range of the cockpit.

### WARNING



Dangerous voltage levels are present in the Power Cabinet and cables during the operation and for up to a few minutes after turning off the machine.



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## How to safely turn on and use the QS-220:

- Ensure that everyone around is aware of cockpit's rapid movements.
- Ensure that no one stands in the range of the motion (minimum of 1.5 m [5 feet]).

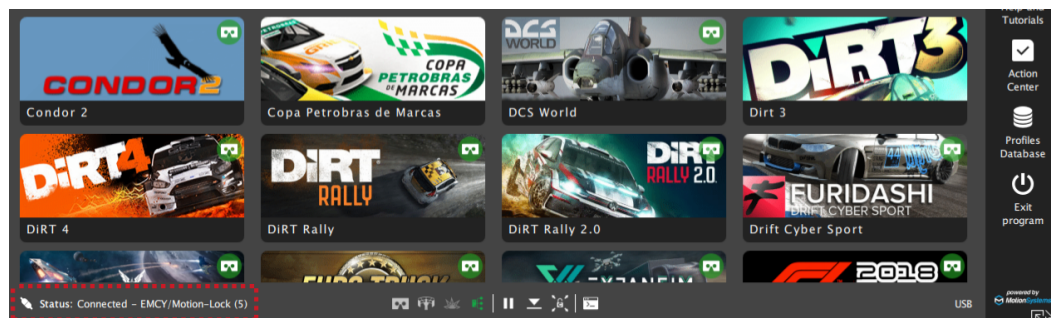
### WARNING

In order to perform a start-up calibration QS-220 will move automatically after turning it on. **DO NOT** approach the device and **DO NOT** interfere until the procedure is over.

- **DO NOT** change the payload weight mounted to the QS-220 during a start-up calibration.
- Motion Lock Switch should be mounted within the reach of the user – it has to be available immediately in every situation. Different seat positioning setups should be taken into account.
- Check the Motion Lock Switch **AT LEAST** once a month to reduce the possibility of unknown and unexpected failure – more information available in chapter 4 on page 47.
- Before getting on and off the machine activate Motion Lock Switch by pressing it down.
- In case of game crash or freeze - Motion Lock Switch must be triggered (pressed down) before getting off the machine.

### INFO

To check if the QS-220 is in the Motion Lock mode - go to QubicManager application main window. Platform status is displayed in the lower left corner of the main application window:



**WARNING**

Motion Lock input is not SIL/PL (safety integrity level/performance level) rated and **DOES NOT** guarantee safety. If you wish to achieve specific SIL/PL ranking, consider introducing a power cut-off device that is controlled by an external safety relay and cuts off the power to all Power Cabinets. Example application of the power cut-off contactor can be found in section **6.3.2** and **6.3.3** on pages **56** and **58**.

- For VR Headset users:
  - Remove the VR goggles before getting on or off the rig.
  - Ensure that cables from the VR Headset are not in the movement range of the QS-220.
  - Ensure that the whole VR setup is not in the motion range of the QS-220.
  - Ensure that VR setup cables are protected from being crushed by the QS-220
    - **DO NOT** place them loosely under the motion rig.

**INFO**

It is **recommended** that the connected PC is capable of running the game at stable 90 frames per second or more when VR Headset is used. Lower values can cause VR sickness.

- **DO NOT** use QS-220 if you are pregnant, tired, or under the influence of alcohol or narcotic substances.
- **STOP USING** the QS-220 immediately if you start feeling pain, fatigue or any physical or mental discomfort.
- For every two hours of playing, we recommend at least **15 MINUTES OF BREAK**.
- **DO NOT** put your hands or legs in the actuator’s range of motion!
- **DO NOT** use the QS-220 with small children or pets around.
- **DO NOT** put any items between actuators and stabilization plates.
- **DO NOT** pull the wires connecting the actuators with the Power Cabinets.



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## 2. TECHNICAL DETAILS

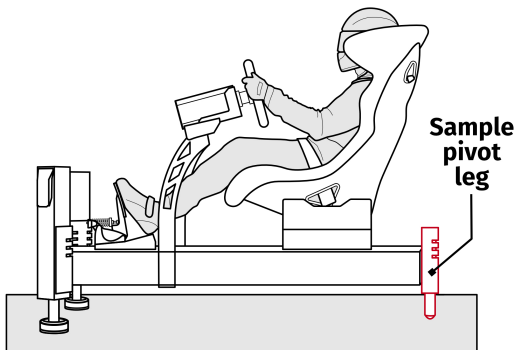
### 2.1. PRODUCT DESCRIPTION

QS-220 is a set of industrial-grade linear actuators with necessary accessories. It enables users to introduce vertical movement into their gaming rigs to increase the immersion of the simulation.

QS-220 is sold in two variants - 2DoF (two degrees of freedom) and 3DoF. It is designed with upgradeability in mind – it is possible to expand from 2DoF to 3DoF setup later on. Available variants are presented below (illustrations show an example assembly).

#### WARNING

QS-220 is delivered without the pivot leg.



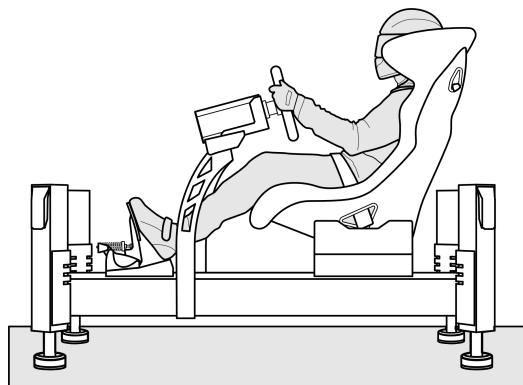
QS-220 2DoF - Front variant



QS-220 2DoF - Back variant

#### INFO

Single pivot leg should be mounted in the middle of the rig - in a longitudinal axis defining the center between the front or back actuators.



QS-220 3DoF

## 2.2. LIST OF COMPONENTS

Qubic System provides the option to buy the QS-220 motion set that contains **QS-MC6** and **QS-220** 2DoF or 3DoF packages (**QS-220 is delivered without the pivot leg**).

### WARNING

Check if the package contains all listed parts. If incomplete, please contact the distributor/reseller.

### 2.2.1 QS-MC6 SET

M10 controller (from the QS-MC6 package) is specifically designed to use communication protocol created by Qubic System. It allows connecting PC with the QS-220- **DO NOT** try to substitute this device. M10 requires USB connection (with an USB port on your PC).

### INFO

M-BUS terminator, which is a RJ45 connector with a resistor, is a small but very important part used in the last Power Cabinet in the set.

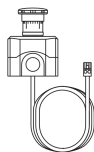
For cable connections information go to section **3.5** on page **27**.

The QS-MC6 package includes following components :

- M10 controller (x 1)
- Motion Lock Switch (x 1)
- M-BUS Terminator (x 1)
- M-BUS communication cable (x 1)
- USB cable (x 1)



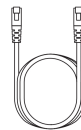
1 x  
M10  
controller



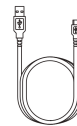
1 x  
Motion lock switch



1 x  
M-BUS  
Terminator



1 x  
M-BUS  
communication  
cable



1 x  
USB cable

## 2.2.2 QS-220 2DOF SET

QS-220 2DoF is a set composed of two actuators integrated with a Power Cabinet. For beginners, two actuators variant will be sufficient. It is possible to expand 2DoF setup into 3DoF setup later on by purchasing another QS-220 2DoF set.

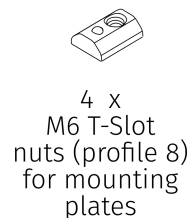
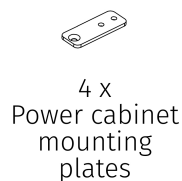
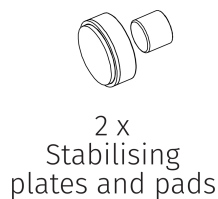
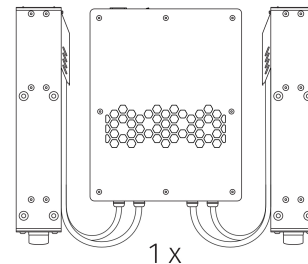
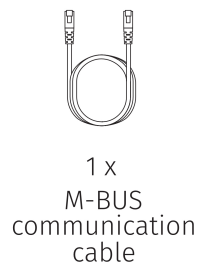
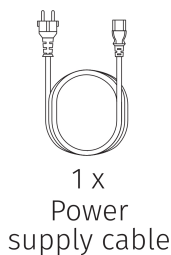
It can be used to set up various motion rigs. For installation details go to section 3.2 on page 21.

### WARNING

- Check if the package contains all listed parts. If it is incomplete, please contact the distributor/reseller.
- QS-220 is delivered without the pivot leg.

The QS-220 2DoF package includes following components:

- QS-220 Power Cabinet (x 1)
- QS-220 actuator [integrated] (x 2)
- Power supply cable (x 1)
- M-BUS communication cable (x 1)
- Motion Lock interlink cable (x 1)
- Stabilization plate (x 2)
- Power Cabinet mounting plates (x 4)
- M8 x 20 bolts [DIN 912] (x 16)
- M6 x 16 bolts [ISO 7380-1] (x 4)
- M6 x 16 [DIN 7991] (x 4)
- M6 T-Slot nuts (x 4)



### INFO

QS-220 adapter brackets for actuators are sold separately.

### 2.2.3 QS-220 3DOF SET

QS-220 3DoF is a set composed of four actuators and two Power Cabinets.

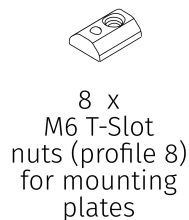
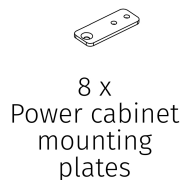
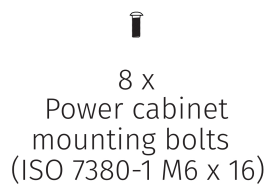
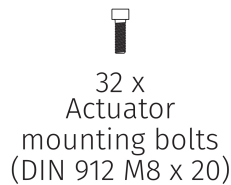
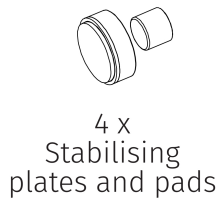
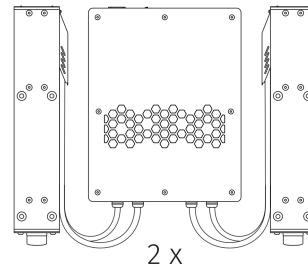
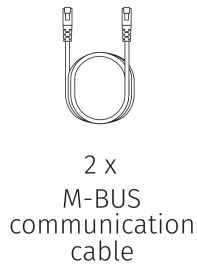
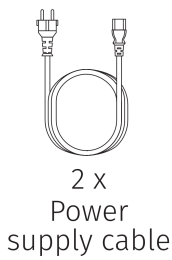
It can be used to set up various motion rigs. For installation details go to section 3.2 on page 21.

#### WARNING

Check if the package contains all listed parts. If it is incomplete, please contact the distributor/reseller.

The QS-220 3DoF package includes following components:

- QS-220 Power Cabinet (x 2)
- QS-220 actuator [integrated] (x 4)
- Power supply cable (x 2)
- M-BUS communication cable (x 2)
- Motion Lock interlink cable (x 2)
- Stabilization plate (x 4)
- Power Cabinet mounting plates (x 8)
- M8 x 20 bolts [DIN 912] (x 32)
- M6 x 16 bolts [ISO 7380-1] (x 8)
- M6 x 16 [DIN 7991] (x 8)
- M6 T-Slot nuts (x 8)

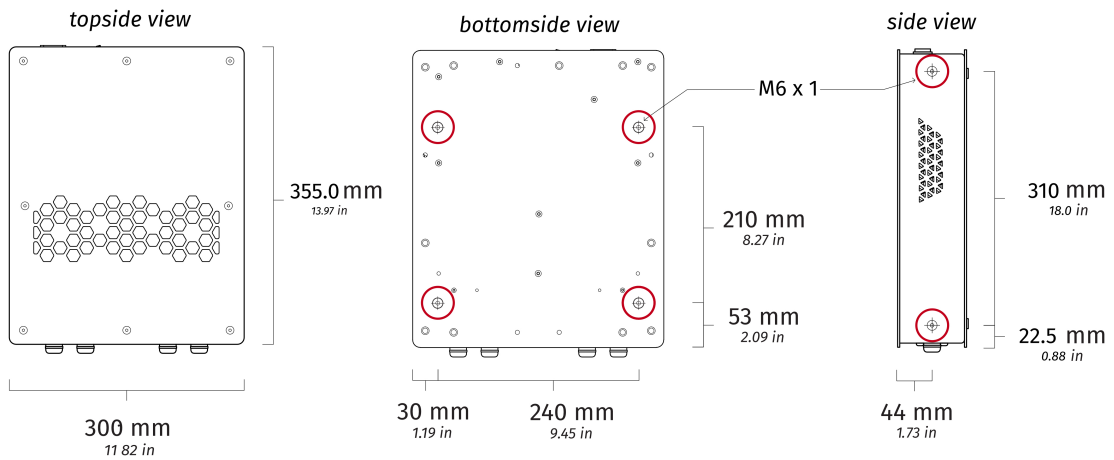


#### INFO

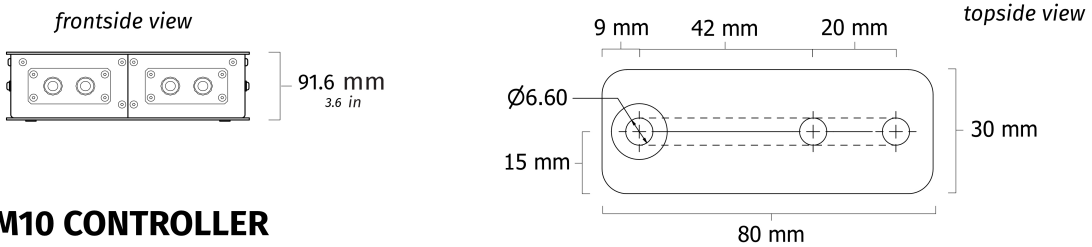
QS-220 adapter brackets for actuators are sold separately.

## 2.3. DIMENSIONS

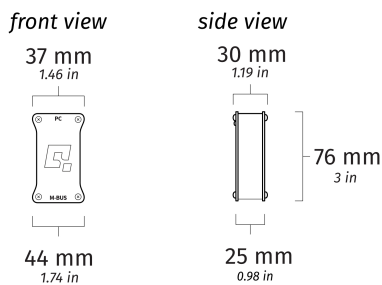
### POWER CABINET



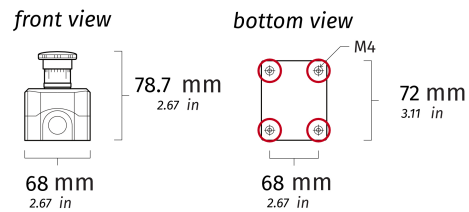
### POWER CABINET ADAPTER PLATE



### M10 CONTROLLER



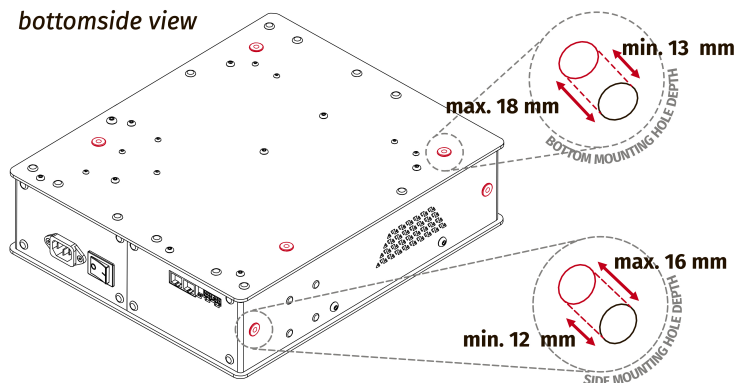
### MOTION LOCK



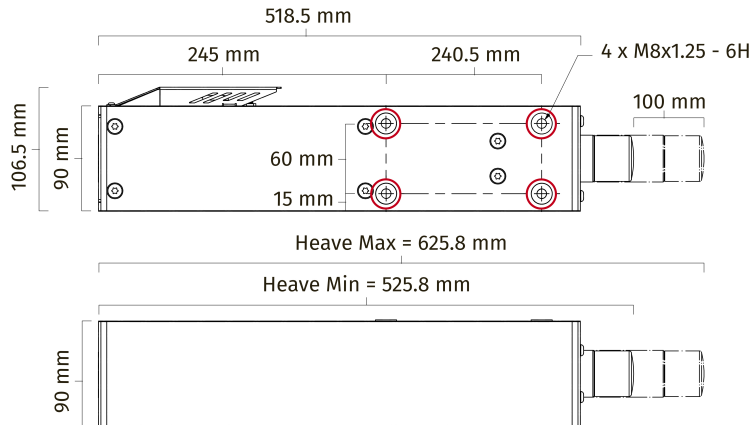
### POWER CABINET'S MOUNTING HOLE DIMENSIONS

The Power Cabinet's mounting bolts insertion depth:

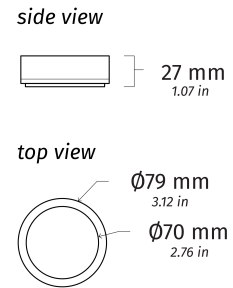
- At the bottom: **CANNOT** exceed **18 mm** and **CANNOT** be less than **13 mm**.
- On the sides: **CANNOT** exceed **16 mm** and **CANNOT** be less than **12 mm**.



**QS-220 ACTUATOR**

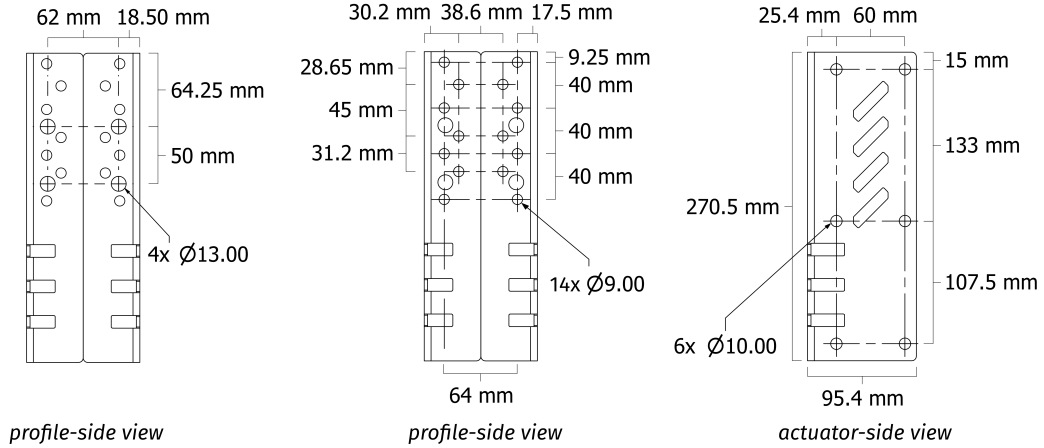


**QS-220 ACTUATOR STABILIZATION PLATE**



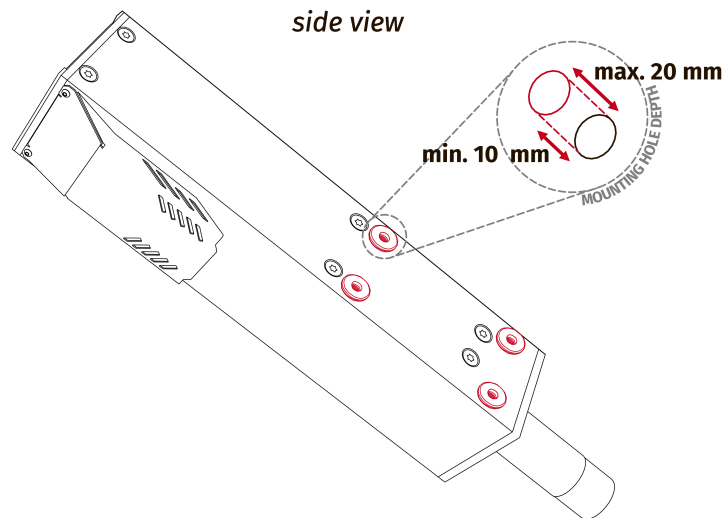
**QS-220 MOUNTING BRACKETS**

(sold separately)



**QS-220'S MOUNTING HOLE DIMENSIONS**

The QS-220's mounting bolts insertion depth **CANNOT** exceed **20 mm** and **CANNOT** be less than **10 mm**.





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## 2.4. POWER REQUIREMENTS

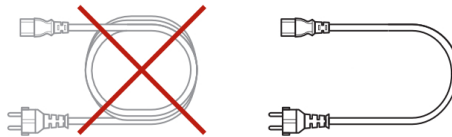
### INFO

QS-220 requires a 120/230±10% VAC 50-60 Hz single phase with ground and neutral connection (for grounding details go to section **2.6** on page **18**).

Power Cabinet contains the power supply for connected actuators. If there is no certainty if fuses or entire electrical installation can handle QS-220's power requirements, contact a qualified electrician. Be aware that with heavy payload and/or more intense simulations average power consumption may rise.

### WARNING

Always **UNWIND THE CABLE COMPLETELY** when using a cable reel and untangle an extension cord before connecting the device to the power supply.



### INFO

If your motion rig with two (or more) Power Cabinets (4 actuators setup) is connected to a 120V power supply, it is **recommended** that all Power Cabinets are connected to a different wall socket with a separate fuse.

If your electrical installation does not provide you with that option look into other electrical safety protection systems in section **6.3.2** on page **56**.

## 2.5. POWER CONSUMPTION

Tables below contain power consumption data for QS-220 3DoF setup:

230V ±10% 50-60Hz Single phase	HEAVY DUTY	PERFOR- MANCE	Q-MODE
Average power consumption - stress test [W]	300	300	500
Average power consumption - typical game [W]	70	40	30
Peak power for converter specification [kVA]	1,5	1,6	2,2
Peak current for breaker specification [A]	7	7	10

### INFO

Q-MODE is unavailable for QS-220 in 120 VAC environment.

120V ±10% 50-60Hz Single phase	HEAVY DUTY	PERFORMANCE
Average power consumption - stress test [W]	300	300
Average power consumption - typical game [W]	600	500
Peak power for converter specification [kVA]	1,5	1,5
Peak current for breaker specification [A]	12	13

## 2.6. GROUNDING REQUIREMENTS

In case of a system malfunction or breakdown, grounding provides a path of the least resistance for electric current to reduce the risk of electric shock. If the location (where the QS-220 is set up) can not provide proper grounding according to the description, please contact a qualified electrician for assistance.

**DO NOT** modify the plug provided with the power cord - if it does not fit the outlet, contact a qualified electrician for assistance.

### WARNING

The device is **NOT** intended to be used in an IT earthing/grounding system.

### INFO

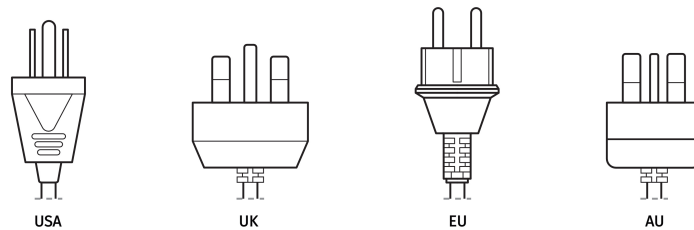
Use only high-quality power plug adapters purchased from a trusted supplier.

## WARNING

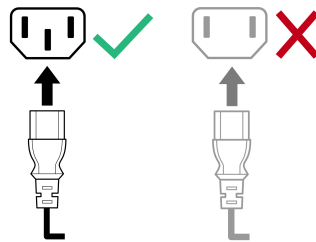
The power supply for QS-220 includes an electric cord with an equipment-grounding conductor and a grounding plug. The plug must be plugged into a matching socket that is correctly installed and grounded in accordance with appropriate local codes and ordinances. It is recommended to use multiple, separately fused wall sockets.

If your electrical installation does not provide you with that option look into other electrical safety protection systems in section 6.3.2 on page 56.

### Applicable plugs for different regions:



Check if the power cord plug has a grounding connection (3 pins). In order to reduce risk of electric shock **DO NOT** use a plug without grounding connection (without a center pin).



## 2.7. ENVIRONMENTAL CONDITIONS

The QS-220 should be operated within ambient conditions as specified below:

- Indoor use and storage only
- Temperature: 5° - 40° Celsius / 41° - 104° Fahrenheit
- Humidity: 0% - 70% (without water vapor condensation)
- Maximum altitude: up to 2000 m / 6561 ft

### 3. SETUP AND INSTALLATION

#### 3.1. BEFORE INSTALLATION

Qubic System **DOES NOT** approve exceeding or ignoring any of the points below and **IS NOT** responsible for malfunctions, failures or injuries that are results of these actions.

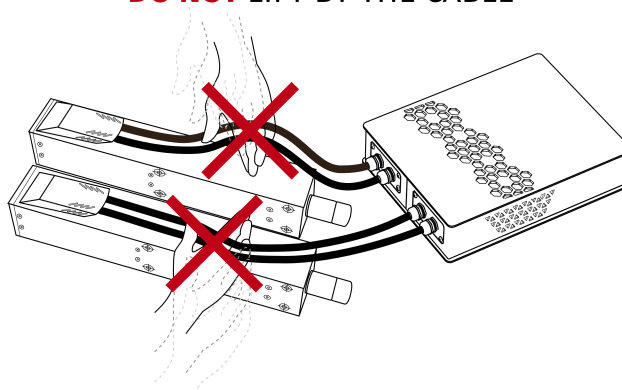
**WARNING**



Dangerous voltage level may occur in the Power Cabinet and connected cables during the operation and up for a few minutes after turning off the machine. Do not touch the device when the power switch is on.

**WARNING**

**DO NOT LIFT BY THE CABLE**



- Cables **MUST NOT** be stretched and should be arranged in a way that prevents them from getting under the actuator or any part that can crush or tear them.
- **DO NOT** place the actuators down on the cable side on any surface - always place them down with cable side up to avoid cable damage.
- Each actuator **MUST BE** used with the Stabilization Plate on and should be placed on a flat surface.
- **DO NOT** use the actuators on a soft or fragile surface like rubber, glass, or foam.
- Be aware that QS-220 will crawl a little in every direction during normal operation. These movements could damage the surface in the long term. The manufacturer, its subsidiaries and their partners are not responsible for any floor damages.
- **DO NOT** mount the rig in tight or cluttered spaces - remember that actuators set motion to the cockpit and nothing should restrict its motion range.
- Seat belts and any other harness should be mounted as part of a moving cockpit and move together with the seat. **DO NOT** attach them to any stationary part of the rig or ground.
- If you want to use the QS-220 in an unusual application and you are not sure, that the desired setup is attainable - contact the distributor/reseller.

### 3.2. CONNECTING QS-220 TO A COCKPIT

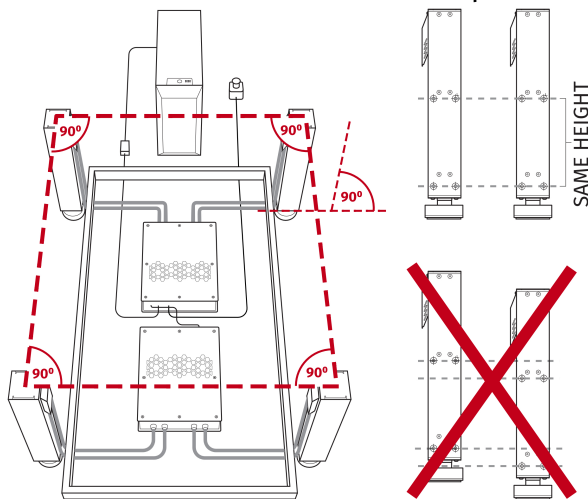
- Actuators **MUST BE** connected with the mounting brackets with 8 bolts (M8x20) each.
- Mounting brackets **MUST BE** connected with user's cockpit with 4 bolts (M8x16) each.
- Power Cabinet has to be mounted to cockpit using at least 4 bolts (M6x16) – we recommend mounting it in the middle of the motion rig. It is possible to mount Power Cabinets using the bottom or side mounting holes. Check section 3.2 on page 23 for details.

#### WARNING

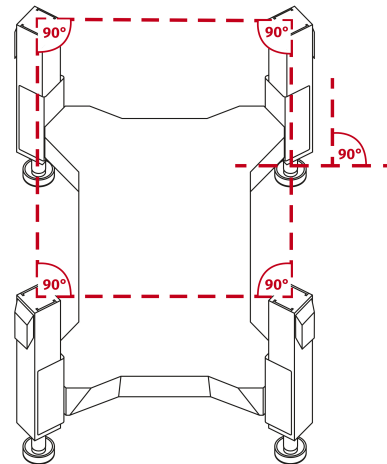
Ensure that the Power Cabinet will not collide with the floor in any position of the motion rig.

Illustrations below shows an example applications of assembled motion cockpits – notice that actuators have to be perpendicular to the ground:

VARIANT 1: Parallel actuators setup



VARIANT 2: Diagonal actuators setup



#### WARNING

All actuators **MUST** be mounted at the same height.

Ensure that the motion rig elements will not block air vents of the Power Cabinet. The minimum distance between the air vents and any part of the cockpit is 10 cm (4 in.).

#### INFO

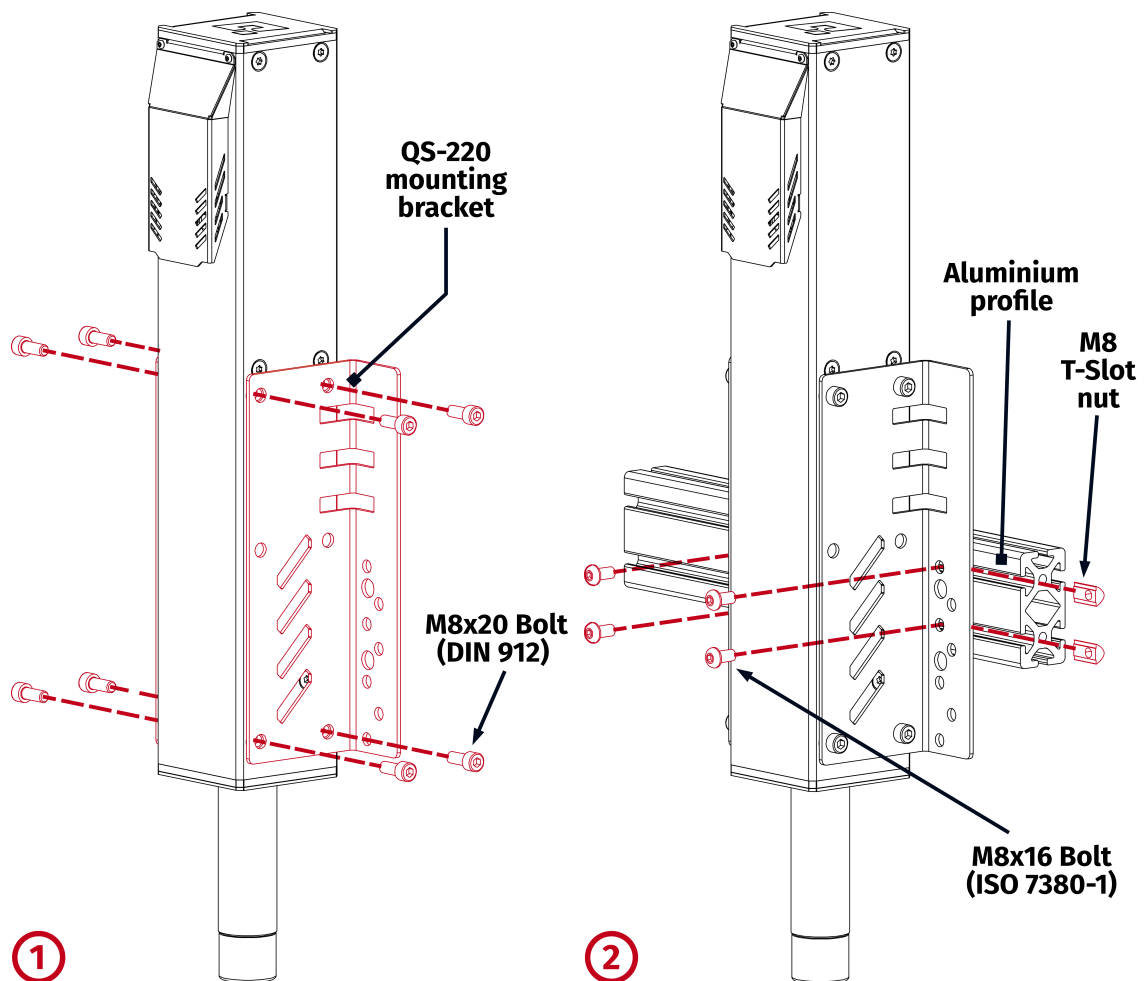
The manufacturer is not responsible for quality nor compatibility of the third-party motion rigs.

**INFO**

QS-220 adapter brackets for actuators are sold separately.

**To connect the QS-220 actuator to the aluminium based profile cockpit, following hardware is provided:**

No.	Part description	Qty.
1	Mounting bracket (2 pieces)	2
2	Bolt M8 x 16 (DIN 912)	8
3	T-Slot (profile 8) nut M8	4
4	Bolt M8x16 (ISO 7380-1)	4



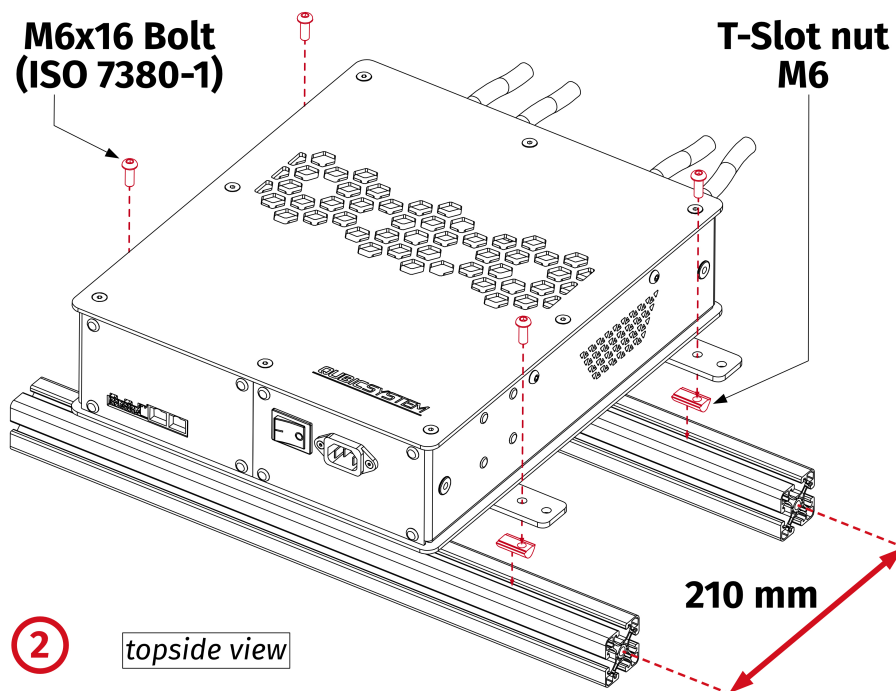
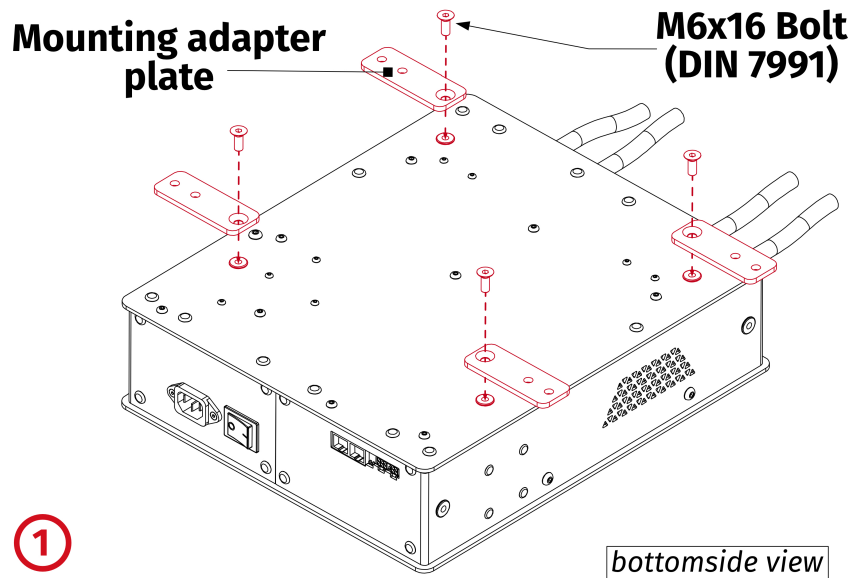
**WARNING**

- All included bolts **MUST** be used during assembly.
- Max torque specification for included bolts is 25 Nm.

To connect the Power Cabinet to the aluminium based profile cockpit, following hardware is provided:

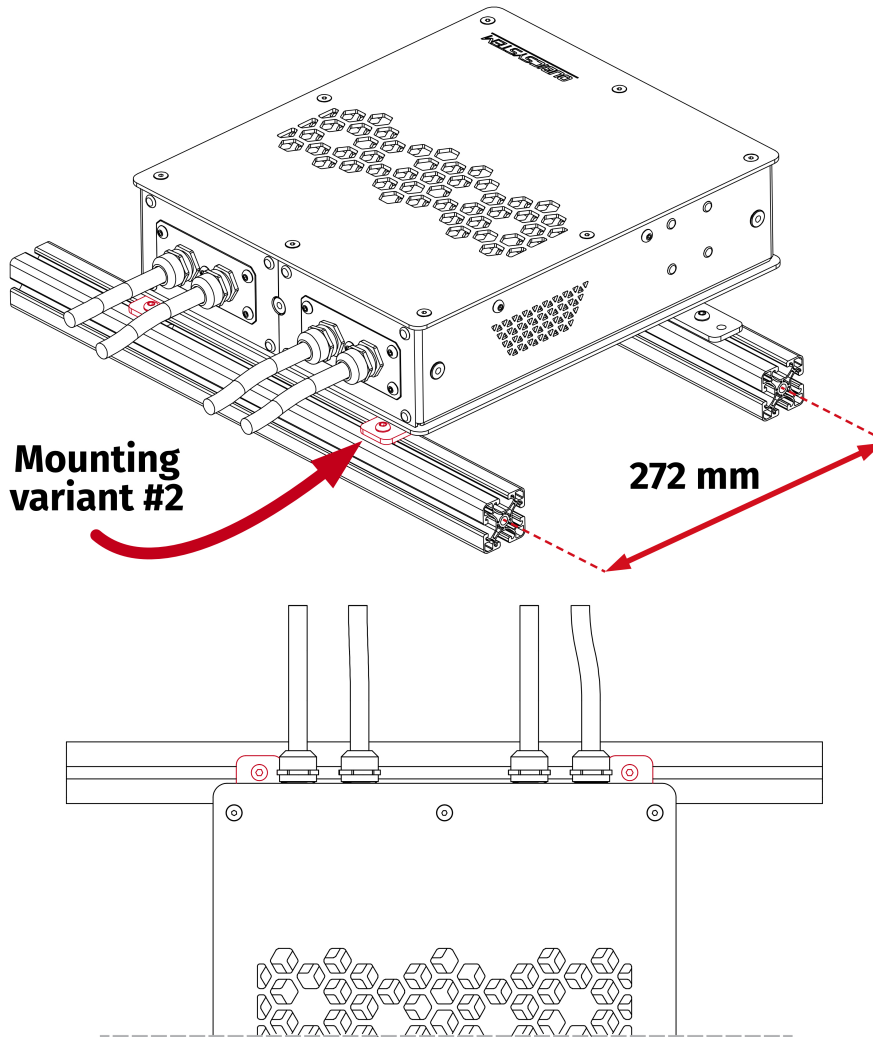
No.	Part description	Qty.
1	Adapter plate	4
2	Bolt M6x16 (DIN 7991)	4
3	T-Slot (Profile 8) nut M6	4
4	Bolt M6x16 (ISO 7380-1)	4

Illustrations of Power Cabinet mounting to an aluminium based profile (profile 8) cockpit (space between two profiles must be **210 mm**):



### Mounting variant no. 2

There is an alternative way of mounting the QS-220's Power Cabinet. Use the outer holes in the adapter plates to mount the Power Cabinet to a profile that is further away (**272 mm** between the two profiles).



#### INFO

You can mount the Power Cabinet differently to fit your cockpit using bottom or side mounting holes. Go to section 2.3 on page 15 for dimensions information.

#### WARNING



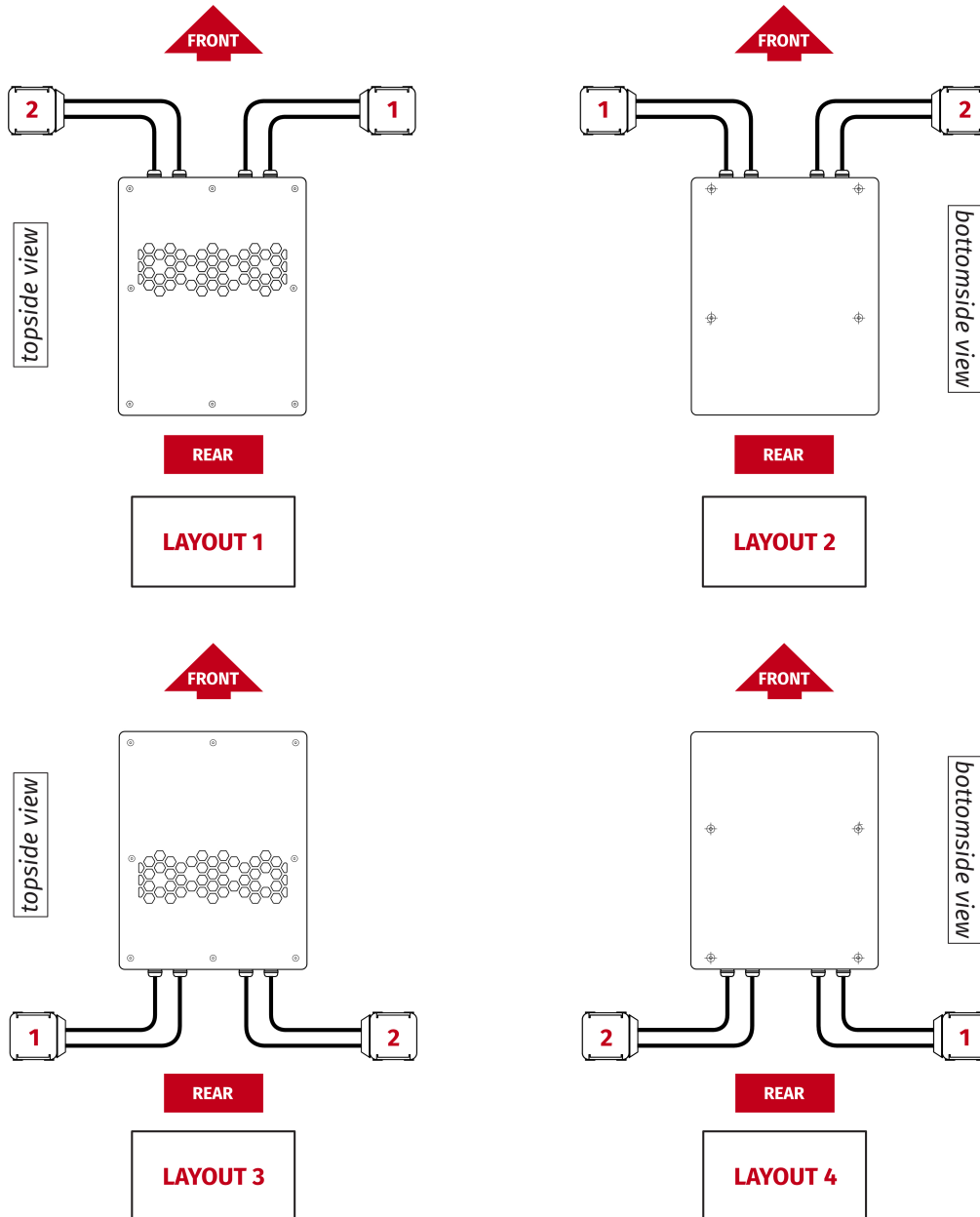
Remember to arrange the cables correctly. They **MUST NOT** be stretched and should be arranged in a way that prevents them from getting under the actuator or any part that can crush or tear them.



---

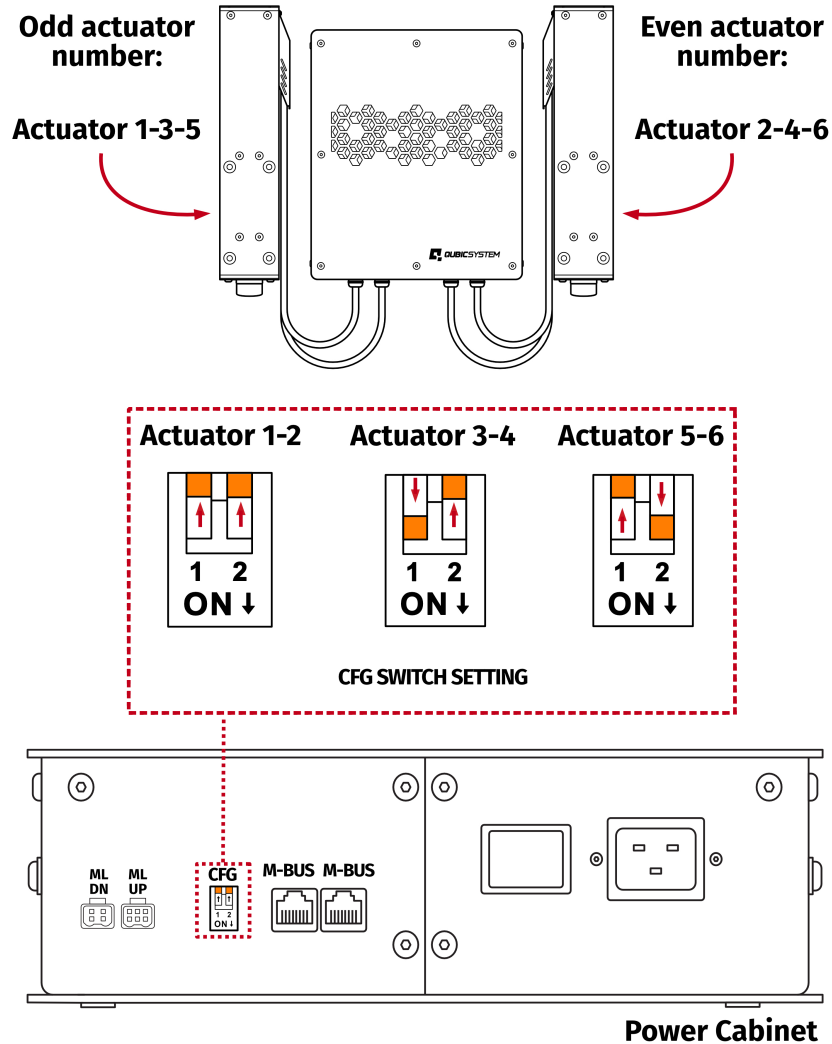
### 3.3. QS-220 2DOF LAYOUTS

Number of the actuator is defined by the CFG DIP switch on the Power Cabinet.  
For more information go to **3.4** on page **26**.



### 3.4. QS-220 2DOF CFG DIP SWITCH CONFIGURATION

The CFG DIP switch **MUST BE** set to an appropriate position. It specifies the actuator pair number (1-2, 3-4, 5-6, etc.). Refer to layouts (section 3.3 on page 25) for 2DoF actuator numbers in a specific settings and set the CFG DIP switches accordingly.

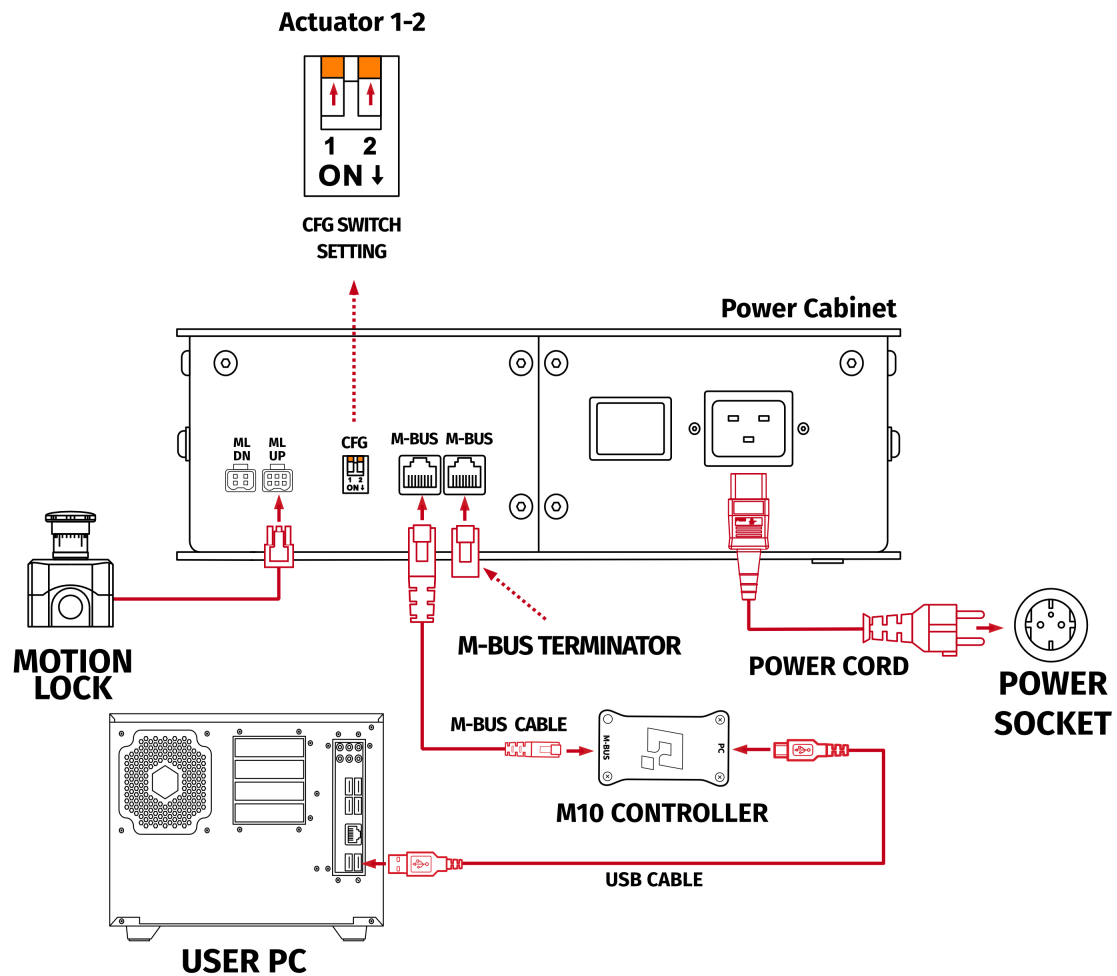


#### WARNING

- When changing CFG DIP switch setting the main power must be **SWITCHED OFF**.
- When changing the CFG DIP switch setting **FIRMLY SET THE SWITCH** into lower or upper position. Do not leave it in the floating position (neither up or down position), otherwise the device will not work.

### 3.5. QS-220 2DOF CABLE CONNECTIONS

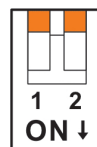
To connect the QS-220 2DoF variant proceed with following steps and connect the cables according to the connections diagram:



#### INFO

- In the QS-220 2DoF set both the CFG DIP switches in the UP position.

Actuator 1 - 2



**INFO**

The order of connecting the cables to Power Cabinet is not important. But ensure keeping the CFG DIP switches set according to appropriate layout. Check section **3.4** on page **26** for layout setup information.

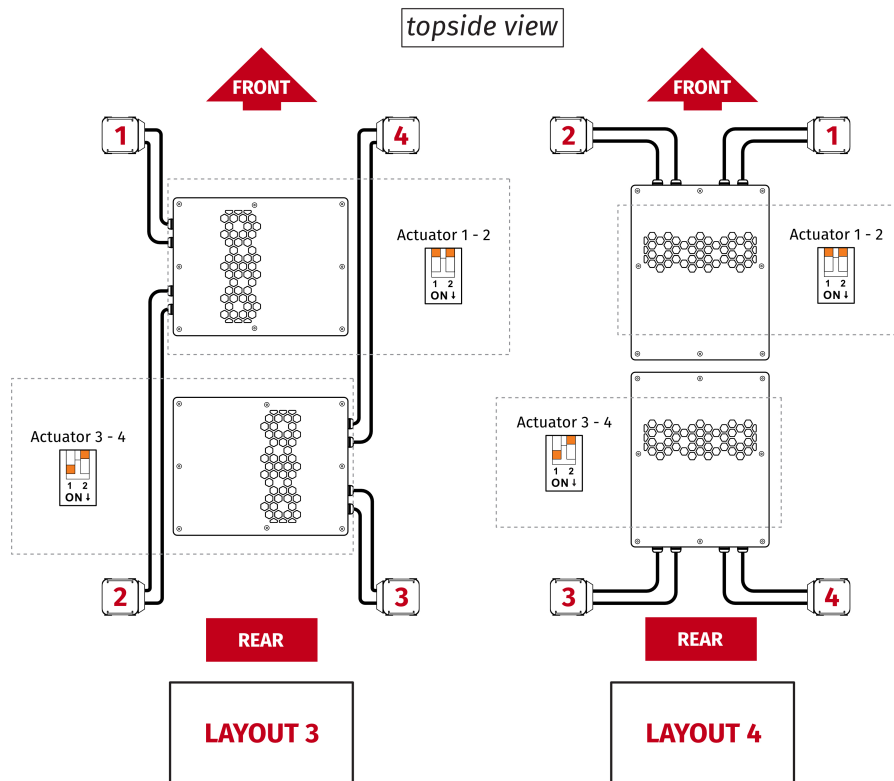
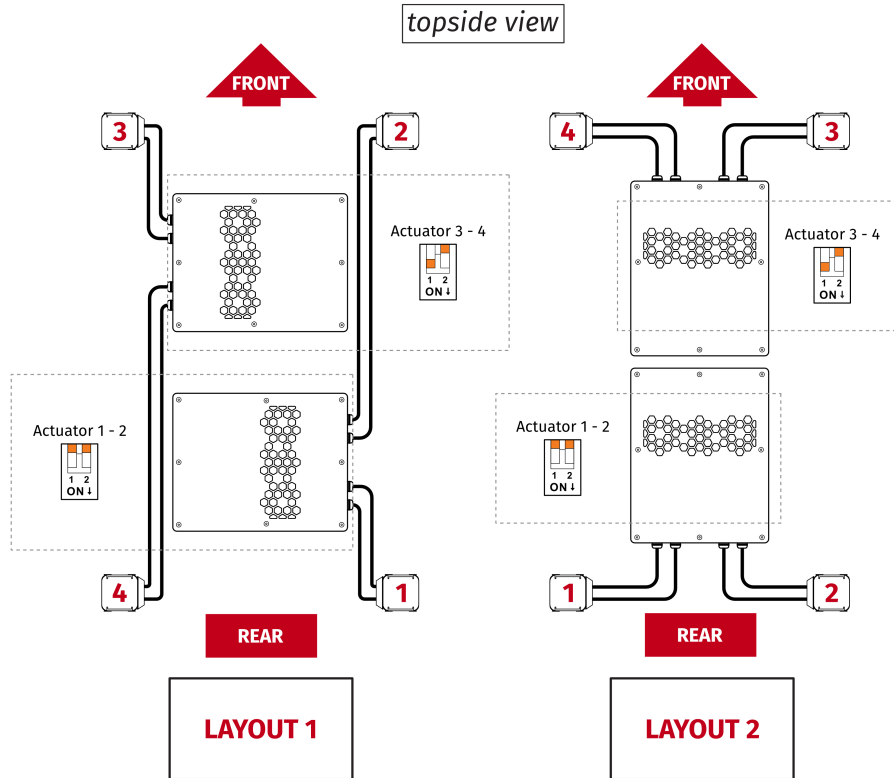
1. Set the correct position of the CFG DIP switch according to the actuators layout of your choice (more information about QS-220 2DoF CFG Switch position and layout selection in section **3.4** on page **26**).
2. Plug in the Motion Lock Switch into the "ML UP" port in the Power Cabinet.
3. In a 2DoF variant (and if you don't have any other QubicSystems devices) Motion Lock "ML DN" is not used.
4. Connect M-BUS port in Power Cabinet with M-BUS port in M10 Controller using M-BUS communication cable (Power Cabinet M-BUS ports are interchangeable).
5. Insert M-BUS terminator in the second M-BUS port in the Power Cabinet (if you have any other QubicSystems devices [Power Cabinets], M-BUS terminator will be used in the last Power Cabinet - for more information refer to section **3.9** on page **34**).
6. Connect the M10 controller with your PC using USB cable.
7. Plug in the power cord to the Power Cabinet and a correct power socket.
8. Make sure everything is connected correctly (check if the CFG DIP switches are switched all the way up or down).
9. Turn on the power by switching the Power Cabinet power switch on.
10. For the QS-220 2DoF (or any QubicSystem device) to work - QubicManager Software must be set up correctly. Go to section **3.11** on page **39** for installation details.
11. After software installation go to **QubicManager** → **Tools and Diagnostics** → **Devices** and select **Configure** (details in section **10.** on page **41**).

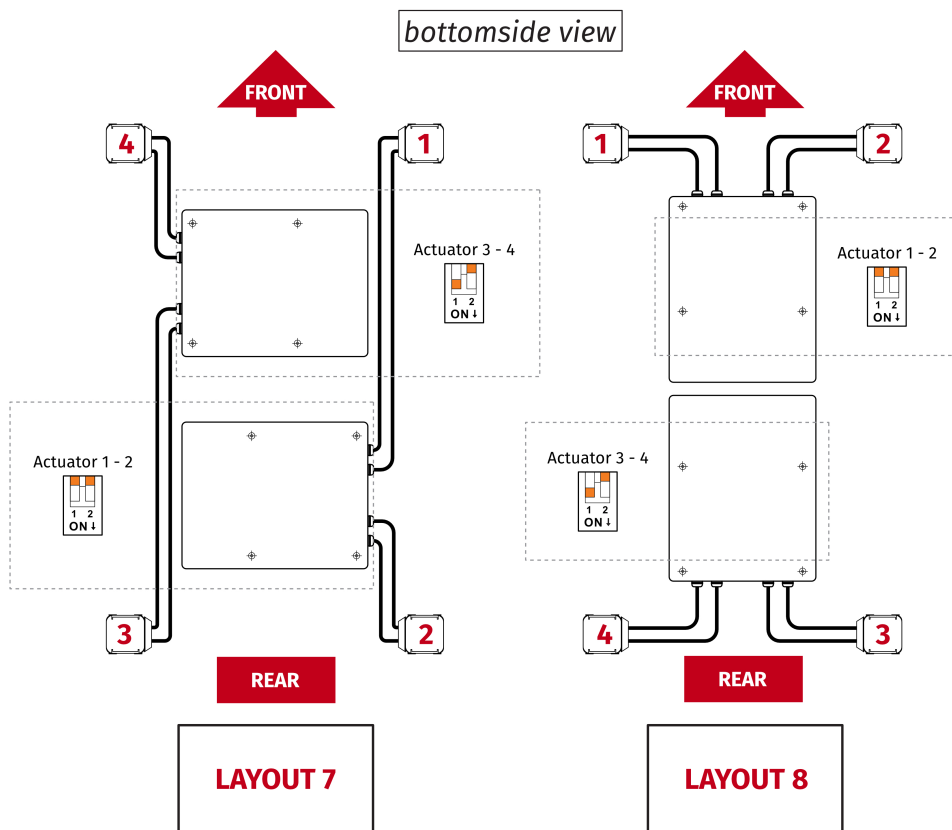
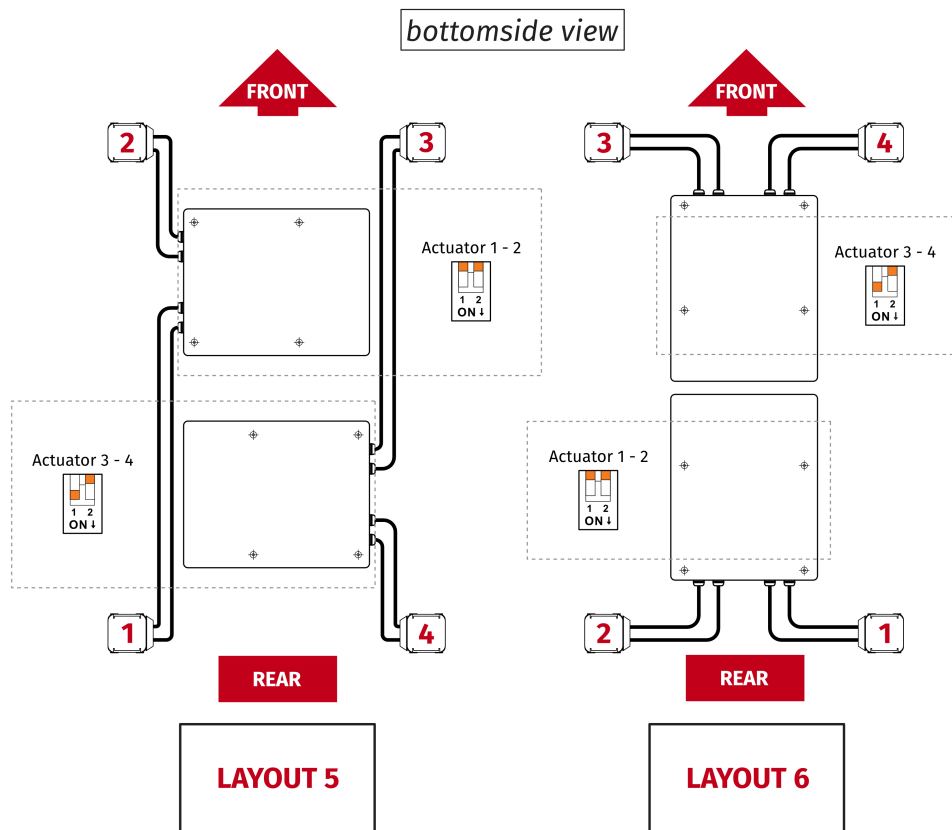
**INFO**

In case of any motion platform operation problem - go through all the points above to check for connection errors. After that refer to section **5** on page **48**.

### 3.6. QS-220 3DOF LAYOUTS

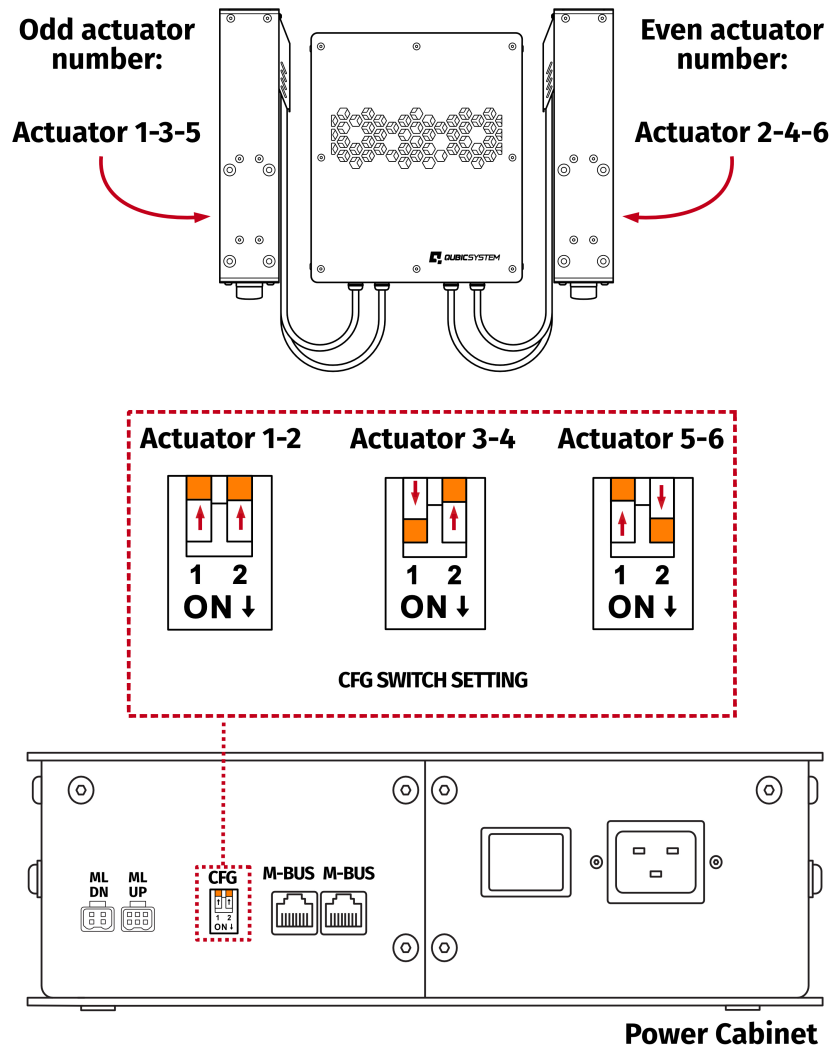
Number of the actuator is defined by the CFG DIP switch on the Power Cabinet. For more information go to 3.7 on page 31.





### 3.7. QS-220 3DOF CFG DIP SWITCH CONFIGURATION

The CFG DIP switch **MUST BE** set to an appropriate position. It specifies the actuator pair number (1-2, 3-4, 5-6, etc.). Refer to layouts (section 3.6 on page 29) for actuator numbers in a specific settings and set the CFG DIP switches accordingly.

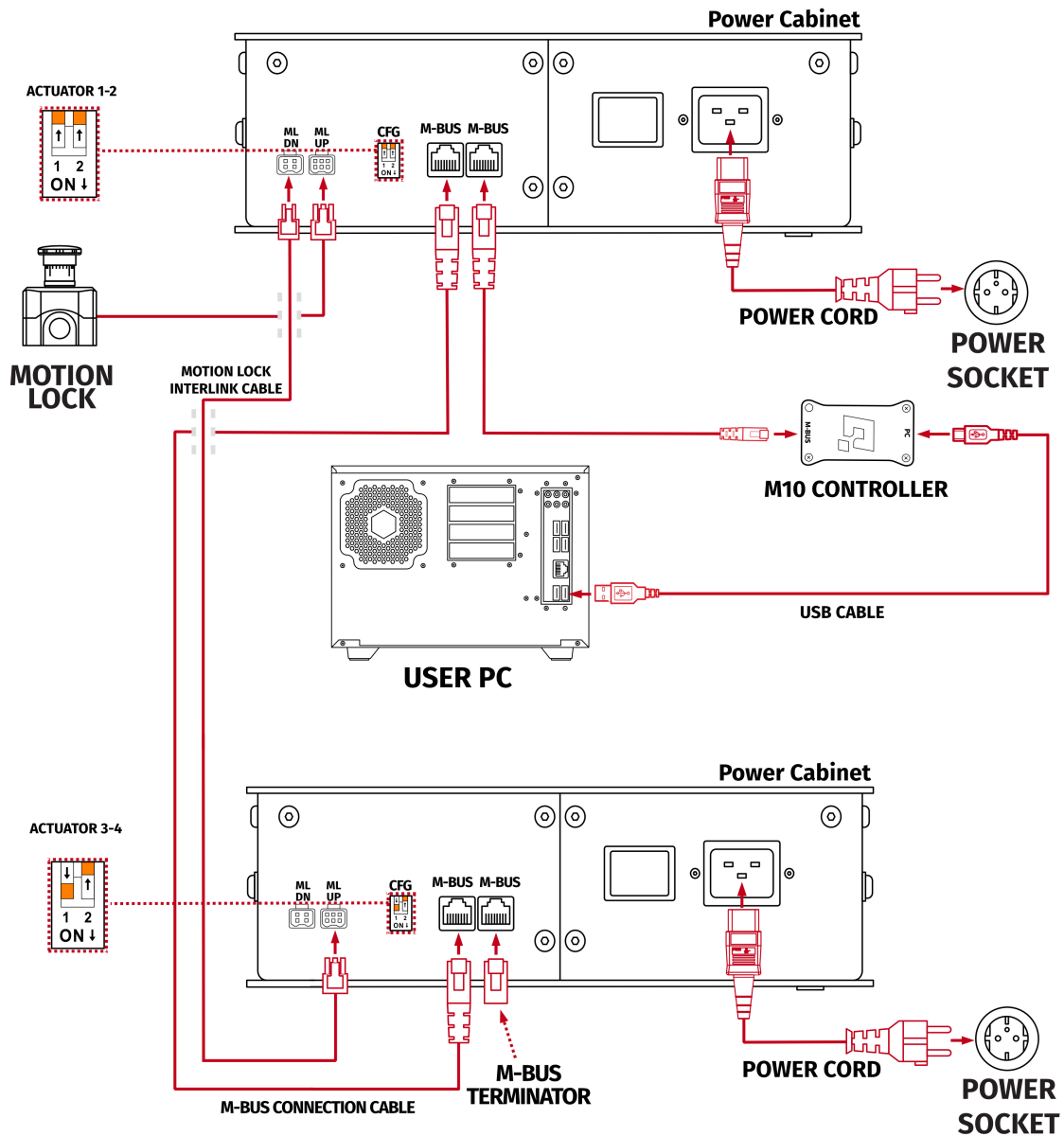


#### WARNING

- The CFG DIP switch **CAN NOT** be set in the same position in both (or more) Power Cabinets.
- When changing CFG DIP switch setting the main power must be **SWITCHED OFF**.
- When changing the CFG DIP switch setting **FIRMLY SET THE SWITCH** into lower or upper position. Do not leave the switch in the floating position (neither up or down position), otherwise the device will not work.

### 3.8. QS-220 3DOF CABLE CONNECTIONS

To connect the QS-220 3DoF variant proceed with following steps and connect the cables according to the connections diagram:



#### INFO

Motion Lock can be plugged into any Power Cabinet in the circuit but in order to create a working safety-stop system - **ALL** Power Cabinets in circuit must be connected together with Motion Lock interlink cables (for Motion Lock connection diagrams go to section 3.10 on page 36).



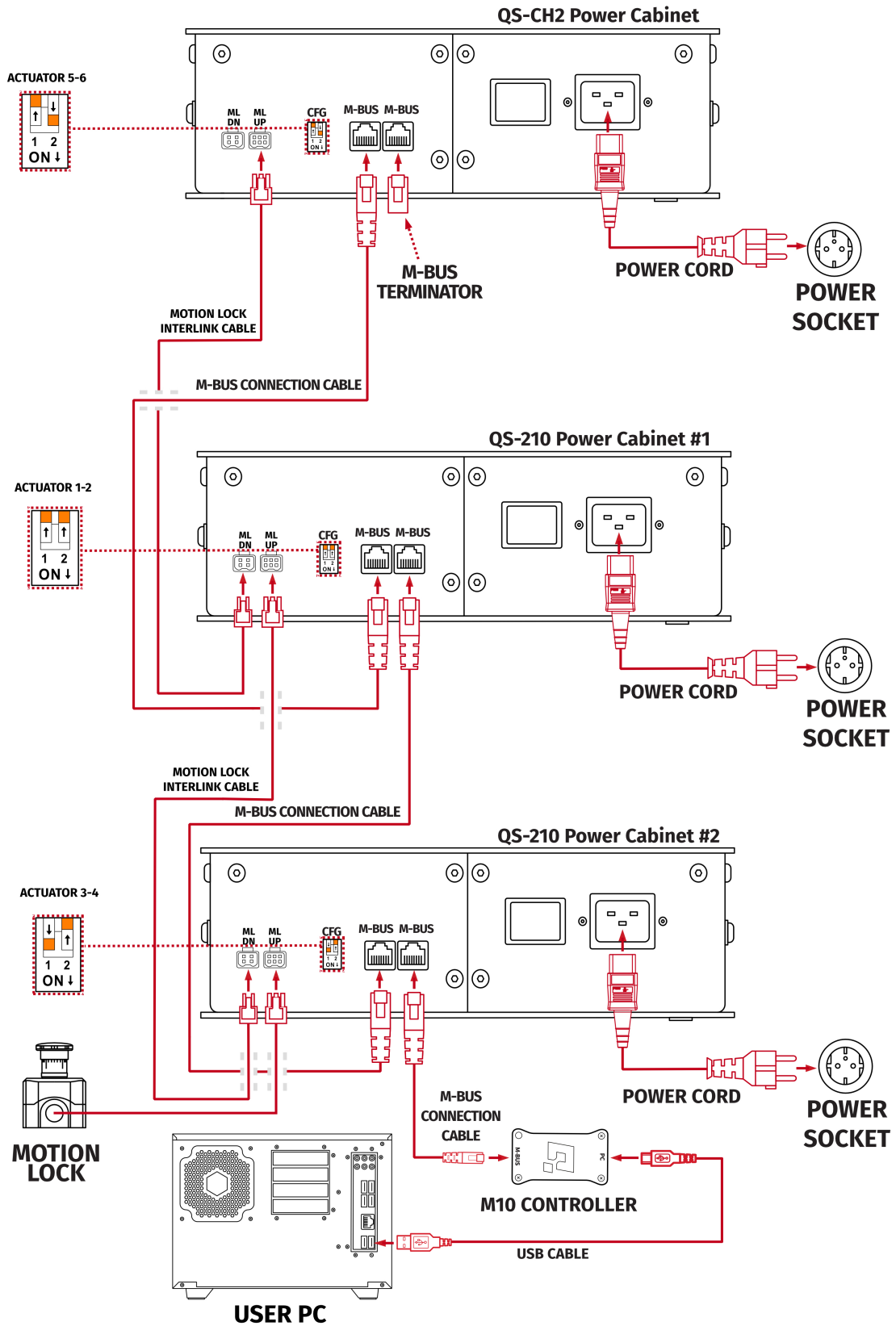
- 
1. Set the correct position of the CFG DIP switches according to the actuators layout of your choice (more information about QS-220 3DoF CFG DIP switch position and layout selection in section **3.7** on page **31**).
  2. Plug in the Motion Lock Switch into the "ML UP" port in the first Power Cabinet.
  3. Connect first and second Power Cabinet with a Motion Lock interlink cable ("ML UP" port requires a 6 pin plug and "ML DN" port requires a 4 pin plug).
  4. If you have more than two Qubic System devices (Power Cabinets), refer to section **3.9** on page **34** for more cable connection information.
  5. Connect M-BUS port in Power Cabinet with M-BUS port in M10 Controller using M-BUS communication cable (Power Cabinet M-BUS ports are interchangeable).
  6. Connect both Power Cabinet's M-BUS ports with M-BUS cables.
  7. Insert M-BUS terminator in the second M-BUS port in the second Power Cabinet (if you have any other QubicSystems devices [Power Cabinets], M-BUS terminator will be used in the last Power Cabinet - for more information refer to section **3.9** on page **34**).
  8. Connect the M10 controller with your PC using USB cable.
  9. Plug in the power cords to both Power Cabinets and a correct power sockets (separately fused, as suggested in section **2.4** on page **17**).
  10. Make sure everything is connected correctly (check if the CFG DIP switches are switched all the way up or down).
  11. Turn on the power by switching both Power Cabinet's power switches on.
  12. For the QS-220 3DoF (or any QubicSystem device) to work - QubicManager Software must be set up correctly. Go to section **3.11** on page **39** for installation details.
  13. After software installation go to **QubicManager** → **Tools and Diagnostics** → **Devices** and select **Configure** (details in section **10.** on page **41**).

#### INFO

- In case of any motion platform operation problem - go through all the points above to check for connection errors. After that refer to section **5** on page **48**.
- The order of connecting the cables to Power Cabinets is not important, you can connect the M10 controller or Motion Lock Switch to either of the Power Cabinets. But ensure keeping the CFG DIP switches set according to appropriate layout. Check section **3.6** on page **29** for layout setup information.

### 3.9. QS-220 WITH QS-CH2 CABLE CONNECTIONS

Example of QS-220 3DoF connecting with a traction loss system (QS-CH2).



- 
1. Set the correct position of the CFG DIP switches according to the actuators layout of your choice (more information about QS-220 3DoF CFG DIP switch position and layout selection in section **3.7** on page **31**).
  2. Set the correct position of the QS-CH2 CFG DIP switch, according to a diagram from a previous page.
  3. Plug in the Motion Lock Switch into the "ML UP" port in the first of QS-220's Power Cabinet.
  4. Connect all Power Cabinets with a Motion Lock interlink cables ("ML UP" port requires a 6 pin plug and "ML DN" port requires a 4 pin plug).
  5. "ML DN" port in the last Power Cabinet will not be used.
  6. Connect M-BUS port in Power Cabinet with M-BUS port in M10 Controller using M-BUS communication cable (Power Cabinet M-BUS ports are interchangeable).
  7. Connect all Power Cabinet's M-BUS ports with M-BUS cables in a row.
  8. Insert M-BUS terminator in the last M-BUS port in the last Power Cabinet.
  9. Maximum amount of interconnected Power Cabinets is 12.
  10. Connect the M10 controller with your PC using USB cable.
  11. Plug in the power cords to all the Power Cabinets and a correct power sockets (separately fused, as suggested in section **2.4** on page **17**).
  12. Make sure everything is connected correctly (check if the CFG DIP switches are switched all the way up or down).
  13. Turn on the power by switching all the Power Cabinet's power switches on.
  14. For the QS-220 3DoF + QS-CH2 setup (or any QubicSystem devices) to work - QubicManager Software must be set up correctly. Go to section **3.11** on page **39** for installation details.
  15. After software installation go to **QubicManager** → **Tools and Diagnostics** → **Devices** and select **Configure** (details in section **10.** on page **41**).

#### INFO

- Order of connecting the cables is not important, you can connect the M10 controller or Motion Lock Switch to either of the Power Cabinet. Keep the CFG DIP switches according to appropriate layout - check section **3.7** on page **31**
- When connecting QS-CH2 to other Qubic System devices which uses two Power Cabinets the CFG DIP switch on the QS-CH2 must be set to actuator 5-6 position - check section **3.9** on page **34**.

### 3.10. QS-220 WITH QS-CH2, QS-BT1 AND QS-DD-20 MOTION LOCK DIAGRAMS

Neither QS-DD-20 nor QS-BT1 need a M-BUS connection with any Power Cabinet. They communicate via USB cable directly with the PC.

#### INFO

For more information on cable connections with other Qubic System devices go to [QS-BT1 User Manual](#) (section 5.6. on page 24).

#### WARNING

1. All Motion Lock connections must be performed with **power switched OFF**.
2. Motion Lock interlink cables have different ML/UP (6 pin) and ML/DN (4 pin) plugs on each side.

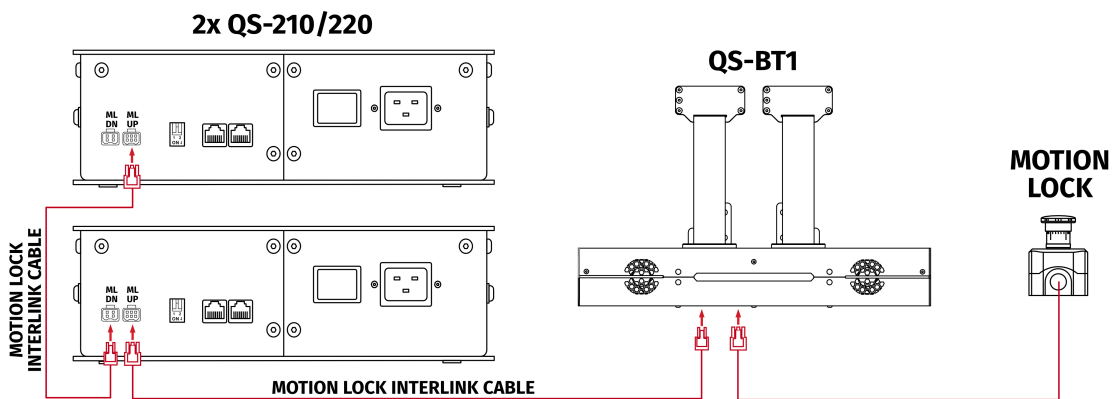
#### INFO

- We recommend including QS-220 in the Motion Lock circuit, if you are running other QS-series devices. Refer to diagrams below.
- Motion Lock can be plugged into any Power Cabinet in circuit but in order to create a working safety-stop system - **ALL** Power Cabinets in circuit must be connected together with Motion Lock interlink cables.

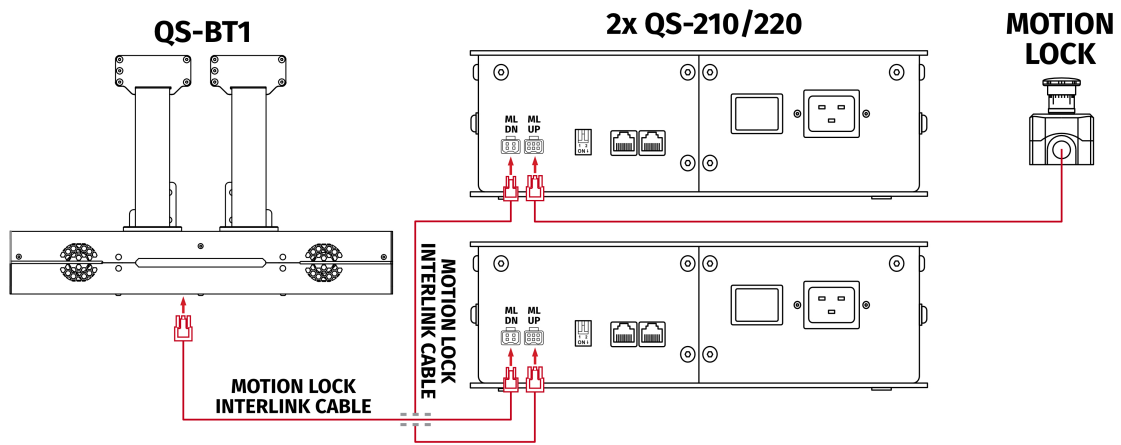
Diagrams below show Motion Lock connections with QS-220 and QS-DD-20, QS-BT1 and two of them combined in various variants.

1. QS-220 3DoF with a seat belt tensioner (**QS-BT1**).

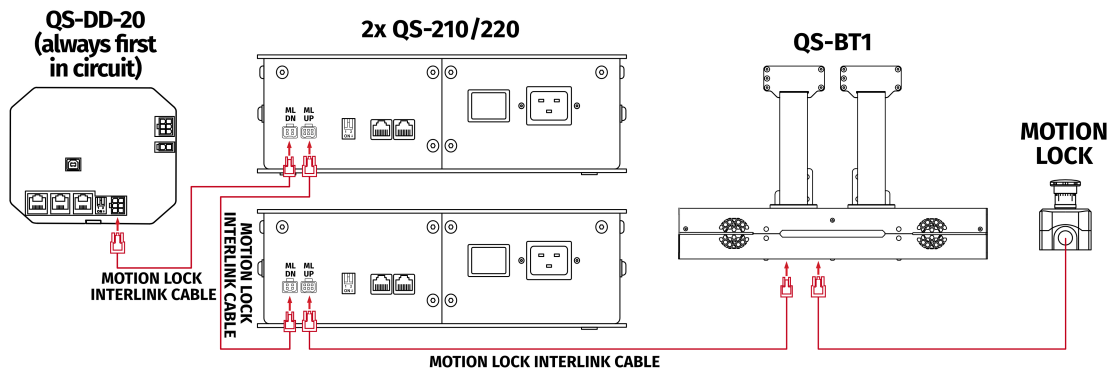
#### Variant #1



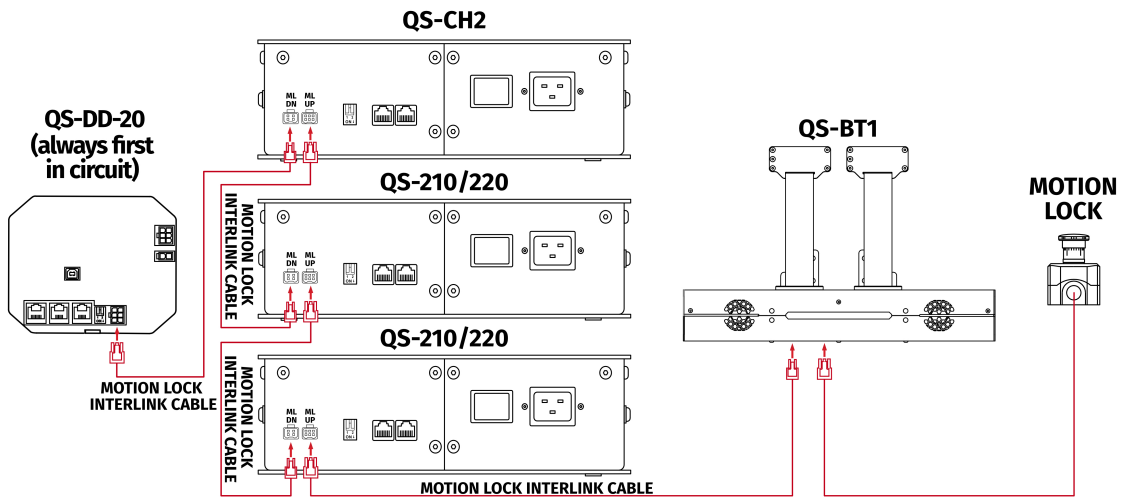
## Variant #2



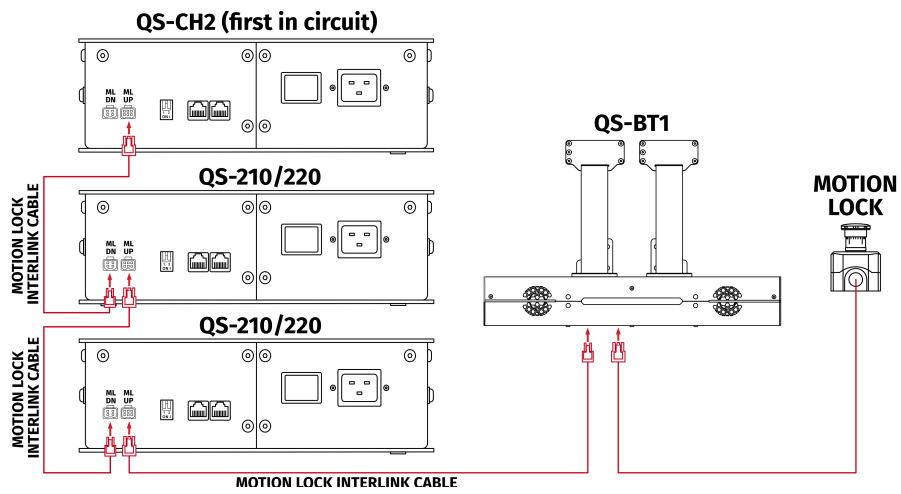
2. QS-220 3DoF with a seat belt tensioner (QS-BT1) and a direct drive steering wheel (QS-DD-20).



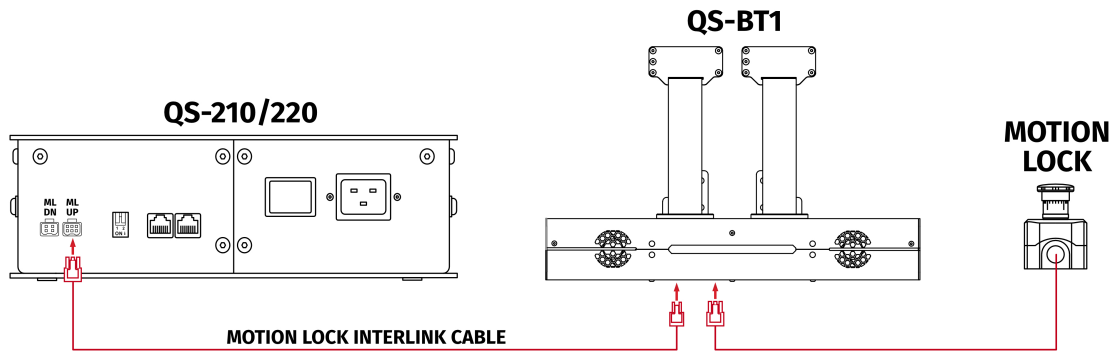
3. QS-220 3DoF with a motion platform (QS-CH2), seat belt tensioner (QS-BT1) and a direct drive steering wheel (QS-DD-20).



4. QS-220 3DoF with a motion platform (QS-CH2) and seat belt tensioner (QS-BT1).



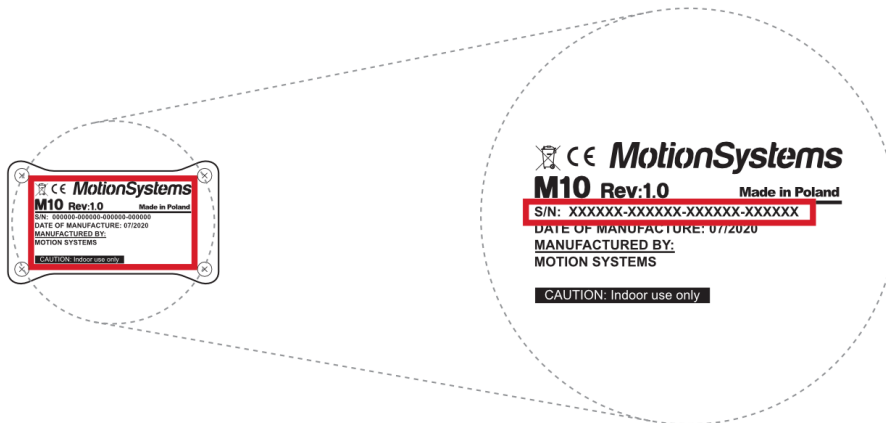
5. QS-220 2DoF with a seat belt tensioner (QS-BT1).



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### 3.11. SOFTWARE INSTALLATION

The **SERIAL NUMBER** can be found on the M10 identification label in the **XXXXXX-XXXXXX-XXXXXX** format. This serial number is also used for activation of FSMI (ForceSeatMI) and MT (Motion Theater) licenses - check information in section 3.11 on page 46.



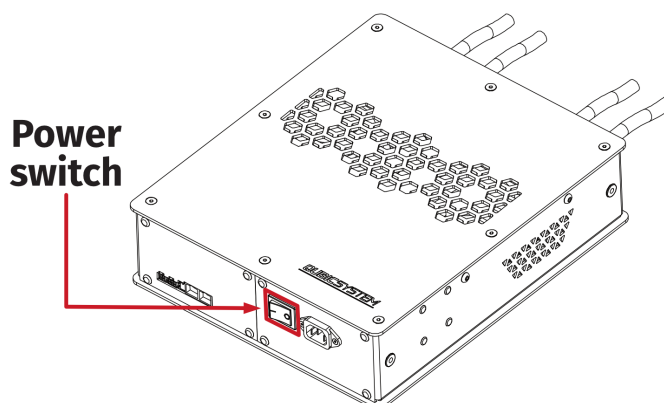
#### Software installation procedure:

1. Connect the devices according to the cables connection diagram - see section 3.5 for QS-220 2DoF (p. 27), section 3.8 for QS-220 3DoF (p. 32) or section 3.9 for QS-220 3DoF + QS-CH2 (p. 3.9).
2. Download QubicManager from [QubicSystem.com/Download](https://www.qubic-system.com/download)
3. Enter the serial number located on the identification label.

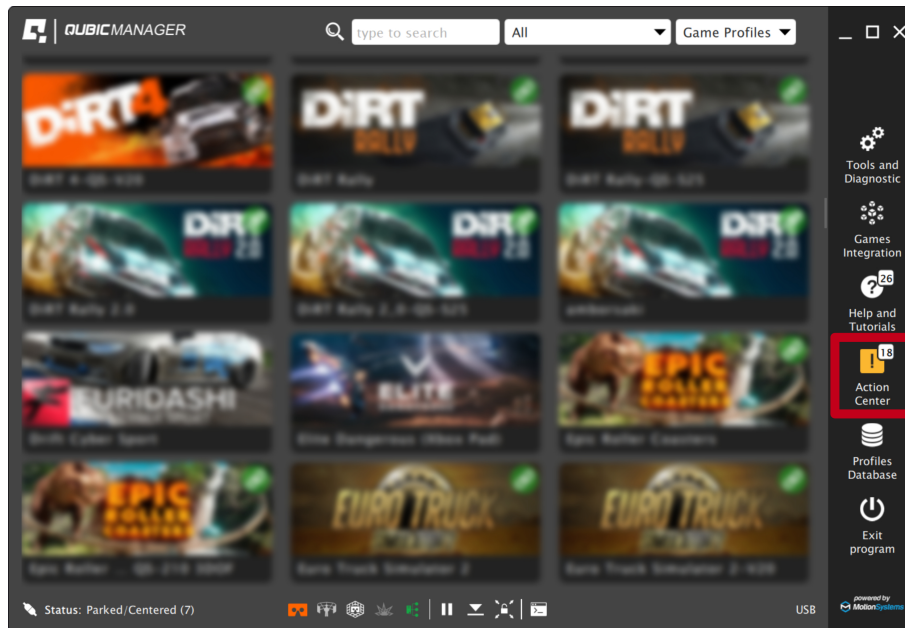
#### INFO

Alternatively, you can download a small application that will read the code directly from your device (if it is connected via USB): [Download link](#)

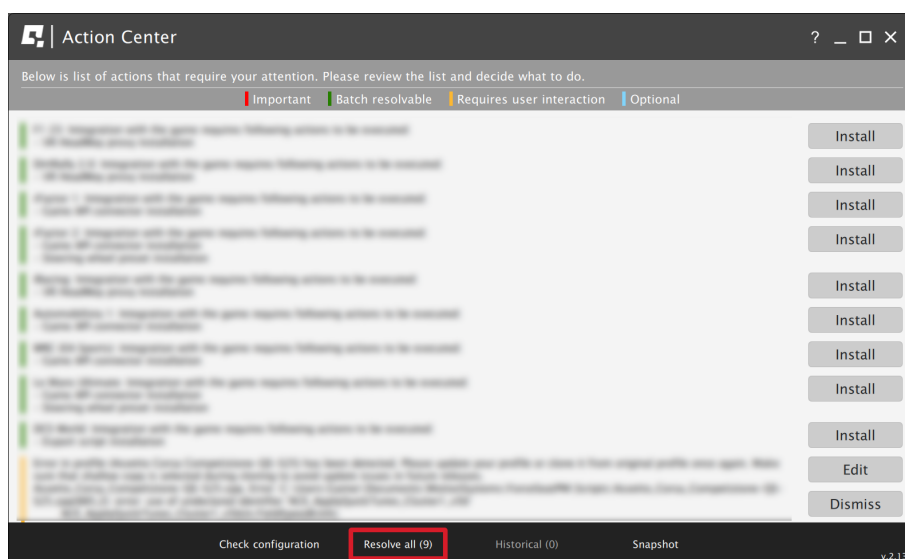
4. Proceed with the installation steps and launch the application.
5. Turn on the device by switching on the power switch button on the Power Cabinet (on all of them, if you have more than one)



6. Check position of the Motion Lock Switch - unpress if needed (go to sub-section 5 on page 48 for a reference illustration).
7. The QS-220 will perform a start-up calibration - **DO NOT** change the payload of the QS-220 until the procedure is over.
8. If QubicManager has recognized the QS-220 correctly, the status of the machine visible in the lower left corner will change to **Connected**.
9. Check **Action Center** on the right side panel for a list of actions that requires attention:



It is possible to solve them one by one or by pressing the **Resolve All** button. Firmware update may require additional confirmation in the dialogue box.





10. Go to **Tools and Diagnostics** → **Devices** and select **Configure**.

Below are all recognized devices including motion platforms and accessories.

<b>Device #1:</b> OS-4xx				<b>Configure</b>
Serial number:	XXXXXX-XXXXXX-XXXX-XXXXXX	<a href="#">(copy to clipboard)</a>		
Status:	OK			<b>Levelling</b>
Firmware:	141.16	Temperature (C):	N/A	
Work time:	1h 05m 17s	Up time:	0h 21m 02s	
Paused:	no	Parking:	finished (normal)	<b>Quick Codes</b>
		Hardware ID:	54	
		Features:	default	
		Offline:	no	
<b>Device #1.1:</b> HVFMC100				
Serial number:	XXXXXX-XXXXXX-XXXXXX-XXXXXX	<a href="#">(copy to clipboard)</a>		
Status:	OK (33)			
Firmware:	144.30	Temperature (C):	24, 31	
Work time:	-	Up time:	0h 20m 29s	
		Hardware ID:	58	
		Features:	default	
<b>Device #1.2:</b> HVFMC100				
Serial number:	XXXXXX-XXXXXX-XXXXXX-XXXXXX	<a href="#">(copy to clipboard)</a>		
Status:	OK (33)			
Firmware:	144.30	Temperature (C):	24, 31	
Work time:	-	Up time:	0h 20m 29s	
		Hardware ID:	58	
		Features:	default	

11. For **QS-220 2DoF set**: Choose the correct layout variant from the list (2 actuators setup).

Hardware Configuration

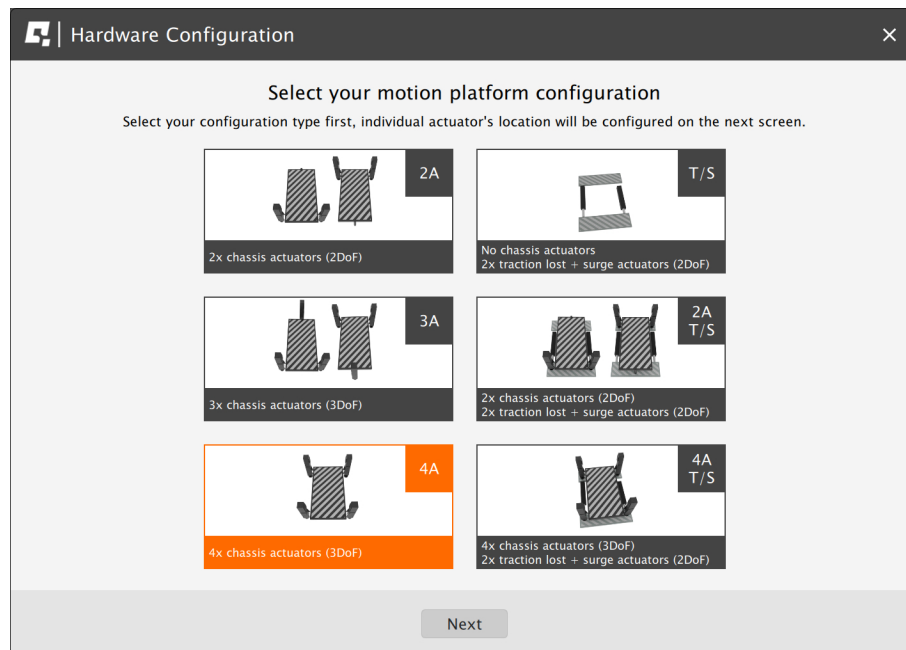
Select your motion platform configuration

Select your configuration type first, individual actuator's location will be configured on the next screen.

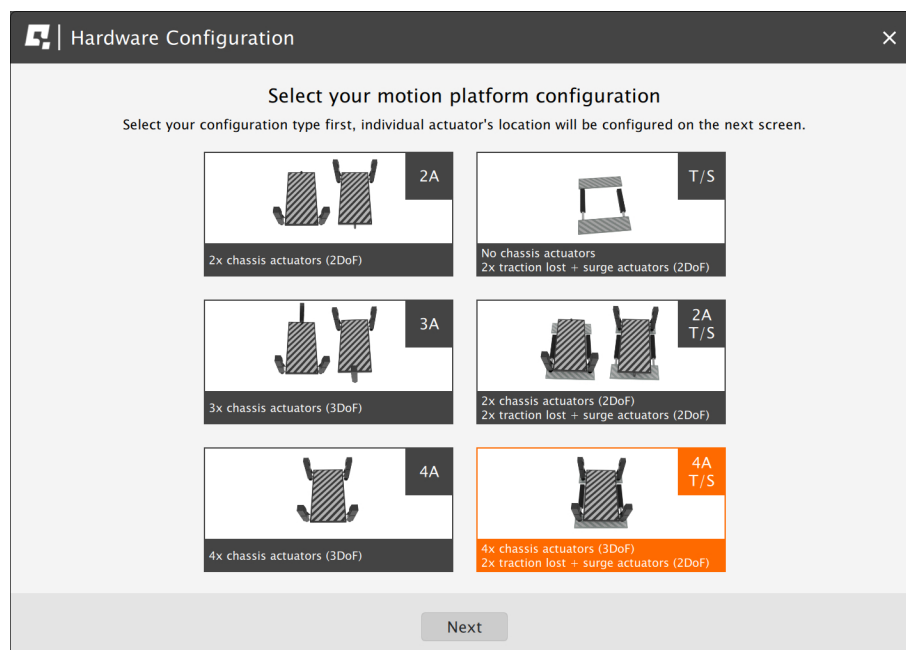
 2A 2x chassis actuators (2DoF)	 T/S No chassis actuators 2x traction lost + surge actuators (2DoF)
 3A 3x chassis actuators (3DoF)	 2A T/S 2x chassis actuators (2DoF) 2x traction lost + surge actuators (2DoF)
 4A 4x chassis actuators (3DoF)	 4A T/S 4x chassis actuators (3DoF) 2x traction lost + surge actuators (2DoF)

Next

**For QS-220 3DoF set:** Choose the correct layout variant from the list (4 actuators setup).



**For QS-220 3DoF set with traction loss control (QS-CH2):** Choose the correct layout variant from the list (4A+T setup).



12. Measure the width between front side actuators. Enter the value in the platform dimensions **Width** field (in millimeters).
13. Measure the length between front and rear side actuators. Enter the value in the platform dimensions **Length** field (in millimeters).

**Hardware Configuration**

**Platform dimensions**

Actuators geometry is based on rectangle shape. To make everything work properly you need to specify width and length of that rectangle. Only valid values guarantee that system is stable and math calculations are correct.

Width [mm]:  T-Pivot [mm]: 799

Length [mm]:  T-Width [mm]: 796

Stroke [mm]: 60 T-Min [mm]: 838

T-Stroke [mm]: 100

Since different models of traction units are available, to make sure your geometry is configured correctly, select your model from the list below to upload its configuration.

Configure for: (select) ▼

If the position of the actuators in the cockpit is different from that shown in the figure on the right, choose a different layout. Not all combinations are supported. If you do not find a layout that matches your settings, you will have to change the position of the actuators in the cockpit.

Layout: Layout 6 ▼

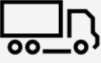

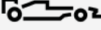
NOTE: If you are not sure what are your actuators indexes, use

OK

14. Scroll down and choose one of the operation modes:

**Operation Mode**

Operation modes let you flexibly adapt the system configuration to varying requirements, maximizing the use of available system resources. You can define one of the operation mode to increase your device performance.

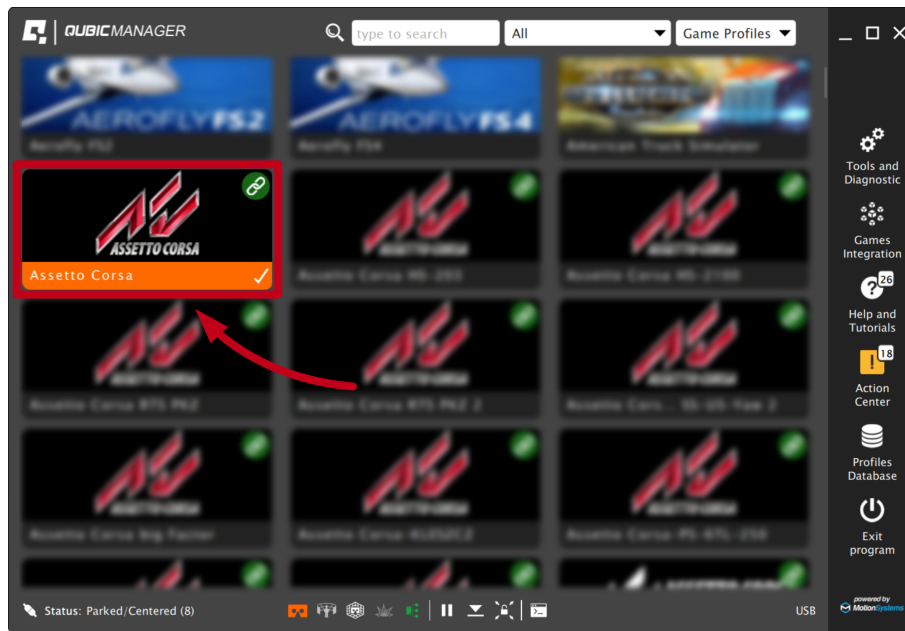
 <b>Heavy-Duty</b> Moderate acceleration Moderate speed Increased payload 115/230 VAC <input type="radio"/>	 <b>Performance</b> Increased acceleration Increased speed Moderate payload 115/230 VAC <input checked="" type="radio"/>	 <b>Q-MODE</b> Maximum acceleration Maximum speed Reduced payload only 230 VAC <input type="radio"/>
--	---	---

OK

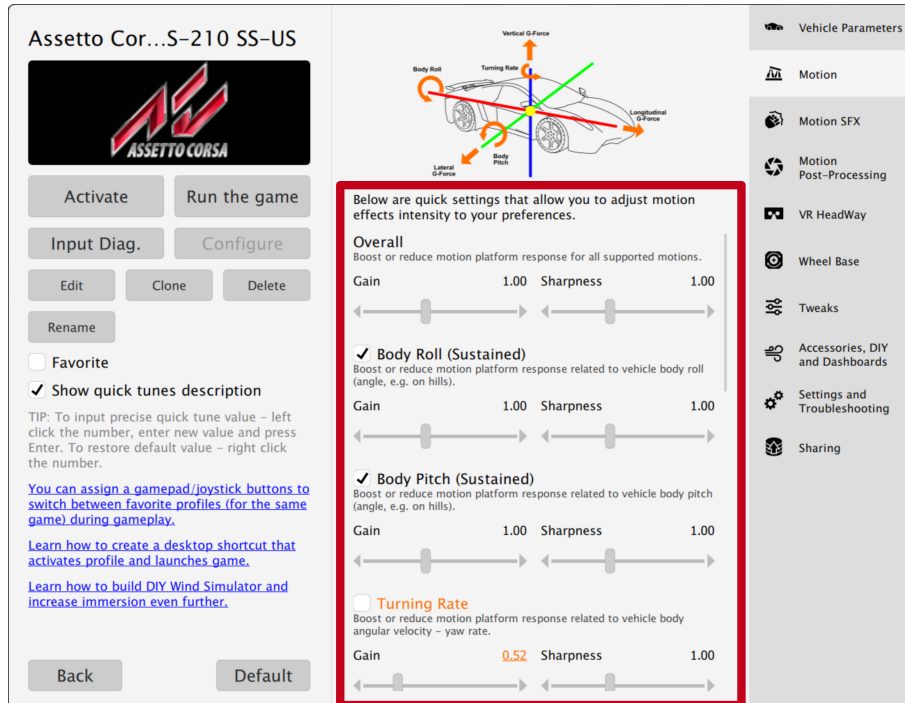
**INFO**

Q-MODE is unavailable for QS-220 in 120 VAC environment.

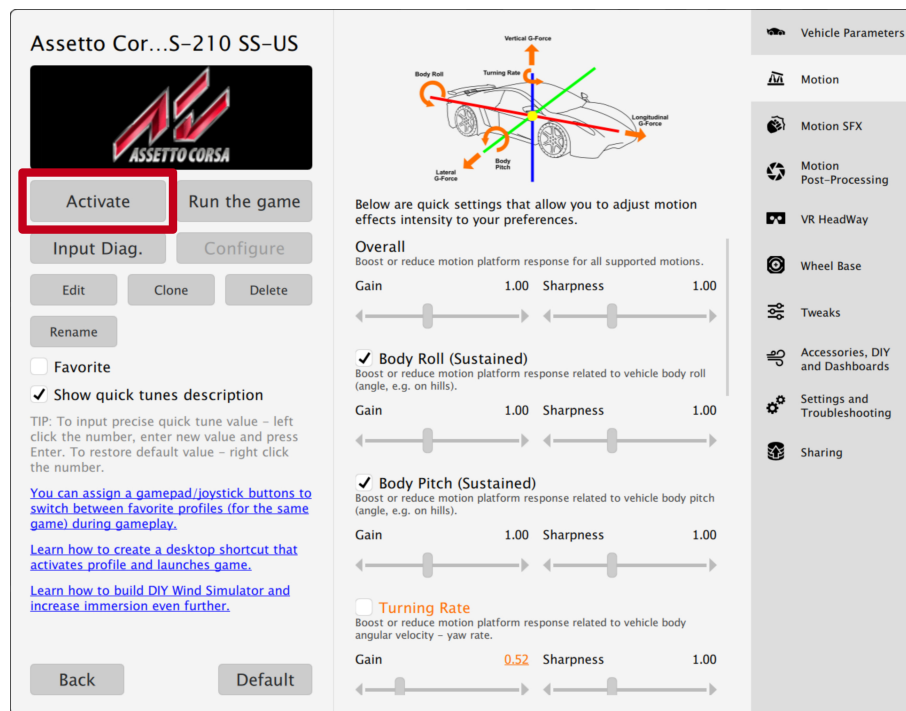
15. Close the configuration and return to the main application window. Choose the game and check profile details by clicking on the game tile.



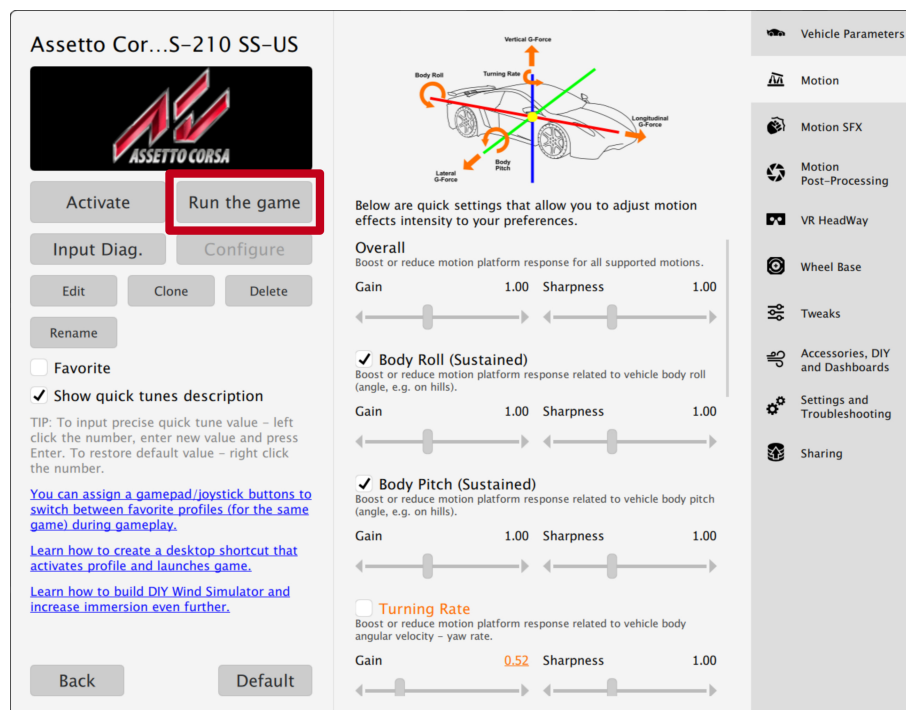
16. Adjust the motion effects intensity up to your preferences in the game profile window. Scroll down to see all of the settings.



17. Activate a profile by clicking the **Activate** button.



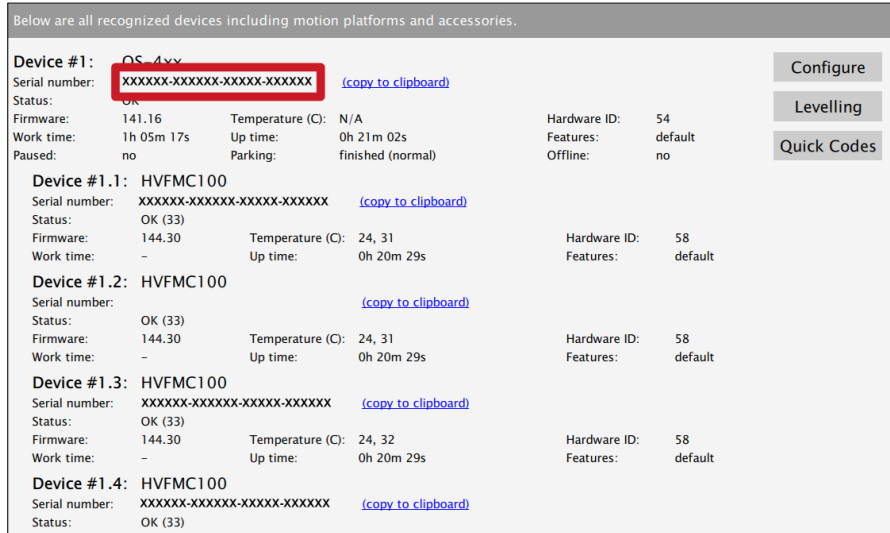
18. Launch the game by clicking the **Run the game** button.



19. You can also adjust the settings during the game simulation by pressing **ALT+TAB** and switching between the applications - once the profile is active changes will apply instantly.

**INFO**

If you need the serial number to activate other software licenses such as ForceSeatMI or ForceSeatDI, it can be found in the QubicManager. After connecting the QS-220 go to **Tools and Diagnostics → Devices**. Serial number is visible under the device name:



**WARNING**

The software is provided "as is", without warranty of any kind, express or implied, including but not limited to the warranties of merchantability, fitness for a particular purpose, and non-infringement. In no event will the authors or copyright holders be liable for any claim, damage, or other liability, whether in an action of contract, tort or otherwise, arising from, out of, or in connection with the software or the use or other dealings in the software.

The software sends anonymous usage data to the Motion Systems company. The data is used to improve the software and game profiles. The data is not used for advertising purposes.

---

## 4. MAINTENANCE AND CLEANING

To minimize the risk of abnormal heating that can result in system failure, keep the QS-220 uncovered, clean and dust-free. The unit cleaning should be performed only with a soft, dry cloth. **DO NOT** use any chemicals, water and other liquids to clean the device.

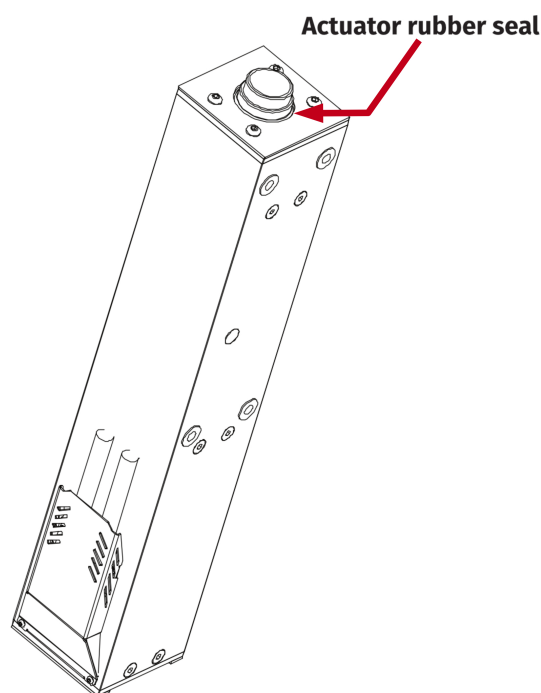
Check if the Motion Lock Switch is working correctly at least once a month – turn on the QS-220 (with no one using the rig) and push the red button. If the machine turns off and does not react to any signal (turn on a simulation or game to test it) then the Motion Lock Switch works correctly. If the machine reacts in any different way, stop using it and contact technical support immediately.

### WARNING

To minimize the risk of QS-220's actuator failure, check the condition of the linear actuator's rubber seals once a month. Lubricate them externally, if necessary, using silicon grease.

#### Manufacturer tested silicon grease specifications:

- Working conditions (°C): -40 do +200
- Density (g/cm<sup>3</sup>): 1,02
- NLGI class: 2
- Worked penetration: 220-270
- Dielectric constant (100 Hz): 2,9
- Breakdown voltage (kV/mm): 30
- pH of water lift: 4 to 6



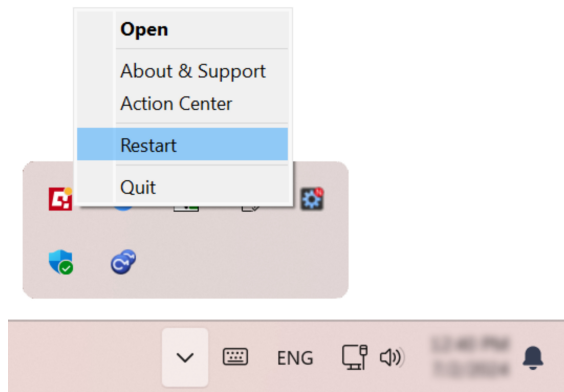
## 5. TROUBLESHOOTING

### WARNING

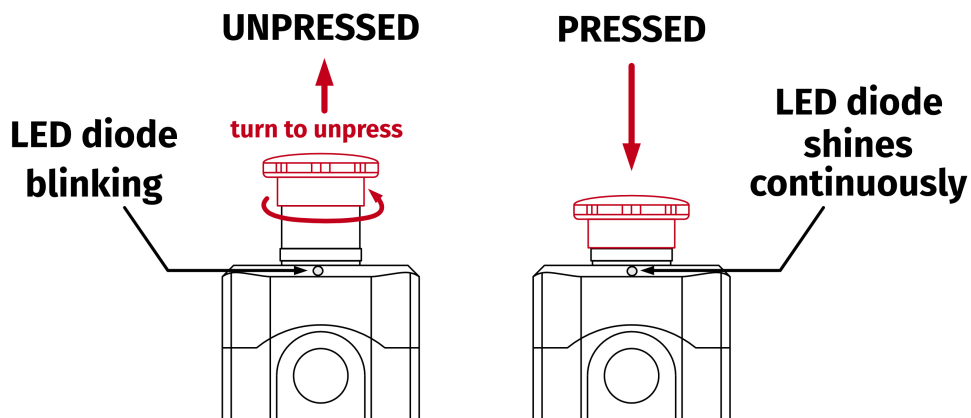
**DO NOT** attempt to do any repairs by yourself. It is dangerous and voids the warranty! Repairs should be consulted with technical support and then performed by a qualified technician.

#### Before contacting technical support, try this:

- Check Action Center in QubicManager.
- Check all cable connections in the device.
- Restart QubicManager application by right-click on the application icon in the system tray and selecting **Restart**:



- Check Motion Lock Switch position (it should be unpressed to activate the motion)



- Try different USB ports.
- If a problem occurred abruptly, it could be caused by a thermal protection. Turn off the QS-220, disconnect it from power outlets and wait at least 15 minutes to let it cool down. Try turning it on again later.
- In case of any unclear electrical issues or strange behavior, contact technical support
- If the device suffers from abnormal work conditions, please immediately contact the distributor/reseller for technical support.



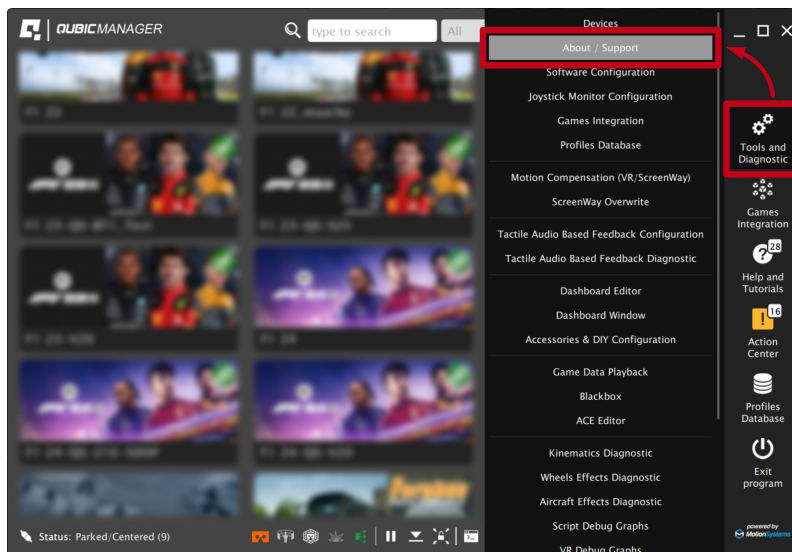
## 5.1. CREATING A SNAPSHOT

A snapshot is the easiest and fastest way to diagnose a problem. If you send in the zip file generated in the snapshot menu along with a description of the problem, technical support receives the necessary information about the product and its configuration. It can be then analyzed to provide the best solution.

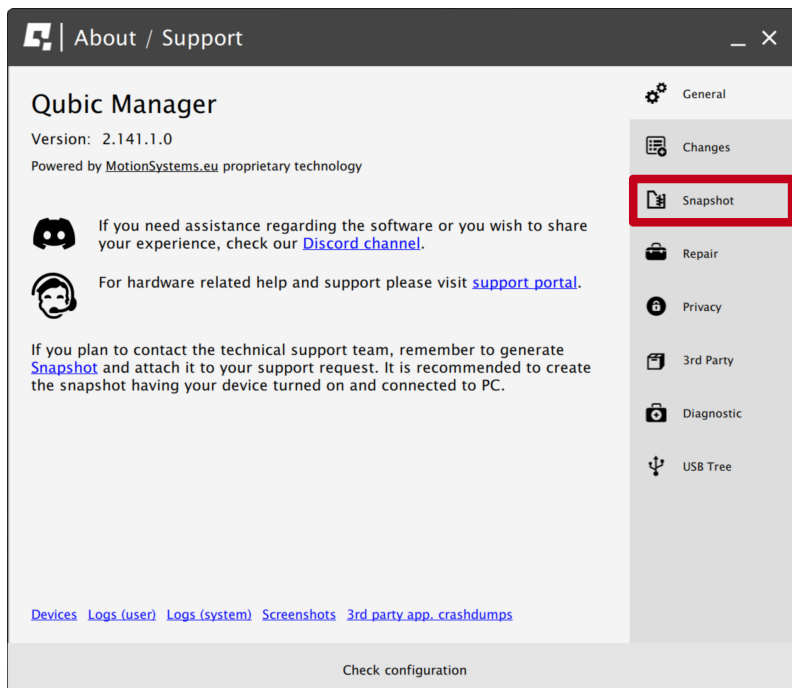
### WARNING

The QS-220 and all interconnected Power Cabinets **MUST BE** be powered up when creating the snapshot.

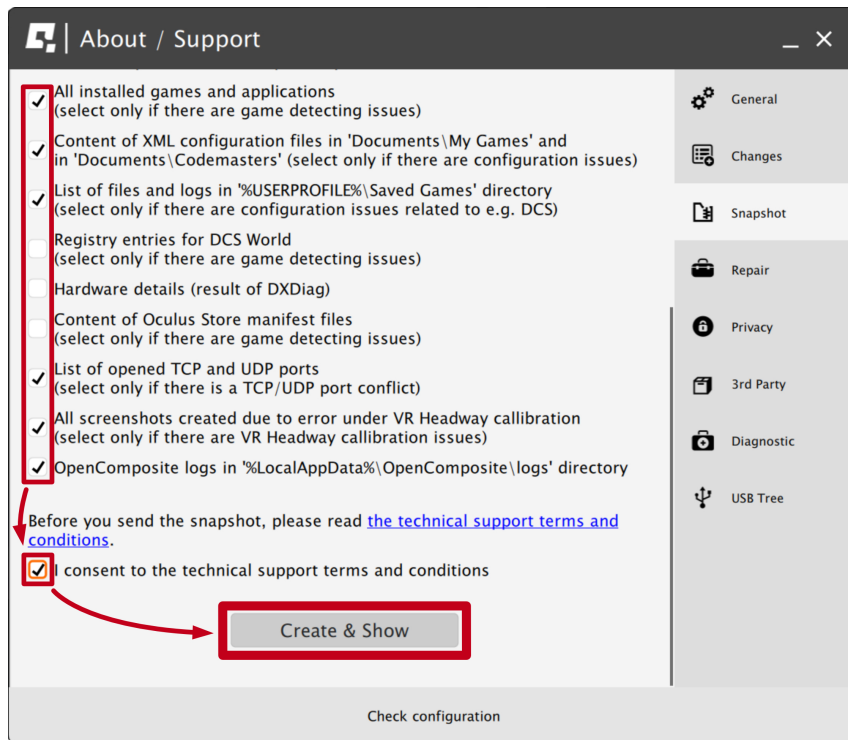
1. Open the main window of the QubicManager application.
2. Go to **Tools and Diagnostic** → **About / Support**.



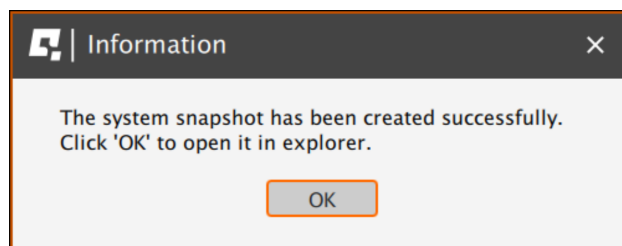
3. Open the **Snapshot** window:



4. Select data that will be included in the snapshot.
5. Scroll down, consent to the technical support terms and conditions and select **Create & Show**:



6. The snapshot has been created, click the **OK** button - the folder with the snapshot ZIP file will open.



7. Attach the snapshot ZIP file to your support request.

---

## 5.2. DISCORD CHANNEL

We strongly recommend joining our discord channel, where our growing community is sharing amazing tips and ideas of how to set up, use and tune the Qubic System products. You can also send questions for technical support or get answers directly from the community.

Join our discord channel by following the invitation link:

<https://discord.com/invite/tuAtybvTRn>



## 6. ADVANCED APPLICATIONS

### INFO

Examples shown in this section describes optional application of external safety and power cut-off devices. If you wish to expand the functionality of your motion system, read the whole section to have a good understanding of how to apply and what functionality to expect. Apply at your own discretion.

### WARNING

Motion Lock input is not a SIL/PL (safety integrity level/performance level) rated and **DOES NOT** guarantee safety. If you wish to achieve specific SIL/PL ranking, consider introducing a power cut-off device that is controlled by an external safety relay and cuts off the power to all QS-SB2. Example application of the power cut-off contactor can be found in section 6.3.2 and 6.3.3.

### INFO

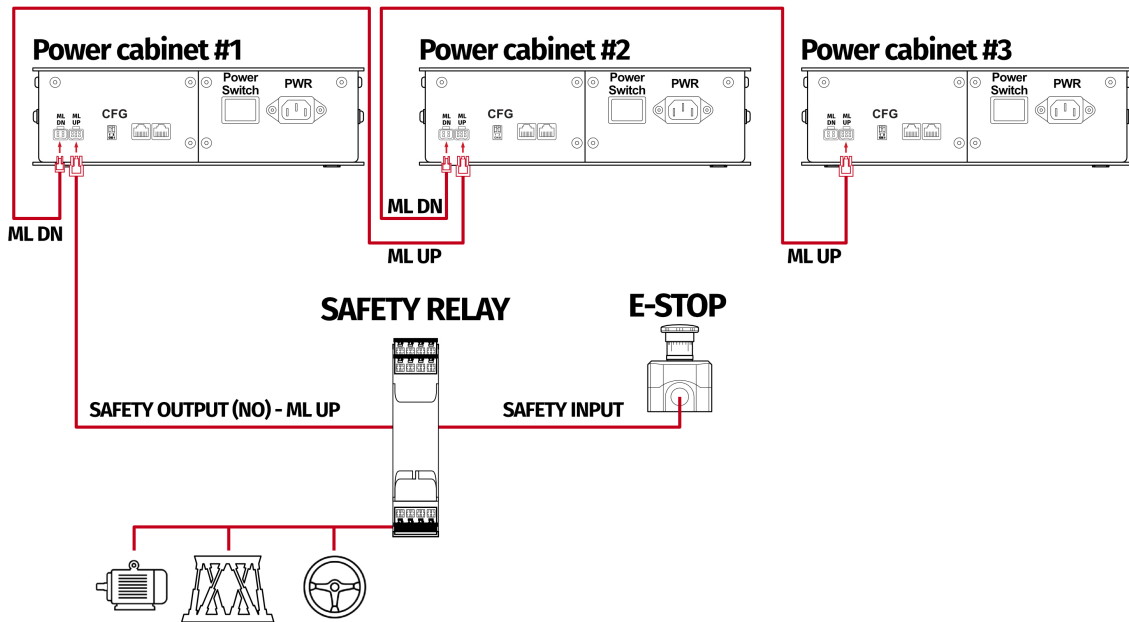
When applying safety relay to the Motion Lock :

- Use input cables according to your safety relay manual.
- Use output cables according to your safety relay manual and cross section  
no less than 0,75 mm<sup>2</sup>

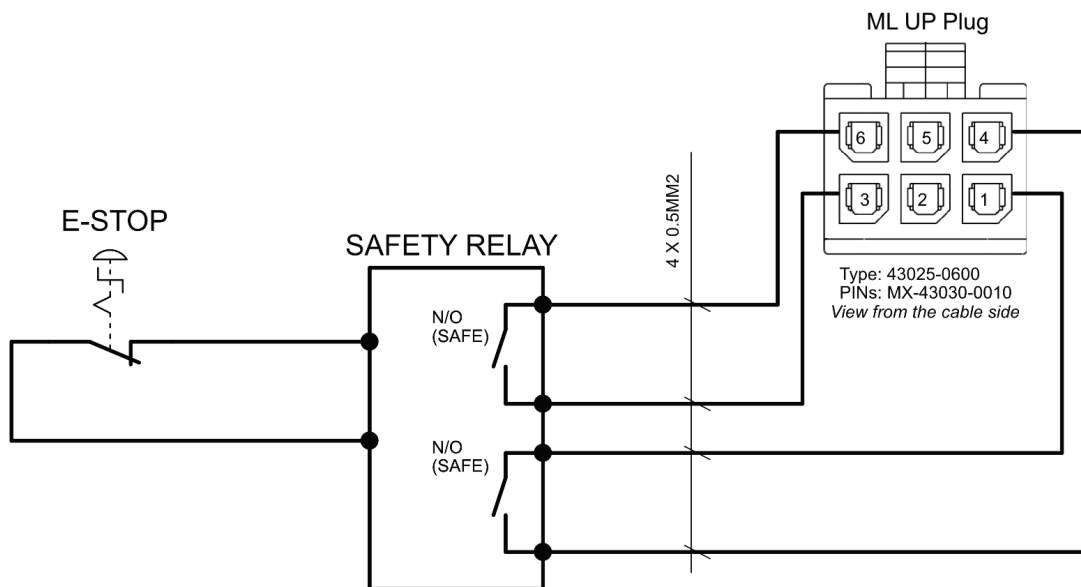
### 6.1. ADDING ADDITIONAL DEVICES TO THE MOTION LOCK CIRCUIT

If there is necessity to stop other devices, apart from the QS-220, ML (Motion Lock) and additional user devices can be controlled by safety relay outputs. In the example application, the E-STOP button is connected to the external safety relay. When the E-STOP is triggered, the safety relay will activate the Motion Lock function, which will stop motion of the platform and additional devices.

**Example application of single-channel safety relay that controls ML and additional devices :**



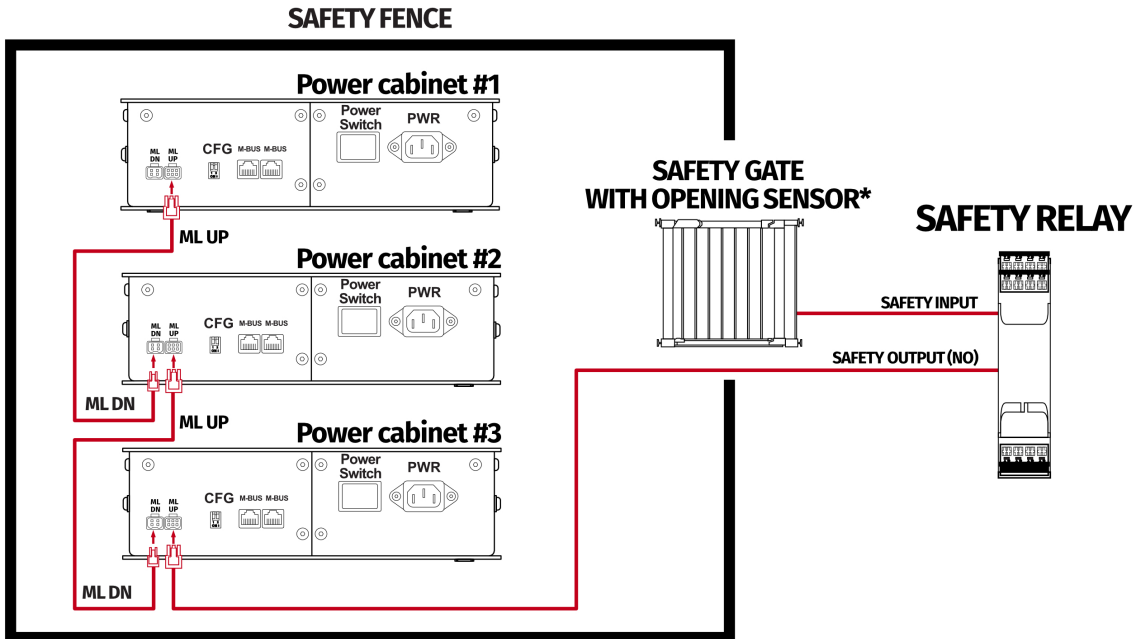
**Example wiring diagram of application of one-channel safety relay with E-STOP button:**



## 6.2. IMPLEMENTING THE WORKING ZONE PROTECTION

For protection against accidental hit from moving parts of the platform, safety gate with opening sensor\* can be connected to safety relay input for activating ML function. When the gate is opened, the safety relay output activates the ML (Motion Lock) function and stops the motions of the platform.

**Example application of safety gate opening sensor:**



\*Check your safety relay manual for list of applicable sensors

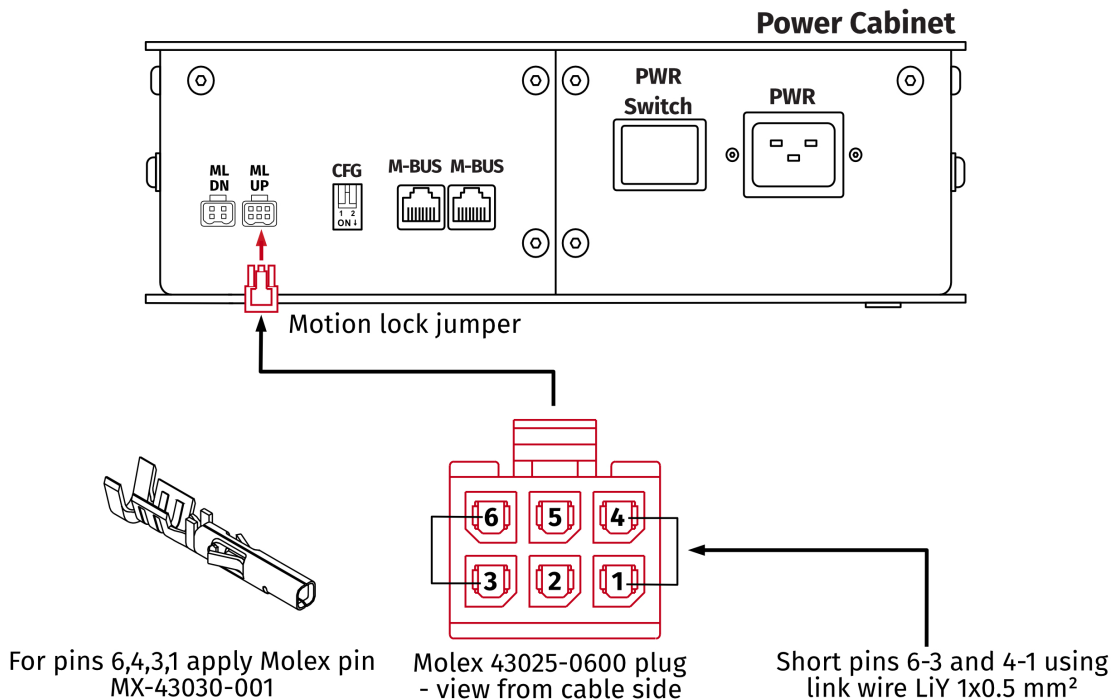
### 6.3. INCREASING SAFETY LEVEL

#### WARNING

Modifications of the safety system, involving application of the power line contactors, shall be performed only by a competent person. A competent person is a qualified and knowledgeable person, who because of their training, experience has the knowledge required to apply those changes. It is user responsibility to commission modification of the safety system to a competent person, experienced with industrial wiring practices, which will be required to undertake the installation. Commissioning shall be undertaken by a trained electrical technician experienced in safety installations.

#### 6.3.1 ASSEMBLING MOTION LOCK JUMPER

To apply solutions which require to use power line contactors, Motion Lock connection cables in the QS-SB2 power cabinet needs to be replaced with jumpers, which are not provided with the QS-220. To prepare jumper, you need to assemble recommended connector as shown below :



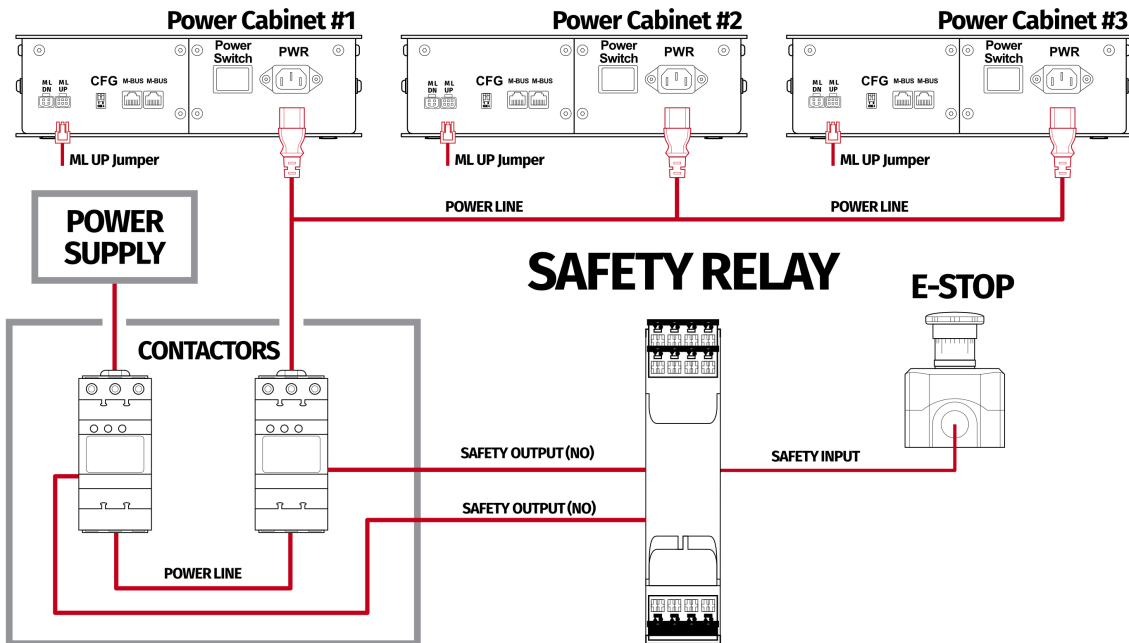
### 6.3.2 ADDING POWER-CUT CIRCUIT WITH E-STOP BUTTON

If specific SIL/PL rated level needs to be achieved, it might be necessary to install a power cut-off device. Two contactors connected in series and controlled by safety relay can be used to provide or cut-off power line to QS-SB2 power cabinets. When safety function on safety relay input is triggered, a safety relay will switch off the contactors, thus cutting-off the power to the platform. To apply this solution, ML UP connection cables needs to be replaced with prepared jumper as described in section 6.3.1

**INFO**

To achieve required safety performance level it is necessary to perform safety risk assessment at user site.

**Example application of power line contactors and E-STOP button:**

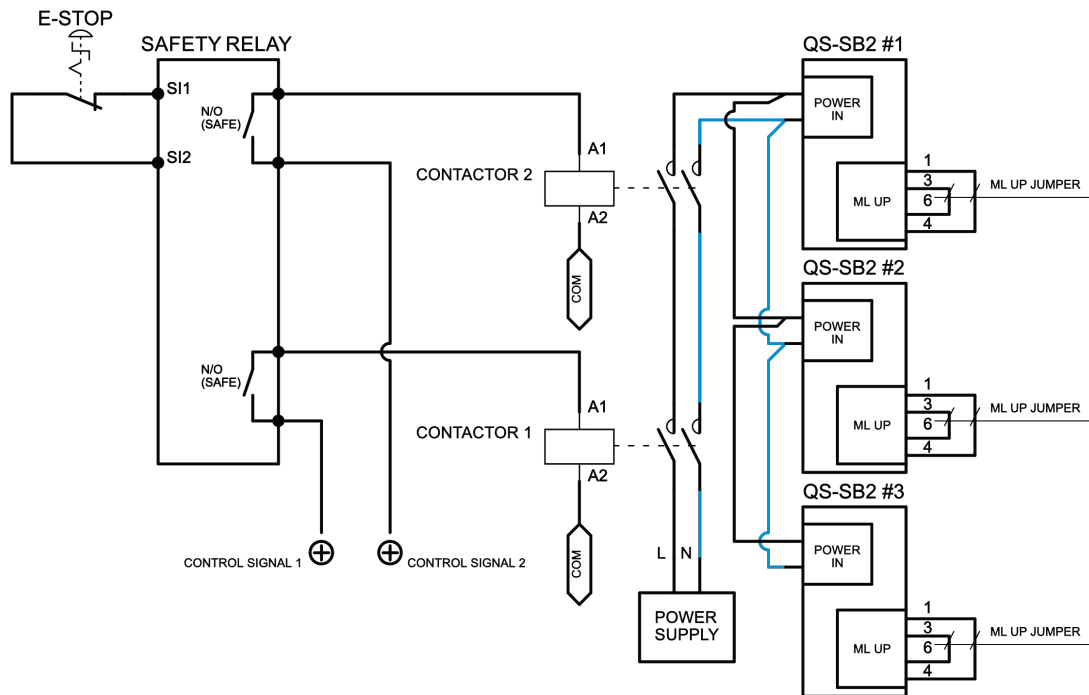


**INFO**

In order to increase SIL/PL level it's a good practice to apply well-known contactors of two different manufacturers in order to decrease probability of failure resulting from serial production.



## Example wiring diagram of application of power line contactors and one-channel safety relay with E-STOP



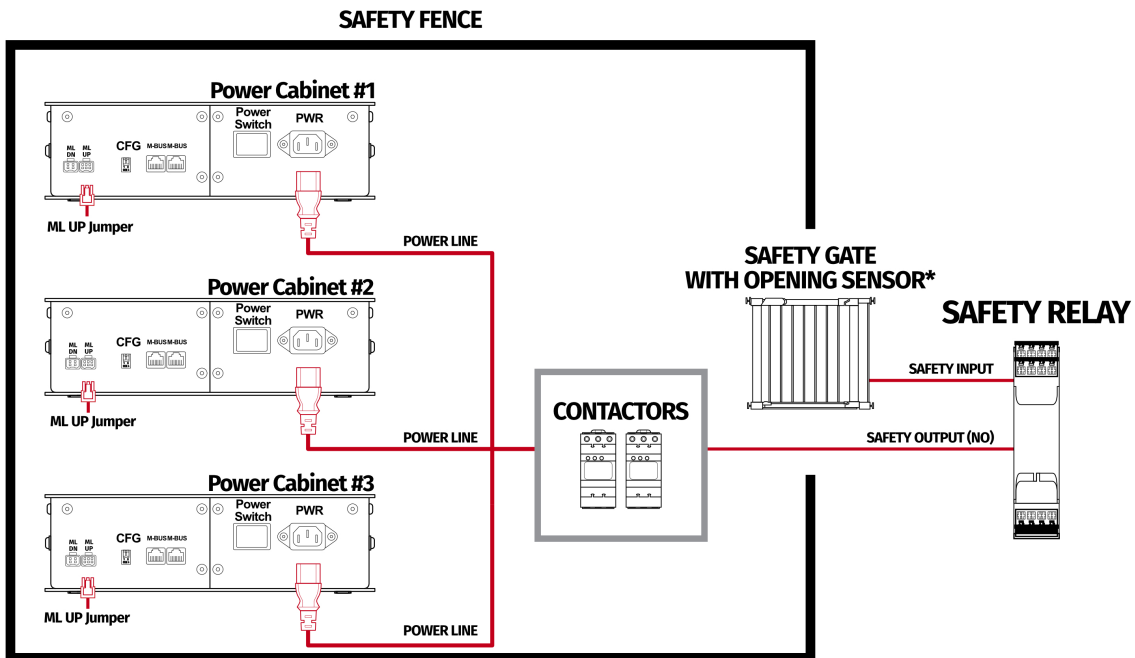
### INFO

PE (protective grounding/earthing) connection is omitted for better transparency

### 6.3.3 IMPLEMENTING THE WORKING ZONE PROTECTION WITH POWER-CUT CIRCUIT

In example application contactors connected in series provide power line to the QS-SB2 power cabinets. When safety function on safety relay input is triggered, a safety relay will switch off the power contactors, thus cutting-off the power to the platform.

**Example application of power line contactors with safety gate opening sensor:**



\*Check your safety relay manual for list of applicable opening sensors

#### INFO

When applying safety relay and contactors to the power line remember to:

- Use control cables according to your safety relay manual
- Power line cables shall be chosen accordingly to power requirements of motion system. See power requirements of specific motion system.

---

## 7. ENVIRONMENTAL IMPACT AND DISPOSAL



**DO NOT** dispose this product with standard household waste, leave it at the nearest collection point for the disposal of electrical and electronic equipment.

QS-220 is an advanced device and if stored or disposed of incorrectly, it could harm the environment or/and other people. Please contact your local authorities for information at the collection point nearest you.

## 8. LIABILITY DISCLAIMER

If permitted under applicable law, Motion Systems and its subsidiaries disclaim all liability for any damages caused by one or more of the following:

- The product has been modified, opened, or altered.
- Failure to comply with a User Manual.
- Inappropriate or abusive use, negligence, an accident (an impact, for example).
- Normal wear.

### INFO

If permitted under applicable law, Motion Systems and its subsidiaries disclaim all liability for any damages unrelated to the material or manufacturing defect with respect to the product (including, but not limited to, any damages caused directly or indirectly by any software, or by combining the QS-220 with any unsuitable element or not other elements not supplied or not approved by Motion Systems for this product).

## **9. WARRANTY**

Motion Systems warrants to the consumer that this product shall be free from defects in materials and workmanship, for a warranty period which corresponds to the time limit to bring an action for concerning this product.

For commercial customers, there is a one (1) year limited warranty, starting on the original date of purchase.

Within the warranty period, the product will be repaired or replaced free of charge, excluding shipping charges.

This warranty shall not apply:

- If the product has been modified, opened, altered, or has suffered damage as a result of inappropriate or abusive use, negligence, an accident, normal wear, or any other cause unrelated to a material or manufacturing defect (including, but not limited to, combining the QS-220 with any unsuitable element, including in particular power supplies, chargers, or any other elements not supplied or approved by Motion Systems for this product).
- In the event of failure to comply with the instructions provided by technical support.
- To software, said software being subject to a specific warranty.
- To accessories (cables, cases, for example).
- If the product was sold at public auction or if the product has suffered damage as a result of natural disaster: flood, fire, earthquake, storm.

This warranty is non-transferable. No new warranty period commences if the product is repaired or replaced. Your statutory rights towards the seller are not affected or restricted by this warranty. Motion Systems, and their partners are not liable for any indirect, incidental, or punitive damages from use of this product. In case of malfunction during the warranty period immediately contact technical support.

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## 10. COPYRIGHT

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### INFO

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## 11. MANUFACTURER INFORMATION

**Motion Systems**  
Miedziana 7  
55-003 Nadolice Wielkie  
Poland



### INFO

In support queries please contact your reseller.



 **QUBICSYSTEM**



**QS 220**



QS-220

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