# PULSE ROBOTIC ARM

## **QUICK-START GUIDE**





## **GETTING STARTED WITH THE PULSE ARM**

It takes the **SIX STEPS** to get started with the PULSE ARM:

### **STEP 1. Mount the arm.**

**STEP 2.** Connect the arm with the control box, the local network, and the peripheries

**STEP 3. Switch the arm** 

**STEP 4. Set communication with the arm** 

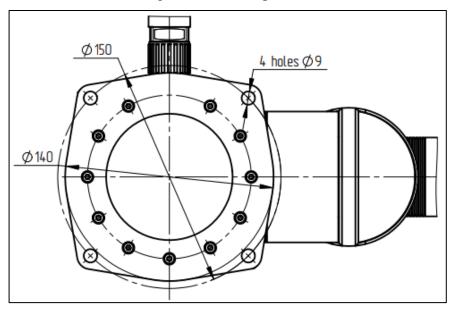
## **STEP 5. Start the PULSE DESK**

**STEP 6. Run a sample program** 

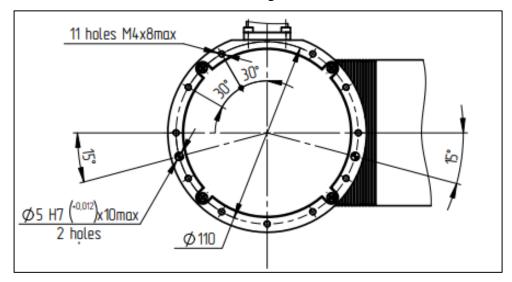
### **STEP 1. Mount the arm.**

- 1. Unpack and position the arm vertically.
- 2. Holding the arm tight on the body, bolt it down onto a mounting surface using one of the following methods:

**Method 1.** Insert four M8 bolts into the 9-mm dia. holes on the edges of the transition plate pre-assembled with the arm and tighten the bolts up.



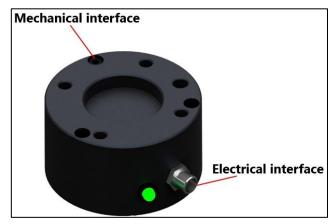
**Method 2.** Dismantle the transition plate pre-assembled with the arm by removing the 2 pins and 11 bolts that hold together the arm base and the plate. Then, use the same 2 pins and 11 bolts to bolt down the arm base to the mounting surface.



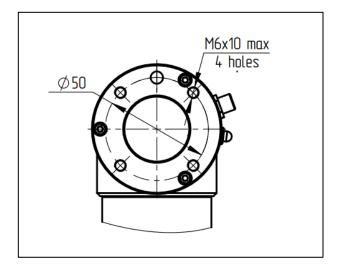
This is it! The arm is now ready for STEP 2.

## **STEP 2.** Connect the arm with the control box, the local network, and the peripheries

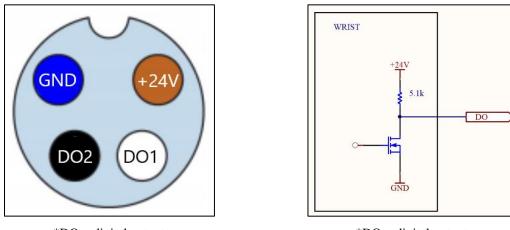
1. Attach your selected end effector, using the **mechanical** and **electrical interfaces** on the wrist of the robotic arm as illustrated below:



#### Mechanical interface

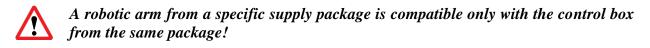


#### **Electrical interface**



\*DO = digital output

2. Connect the arm with the control box, using the 48V hybrid cable from the supply package. The cable should run from the connector at the bottom of the robotic arm to the 48V connector on the back panel of the control box.





3. Plug the emergency stop button cable (attached to the button) into the appropriate connector on the back panel of the control box as shown below



4. Connect the 220V power cable included in the supply package to the power supply connector on the back panel of the control box.



5. Connect the arm directly to a personal computer (PC), using the Ethernet cable.



6. (*Optional*) To connect any required additional equipment (e.g., a sensor, a safeguard, a PLC) to the robotic arm, use the digital inputs and outputs on the back panel of the control box.



**Note:** For detailed connection requirements and parameters, refer to the **HARDWARE** *INSTALLATION MANUAL*.

The arm is now ready for switching at STEP 3!

#### **STEP 3. Switch the arm**



Do not move the arm manually until the initialization is over and the wrist LED on the arm is steady green!

- 1. Plug the power cable connector into the mains socket.
- 2. Flip the power switch on the back panel of the control box to the ON position.



The control box starts receiving power and initializing. During the initialization, the LED on the arm wrist is off, while the green LED on the control box is blinking.



Once the initialization of the control box is over, the green LED goes from blinking to steady green. Then, the arm starts initializing, too.

After the arm initialization is over, the wrist LED turns steady green.



Now, you can go to Step 4!

## STEP 4. Set communication with the arm

For the quick start, the robotic arm is connected directly to a PC. Therefore, to set communication with the arm, use a **static IP**. For the arm, the static IP is **10.10.10.20 by default**.

Below, you will find the instructions how to set communication via a static IP, depending on the operating system in use.

## Windows OS

- 1. Switch on your PC.
- 2. In the right-hand corner of the Taskbar, left-click the network connection indicator.



3. Among the displayed connection options, select Npcap Loopback Adapter.



4. In the displayed Ethernet settings window, click Change adapter options.

Settings		– 🗆 X
Home	Ethernet	
Find a setting	Ethernet	Related settings Change adapter options
Network & Internet	F rozum.local	Change advanced sharing options
⊕ Status	Npcap Loopback Adapter	Network and Sharing Center
<i>i</i> ∕⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄⁄∕	Npcap Loopback Adapter No Internet	HomeGroup
ም Ethernet		Windows Firewall
ଳ Dial-up		Have a question?

5. In the displayed **Network Connections** window, right-click the **Ethernet** icon and select **Properties.** 

ſ	Network Connections				
N	🔶 🔶 🔨 🛧 🛃 🗸 Co	ontrol Panel > Netw	ork and Internet > Network Co	nnections	
	Organize 🔻 Disable th	is network device	Diagnose this connection	Rename this connection	View status of this connection
Ę		et Llocal. Shared BEE Famil	Ethernet 2 Disabled TAP-Winde	ows Adapter	Npcap Loopback Adapter Enabled
	Status Diagnose	лючение			
•	Bridge Connections	d			
•	Create Shortcut Delete				
6	Rename				
6	Properties 🚽 ——				

6. On the **Networking** tab in the displayed **Ethernet properties** window, double-click **Internet Protocol Version 4 (TCP/IPv4).** 

Ethernet Properties			×
Networking Sharing			
Connect using:			
🕎 Realtek PCIe GE	E Family Controller		
		Conf	igure
This connection uses the	ne following items:		
✓ <sup>3</sup> QoS Packet S ✓ <u>1</u> Internet Protoc	r Sharing for Microsoft IS6 Bridged Networkin cheduler sol Version 4 (TCP/IPv vork Adapter Multiplex	ng Driver (4)	* *
Install	Uninstall	Prop	erties
Description			
	C	K	Cancel

7. In the **IP Version 4 (TCP/IPv4) Properties** window, select **Use the following IP address** and set the **IP address** and the **Subnet Mask** fields to the values as shown below.

•

For the last digit in the IP address field, you can use any value from 1 to 255, except for 20, since 10.10.10.20 is the default static IP address of the arm.

IP version 4 (TCP/IPv4) Properties		Х
General		
You can get IP settings assigned autom this capability. Otherwise, you need to for the appropriate IP settings.		
🔨 🔿 Obtain an IP address automatical	у	
OUse the following IP address:		
IP address:	10 . 10 . 10 . 1	
Subnet mask:	255.255.255.0	
Default gateway:		
Obtain DNS server address autom	atically	
• Use the following DNS server add	resses:	
Preferred DNS server:		
Alternate DNS server:		
Ualidate settings upon exit	Advanced	
	OK Cancel	

8. Click **OK** to confirm the settings.

## Linux OS

- 1. Switch on your PC.
- 2. Open **Network Connections** and double-click **Ethernet** to open the editing window as shown below.

	✓ Network Connections	- + ×
	Name	Last Used 👻
	Ethernet	
	Wired connection 1	14 days ago
	✓ Wi-Fi	
	Rozum	
	Editing Wired connection 1 ÷ ×	
Connection name: Wired	l connection 1	
General <b>Ethernet</b>	802.1X Security DCB Proxy IPv4 Settings IPv6 Settings	
General	ouz. In security Deb Floxy IFV4 securitys IFV0 securitys	
Device:	8C:EC:4B:1E:A6:DA 👻	
Cloned MAC address:		
Cioned MAC address:	¥	
MTU:	automatic — + bytes	
	✓ Default Phy Unicast Multicast	
Wake on LAN:	Ignore Broadcast Arp Magic	
Wake on LAN password:		
Link negotiation:	Ignore 👻	
Speed:	100 Mb/s 🔹	
Duplex:	Full	
	Cancel 🗸 Save	

3. In the displayed window, select the IPv4 Settings tab.

			Editing Wi	red connectio			+ ×
Connection r	name:	Wired o	connection 1				
General	Eth	ernet	802.1X Security	DCB I	Proxy	IPv4 Settings	IPv6 Settings
Method:	Autom	atic (DH	CP)				-
Additional	l static a	addresse	25				
Address			Netmask		Gatew	ay	Add
							Delete
Addition	al DNS s	servers:					
Addition	al searcl	h domair	ns:				
DHCP cli	ent ID:						
Requi	ire IPv4	addressi	ng for this connectio	n to comple	ete		
							Routes
						Can	ncel 🗸 Save

4. In the Method dropdown box on the IPv4 Settings tab, select Manual.

~		Editing Wir	ed connection	n 1	_		÷×
Connection name:	Wired con	nection 1					
General Eth	ernet 8	02.1X Security	DCB	Proxy	IPv4 Settings	IPv	6 Settings
Method: Manua	al						1
Addresses							
Address		Netmask		Gatew	ay		Add
							Delete
DNS servers:							
Search domains							
DHCP client ID:							
Require IPv4	addressing	for this connectio	n to compl	lete			
							Routes
					Ca	ncel	

5. In the Addresses area on the same tab, click Add and specify the Address, Netmask, and Gateway as shown in the figure below.

~			Editing Wi	red connect	l' noi				÷	×
Connection na	ame:	Wired cor	nection 1							
General	Eth	ernet a	302.1X Security	DCB	Pro	xy I	Pv4 Setti	n <b>gs</b> IF	v6 Settings	
Method: 1	Manua	al							•	
Addresses										
Address			Netmask			Gateway			Add	
10.10.10.1			255.255.255.0			10.10.10.	1		Delete	
DNS serve	rs:									
Search dor	mains									
DHCP clier	nt ID:									
Require	e IPv4	addressing	for this connectio	n to comp	olete					
									Routes	
								Cancel	✓ Save	9

•

Specifying the last digits in the Gateway and the Address fields, it is possible to use any value from 1 to 255, except for 20, since 10.10.10.20 is the default static IP address of the arm.

6. Click the **Save** button to confirm the settings.

Now, you have all you need to start working with it via the PULSE DESK user interface!

### **STEP 5. Start the PULSE DESK user interface**

- 1. Open a browser.
- 2. In the browser line, type in either the default static IP address 10.10.10.20 and the port number 8080.

🔇 PulseDesk	· · · · · · · · · · · · · · · · · · ·	P address and port number of he PULSE arm
$\leftrightarrow$ $\rightarrow$ C 🛈 10.1	0.10.20:8080	

The browser page displays the starting screen of the PULSE DESK user interface.

≡	pick-and-place-nuts

Now, you can start programming the PULSE arm using the interface. To help you make your first steps, we provide a sample PULSE DESK program in Step 6.

For a more detailed program, refer to the PULSE DESK USER MANUAL.

### STEP 6. Run a sample program

**Task:** To perform a pick-and-place operation, moving an object (e.g., a nut) from one location to another.



All parameter values are for reference only. To create a program for your purpose, use your own values specific to your application and operating conditions.

The general recommendation is to observe the following sequence:

- 1. Creating a new program
- 2. Setting a basic trajectory by hand guiding
- **3. Setting intermediary waypoints**
- 4. Verifying and editing the trajectory
- 5. Conducting a test run

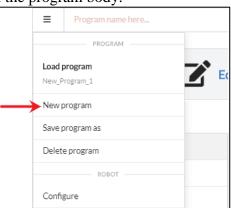
## **6.** Executing and stopping the program

#### Creating a new program

1. On the screen displayed at PULSE DESK start, click the Main Menu button.



2. On the **Main menu**, select **New program**. PULSE DESK loads the **Edit** screen with the **Wait for** command already in the program body.



Simultaneously, you will see the wrist LED turn yellow. This means the LEARN mode is now on, and the control buttons on the arm elbow are enabled.

3. On the **Main Menu**, select **Save program as** and type in a name for your program (e.g., *pick-and-place-nuts*) in the displayed dialog box.

Save changes	
Save this program as pick-and-place-nuts	
	No Yes

4. Click **Yes** to confirm saving the program under the name and close the dialog box. The specified name appears in the **Program Name** field.

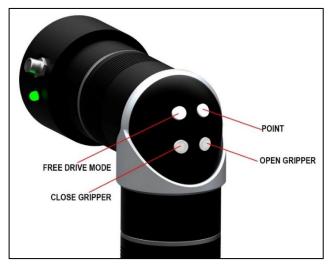


#### Setting a basic trajectory by hand guiding

For the particular trajectory, we will use the buttons on the arm elbow (see the figure below) to set **three basic waypoints**:

- **Point 1**—start position
- **Point 2**—to pick up the object from its initial location
- **Point 3**—to move the object from its initial location to another spot

In addition, we will **add commands to open/close the gripper** at the waypoints.





The elbow buttons are active in the LEARN mode only. When you switch to the PULSE DESK interface to perform any actions (e.g., to edit a point, add a command via the Commands menu), the mode is off. To switch back into the LEARN mode, you will have to create a new program.

5. Press the **Free Drive** button on the elbow of the robotic arm to set the arm into the **Free Drive mode**.

The LED turns blue and you can now drive the arm to any position manually.



In the Free Drive mode, the arm joints are not locked. Make sure to hold the arm tightly, providing proper support, to avoid damages due to the robot falling.

6. Set the arm into a starting pose by hand guiding. The recommended starting pose is as illustrated below.



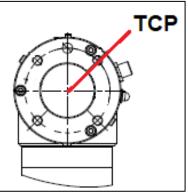
- 7. Once you are in the required starting pose, press the **Free Drive** button again. The arm goes to the **Freeze mode**, which means its joints are locked in their current positions.
- 8. Press the **Point** control button to remember the arm pose as the first waypoint in the required trajectory.

Now, if you look at the screen of your PC, you will see the following:

- PULSE DESK adds the point to the program body (default name **Point 1**), clearing the **Wait for** command.
- The **Service panel** displays **Point 1** parameters—the coordinates and rotation angles of the tool center point (TCP) in the position.

*Physically, the TCP is located at the centre of the arm wrist as shown below.* 





	≡	pick-and-place-nuts									
			Edit		Check		Run			> Next	
ram /		₹ 1 Point 1		Para	neters for Point 1		P coordi gles at P	nates and oint 1			
				×	-83	mm	RX	90	•		
				Y	-93	mm	RY	17	•	Move to the point	Ser par
				z	927	mm	RZ	-180	•	1	
										-	

9. With the arm in the same pose, press the **Open gripper** button. The **Open gripper** command appears below **Point 1** in the program body.

≡	pick-and-place-nuts		
		Edit Check Run	> Next
	<ul> <li>Foint 1</li> <li>Open gripper</li> </ul>	Parameters for Open gripper	

- 10. Press the **Free Drive** button to switch the arm back into the **Free Drive** mode. Drive the arm by hand guiding towards the nut so as to pick it up from its original location.
- 11. Once the gripper is in the right position and orientation to pick up the nut, press the **Free Drive** button again to freeze the arm in the pose.
- 12. Press the **Point** button to remember the pose as **Point 2** of the required trajectory.

A corresponding command line (default name **Point 2**) appears in the program body. On the **Service panel**, you can see the TCP coordinates and rotation angles specifying the arm position at the point.

≡ pick-and-place-nuts		
Ed	Check Run	> Next
F 1 Point 1	Parameters for Point 2	
2 Open gripper	X -14 mm RX 180 °	
F 3 Point 2	Y 488 mm RY 0 °	Move to the point
	Z 242 mm RZ 87 °	

13. To grab the nut at **Point 2**, press the **Close gripper** button on the arm elbow. The corresponding command appears below **Point 2** in the program body.

C.	Edit Check Run	Next
F 1 Point 1	Parameters for Close gripper	
🔓 2 Open gripper		
🐺 3 Point 2		
A Close gripper		

- 14. Press the **Free Drive** button to switch the arm back into the **Free Drive** mode. Drive the arm by hand guiding to move the nut from its original location to another spot.
- 15. Once the gripper is at the required spot, press the **Free Drive** button again to freeze the arm in the pose.
- 16. Press the **Point** button to remember the pose as **Point 2** of the required trajectory.

A corresponding command line (default name **Point 3**) appears in the program body. On the **Service panel**, you can see the TCP coordinates and rotation angles specifying the arm position at the point.

≡	pick-and-place-nuts		
		Check Run	> Next
	¥ 1 Point 1	Parameters for Point 3	
	🔓 2 Open gripper	X 440 mm RX -180	•
	¥ 3   Point 2	Y 47 mm RY 0	• Move to the point
	4 Close gripper     5 Point 3	Z 353 mm RZ 90	°

17. To open the gripper and release the nut at the spot, press the **Open gripper** button. The **Open gripper** (1) command appears below **Point 3** in the program body.

≡	pick-and-place-nuts		
	Ed	Check Run	> Next
	¥ 1 Point 1	Parameters for Open gripper (1)	
	2 Open gripper		
	🖡 3 Point 2		
	A Close gripper		
	🖡 5 Point 3		
1	6 Open gripper (1)		

Now that a basic pick-and-place trajectory is set, you can start working with **Add commands menu**. Your next task is to add intermediary points to make the arm trajectory smoother.

#### Setting intermediary waypoints

In this particular case, we set up **two intermediary waypoints** for each of the already preset points in the basic trajectory—**Point 2** and **Point 3**. One of the intermediary waypoints is to approach a preset point before lowering the gripper and the other—to lift the gripper before moving on to another waypoint. In addition, we will set **an end pose** to finish the program. 18. Add an intermediary waypoint to approach **Point 2**. To do this, select the command preceding the point in the program body. Click (+). In the displayed menu, select **Point**.

New_Program_1		
Edit	Check Run	> Next
¥ 1 Point 1	Parameters for Open gr Wait for	
2 Open gripper     3 Point 2	Send to	
Close gripper	Delay	
F 5 Point 3		
6 Open gripper (1)	Close gripper	
	Open gripper	
	Point ←	
	Comment	
	×	

A new command line (default name **Point 4**) appears in the program body preceding **Point 2**. The parameter fields on the **Service panel** for the new command contain default zeros.

≡ pick-and-place-nuts							
Edit		Check		Run			> Next
¥ 1 Point 1	Paran	neters for Point 4					
🔓 2 Open gripper	x	0	mm	RX	0	•	
F 3 Point 4	Y	0	mm	RY	0	•	Move to the point
F 4 Point 2	z	0	mm	RZ	0	•	
▲ 5 Close gripper							
🖡 6 Point 3							
C 7 Open gripper (1)							

19. In the parameter fields on the **Service panel** for **Point 4**, type in the same coordinates and rotation angles as for **Point 2**. The **only change** you need to make is to adjust the Z coordinate to a higher value so that the gripper at **Point 4** would be slightly above **Point 2**.

'aran	neters for Point 2				
х	-14	mm	RX	180	۰
Y	475	mm	RY	0	٥
-	240				•
Z	240			90 ter values fo	r the
	meters for Point 4	The	paramet points s		r the ntical,
	_	The	paramet points s	ter values fo hould be ide	r the ntical, te
Parar	meters for Point 4	The two exe	paramet points s pt for the	ter values fo hould be ide Z coordinat	r the ntical,

20. Set an intermediary waypoint to lift the gripper at **Point 2**. To do this, select **Close gripper** in the program body and click (+). In the displayed menu, select **Point**.

A new command line (default name **Point 5**) appears in the program body below **Close gripper**. The parameter fields on the **Service panel** for **Point 5** contain default zeros.

21. In the parameter fields on the **Service panel**, specify the same coordinates and rotation angles as for **Point 4**.

Param	neters for Point	5			
х	-14	mm	RX	180	ø
Υ	475	mm	RY	0	٥
Z	260	mm	RZ	90	۰
2	260	mm	κz	90	

22. To set an intermediary waypoint to approach **Point 3**, select the command preceding the point in the program body. Click (+). In the displayed menu, select **Point.** 

A new command line (default name **Point 6**) appears in the program body preceding **Point 3**.

- 23. Instead of the default zeros on the **Service panel** for **Point 6**, specify the same coordinates and rotation angles as for **Point 3**. The only change you need to make is to adjust the Z coordinate to a higher value so that the gripper at **Point 6** would be slightly above **Point 3**.
- 24. To set an intermediary waypoint to lift the gripper at **Point 3**, select **Open gripper (1)** in the program body and click (+). In the displayed menu, select **Point**.

A new command line (default name **Point 7**) appears in the program body below **Open gripper (1)**.

- 25. In the parameter fields on the **Service panel**, specify the same coordinates and rotation angles as for **Point 6**.
- 26. Set the end pose. To do this, click + and choose **Point**. In the parameter fields on the **Service panel**, set the same coordinates and rotation angles as for the starting position.

#### Verifying and editing the trajectory

- 27. To verify **Point 1**, select the point in the program body. On the **Service panel**, click the **Move to the point** button to see how the arm moves to the specified position.
- 28. Adjust the coordinates and rotation angles on the **Service panel**, changing manually the values in the parameter fields.
- 29. Repeat the same actions as described in **Step 27 to 28** to verify and adjust the rest of the points in the program body.



The Open gripper and Close gripper command have no parameters to edit.

30. Click **Next** or **Check** in the **Stepper** to move on to check the created program. PULSE DESK switches to the **Check** stage screen as shown below, where you can start a test run of the program.

E pick-and-place-nuts			
PULSE DESK	Edit Cr	neck Run	> Next
Commentary	Parameters for Send	to 1 (Low)	
🕫 2 Wait for 1 (High)	Output Type	Output #1	•
¥ 3 Point 1			
C 4 Open gripper	Value	Low	•
🖡 5 Point 6			
F 6 Point 2			
A 7 Close gripper			
🖡 8 Point 7			
¥ 9 Point 8			
¥ 10 Point 3			
🔓 11 Open gripper (1)			
¥ 12 Point 9			
🕪 13 Send to 1 (High)			
(C. a)			
Speed contro	ы	Default speed setting	

#### Conducting a test run



For the first test run, it is advisable to set the arm to operate at the default 10% speed. Subsequently, you can increase the speed by dragging the speed control to the right.

31. Click PULSE DESK starts executing the specified sequence of commands from the first command in the program body and down.

The button changes to U.You can monitor the test run progress by the way PULSE DESK moves the selection from one command to another.



In case, during a test run, you find out some of the preset parameters need adjustment, click (II) and switch to the Edit stage to make necessary adjustments.

32. When PULSE DESK executes the last command, it stops and displays an appropriate warning. Click **OK** to return to the **Check** screen.



33. Click **Next** to move on to execute the program. If you click **Next**, PULSE DESK displays the **Run** stage screen.

<u></u>		
- Ed	it Check V Run	🚽 Save & Run
Commentary	Parameters for Commentary	
<ul> <li>Wait for 1 (High)</li> </ul>	Note	
🐺 3 Point 1	Picking 2 nuts	
🖴 4 Open gripper		
🖡 5 Point 6		
F 6 Point 2		
Close gripper		
🖡 8 Point 7		
¥ 9 Point 8	-	
¥ 10 Point 3		
🔓 11 Open gripper (1)		
¥ 12 Point 9		
🕪 13 Send to 1 (High)		
Speed adjustm	ent is also available	
	Speed 10%	

#### Executing and stopping the program

34. On the Run stage screen, click **Save&Run** to start execution of the program. PULSE DESK executes the sequence of commands in the **Program Body**. The **Save&Run** is replaced with the **s**top button.



Once PULSE DESK completes the sequence, it resumes execution of commands from the very beginning and keeps repeating it until you stop the execution.

35. Click to stop the program execution.



If you click the Save & Run button again after stopping the program, PULSE DESK starts executing the program from the very beginning.

36. Close the browser window to quit PULSE DESK.



If you close the browser without stopping the program, the robotic arm continues executing it.

37. To switch off the arm, set it into a safe position where it can remain stable after power supply is disconnected (e.g., see the figure in step 6). Then, toggle the power supply switch on the back panel of the control box to the OFF position.