Delta Articulated Robot
DCV Controller
User Manual

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Preface

Thank you for using this product. This manual contains information related to the Delta Articulated Robot series and provides instructions that you must follow to safely operate the robot. Before operating the robot, read this manual carefully to ensure your safety and proper robot use. In addition, keep this manual in a safe location for reference whenever required.

This manual applies to the DRV70L and DRV90L Series robots and the DCV Series robot controller.

The DRV70L and DRV90L Series robots work only with our company's DCV Series controller. Do not modify the robot and DCV controller or use it with other robots and controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.

The following are the robot models and document numbers and versions for this manual.

Published By: Delta Electronics Inc.

Applicable Robots: DRV70L Series and DRV90L Series

Version: V1.0

The contents of this articulated robot manual include:

- Precautions for safe controller use
- Transportation and Installation
- Controller installation and inspection
- Safety protection
- Wiring
- Maintenance
- Troubleshooting

Due to the varied working environments and operator safety, we provide special training for personnel who work with articulated robots. Contact your local dealer or Delta for related training courses. This manual is a reference for the following users:

- System integration designer
- Installation and wiring workers
- Maintenance and inspection workers

Caution

Read this manual carefully before operating the robot to ensure proper use. In addition, keep this manual in a safe location for reference whenever required.

You will learn do to the following tasks when you have finished reading this manual:

- Set up the robot in a safe and protected location with safety protection such as railings and gratings. Do not operate the robot outside the safety protection area to prevent injuries to the operator.
- The installation environment must have no steam, corrosive gas or flammable gas to prevent accidents such as malfunctions or explosions.
- Read this manual carefully before wiring the DCV controller and the robot to prevent damage to the robot and the DCV controller.
- The equipment must be grounded properly.
- Do not disassemble or change the wiring while the power is on to prevent electrical shocks.
- Ensure that the emergency stop device can be operated at any time before powering the robot on.
- Turn off the power to the DCV controller before performing repairs or maintenance.
- Do not get close to the operating range of the robot before and after powering on for operations, and leave a warning in an obvious place to prevent injuries or fatalities to the workers.

If you have questions concerning the robot use, please contact your dealer or our company's Customer Service Center.

The contents and specifications in this manual may change without further notification. You can download the latest version from the Delta website.

Safety Notice

This manual includes safety precautions for user safety and to prevent damage to the robot. Warnings and notes in this manual describe important safety precautions. Warnings describe supplementary explanations. Users must read the items in the warning, danger and prohibited notes carefully to prevent accidents or injuries to the workers.

Only qualified workers should install and transport the robot and they should comply with the regional, country and local laws and regulation requirements.

The final system integrator should integrate the robot and the robot's peripherals as well as execute the construction of the safety protection devices to ensure the overall system safety.

This robot is designed only as an accessory for specific applications. We strongly suggest that you do not modify this robot or use it for any application processes other than what it is designed for. If you have any application problems, do not use the robot until you have received detailed explanations from your dealer.

Definition of Robot Operators

Operator:
Able to perform operations such as powering the DCV controller ON/OFF.
Able to start the robot from the final system integrated operating panel.

Program Editor:
Performs operations with the robot.
Uses the manual mode to operate the robot or for teaching from outside the safety railings.

Repair or Inspection Worker:
Performs simple operations on the robot.
Uses manual mode to operate the robot from outside the safety railings.
Performs operations such as maintenance, repairs, adjustments and replacements to the robot and DCV controller.

- Note: Read this manual carefully before operating, maintaining or inspecting the robot and DCV controller, and be sure to follow the safety regulations. Please contact our company for details if you have any questions.

Definitions of Prohibited, Danger and Warning

For your safety, read this manual before using the robot and have a clear understanding of all contents related to safety and warnings.

■ The following table explains the symbols “Danger”, “Warning”, “Prohibited” and “Noise Prevention”.

“Danger” 	There is imminent danger of fatalities or severe injuries to the workers if not prevented.
“Warning” 	There is a potential danger of fatalities or severe injuries to the workers if not prevented.
“Prohibited” 	These activities are absolutely prohibited. Failure to comply may result in damage or malfunctions in the product causing the product to be unusable or it may result in injuries to the workers.
Noise Prevention 	There is excessive noise that may affect the operator’s hearing when the robot is operating. Operators should wear ear protection to protect their hearing.

■ Installation Safety

- Read this manual carefully before installing the robot to make sure that you install the robot in a suitable location and environment to avoid affecting the mechanisms and useful life of the electronic components, or encounter other safety problems.
- The DRV70L and DRV90L Series robots can work only with our company's DCV Series controller. Do not modify the machine and wiring or use it with other controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- Follow the instructions in this manual to correctly transport and install the robot and DCV controller to prevent damage to the robot or DCV controller.
- Related licenses are required for workers who operate equipment such as stackers or forklifts.
- Workers must wear proper safety work clothes, helmets, gloves and shoes when installing the robot to ensure their safety.
- On automated production lines, the operating range of multiple robots may overlap. Make sure that they do not interfere with one another to prevent damage to the robots from impacts.
- Please do not add additional equipment such as cables or hoses inside the mechanism. When installing the robot's exterior cables, ensure that the cables and mechanisms do not interfere with one another during operations.
- Use only clean dry air (CDA) for the air source at the robot air hose input terminal.
- You can use the robot in IP40 environments and it is able to resist solid matter with a diameter over 1mm. It is not protected against any liquids.
- Follow the manual and install the safety protection devices such as railings, gratings, regional lasers or pressure pads to prevent injuries or other dangers to the workers from impact with the robot in its operating range.
- Install the user operating buttons and alarm indicators outside the railings to ensure safe use. The operating interface should be at a suitable height (0.6–1.7 m) for operators to reach easily.
- Do not turn the power on and off frequently to prevent damage to the DCV controller.
- Install the robot system under the specified conditions; in the foreseeable use period, the robot may not be tilted or moved by uncontrolled methods during transportation, assembly, disassembly, suspended or discarded periods.
- Properly ground all robot systems before connecting the power.
- The final system integrator should install protection devices to prevent users from getting close to the danger area.

- Removing or changing the locations of any safety warning labels on the equipment is strictly prohibited to prevent danger and injuries to the workers.
- Performing any unsafe actions at the safety warning locations on the equipment is strictly prohibited to prevent injuries to the staff.
- Workers must not stand underneath when using equipment such as stackers or forklifts to move the robot to prevent injuries or other dangers.
- Placing objects on top of the robot, DCV controller or cables is strictly prohibited to prevent damage to the robot, DCV controller or cables.
- Changing or modifying the robot and DCV controller is strictly prohibited to prevent damage to the robot or DCV controller and danger to the workers. Our company will not be held responsible for any work accidents.
- Installation and wiring the robot by unqualified people without the related professional knowledge or licenses is strictly prohibited.

■ Use and Operation Safety

- Read this manual carefully before using the robot to ensure proper use and the workers safety.
- Due to varied operational environments and operator safety considerations, our company provides dedicated training for personnel who work with the robot to ensure safe use. Please contact our company or your local dealer if training is needed.
- Wire the robot according to this manual. The wiring must be performed by qualified workers with related professional knowledge or licenses.
- The DRV70L and DRV90L Series robots can work only with our company's DCV Series controller. Do not modify the machine and wiring on or use it with other controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- Use our company's handheld teaching pendant and install it on the DCV-2J00-AA controller to perform manual operations and to edit programs.
- Do not use this robot on production lines where there are flammable, explosive, or toxic conditions or there is the risk of the robot being sprayed by liquids.
- Select a suitable model according to the load capability. Do not exceed the machine model specifications.
- The robot is a partially completed machine. The assembly and construction of the protection and safety circuits are the responsibility of the final system integrator.
- Keep all children and visitors a safe distance away from the robot's operating area.

- Do not wear loose clothes, ties, rings or bracelets, and wear protective nets as these things can get caught easily in the machine by accident and cause injuries to the workers or other dangers during operations.
- Turn off the power, isolate the power properly and wait for the robot to stop completely when the robot is no longer in use before leaving the area.
- Install safety protection devices such as railings, gratings, laser scanners or pressure pads according to the instructions in the manual to prevent workers from entering the working range of the robot and being injured by the robot.
- Confirm that there is no one inside the railings before operating the robot.
- Do not interact with other workers while operating the robot. A lack of attention may result in a collision with the robot or injuries to other workers.
- Install the user operating buttons and alarm indicators outside the railings to ensure safe use. The operating interface should be at a suitable height (0.6–1.7 m) for operators to easily reach.
- Use the key selection switch to change between modes. The keys must be able to be removed in any mode.
- The senior supervisor should keep the mode selection switch key. Do not drop it carelessly or leave it inserted in the selection switch to prevent other workers from accidentally activating the robot, and causing injuries to the workers.
- Do not stand in the range of the robot when teaching the robot manually for the first time to prevent danger from being unfamiliar with the operations.
- Use slow speed operations when operating the robot manually for the first time; otherwise unfamiliarity with the operations may result in damage to the robot from impact or causing injuries to other workers.
- Do not turn the power on and off frequently to prevent damage to the DCV controller.

- Improper operations may damage the robot.
- When a collision occurs involving the robot, first turn off the power to the robot and then check the robot's components and cables to make sure that they are not damaged before turning the power back on and performing operations again.
- Use a safety lock on the railing switch when entering the railings to operate the robot to prevent the railings from closing suddenly, causing the robot to be activated accidentally.
- Turn off the power before removing the teaching pendant cable from the DCV controller to prevent damage to the teaching pendant.
- The location of the interlock switch between the structure of the safety protection device and the protection device should comply with EN ISO 14120 and EN ISO 14119 standards, and the safety distance should be designed according to EN ISO 13857 standards.

- Do not make any changes to any components on our company's handheld teaching pendant, including the Emergency Stop and Enable switches. Doing so lowers the safety performance and level, or may even eliminate the safety protection.
- Short-circuiting any safety protection signals on the DCV controller is strictly prohibited, and our company will not be held responsible for any work accidents that may occur.
- When operating the robot, all workers are prohibited from standing close to or in the robot working range to prevent injuries to the workers.
- Do not unplug any cables on the DCV controller while the robot is operating to prevent damage to the DCV controller.
- Do not open the protective cover or protection device while the machine and robot are operating.

■ Maintenance Safety

- Properly perform maintenance and inspection according to the manual to prolong the useful life of the robot.
- Add a safety lock on the power switch on the controller when performing maintenance or repair operations to the robot, and place a "Do not power on" safety warning in an obvious place.
- Replacing damaged internal DCV controller components with other brands of components is prohibited to prevent danger or decrease the safety performance levels.
- Make sure foreign objects do not get attached to, or enter the robot when performing maintenance or inspection.
- Use only oil that meets the specifications during maintenance to prevent damaging the performance of the robot or the mechanical components.
- Protection devices and repair doors in the danger areas that need to be opened or removed regularly for the purpose of operations, maintenance, cleaning or configuration should be interlocking.
- Workers performing maintenance or repairs to the robot or robot system should receive the necessary process training to execute the tasks required. Use only genuine parts to prevent grave dangers to the workers.
- The processing of waste material should comply with local laws and regulations, and should be treated carefully.

- Any changes to the maintenance schedule of the robot and maintenance oil are strictly prohibited.
- Maintenance and inspection of the DCV controller and robot is prohibited while power is on to prevent electrical shock or injuries to the workers.
- When a robot component is damaged, replacing it with other brands of components is prohibited to prevent damaging the performance of the robot or the components.
- Wait 10 minutes before opening the controller box after powering it off because there is residual voltage in the controller that may cause electrical shocks.

Contents DRV70L/90L Series Manual

List of Figures

Tables

1. Warning Label Explanations

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1. Warning Label Explanations

This section describes the location and meaning of the safety warning stickers. Operators should be familiar with the locations of the safety warning labels before using the robot and know the meanings of each safety warning to prevent accidents.

- Be aware of the locations of the safety warning labels during operations to prevent worker injuries.
- Operators should be aware of the locations of the safety warning labels before use and know the meanings of each safety warning.

- Removing or changing the location of any safety warning labels is strictly prohibited to prevent danger or injury to the workers.
- Performing any unsafe actions at the safety warning locations is strictly prohibited to prevent injuries to the workers.

1.1 Warning Label Explanations

There are two stickers on the front of the DCV controller: the High Voltage Warning sticker and the Read Before Use sticker, which are attached to the left and right sides of the DCV controller as shown in Figure 1.1.

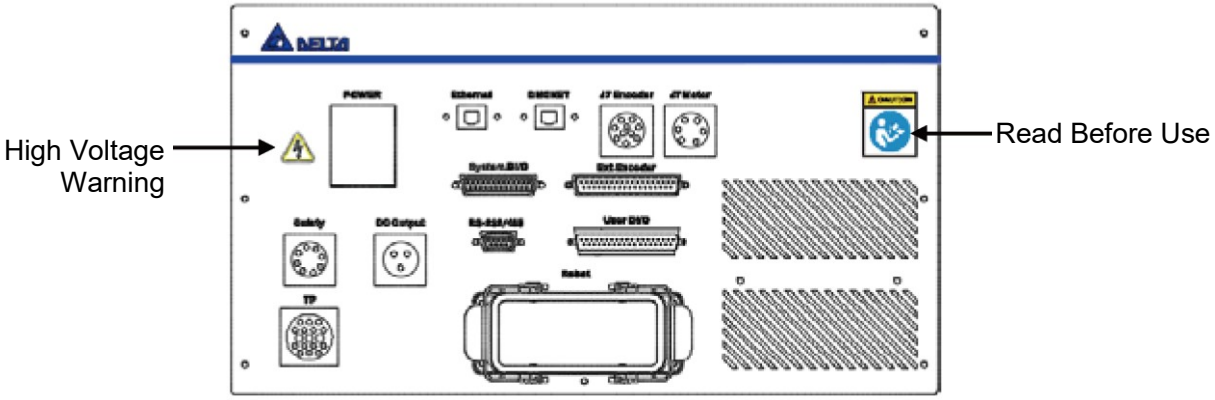


Figure 1.1 Sticker locations on the front of the controller

There is a high voltage warning sticker on the back of the DCV controller, as shown in Figure 1.2.

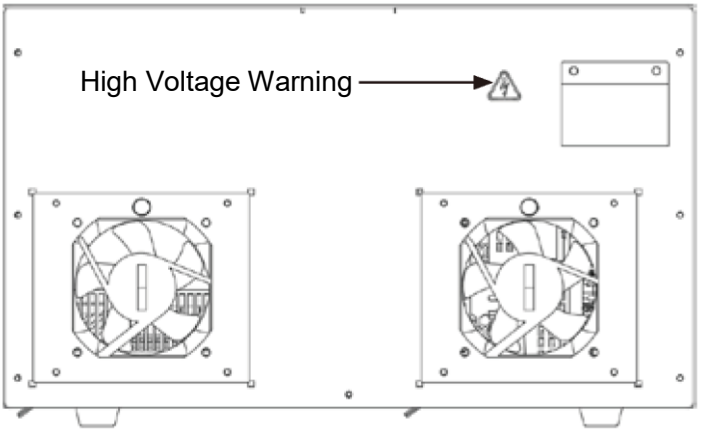


Figure 1.2 Sticker location on the back of the controller

Table 1-1 Sticker Label Name

Item	Name	Flag	NOTE	Qty
1	High Voltage Warning		The high voltage warning label means that high voltage exists in the switch or component; do not disassemble the component while the power is turned on to prevent electrical shock and other danger.	2
2	Read Before Use		Read the product manual and configure related surrounding safety protections before use to prevent danger.	1

1.2 Product Label Explanations

The product label is located on the right side of the DCV controller, and shows DCV controller related information. Figure 1.3 shows the location of the DCV controller product label.

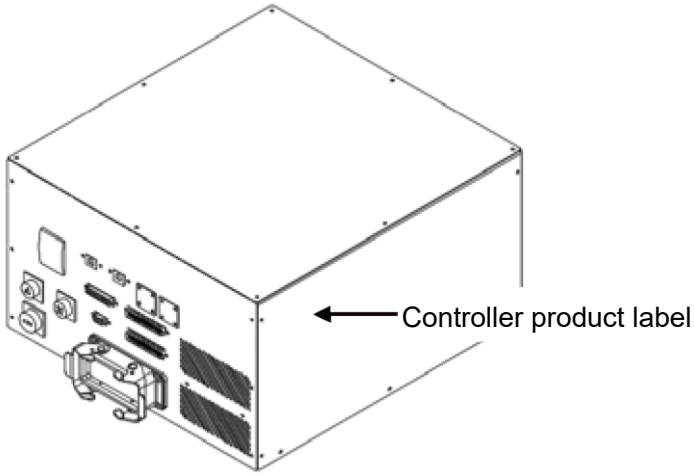


Figure 1.3 Product label location

Figure 1.4 shows the DCV controller product label sticker.

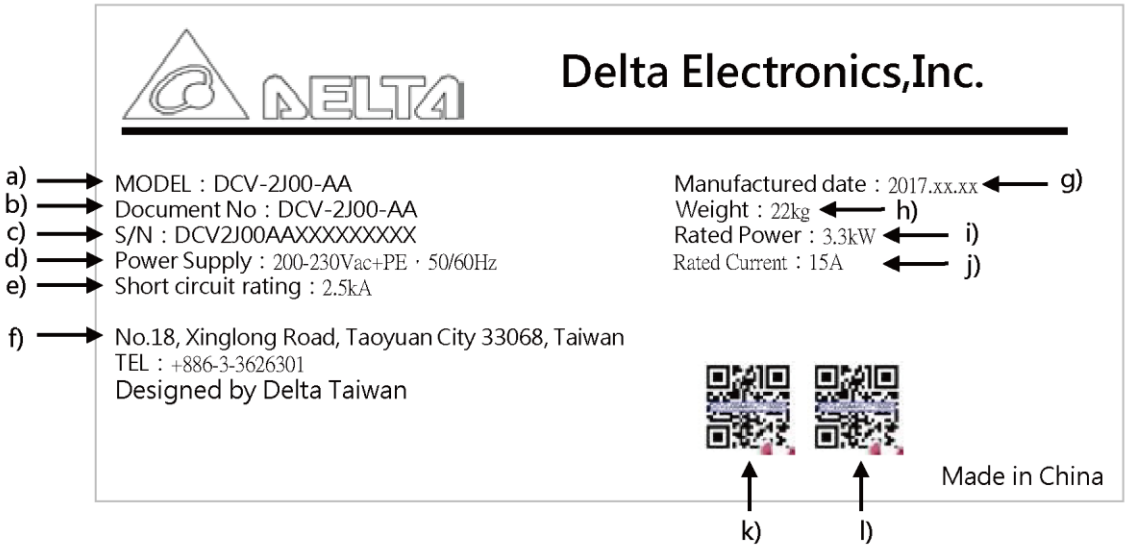


Figure 1.4 DCV controller product label information

Table 1.2 lists the detailed DCV controller product label explanation.

Table 1.2 Controller product Label

Item	Name	Description
(a)	MODEL	Controller Model Number
(b)	Document No	Controller Document Name
(c)	S/N	Controller Product Serial Number
(d)	Power Supply	Required Controller Power Voltage and Frequency
(e)	Short Circuit Rating	Controller Short-circuit Current Capacity
(f)	Address & TEL	Company Address and Contact Number
(g)	Manufactured Date	Manufacture Date
(h)	Weight	Controller Weight
(i)	Rated Power	Controller Maximum Power
(j)	Rated Current	Controller Rated Current
(k)	QR Code	Service QR code
(l)	QR Code	QR Code of Related Information of this Product

Table 1.3 lists the detailed descriptions of the DCV controller model number.

Table 1.3 Controller Model Number

D C V–2 J 0 0–A A			
Code	Definition	Definition	Description
(a)	DC	Product Series	Delta Controller
(b)	V	Type of Pairing Robot	S: SCARA V: Vertical
(c)	2	Generation	
(d)	J	Type of Controller	Drive
(e)	0	Built-in Expansion Shaft	0: No Expansion Shaft; 1:1 Shaft
(f)	0	Reserved	
(g)	A	Certification	A: Standard C: CE U: UL
(h)	A	Reserved	

Notes:
1. Only use robots with controllers that are specified to work together to prevent abnormal operation or damage to the robot.
2. The DCV Series controller is suitable for operation with the DRV70L and DRV90L Series robots.

2. Controller Specifications

2. Controller Specifications

This chapter introduces the specifications and dimensions of the DCV controller, Use the DCV controller according to the specifications.

- Use the robot according to the specified methods to prevent fire, equipment failure, or even worker injuries or fatalities and other danger.
- Do not use this product in locations with substances such as steam, corrosive gas and flammable gas to prevent electrical shocks or fire.
- Read this manual carefully before installation to make sure that you install the robot in a suitable location and environment to avoid affecting the mechanisms and shortening the useful life of the electronic components, or causing other safety problems.
- The DRV70L and DRV90L Series robots can work only with our company's DCV Series controller. Do not modify the machine and wiring or use it with other controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- The robot can be used in IP40 environments and is able to resist solid matter with a diameter over 1mm. It is not protected against any liquids.
- Keep the working range of the robot clean and ensure that the robot is not used in environments affected by substances such as oil, water and dust.
- Use only clean dry air (CDA) as the air source at the input terminal of the robot air hose.

- Use of this robot in non-specified environments is prohibited to prevent damage to the robot or reduce its useful life.
- Do not make any changes to the robot's specification tables.
- Making changes or modifications to the robot is prohibited. Our company will not be held responsible for any safety problems resulting from doing so. Please contact our company if other specifications are needed.

2.1 Controller Specifications

The DCV controller includes the Servo Drive and the safety circuit in one integrated unit. Do not modify the DCV controller parts and wires to prevent abnormal operation or damaging the components. Read this operation manual carefully before use. Table 2.1 lists the DCV controller specifications.

Table 2.1 Controller Specifications

DCV Series Controller		
Power		Single Phase: 200–230 Vac +PE, 15 A, 50/60 Hz
Dimensions (W) x (H) x (D) mm /Weight		383 x 223 x 406 mm / 22 kg
Cooling Method		Fan cooling
Robot Control	**Program Language**	Delta Robot Language
	Movement Mode	Point-to-point movement, linear interpolation, circular interpolation
	Memory Capacity	20 MB: For user-defined program and data 1 K Position: For global variables (shared by different programs) 30 K Position: For program editing by all users
I/O	**Standard DI/O**	System DI/O: 7-set input, 8-set output User-defined DI/O: 24-set input, 12-set output
Interface	**Ethernet**	1 Channel, RJ-45
	DMCNET	1 Channel, RJ-45: For connecting to Delta DMCNET products.
	RS-232 / RS-485	1 Port, D-sub 9-Pin/Female
	Teach pendant	1 Circular connector
	Safety	8-Pin circular connector Two sets of dual-channels provided to connect external emergency stop buttons, and two sets of dual-channels to connect safety protection devices.
	Ext .Encoder	D-sub 37-Pin/Female: Provides one set of connections for feedback from an external Encoder.
	DC Power	3-Pin circular connector provided for user-defined DI/O connection selection.
	Power IN	3-Pin connector terminal block for the AC power.
	Robot	European-spec. Multi-class connector/Female
Environmental Specifications	**Installation Location**	Indoors (avoid direct sunshine), non-corrosive vapor (no fumes, combustible gas or dust).
	Elevation	Below 1000 m in altitude
	Atmospheric Pressure	86–106 kPa
	Environmental Temperature	0–40ºC (if the ambient temperature is over 45ºC, use forced air circulation for cooling).
	Humidity	Below 0–90% RH (non-condensing)
	Vibration	Below 20 Hz 9.80665 m/s^2 (1 G), 20–50 Hz 5.88 m/s^2 (0.6 G)
	IP Level	DCV controller IP20; robot IP40
	Ground System	TN System: The neutral point of the electrical system must be connected to the ground. The exposed metal component must also be connected to the ground through a protective grounding conductor.

Figure 2.1 shows the DCV controller dimensions.

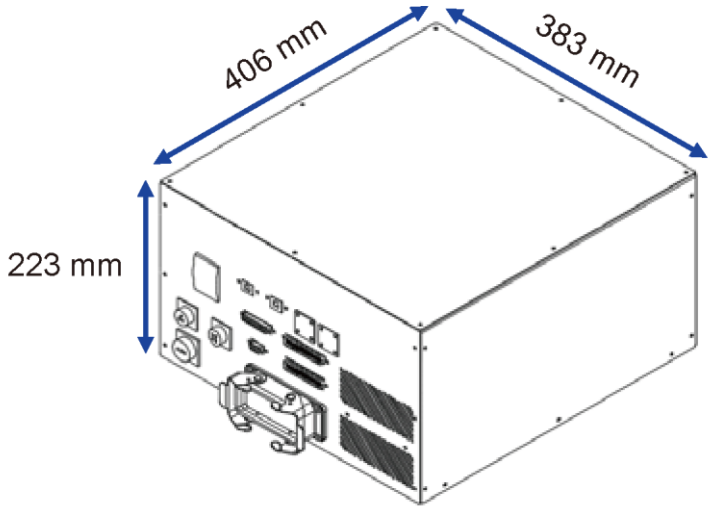


Figure 2.1 Controller appearance and dimensions

Controller Installation Notes:

- Do not put your fingers or foreign matter into the DCV controller cooling fan to prevent injury.
- This DCV controller does not have explosion-proof or splash-proof containment, so do not use it in locations that are too humid or can be splashed by liquids.
- Read this manual carefully before moving, installing, wiring and using this equipment.
- Do not stack objects on top of the DCV controller, and do not bump into the DCV controller.
- Do not install the DCV controller in a location that is subject to excessive vibration.
- Do not plug or unplug the power while the DCV controller is ON status or operating to prevent damage to the robot's and DCV controller's internal components. The input power of the DCV controller is 200–230 Vac, 50/60 Hz. Do not connect non-specified voltages to prevent damage to the DCV controller or inaccurate robot movements.

3. Transport and Installation

3. Transport and Installation

Follow the transportation and installation instructions in the manual to prevent dropping and damaging the robot or DCV controller.

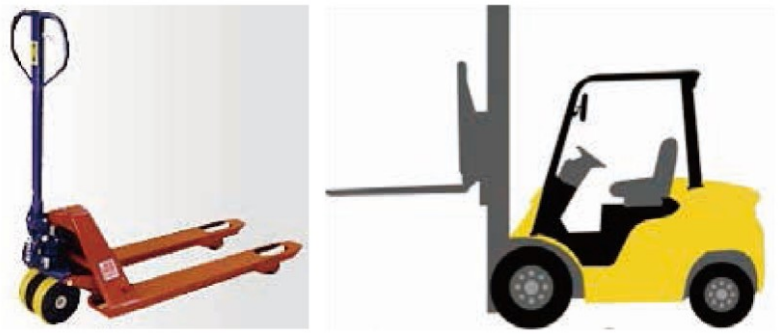
WARNING

- Only qualified workers with related licenses can operate equipment such as stackers and forklifts when transporting the robot.
- There are precision electronic components inside the robot. Be careful not to allow this device to collide with other objects during transport.
- Workers must not stand underneath the transported object when operating a lift. Workers must direct the operation from the side (in addition to the lift operator) to prevent accidents.
- Be careful not to tilt the robot when using a lift to prevent injuries.
- Remember to wear safety shoes and safety gloves when manually moving the DCV controller to prevent injuries.

3.1 Transportation

3.1.1 Transport of the Robot and Controller Together

Figure 3.1 shows the two methods to transport the robot: forklift or lift.



Forklift Lift

Figure 3.1 Forklift and lift

Notes:

1. Operators must have related licenses when using forklifts or lifts, or have an equal number of training hours before performing operations to prevent damage to the robot and to prevent injuries to the workers.
2. Properly extend the forklift under the wooden pallets as shown in Figure 3.2 to prevent tilting injuries.
3. Elevate the forklift or lift until it is off the ground and make sure it is not tilted to prevent dropping the product during transportation. When moving uphill or downhill, adjust the height or tilt angle of the forklift accordingly so that the product does not tilt, or secure the product in advance.
4. Check for anyone close by during transport. There should be workers on the sides who are responsible for guiding and directing (in addition to the lift operator). Operate the lift at the speed set by the company rules. Do not operate the lift at a high speed.

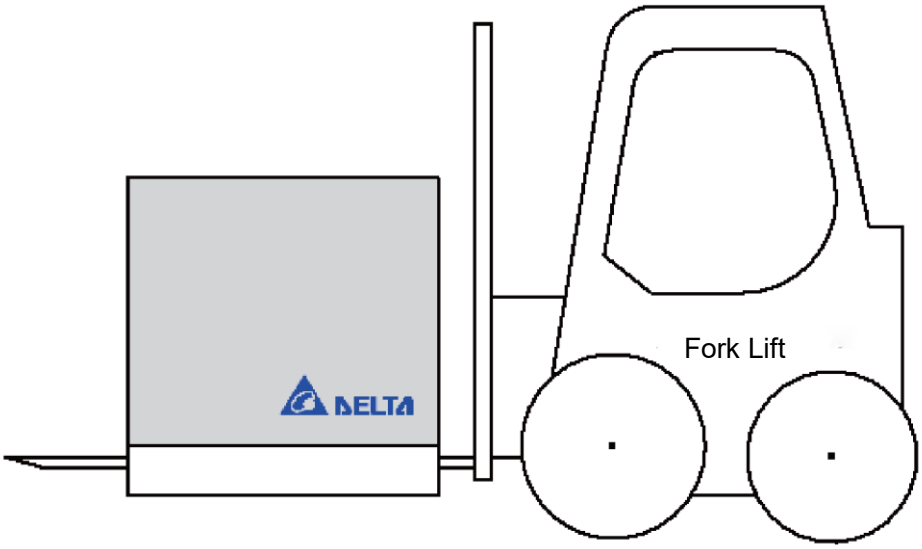


Figure 3.2 Forklift transportation example

3.1.2 Transporting the Controller Alone

1. Use a van for transportation.
2. When transporting the DCV controller with you hands, lift and support the DCV controller from the bottom.

3.2 Installation

- Read this manual carefully before installing the robot to make sure that you install the robot in a suitable location and environment to avoid affecting the mechanisms and useful life of the electronic components, or encountering other safety problems.
- The DRV70L and DRV90L Series robots can work only with our company's DCV Series controller. Do not modify the machine and wiring or use it with other DCV controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- Install the robot system under the specified conditions; in the foreseeable usage period, the robot may not be tilted or moved by uncontrolled methods during transportation, assembly, disassembly, suspended or discarded periods.
- Workers must wear proper safety work clothes, helmets, gloves and shoes when installing the robot to ensure their safety.
- On automated production lines, the operating range of multiple robots may overlap. Make sure that they do not interfere with one another to prevent damage to the robots from impacts.
- Do not add additional equipment such as cables or hoses inside the mechanism. When installing cables outside the mechanism, ensure that the cables and mechanisms do not interfere with one another during operations.
- Turn the power off before performing peripheral equipment adjustments.
- Use only clean dry air (CDA) for the air source at the input terminal of the robot air hose.
- Since the robot is a semi-finished product, if you add other operating modules or make any modifications, the original manufacturer will not be held responsible for any resulting problems.
- The robot can be used in IP40 environments and is able to resist solid matter with a diameter over 1 mm and a length not exceeding 80 mm.
- Keep the working range of the robot clean. Ensure that the robot is not used in environments with contaminants such as oil, water and dust.
- Follow the manual and install safety protection devices such as railings, gratings, regional lasers or pressure pads to prevent injuries or other dangers to the workers from impact by the robot.
- Install the user operating buttons and alarm indicators outside the railings to ensure safe use.
- Properly ground all robot systems before connecting the power.
- The final system integrator should install safety protection devices to prevent workers from getting close to the danger area.

- The robot does not have explosion-proof or splash-proof structures, so do not place it in locations that are too humid or where the robot can be easily splashed by liquids.
- Do not place objects on top of the robot and do not bump into the robot.
- Do not place any objects on top of the cables connecting the DCV controller and robot to prevent damage to the cables and to prevent injuries.

The DCV controller uses forced air fan cooling. Do not place the DCV controller against the wall during installation to prevent poor DCV controller cooling. Keep the back of the DCV controller at least 10 cm away from walls or barriers, and leave a space of at least a 5 cm on the left side. The connection interface and cooling air inlet are in the front of the DCV controller, so leave a space of at least 15 cm to ensure efficient cooling and so the cables can be installed properly.

Figure 3.3 shows the installation distances around the DCV controller.

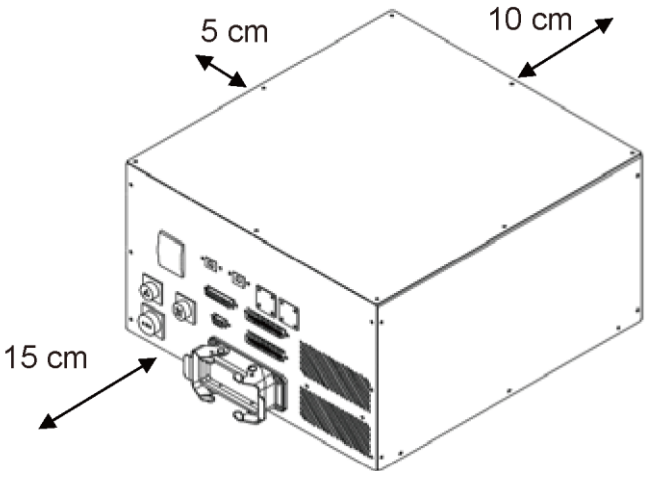


Figure 3.3 Controller installation spacing

4. Robot Safety Protection

4. Robot Safety Protection

- The final system integrator must follow the instructions in this manual to construct a safe overall protection system for the robot to prevent injuries or fatalities to workers.
- Once the safety protection system and wiring are completed, then you can connect power to the DCV controller and operate the robot.
- Follow the instructions in this manual for the safety protection and wiring, or our company will not be held responsible for any injuries sustained by the workers.

- Do not perform any operations with the robot before the safety protection system construction is complete.
- Do not bypass the safety protection system. The safety protection system includes the Emergency Stop signal, railings, pressure pad, gratings, laser scanners and any safety device signals that protect the workers.

4.1 Robot Safety Protection

Robot safety protection refers to the protection equipment set up around the robot. These prevent workers from getting close to the robot while it is operating and being accidently hit by the robot. The final system integrator should properly construct the safety protection devices to ensure that the workers do not get hit and injured by the robot.

The complete robot safety protection should include:

1. **Emergency Stop Device**
   Must be a dual-channel NC contact mechanical type emergency stop device.
   This type of device can be an Emergency Stop button, pull-rope switch or a similar device.

2. **Railings, Gratings, Pressure Pads or Laser Scanners**
   Use equipment such as railings, gratings, pressure pads or laser scanners in the working range of the robot to prevent workers from getting close and being injured.
   The maximum working range of the robot must be considered for the protection range.

3. **Teaching Pendant Enable Switch**
   This is the third switch on the back of the teaching pendant. You must press the Enable switch when manually performing teaching point operations to teach the robot. You stop robot operations by either releasing the switch or by pressing the switch all the way to the bottom.

4.2 Robot Safety Protection Construction and Installation

4.2.1 Emergency Stop Device Installation

This must be a dual-channel NC contact mechanical type emergency stop device.

When using the Emergency Stop button:

1. **The button must be red with a yellow background (the area of the yellow background must be greater than the area of the red), as shown in Figure 4.1.**

Figure 4.1 Emergency Stop button

2. **It must be equipped with a manual reset function, as shown in Figure 4.2.**

Figure 4.2 Emergency Stop switch reset method

3. **It must be equipped with a disconnect function so that when the contacts are closed, pressing the button disconnects the closed contacts.**
   This function symbol is shown in Figure 4.3.

Figure 4.3 Emergency Stop Safety Disconnect symbol

4. **Install multiple emergency stop devices according to the actual overall system, and do not make the installation distance between each emergency stop device so far that a worker cannot press the button when an emergency event occurs.**
   Make sure the height of the Emergency Stop button is not too high or low. Install it at a height that is accessible to workers.
   The Emergency Stop buttons must be installed in obvious places that cannot be blocked by other devices.

4.2.2 Emergency Pull-rope Device Installation

This must be a dual-channel NC contact mechanical device, and must have a reset button. The pull-rope must be able to be triggered from any position.

Install the pull-rope at an accessible height for workers of average height. Installing it too high results in workers being unable to reach it.

The railing protection is still needed after you install the pull-rope switches. The pull-rope switches are there so that the emergency stop function can be triggered from any position.

When installing emergency pull-rope devices, place them around the entire safety protection railing as shown in Figure 4.4.

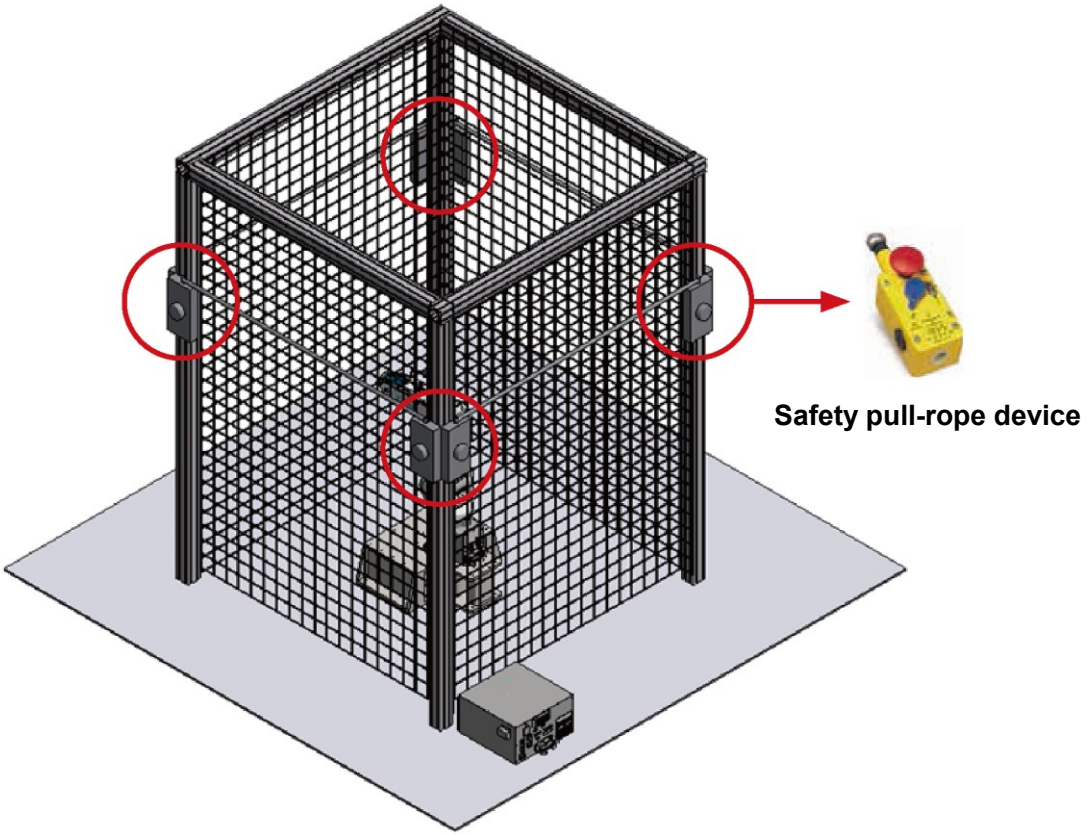


Figure 4.4 Safety pull-rope switch installation example

4.2.3 Railing Installation

Disconnect the DCV controller power before performing adjustments to surrounding devices. Confirm that the robot arm has stopped operating completely before performing adjustments according to EN ISO 13857 (EN294&EN811) Safety Distance for Upper and Lower Limbs.

You must consider the operating range of the robot arm height in setting the height of the railings, as well as the distance to worker contact and the time for the robot arm to stop moving after the power has been disconnected. Figure 4.5 shows the recommended installation distance for operating the DRV70L robot arm in full stroke (when the railing height is 2 m). Table 3.1 lists the installation distances between the robot and the railings.

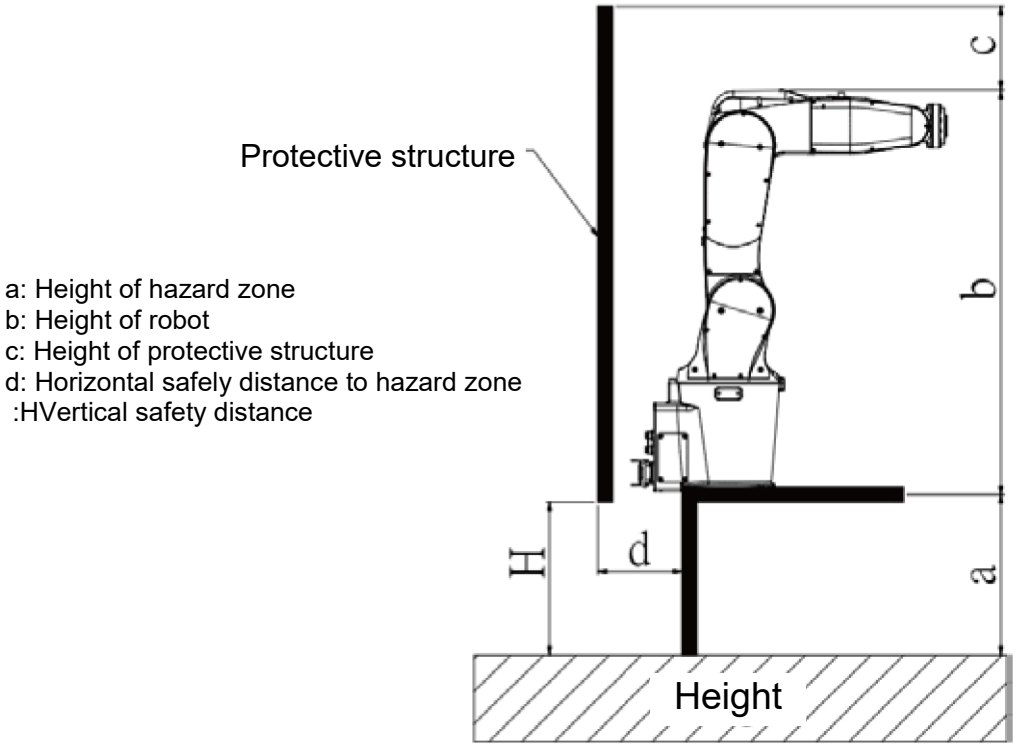


Figure 4.5 Installation height for railings around the robot

Table 3.1 Installation Distance between the Robot and Railings

	a	b	c	d	H
	Machine installation height	**Machine height**	**Railings should be higher than the machine height**	**Railings distance should be greater than the table distance**	**Height under the fence**
DRV70L	30–100 cm	68±3 cm	Over 100 cm	Over 30 cm	5–20 cm
DRV90L	30–100 cm	68±3 cm	Over 100 cm	Over 30 cm	5–20 cm

In addition, consider the length of the workers' arms so that the workers cannot touch the robot.

Figure 4.6 shows an insufficient railing installation height: the worker's arm can still reach inside the railing. The height of the railing must be set according to the specifications to prevent worker injuries or fatalities.

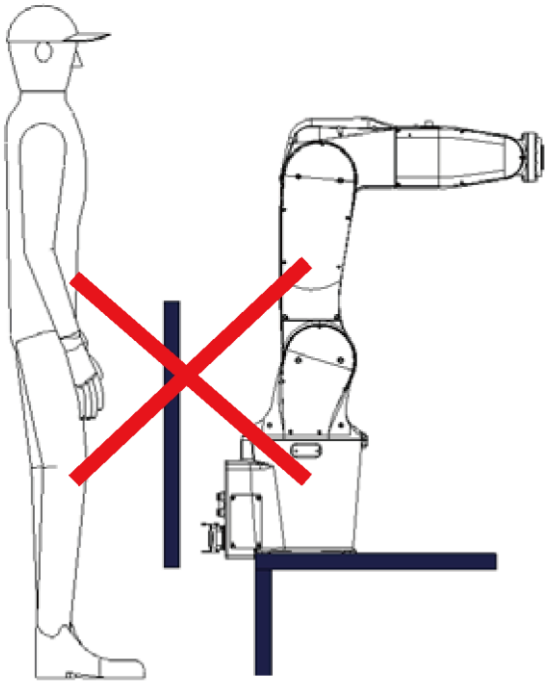


Figure 4.6 Insufficient railing installation height

4.2.4 Safety Grating Installation

The safety grating system shall comply with IEC 61496-1 and -2.

Improper installation and use risks the workers being hit by the robot arm.

Set up the grating system around the robot so that the grating system can detect workers no matter where they enter from.

DRV70L/90L Safety Grating Protection Area

Figure 4.7 shows the DRV70L safety grating installation distances. Table 3.2 lists the grating distances.

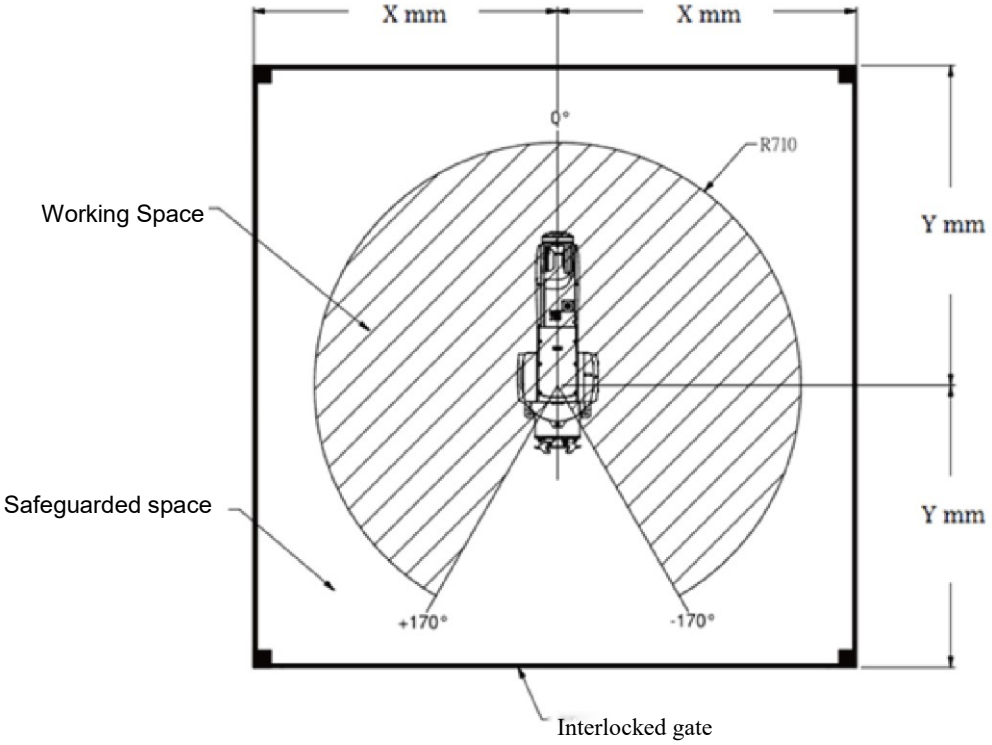


Figure 4.7 DRV70L safety grating installation distances

Table 3.2 DRV70L/90L Safety Grating Safe Distances

DRV70L/90L safety grating safe distances			
Item Number	**Model Number**	**X**	**Y**
1	DRV70L	≥ 810	≥ 810
2	DRV90L	≥ 1000	≥ 1000

4.2.5 Safety Mat Installation

The safety mat shall comply with EN 1760-1 (ISO 13856-1), and shall be able to detect operators over 35 kg.

Installing a safety mat is another type of protection system around the robot. Since safety mats rest on the floor, the do not have height protection like railings. Calculate the size of the safety mats according to the total moving range of the robot arm.

Do not place safety mats around the robot when it is in use, and cover the entire working area with the safety mat.

DRV70L/90L Safety Mat Installation Area

Figure 4.8 shows the safety mat installation area for the DRV70L/90L. In addition to calculating the maximum work area of the robot, add an average of 1 m for worker arm length to prevent the workers' arms from hitting the robot. The actual installation takes into consideration the arm length of most workers in that area. Table 3.3 lists the safety mat distances.

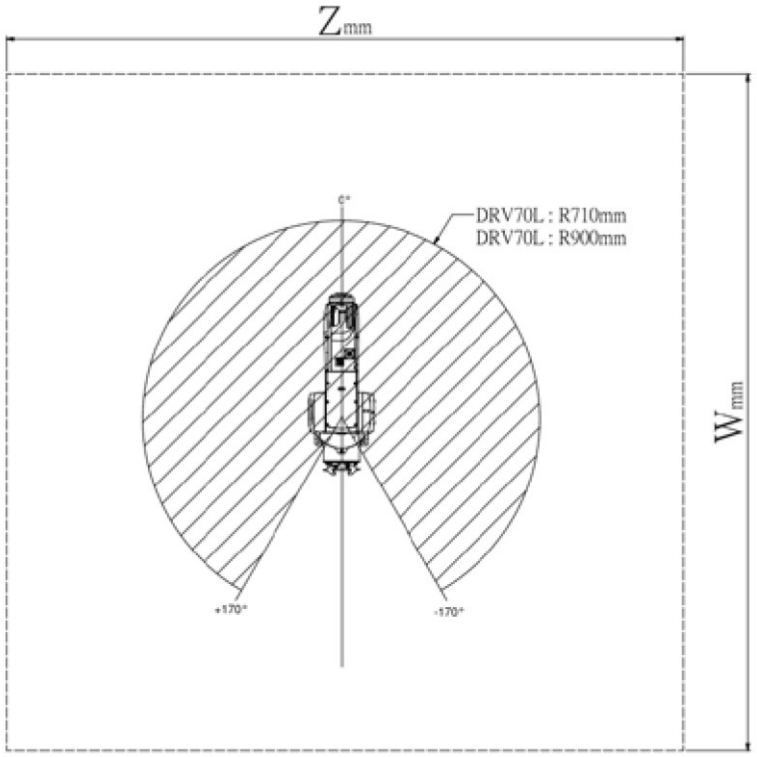


Figure 4.8 DRV70/90L safety mat area

Table 3.3 DRV70L/90L Safety Mat Distances

DRV70/90L safety mat distances			
Item Number	**Model Number**	**W mm**	**Z mm**
1	DRV70L	≥ 2420	≥ 2800
2	DRV90L	≥ 2420	≥ 2800

4.2.6 Laser Scanner Installation

When installing the laser scanner, take into consideration both operating range of the robot and the distance that the workers' arms reach into the robot.

The laser scanner cannot detect a full 360°, so another laser scanner for blind spots or where there are safety concerns. Figure 4.9 shows a laser scanner installation.

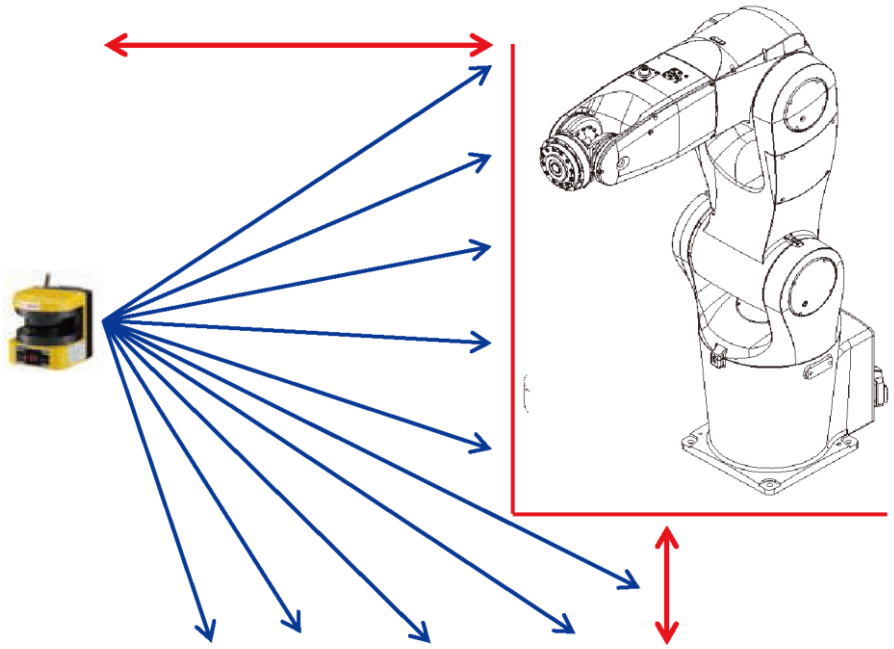


Figure 4.9 Laser scanner installation

5. Wiring

5. Wiring

This chapter introduces the wiring for the peripheral systems, the DCV controller and the robot.

The robot is a semi-finished product system. You must construct the additional equipment such as safety protection systems, operation buttons and lamps around the robot according to the instructions in this manual to ensure the integrity and safety of the entire system.

- Perform wiring according to the explanations in the manual.
- Install safety protection devices around the robot, such as railings, safety gratings, pressure pads or laser scanners to guarantee the safety of the workers.
- Turn off the power during wiring to prevent a danger of electrical shocks.
- Do not perform any wiring within 10 minutes of turning off the power because there is residual voltage in the DCV controller that has not yet been fully discharged.
- Wiring operations shall be performed by workers with related licenses. Workers without related licenses shall not perform wiring operations.

- Workers without related licenses shall not perform wiring operations.
- Do not bypass the safety protection system. The safety protection system includes the emergency stop signal and railing signal.
- The emergency stop signal and railing signal are no-voltage contact signals. Do not connect any AC or DC power to them to prevent damage to the DCV controller.
- Do not modify any wiring inside the DCV controller. Our company is not responsible for any DCV controller malfunctions or damage resulting from doing so.

5.1 Construction of the Controller Peripheral System

The DCV robot controller is integrated with the servo drive control. You can use this DCV controller with visual systems and teaching pendants. You can expand the system with servo drives or remote input/output modules to easily complete integration with peripheral systems. Figure 5.1 shows a schematic of the combination of DCV controller interface peripherals.

Note: The extendable drives and remote input/output modules must be operated with Delta DMCNET products.

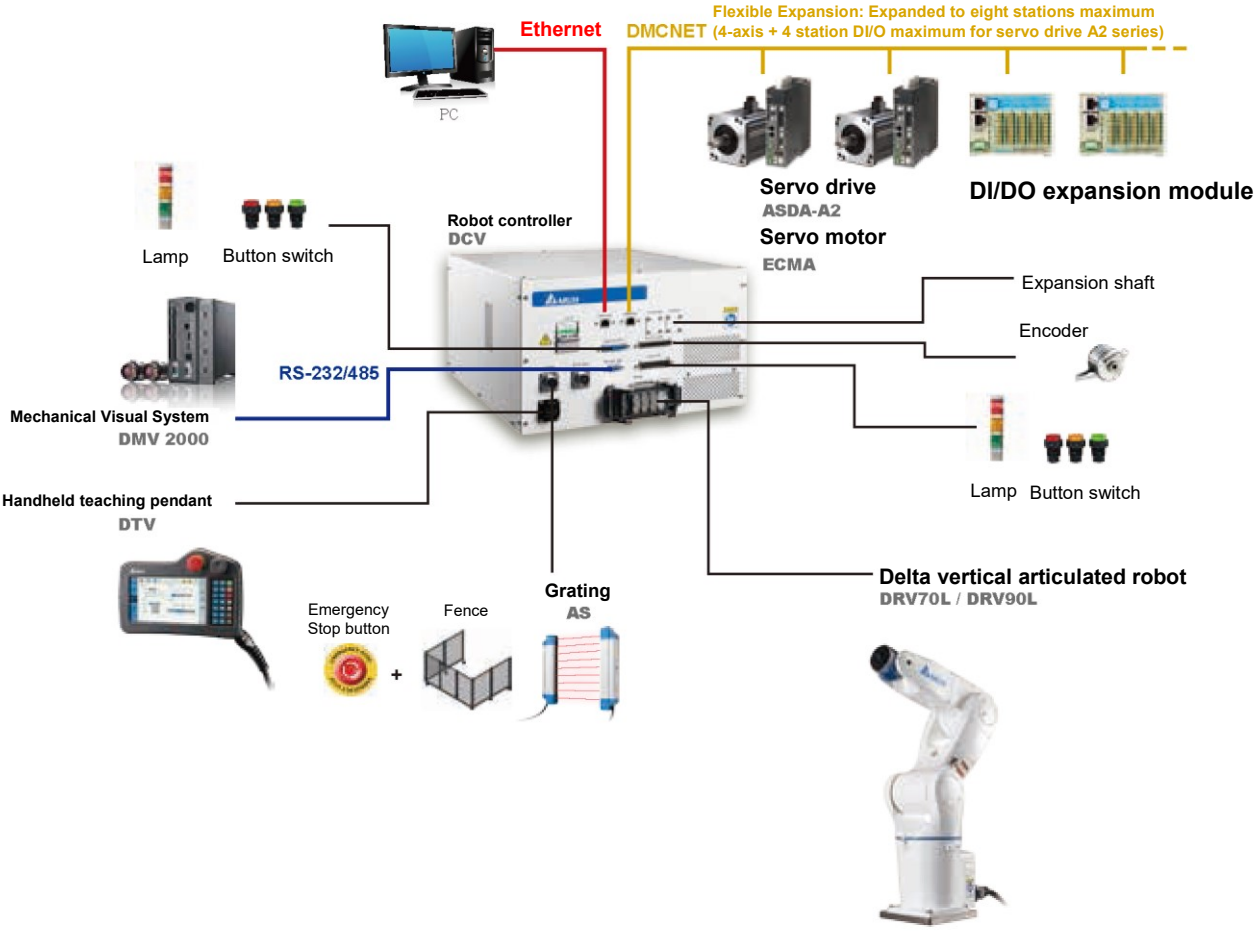


Figure 5.1 Controller peripheral system components

5.2 Controller Interface Description

The following sections describe the DCV controller interface and explain the interface function and the wiring.

5.2.1 Power Input

Figure 5.2 shows the power input terminal located on the back of the DCV controller.

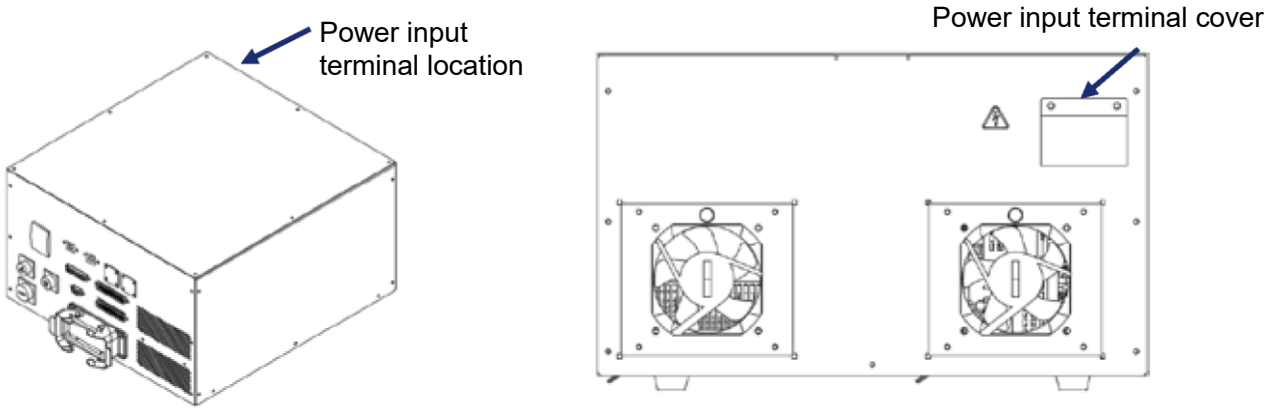


Figure 5.2 Power input terminal location

The DCV controller power is single-phase, 200–230 Vac, 50/60 Hz, 15 A. Connect the power terminal with a power cables of at least 2.0 mm diameter and use 2.0 mm diameter ground cables (yellow/green).

To prevent the terminal from becoming loose and causing danger, lock the power cable tightly in place and use R-type terminal wiring as shown in Figure 5.3.

L and N are power cables and E is the ground cable.

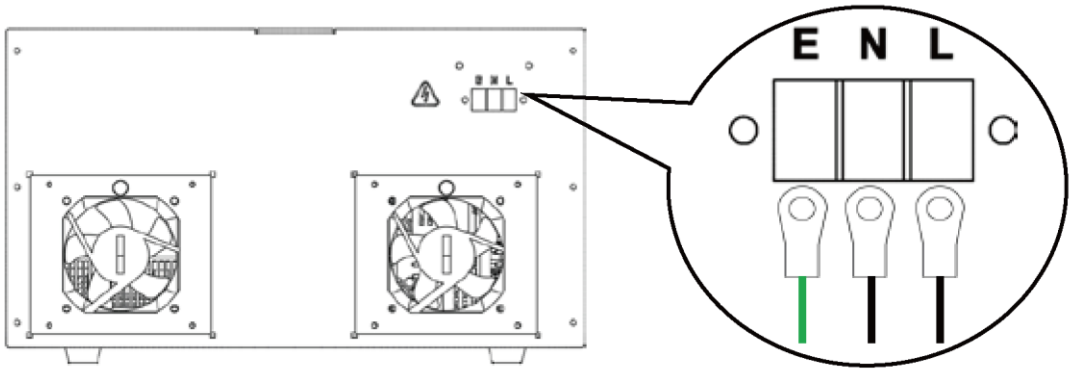


Figure 5.3 Power terminal wiring

Install an EMI filter and electric reactor before the DCV controller to ensure that the DCV controller is not affected by EMI noise interference or harmonic waves. Figure 5.4 shows the related wiring.

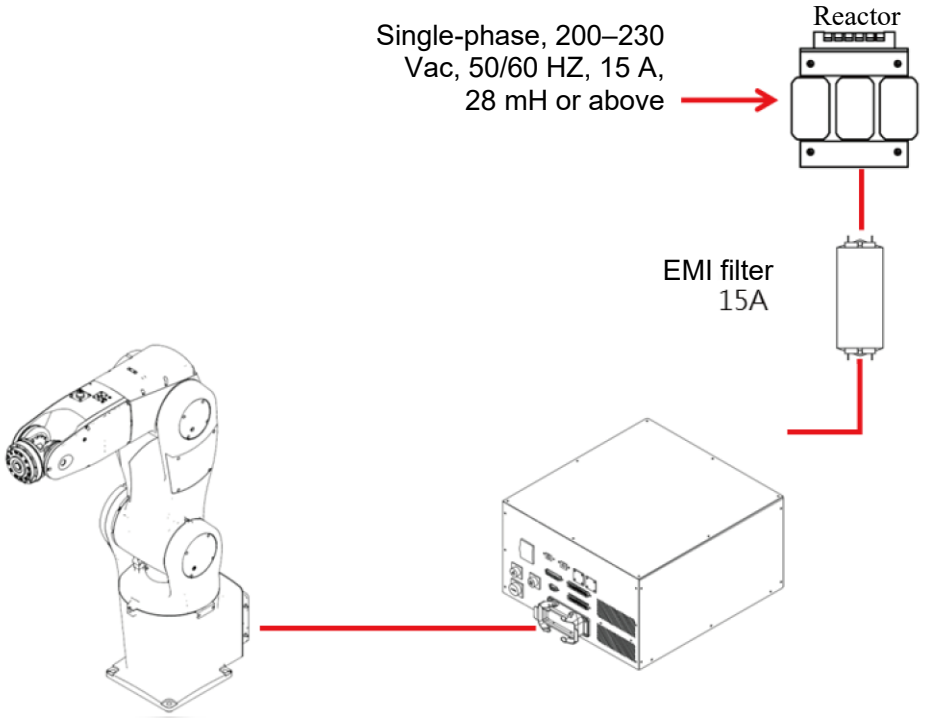


Figure 5.4 Controller with EMI filter and electric reactor

5.2.2 RS-232/485 Wiring

The DCV controller has a standard D-Sub 9-Pin/Female connector. You can communicate with the DCV controller using DCV controllers such as a PC, PLC or HMI that support RS-232/485 communications. You can read the robot data and control the robot. In addition, you can also use DCV controllers that support RS-232/485 communication to read and write data to the DCV controller.

Figure 5.5 shows the location of the RS-232/485 connector.

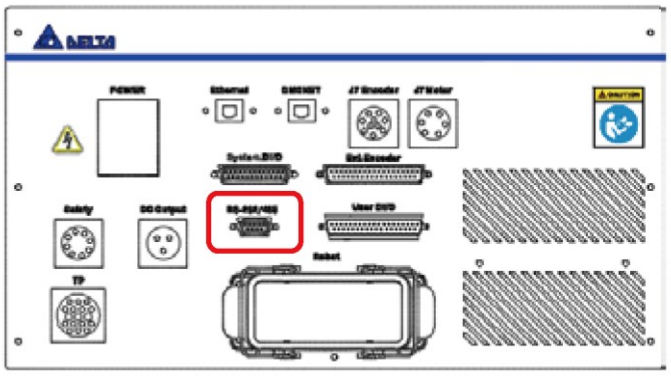


Figure 5.5 RS-232/485 connector location

Use shielded twisted-pair cables to prevent interference in data transmission for the connections. Table 5.1 lists the RS-232/485 pin definitions.

Table 5.1 RS-232/485 Connector Pin Definitions

PIN	NAME	PIN	NAME	PIN	NAME
1	+RS-485	**2**	RS-232/RX	**3**	RS-232/TX
4		**5**	GND	**6**	RS-485
7		**8**		**9**	

5.2.3 Ethernet Connector

You can use a PC for communication with the DCV controller by connecting an Ethernet cable to the DCV controller. In addition, you can perform the following tasks through the Delta DROE software:

- Edit the Robot Program Language and save the program into the DCV controller for project management.
- Perform tasks such as Jog the robot, set the origin and reset the origin.
- Set the servo and robot related parameter settings.
- Execute I/O monitoring.
- Monitor alarms and troubleshoot problems.

Refer to the descriptions in the Delta DROE Operation Manual for the detailed operating instructions for the DROE software.

Figure 5.6 shows the location of the Ethernet connector.

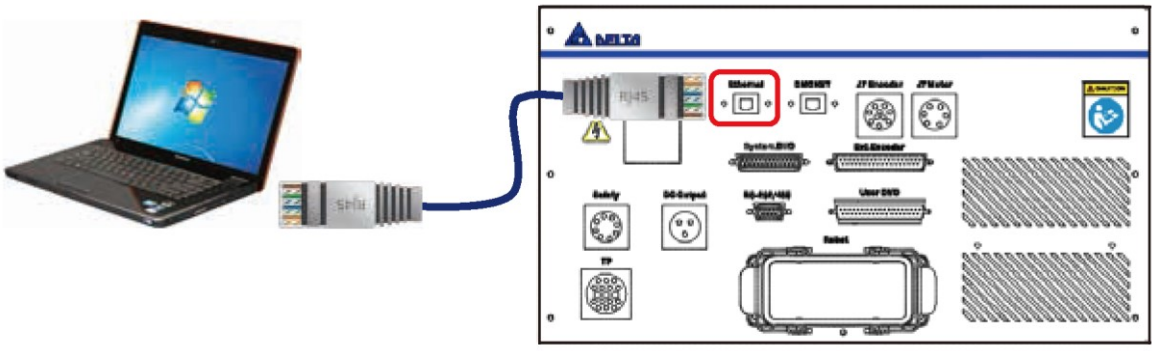


Figure 5.6 Ethernet connector location

5.2.4 DMCNET Connector

You can connect various Delta products through the Delta high speed communication network DMCNET, such as servo drives and remote DI/O modules. Figure 5.7 shows the DMCNET connector that accepts one end of a standard RJ45 cable to the DCV controller interface. You can then connect the other end to the Delta DMCNET product.

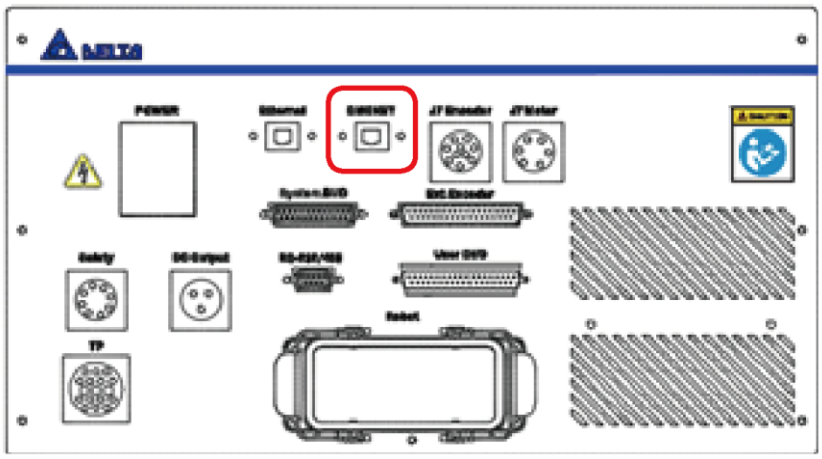


Figure 5.7 DMCNET connector location

You can connect a maximum of 12 Delta product workstations equipped with the DMCNET function through the DMCNET connection, as shown in Figure 5.8.

Note:

1. When you connect an external servo drive to the DMCNET connection, if the controller is a six-axis controller, you can connect at most a four-axis external driver. If the controller is a seven-axis controller, you can connect at most a three-axis external driver.
2. If the connected DMCNET unit has no driver, you can connect a maximum of 12 DI-O module units.

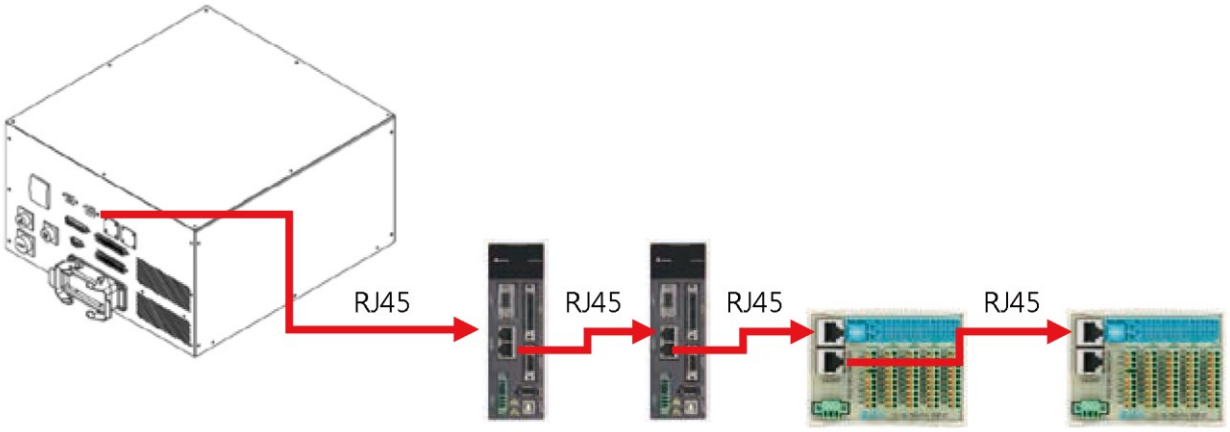
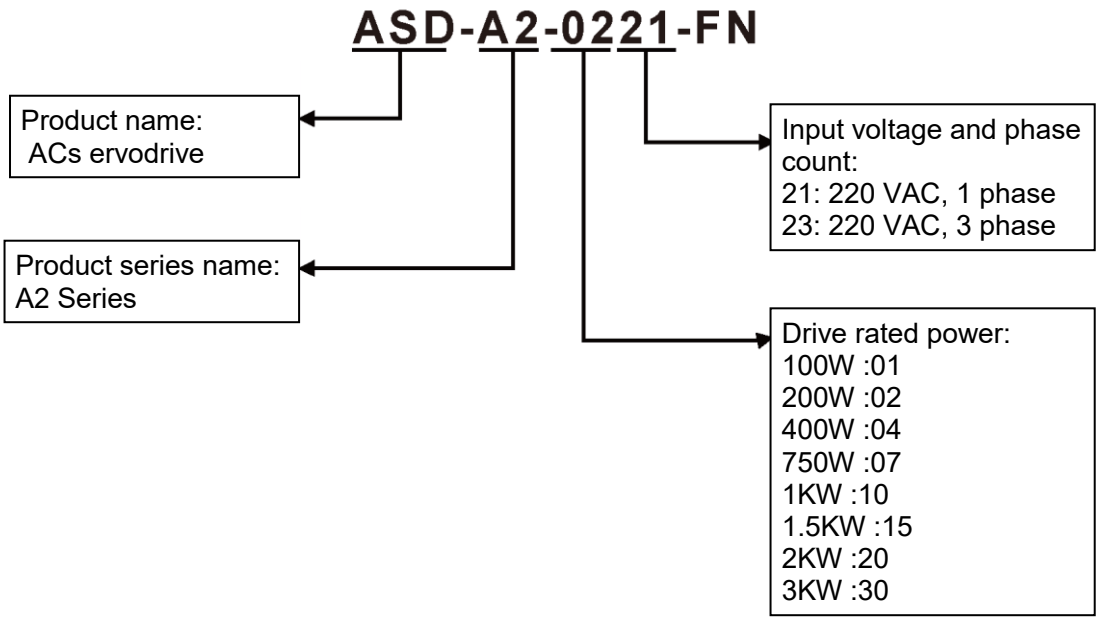


Figure 5.8 Multiple DMCNET connections

The following figure shows the driver models that you can connect through DMCNET.



When connecting an external expansion axis servo drive, add an electromagnetic contactor before the servo drive. Figure 5.9 shows how you control the electromagnetic contactor by using the upper controller (for example, a PLC) or an emergency stop to cut off the AC power to the servo drive.

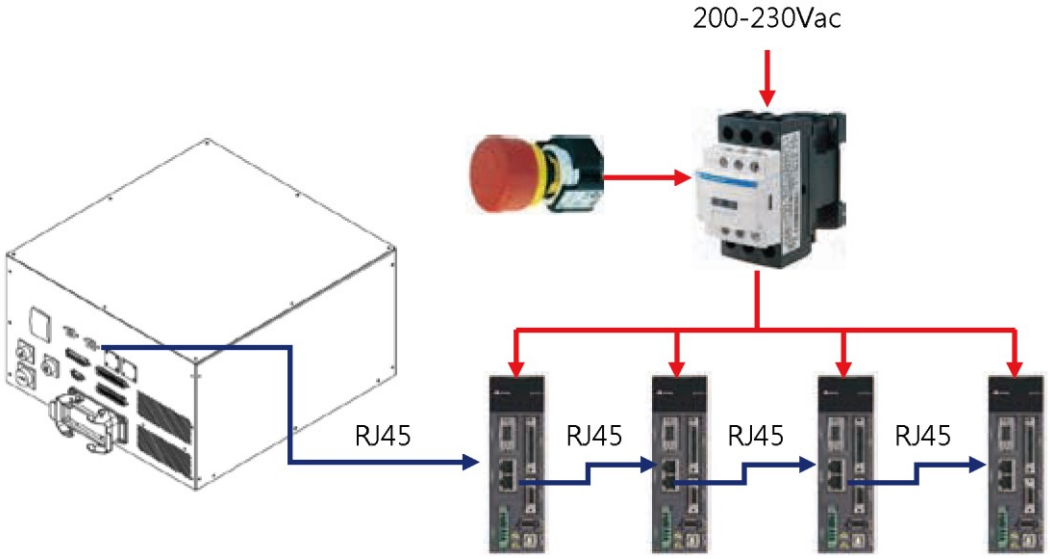


Figure 5.9 Controller with external servo drive system architecture

The DI/O modules models that can be connected are listed below.

Input Module:

- ASD-DMC-RM32MN

  32-point input module.

  Input signal: By connecting to the COM point, you can select PNP or NPN for the input signal.

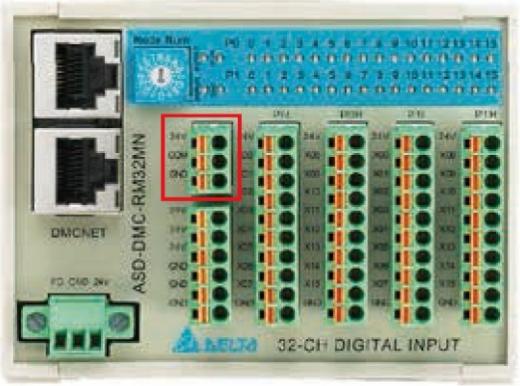


Figure 5.10 ASD-DMC-RM32MN

Shorting COM and 24V: The common point of the input signal is GND.

Shorting COM and GND: The common point of the input signal is 24V.

Output module:

- ASD-DMC-RM32NT
  32-point output module.
  Type of output signal: NPN.
  Rating of output current: 100 mA/1 point.
  Type of output circuit: transistor.

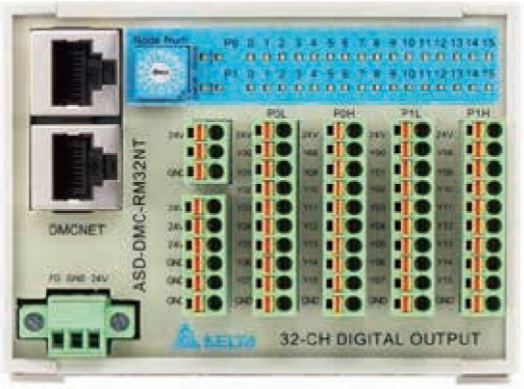


Figure 5.11 ASD-DMC-RM32NT

5.2.5 Handheld Teaching Pendant Connector

You use the handheld teaching pendant (TP) to operate the robot, teach points, edit the robot program and perform I/O monitoring. Figure 5.12 shows the TP connection location.

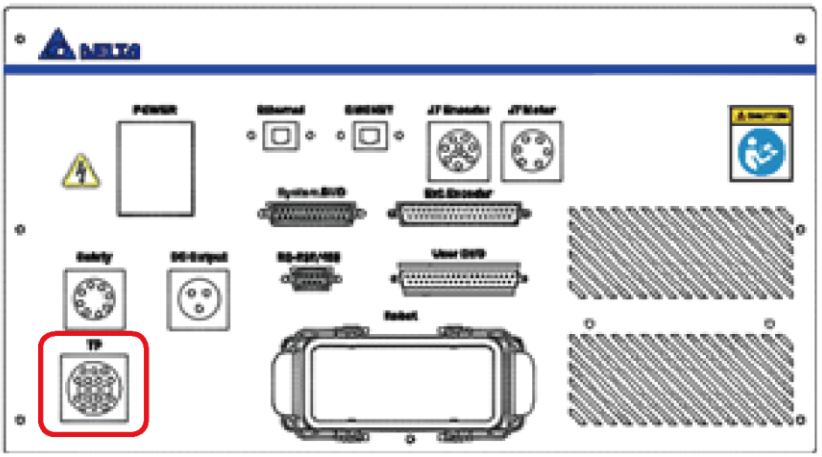


Figure 5.12 Handheld teaching pendant connector location

Notes for operating the handheld teaching pendant:

- The teaching pendant operates in the T1 Mode (JOG teaching), T2 Mode or Auto Mode (automatic execute program operations).
- The JOG speed is limited to 250 mm/sec when the teaching pendant is in T1 Mode.
- When using the teaching pendant to operate the robot, do not stand in the working range of the robot to prevent being hit by the robot.
- When using the teaching pendant to Jog the robot, your left hand must press down on the middle of the Enable switch located on the back of the teaching pendant to Jog the robot. Pressing this switch to any other position cuts all AC power. Figure 5.13 shows the Enable switch on the back of the teaching pendant.

Figure 5.13 Handheld teaching pendant Enable switch location

- In an emergency, press the Emergency Stop button on the front of the teaching pendant or release the Enable switch and the robot immediately stops operating.
- Do not use a sharp object or pen on the teaching pendant screen to prevent damage to the screen.
- Refer to the teaching pendant manual for detailed operations, or download the manual from the official Delta website.

Notes for connecting and disconnecting the teaching pendant:

- Disconnect the DCV controller power before connecting the teaching pendant.
- To disconnect the teaching pendant from the DCV controller, first turn OFF the DCV controller power. After you disconnect the teaching pendant, please connect the teaching pendant bypass connector (short-circuit connector) on the DCV controller as shown in Figure 5.14 to prevent errors from occurring that prevent the DCV controller from operating.

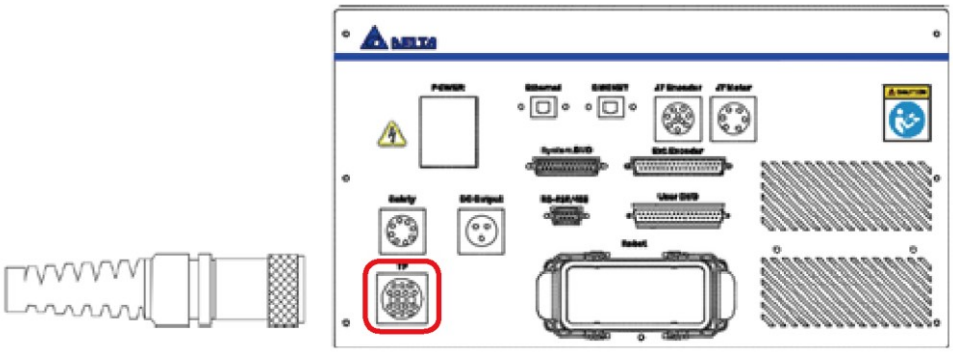


Figure 5.14 Handheld teaching pendant bypass connector location

5.2.6 Safety Connector

The DCV controller includes a connector for eight-point safety signals. You use these eight-point safety signals to construct comprehensive robot safety protection. Figure 5.15 shows the location of the safety connector.

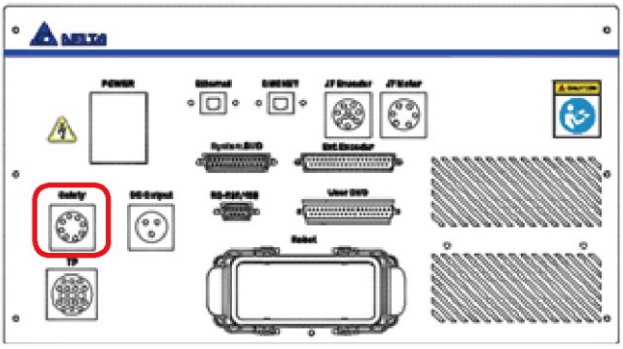


Figure 5.15 Safety connector location

Table 5.2 lists the safety pin definitions.

Table 5.2 RS-232/485 Connector Pin Definitions

PIN	DI	NAME	DI	PIN	NAME
1	DI	Emergency StopNC1	DI	5	Safety ProtectionNO1
2		Emergency StopNC1		6	Safety ProtectionNO1
3		Emergency StopNC2		7	Safety ProtectionNO2
4		Emergency StopNC2		8	Safety ProtectionNO2

Notes for connecting the external emergency stop:

- The emergency stop is a dry contact (voltage-free contact) signal. Do not connect an AC or DC voltage signal to the DCV controller to prevent damage to the DCV controller internal components.
- Short-circuiting the emergency stop signal is strictly prohibited. This ensures the safety of the overall robot system and the workers.
- The emergency stop is a safety signal. Install the Emergency Stop button in a location that can be easily reached.
- Properly wire the emergency stop signal according to the methods described in the wiring diagram. The Emergency Stop button must have 2NC contacts. If only one 1NC contact is connected, the DCV controller will have continuous emergency stop errors.
- Do not connect one 1NC contact to Pins1–4 of the safety connector simultaneously to prevent decreasing the safety level of the system.
- Construct the emergency stop system according to the actual equipment and install one or more Emergency Stop buttons. When connecting multiple emergency stops, use serial connection for the emergency stop NC signal. Do not use parallel connections.
- When the emergency stop signal is triggered, the robot stops immediately and the AC power is cut to reach type 0 safety stop.

Figure 5.16 shows a correct wiring example for a single Emergency Stop button.

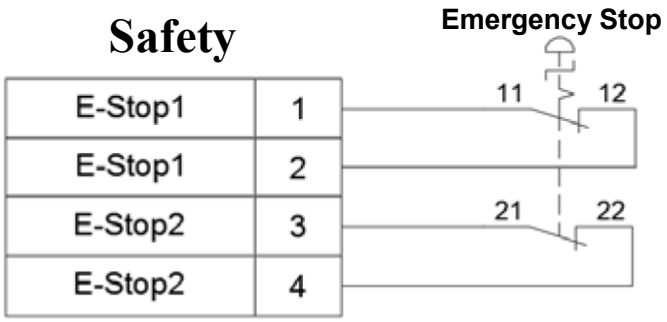


Figure 5.16 Wiring example for a single Emergency Stop button

Figure 5.17 shows the incorrect wiring method when connecting only one Emergency Stop button NC contact. This wiring method is wrong and causes continuous system errors.

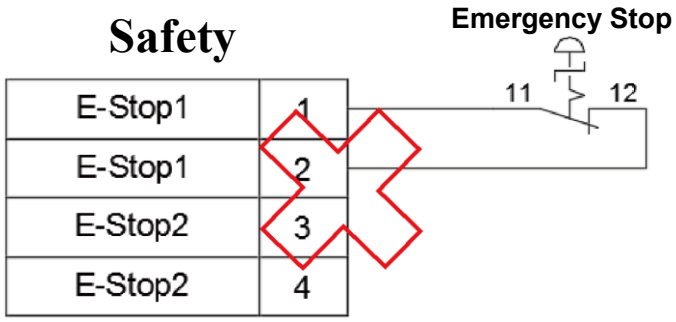


Figure 5.17 Incorrect wiring for a single NC emergency stop

Figure 5.18 shows the incorrect wiring method when using only one Emergency Stop button NC and the safety signal is connected. This wiring method is wrong. Do not use this wiring method. It results in a decreased safety level for the entire system.

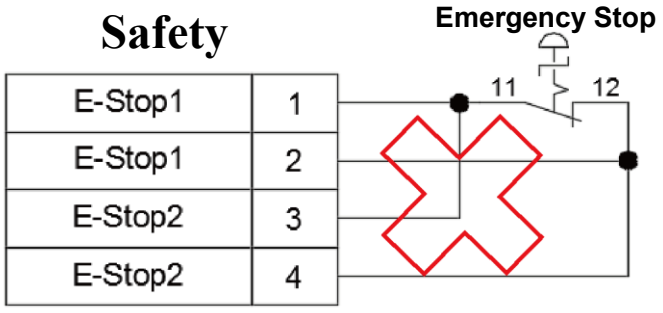


Figure 5.18 Incorrect wiring for a single NC emergency stop with the safety signal connected

When connecting multiple Emergency Stop buttons, wire them according to Figure 5.19. Place the Emergency Stop button so that a worker can quickly press the button to stop the robot.

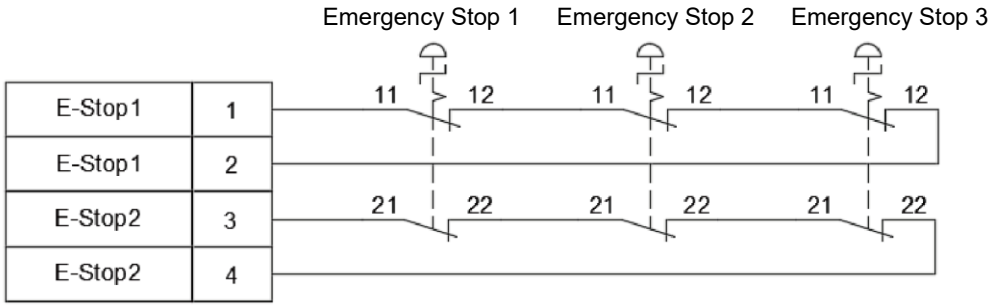


Figure 5.19 Wiring example for multiple Emergency Stop buttons

Pins 5–8 of the safety connector are the safety protection contacts. You can install safety equipment such as railings, safety gratings, pressure pads or laser scanners according to your application. Figure 5.20 shows the wiring for multiple safety protection devices. Refer to the safety protection construction and installation descriptions in Section 4.2 for the installation requirements.

When using safety protection railings, connect the A contact (normal open contact) of the railing signal to Pins5–8. When the railing is properly closed, the NO contact changes to a NC contact. When the railing is opened and workers are about to enter the range of the robot, the NC contact changes to an NO contact. At this time, the power from the DCV controller to the robot is disconnected to ensure that the workers entering the robot range are safe. When using safety protection gratings, pressure pads or laser scanners, connect the contact (normal close contact) safety device signal to Pins 5–8. When these signals are not triggered by workers, they stay as NC contacts. When workers touch the gratings, step on the pressure pads or enter the scanning area of the laser scanners, the NC contact changes to an NO contact. At this time, the power from the DCV controller to the robot is disconnected to ensure that the workers entering the robot range are safe.

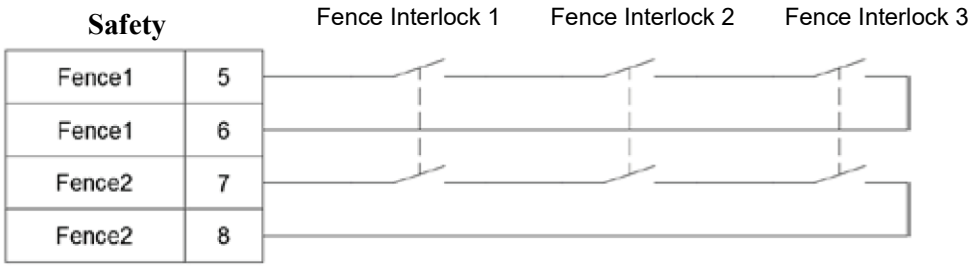


Figure 5.20 Wiring diagram for multiple safety protection devices

Figure 5.21 shows that for safety protection, you can install safety lock switches on the railings to ensure that the safety door closes properly.

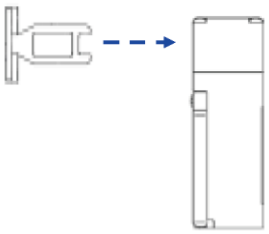


Figure 5.21 Safety door switch installation

A safer practice is to use electromagnetic safety door switches so that when the safety door is closed, the safety switch generates a magnetic force to keep the door lock bolt securely in place. This prevents workers from accidentally opening the door and entering the railing, and protects them from danger.

You can install the power switch for the electromagnetic safety door lock inside the railing so that when workers are accidentally trapped inside the railing, they can turn off the power switch to release the electromagnetic safety door. Figure 5.22 shows the installation method.

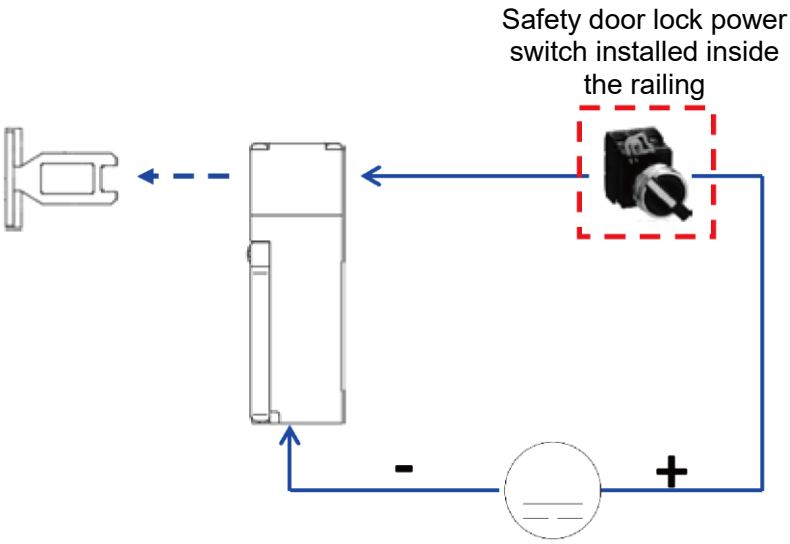


Figure 5.22 Electromagnetic safety switch wiring

5.2.7 System. DI/O

The DCV controller has a standard D-Sub 25-Pin/Female Connector. The System DI/O connector provides seven input points and eight output points to communicate with the upper controller (such as a PLC). Table 5.3 lists the pin definitions.

Table 5.3 System DI/O Pin Definitions

PIN	DI/O	NAME	PIN	DI/O	NAME	PIN	DI/O	NAME
1	DI2	Function Pause	**2**	DI3	Function Pause Release	**3**	DI4	Operation Mode Selection 1
4	DI5	Operation Mode Selection 2	**5**	DI6	Run/Stop Selection 1	**6**	DI7	Run/Stop Selection 2
7	DI8	Alarm Release	**8**	+DO1	Alarm Status	**9**	-DO1	Alarm Status
10	+DO2	Servo Status	**11**	-DO2	Servo Status	**12**	+DO3	Robot Position Status
13	-DO3	Robot Position Status	**14**	+DO4	Function Pause Status	**15**	-DO4	Function Pause Status
16	+DO5	Project Run Status 1	**17**	-DO5	Project Run Status 1	**18**	+DO6	Project Run Status 2
19	-DO6	Project Run Status 2	**20**	+DO7	Controller Ready	**21**	-DO7	Controller Ready
22	+DO8	Reserved	**23**	-DO8	Reserved	**24**		
25								

The system input signal DI has seven inputs Pins 1–7, and has built-in NPN wiring.

Connect the input signal DI using a button or selection switch to the DC output connector Pin 2 (N24G) on the DCV controller interface.

Figure 5.23 shows the locations of the system DI/O connector and DC output connector.

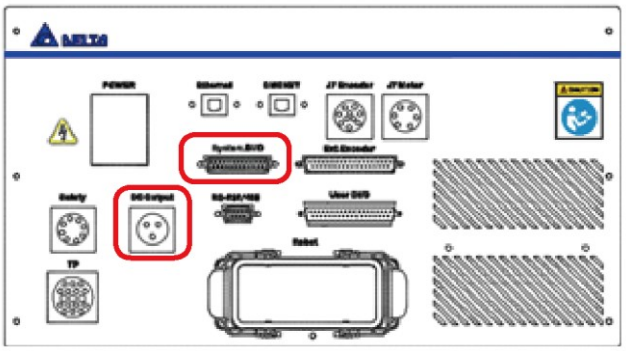


Figure 5.23 System .DIO and DC output connector locations

Figure 5.24 shows the wiring method for the input signal DI.

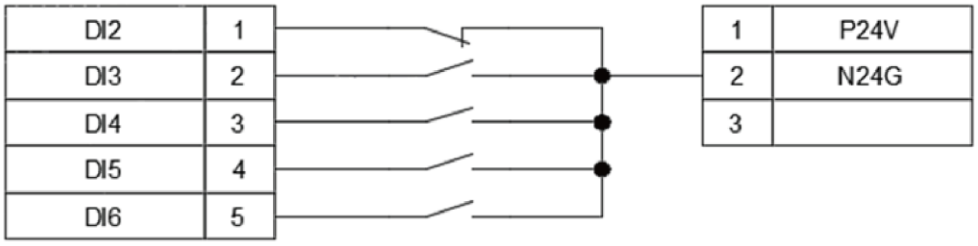


Figure 5.24 Input signal DI wiring

Notes:

1. Use the All System. NPN (sink) connection for all DI signals.
2. The DCV controller DC output connector provides N24G power. Do not connect the System. DI signal to any other power source to prevent interference with the signal or damage to the DI contact.
3. When the transmitted DI signal is live or when transmitting the signal from the upper controller to the DI, execute the signal action through a relay or coupler.

The system output signal DO has eight outputs Pins 8–23, and the output method can be NPN or PNP.
You can choose whether the output voltage signal is the DCV controller voltage output or the upper controller voltage output.

- Figure 5.25 shows the NPN wiring method when using the DCV controller voltage output as the output voltage signal.

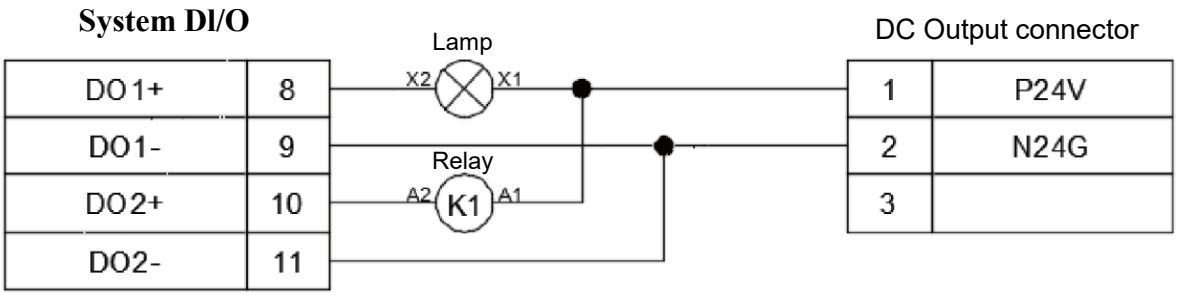


Figure 5.25 System DO DCV controller voltage output NPN wiring

- Figure 5.26 shows the PNP wiring method.

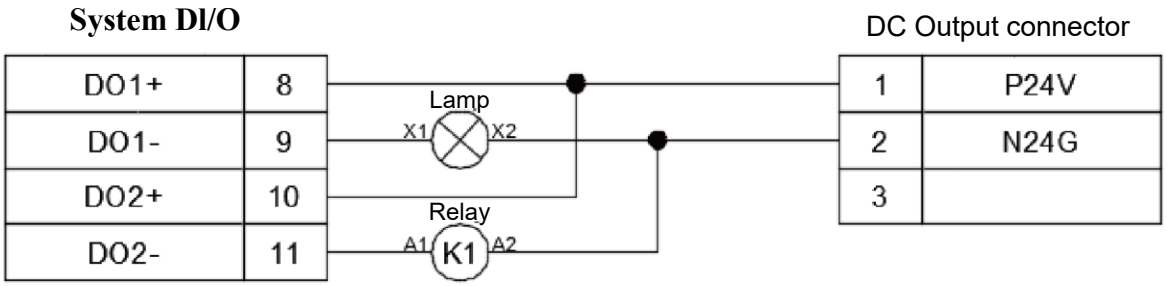


Figure 5.26 System DO controller voltage output NPN wiring

- Figure 5.27 shows the mixed NPN and PNP wiring method.
  This figure uses PNP output wiring for the lamp and NPN output wiring for the relay.

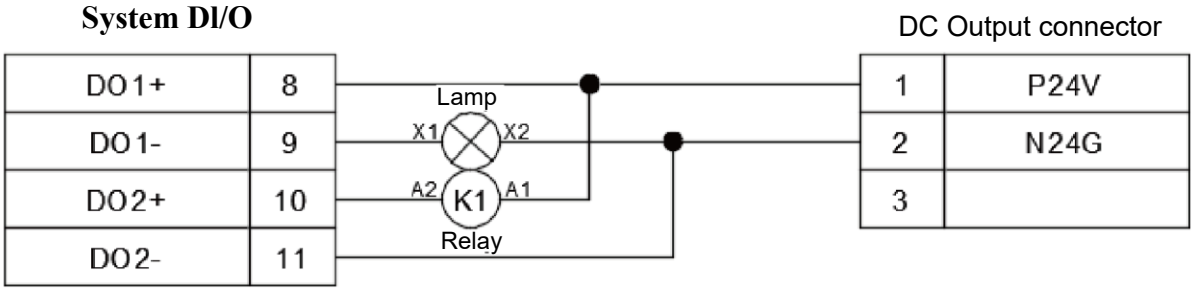


Figure 5.27 System DO DCV controller voltage mixed output wiring

- Figure 5.28 shows the NPN wiring method when the selected output voltage signal is the upper controller voltage output.

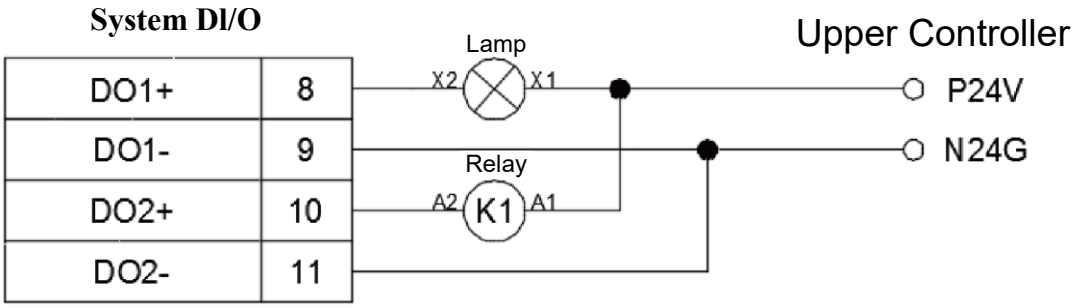


Figure 5.28 System DO upper controller voltage output NPN wiring

- Figure 5.29 shows the PNP wiring method.

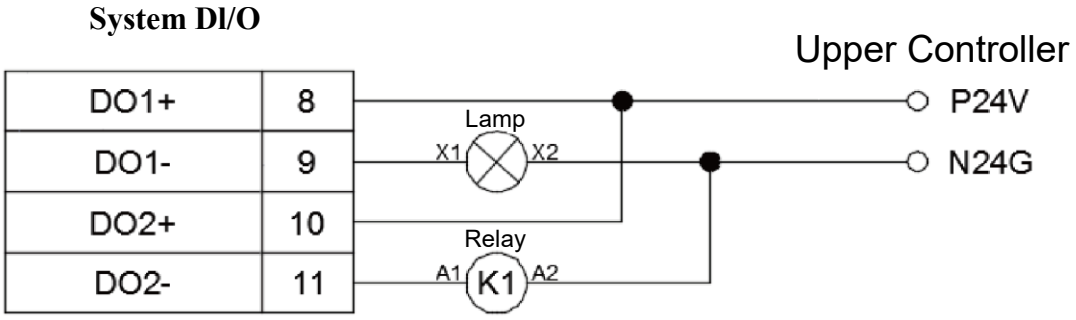


Figure 5.29 System DO upper controller voltage output PNP wiring

- Figure 5.30 shows the upper controller mixed NPN and PNP wiring method.
  This figure uses PNP output wiring for the lamp and NPN output wiring for the relay.

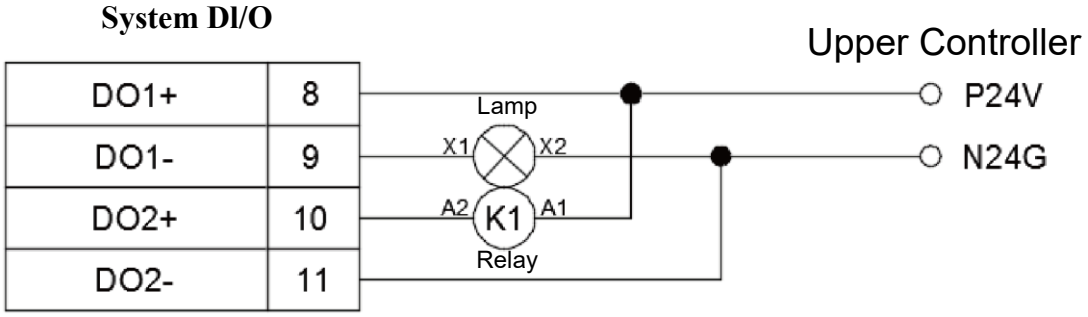


Figure 5.30 System DO upper controller voltage mixed output wiring

Notes

1. Each DO output point can supply a maximum output of 40 mA. To activate a heavier current load, execute the action through a relay.
2. Do not connect AC power to the DO output point to prevent damage to the DCV controller.

Description of DI/O Input, Output Pin Functions

DI2 Function Pause

- Function Pause puts the robot in a paused status. The robot can continue its action when the paused state ends.

Notes

1. Do not connect any safety protection device signals (such as railing and gratings) to this contact to bypass the safety signal in the safety connector. Doing so causes great danger to the workers when they enter the moving range of the robot.
2. If you bypass the safety signal in the safety connector, our company will not be responsible for any consequences.

DI3 Function Pause Release

- Refer to the DROE Manual for details of this function.

DI4, DI5 Operation Mode Selection 1, 2

Table 5.4 lists the operation mode selections (Auto, T1 25% and T2 100%).

Table 5.4 Operation Mode Selection

Function	DI4	DI5
Auto	0	1
T1 25%	1	0
T2 100%	1	1

Auto Mode

- Select Auto mode to automatically execute the robot program. You cannot use the handheld teaching pendant to perform operations in Auto mode.
- Verify that all workers are clear of the robot operation range before executing automatic operations in Auto mode.
- Run the robot at a lower speed the first time you execute automatic operation in Auto Mode. You can proceed with high-speed operation after you confirm that the robot is acting smoothly without any errors.
- The operating speed of the robot is the speed set in the program in Auto mode.
- You can run only the program currently selected by the DROE in Auto mode.

T1 25% Mode

- The combined JOG speed of the robot is less than 250 mm/s in T1 25% mode.
- If the combined speed is over 250 mm/s, the DCV controller automatically forces the robot to run at 250 mm/s.
- You can use the handheld teaching pendant/DROE to execute robot operations in T1 25% mode, but you cannot use DI6 and DI7 to execute program Run/Pause/Stop.
- T1 25% mode is limited to JOG teaching, and you cannot stop the robot when Function Pause is triggered.

T2 100% Mode

- The combined JOG speed of the robot is less than 2000 mm/s in T1 100% mode.
- If the combined speed is over 2000 mm/s, the DCV controller automatically forces the robot to run at 2000 mm/s.
- You can use the handheld teaching pendant/DROE to execute robot operations in T1 100% mode, but you cannot use DI/O to execute program Run/Pause/Stop.
- The Function Pause triggering is active and you can use it to stop the robot from operating in T1 100% mode.

DI6, DI7 Run/Stop Selection 1, 2

Table 5.5 lists the Run/Pause/Stop selections (PAUSE, STOP and RUN).

Table 5.5 Run/Pause/Stop Selections

Function	DI6	DI7
PAUSE	0	1
STOP	1	0
RUN	1	1

Auto Mode

- When DI6, DI7 signals are high, the DCV controller runs the program.
- The DI6 and DI7 signals must be in the ON status for 500 msec in order to run the program with DI6 and DI7.
- To stop the robot program, change the DI6 signal to High and DI7 to Low for 500 msec. The DCV controller stops program execution and the robot immediately.
- If you need to suspend robot operation while running the program, change the DI6 signal to Low and DI7 to High for 500 msec. The robot completes running the program and then stops. To continue running the program, change the DI6 and DI7 signals to High and for 500 msec. The robot then continues running the paused program.

DI8 Alarm Release

- If an error occurs in the robot or the DCV controller, the DCV controller releases the error signal contact.
- The signal must be maintained at the ON status for 200 msec to clear the error.
- Refer to the software manual for the list of errors and troubleshooting methods.

DO1 Alarm Status

- If an error occurs in the robot or the DCV controller, the Alarm signal changes to ON.
- If there is no error in the robot or the DCV controller, the Alarm signal changes to OFF.

DO2 Servo Status

- When all axes of the drive are Servo On, DO2 continuously outputs a signal until Servo Off.

DO3 Robot In-place Status

- When the robot is moving, the machine continuously outputs a DO3 signal. When the robot stops moving, the machine stops outputting a DO3 signal.

DO4 Function Pause Status

- Refer to the DROE Manual for details of this function.

DO5, DO6 Project Running Status 1, 2

- DO5 and DO6 output the corresponding status according to the project running status, as shown in Table 5.6.

Table 5.6 Project Running Status Output

Function	DO5	DO6
PAUSE	0	1
STOP	1	0
RUN	1	1

DO7 Controller is Ready

- After the DCV controller is ready, DO7 is ON.

DO8 Reserved

- Reserved by Delta.

5.2.8 User. DI/O

The DCV controller has a standard D-Sub 50-Pin/Female/3-row connector. This connector provides 24 user-defined input points and 12 user-defined output points.

Table 5.7 lists the pin definitions.

Table 5.7 User. DI/O Pin Definitions

PIN	DI/O	NAME	PIN	DI/O	NAME	PIN	DI/O	NAME
1	DI1	User. DI1	**2**	DI2	User. DI2	**3**	DI3	User. DI3
4	DI4	User. DI4	**5**	DI5	User. DI5	**6**	DI6	User. DI6
7	DI7	User. DI7	**8**	DI8	User. DI8	**9**	DI9	User. DI9
10	DI10	User. DI10	**11**	DI11	User. DI11	**12**	DI12	User. DI12
13	DI13	User. DI13	**14**	DI14	User. DI14	**15**	DI15	User. DI15
16	DI16	User. DI16	**17**	DI17	User. DI17	**18**	DI18	User. DI18
19	DI19	User. DI19	**20**	DI20	User. DI20	**21**	DI21	User. DI21
22	DI22	User. DI22	**23**	DI23	User. DI23	**24**	DI24	User. DI24
25	+DO1	+User. DO1	**26**	-DO1	-User. DO1	**27**	+DO2	+User. DO2
28	-DO2	-User. DO2	**29**	+DO3	+User. DO3	**30**	-DO3	-User. DO3
31	+DO4	+User. DO4	**32**	-DO4	-User. DO4	**33**	+DO5	+User. DO5
34	-DO5	-User. DO5	**35**	+DO6	+User. DO6	**36**	-DO6	-User. DO6
37	+DO7	+User. DO7	**38**	-DO7	-User. DO7	**39**	+DO8	+User. DO8
40	-DO8	-User. DO8	**41**	+DO9	+User. DO9	**42**	-DO9	-User. DO9
43	+DO10	+User. DO10	**44**	-DO10	-User. DO10	**45**	+DO11	+User. DO11
46	-DO11	-User. DO11	**47**	+DO12	+User. DO12	**48**	-DO12	-User. DO12
49			**50**	COM	DI_COM			

Figure 5.31 shows the User. DI/O connector location.

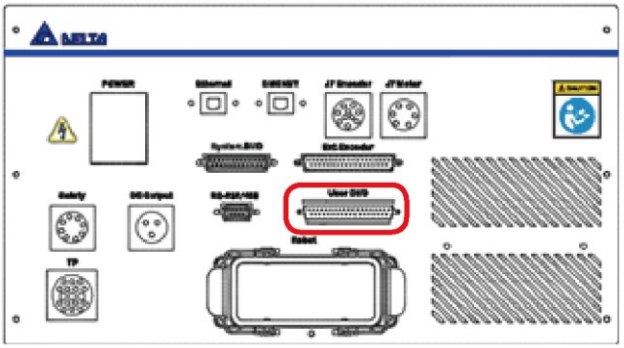


Figure 5.31 User. DIO connector location

The user-defined input signal D1 includes a total of 24 points (Pins 1–24). You can choose either NPN or PNP wiring.

Using the power from the DCV controller for the input signal DI

- Figure 5.32 shows the NPN wiring method. Connect the DI COM (Pin 50) of User. DI/O (D Sub-50P) to P24V (Pin 1) of the DC output, and connect the output signals such as buttons, switches and sensors to DI.

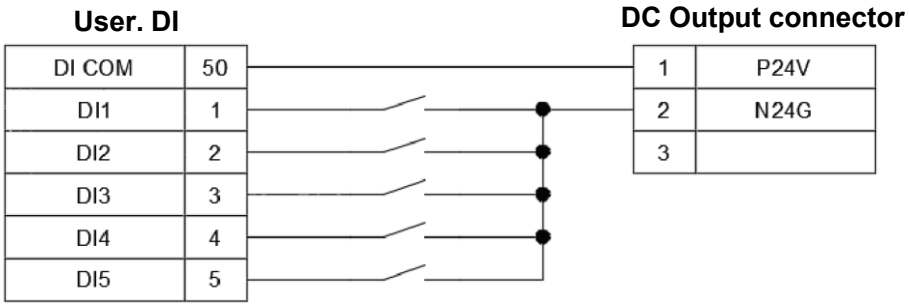


Figure 5.32 NPN wiring when the input signal DI uses power from the DCV controller

- Figure 5.33 shows the PNP wiring method. Connect DI COM (Pin 50) of User. DI/O (D Sub-50P) to N24G (Pin 2) of the DC output, and connect the output signals such as buttons, switches and sensors to DI.

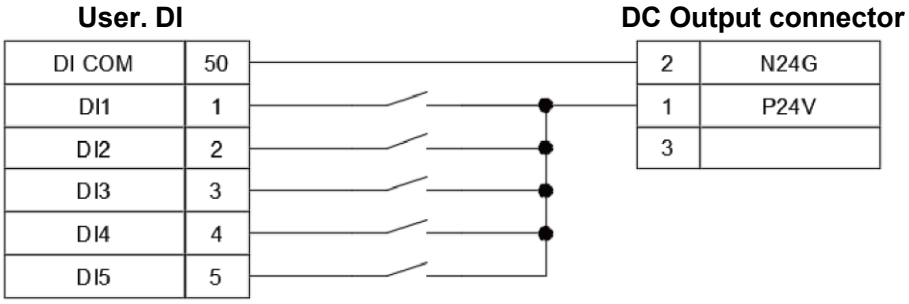


Figure 5.33 PNP wiring when the input signal DI uses power from the DCV controller

Note:

1. The DCV controller DC output connector provides N24G power. Do not connect the System. DI signal to any other power source to prevent interference with the signal cause damage to the DI contact.

Figure 5.34 shows the wiring method when connecting the input signal DI directly to the upper controller using NPN wiring.

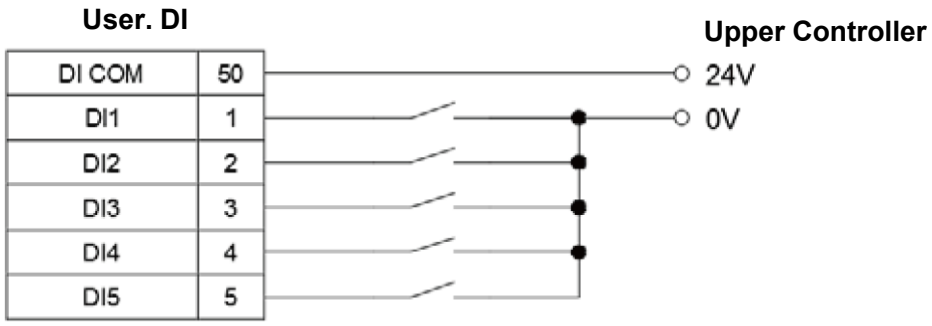


Figure 5.34 Input signal DI connected to the upper controller using NPN connection

Figure 5.35 shows the wiring method when connecting the input signal DI directly to the upper controller using PNP wiring.

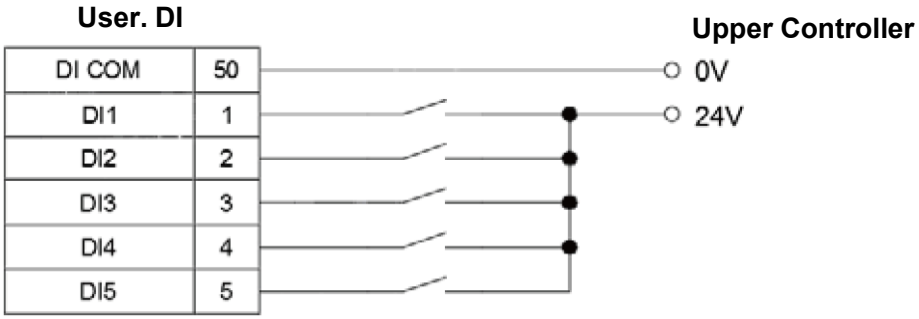


Figure 5.35 Input signal DI connected to the upper controller using PNP connection

The output signal DO includes a total of 24 output points from Pin 25–48, and the output method can be NPN or PNP.

You can use either output voltage signal from the DCV controller voltage output or the upper controller voltage output.

- Figure 5.36 shows the NPN wiring method when using the DCV controller voltage output as the output voltage signal.

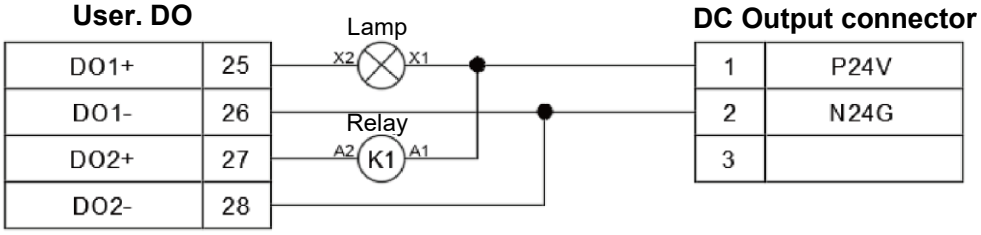


Figure 5.36 User. DO controller voltage output NPN wiring

Notes: When connecting an inductive load (such as a solenoid valve) to the output DO signal, do not connect the DO signal directly to the inductive load. It is best to connect through a relay to protect the DO output contact so that power surges generated when the inductive load switches between ON and OFF do not damage the DO output contact. If you must connect the inductive load directly, connect a flywheel diode to the inductive load using a parallel connection to protect the DO contact.

Figure 5.37 shows the PNP wiring method.

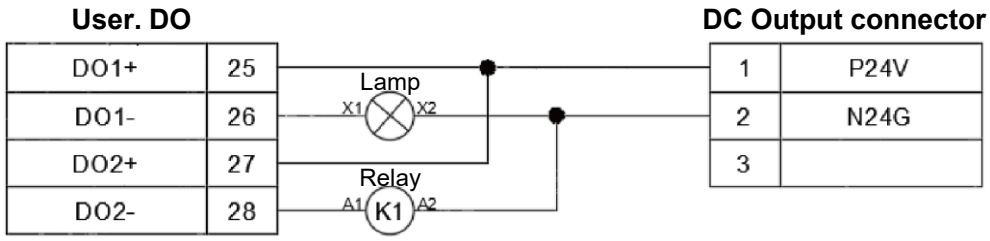


Figure 5.37 PNP wiring when the input signal DI uses power from the Controller

Figure 5.38 shows the mixed NPN and PNP wiring method using PNP output wiring for the lamp and NPN output wiring for the relay.

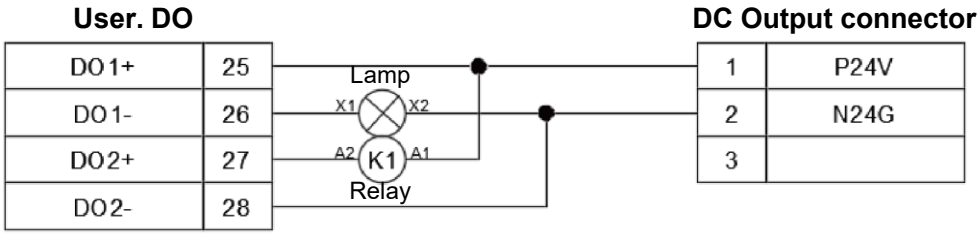


Figure 5.38 User. DO DCV controller voltage mixed output wiring

Figure 5.39 shows the NPN wring method when using the upper controller voltage output as the output voltage signal.

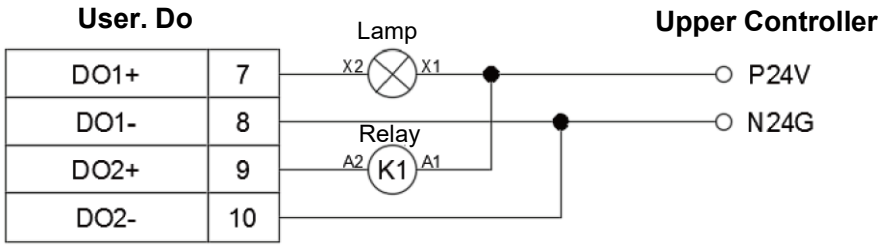


Figure 5.39 User. DO upper controller voltage output NPN wiring

Figure 5.40 shows the PNP wiring method.

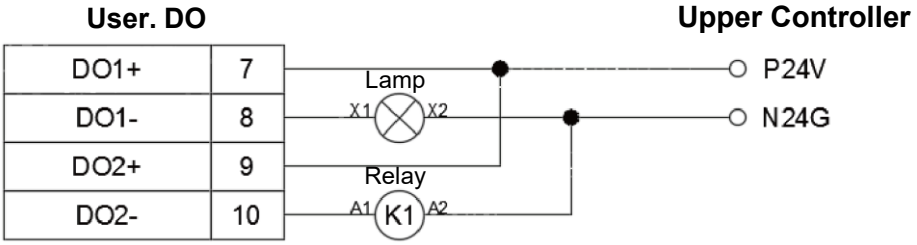


Figure 5.40 User. DO upper controller voltage output PNP wiring

Figure 5.41 shows the upper controller mixed NPN and PNP wiring method using PNP output wiring for the lamp and NPN output wiring for the relay.

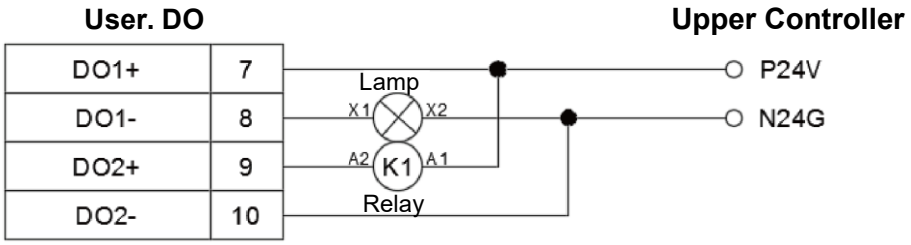


Figure 5.41 User. DO upper controller voltage mixed output wiring

Notes:

1. Each DO output point can supply a maximum of 40 mA. To activate a heavier current load, execute the action through a relay.
2. Do not connect AC power to the DO output point to prevent damage to the DCV controller.

5.2.9 External Encoder

The DCV controller has a Standard D-Sub 37-Pin/Female connector to connect to an external encoder. Refer to the DROE software manual for details on using this function.

Figure 5.42 shows the location of the encoder connector and Table 5.8 lists the pin definitions.

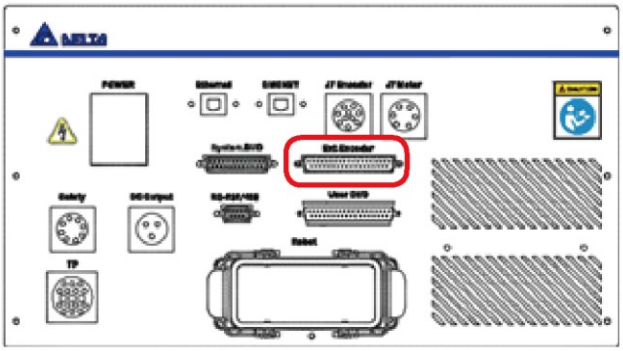


Figure 5.42 External encoder connector location

Table 5.8 External Encoder Pin Definitions

PIN	NAME	PIN	NAME	PIN	NAME	PIN	NAME
1	Z	2	/Z	3	B	4	/B
5	A	6	/A	7	+5V	8	0V
9		10		11		12	
13		14		15		16	
17		18		19		20	
21		22		23		24	
25		26		27		28	
29		30		31		32	
33		34		35		36	
37							

5.2.10 Robot Connector

Figure 5.43 shows the location of the robot connector and Figure 5.44 shows the robot connector cable. The cable connects the robot motor and encoder signals between the robot and DCV controller. Table 5.9 lists the cable pin definitions.

When connecting the robot cable, ensure that the buckles are properly locked in place before turning on the power. Note the connector directions: both ends of the connector have foolproof designs so forcing the connection the wrong way will damage the connector and the equipment. Do not increase the cable length or you may cause problems such as weakening the signals and causing the equipment to malfunction.

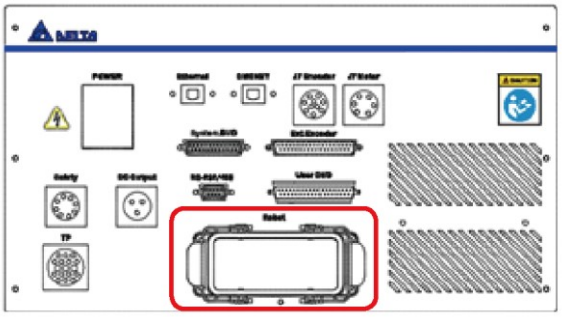


Figure 5.43 Robot cable connector location

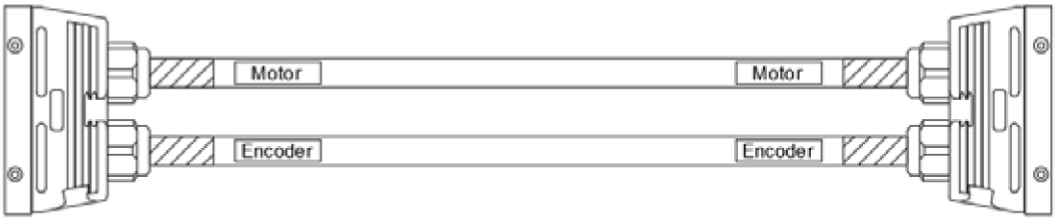


Figure 5.44 Robot cable

Table 5.9 Robot Cable Pin Definitions

PIN	Module 1 12Pos	PIN	Module 2 12Pos	PIN	Module 3 12Pos	PIN	Module 4 12Pos	PIN	Module 4 12Pos
1	J1-U	1	J3-U	1	J5-U	1	J1-5V	13	J4-5V
2	J1-V	2	J3-V	2	J5-V	2	J1-0V	14	J4-0V
3	J1-W	3	J3-W	3	J5-W	3	+J1-T	15	+J4-T
4	J1-Ground	4	J3-Ground	4	J5-Ground	4	-J1-T	16	_J4-T
5	+J1-Brk	5	+J3-Brk	5	+J5-Brk	5	J2-5V	17	J5-5V
6	-J1-Brk	6	-J3-Brk	6	-J5-Brk	6	J2-0V	18	J5-0V
7	J2-U	7	J4-U	7	J6-U	7	+J2-T	19	+J5-T
8	J2-V	8	J4-V	8	J6-V	8	-J2-T	20	-J5-T
9	J2-W	9	J2-W	9	J6-W	9	J3-5V	21	J6-5V
10	J2-Ground	10	J4-Ground	10	J6-Ground	10	J3-0V	22	J6-0V
11	+J2-Brk	11	+J4-Brk	11	+J6-Brk	11	+J3-T	23	+J3-T
12	-J2-Brk	12	-J4-Brk	12	-J6-Brk	12	-J3-T	24	-J6-T

6. Connecting the Controller to the Robot

6. Connecting the Controller to the Robot

This chapter shows how to connect the DCV controller to the robot.

- Correctly wire the DCV controller to the robot according to the descriptions in the manual.
- Turn off the power during wiring to prevent a danger of electrical shocks.
- Wait 10 minutes after turning off the DCV controller power before you perform any wiring because there is residual voltage in the DCV controller that has not yet been fully discharged.
- Only workers with related licenses can perform wiring operations. Workers without related licenses shall not perform wiring operations.
- Before entering the safety railing around the robot, turn off the DCV controller power and place a warning sign on the safety railing. Lock the safety railing open to prevent it from being closed and to prevent other dangers.

- Workers without related licenses shall not perform wiring operations.
- Do not modify any circuits in the robot; our company is not responsible for any danger that occurs as a result of such modifications.
- Do not modify any air pipes within the robot to prevent bent air pipes or other damages.

6.1 Robot Signal Connector

The DRV70L/90L Series robot has a 12-Pos circular connector located at the J4 axis wrist for connect signals.

You can use this 12-Pos connector for sensor signals from sensors you install on the TCP terminal.

The 12-Pos connector at the robot's J4 axis wrist connects to pins 1–12 of the 24-Pos circular connector located on the back of the robot base, as shown in Figure 6.1.

Notes:

1. This 12-Pos connector is only for sensors installed on the TCP terminal. It cannot drive loads exceeding 0.5 A.
2. The maximum current allowed for each of the 12-Pos in the connector is 0.5 A when used to connect external indicators or used as an output signal.

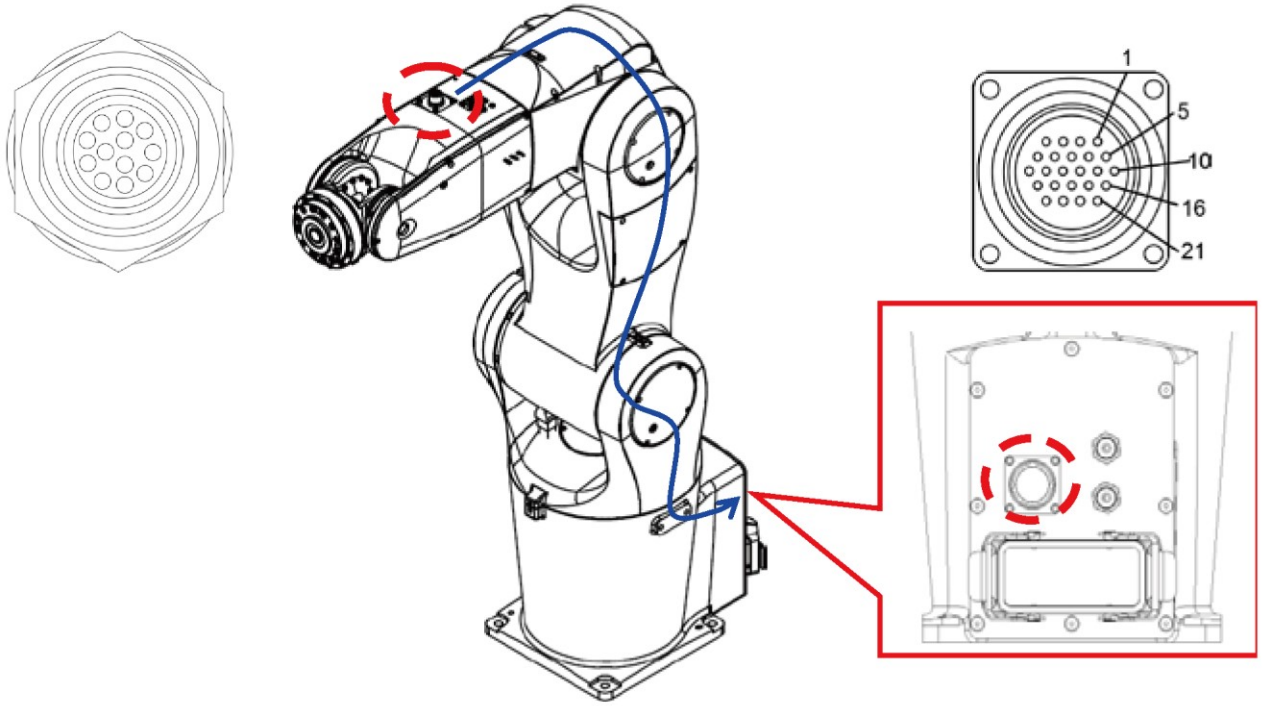


Figure 6.1 Internal wiring of the robot 12-Pos signal connector

6.2 Wiring the Robot's Built-in Solenoid Valve

Figure 6.2 shows the location of the DRV70L/90L series robot three 24 VDC, five-port, three-position central blocking solenoid valves inside the J4 axis robot arms for your use.

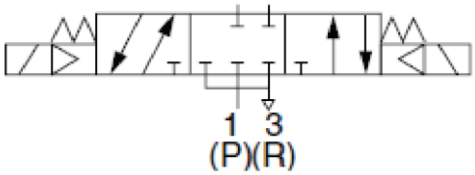


Figure 6.2 Location of solenoid valve inside the robot

The driving coils for these three sets of solenoid valves are 24 VDC. The circuit enters from inside the robot's J5 axis and connects to pins 13–24 of the 24-Pos circular connector located in back of the robot base, as shown in Figure 6.3 below.

Notes:

1. Do not connect AC power to pins 13-24 of the 24-Pos connector on the robot base. The driving coils of these three sets of solenoid valves are 24 VDC.
2. The power of the solenoid valve coil is only 0.35 W. The current needed to drive one side of a single solenoid valve is 15 mA.

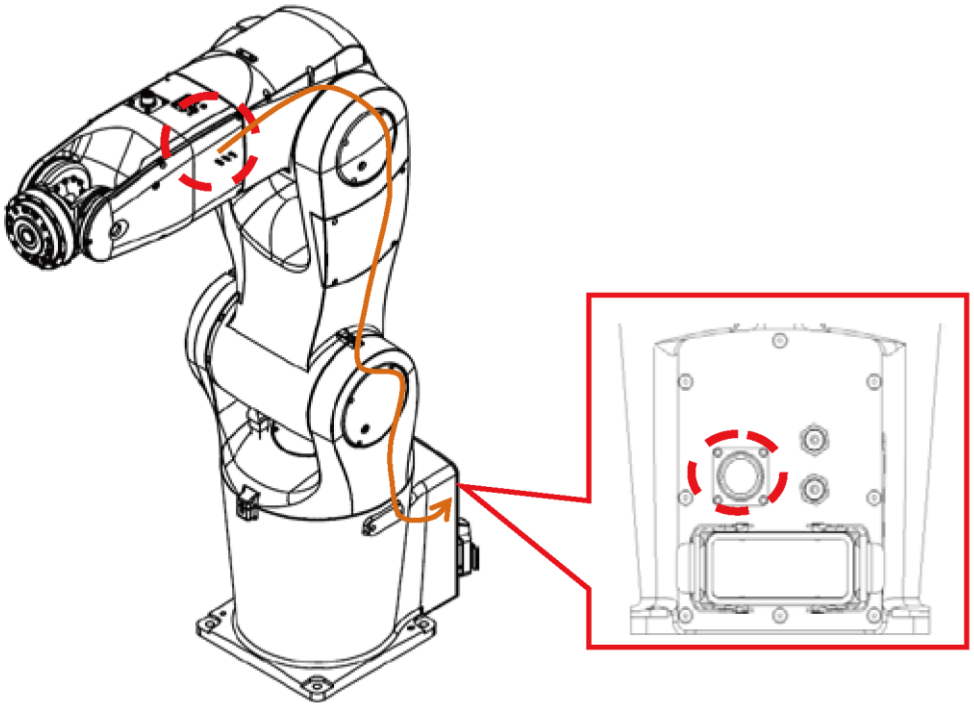


Figure 6.3 The robot's built-in solenoid valve wiring location

The robot includes two ø6 air pipe connectors on the back of the base of the robot for your use. One air pipe is connected to the solenoid valve inside the robot, and the other is connected on the top of the J4 axis for your use. Figure 6.4 shows the robot's first set of internal air pipe location.

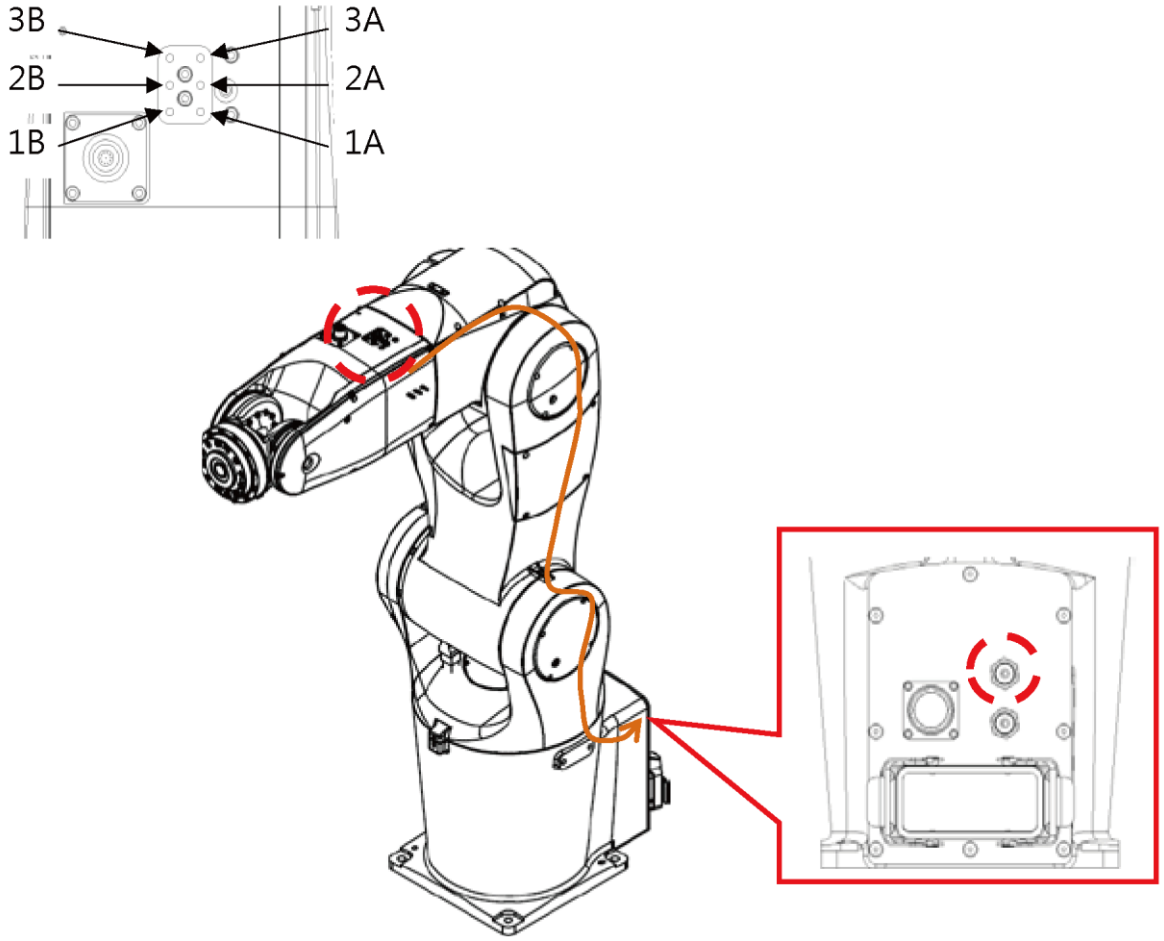


Figure 6.4 The robot's built-in internal air pipe location

Figure 6.5 shows an air pipe and sensor wiring example using a clasping jaw on the robot's TCP terminal. The green cable is the clasping jaw sensor signal cable and the red cable is the clasping jaw air pipe.

You can run the clasping jaw air pipe and sensor cable directly to the J4 arm using a hollow cable running from the TCP terminal of the robot; this method prevents the air pipe or cable from rupturing when the robot rotates the J6 axis.

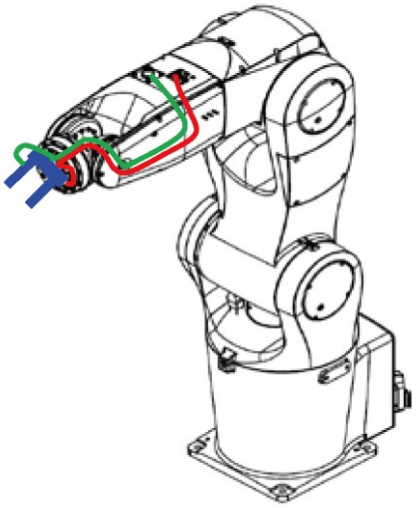


Figure 6.5 TCP Terminal air pipe and sensor wiring example

You can connect the factory terminal air source to the ø6 air pipe connector at the robot's base to provide an air source for the solenoid valve inside the robot. You can also connect the clasping jaw sensor signal cable and solenoid valve coil signal cable to the User. DI/O connector on the DCV robot controller, or to the upper controller terminal using the 24-Pos circular connector at the base of the robot, as shown in Figure 6.6.

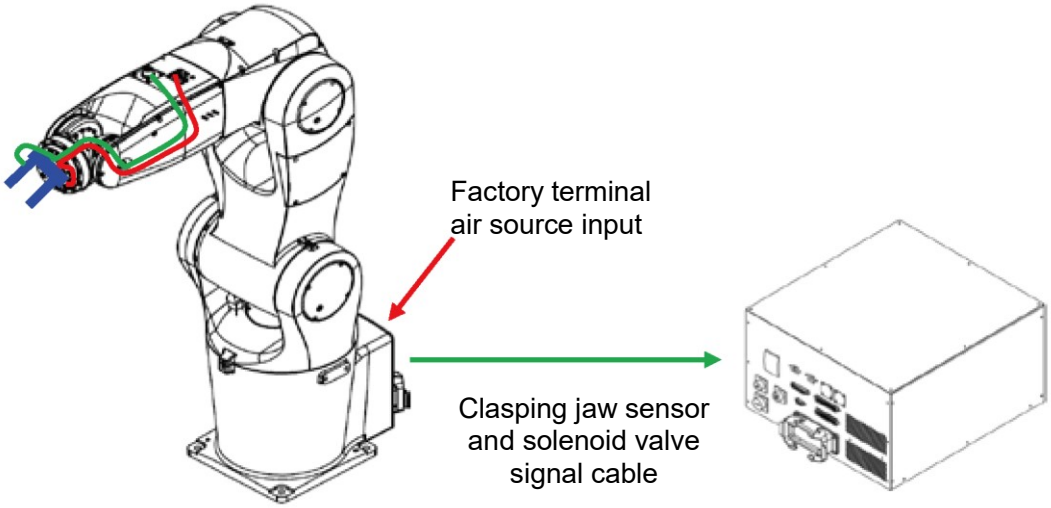


Figure 6.6 Robot clasping jaw signal and DCV controller connection

Note:

1. The robot arm contains only pneumatic system connection pipelines. The system integrators shall install the final actuator and pneumatic system according to EN ISO 4414.
2. Table 6.1 lists the definitions for the 24-Pos connector at the base of the robot.

Table 6.1 Robot Signal Connector Pin Definitions

PIN	NAME	PIN	NAME	PIN	NAME
1	12Pos-1	**2**	12Pos-2	**3**	12Pos-3
4	12Pos-4	**5**	12Pos-5	**6**	12Pos-6
7	12Pos-7	**8**	12Pos-8	**9**	12Pos-9
10	12Pos-10	**11**	12Pos-11	**12**	12Pos-12
13	+Solenoid-1A	**14**	-Solenoid-1A	**15**	+Solenoid-2A
16	-Solenoid-2A	**17**	+Solenoid-3A	**18**	-Solenoid-3A
19	+Solenoid-1B	**20**	-Solenoid-1B	**21**	+Solenoid-2B
22	-Solenoid-2B	**23**	+Solenoid-3B	**24**	-Solenoid-3B

3. The solenoid valve is 24 VDC. Do not connect any AC voltages or any DC voltages that exceed this specification.
4. The solenoid valve coil power is only 0.35 W.
5. The DCV controller DO output uses a transistor. It can drive the solenoid valve directly, but to prevent damaging the DCV controller DO contact or the solenoid valve due to a short circuit, it is recommended that you drive the solenoid valve through a relay. Figure 6.7 shows the wiring example.
6. The solenoid valve is a dual-coil type. Do not transmit power to the A and B terminals simultaneously when driving the same solenoid valve because it causes the solenoid valve iron core to be attracted, and the valve is unable to switch successfully.

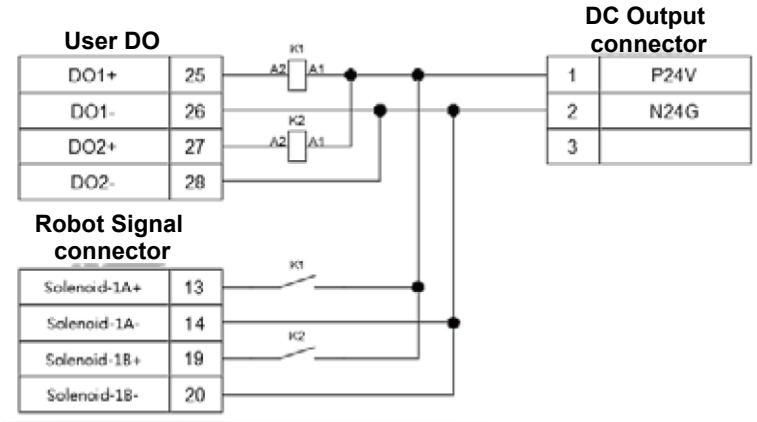


Figure 6.7 Wiring example for driving the solenoid valve

7. Quickstart Robot Wiring

7. Quickstart Robot Wiring

This chapter provides the steps to quickly wire the robot. You must install safety protection devices before operation in order to ensure worker safety. Refer to safety protection equipment descriptions in Chapter 4.

- Correctly wire the robot and DCV controller according to the instructions in this manual.
- Install safety protection devices around the robot, such as railings, safety gratings, pressure pads or laser scanners to guarantee the safety of the workers.
- Turn off the power before wiring to prevent a danger of electrical shocks.
- Wait 10 minutes after turning off the DCV controller power because there is residual voltage in the DCV controller that has not yet been fully discharged.
- Only workers with related licenses shall perform wiring operations. Workers without related licenses shall not perform wiring operations.
- You must install one or more Emergency Stop buttons before working with the robot. Emergency Stop buttons must be installed in a visible location where they can be quickly pressed.
- Keep all workers away from the working range of the robot in order to avoid danger before operating the robot.

- Workers without related licenses shall not perform wiring operations.
- Do not bypass the safety protection system. The safety protection system includes the emergency stop signal and signals from safety equipment such as railings.
- The emergency stop signal and railing signal are no-voltage contact signals. Do not connect any AC or DC power to prevent damage to the DCV controller.
- Do not modify any wiring inside the DCV controller. Our company is not responsible for any DCV controller malfunctions or damage resulting from doing so.

(1) Complete the construction of the safety protection devices. Refer to the safety protection descriptions in Chapter 4 and the wiring in Chapter 5 for details.
(2) Correctly connect the Emergency Stop button and safety signals, as shown in Figure 7.1.

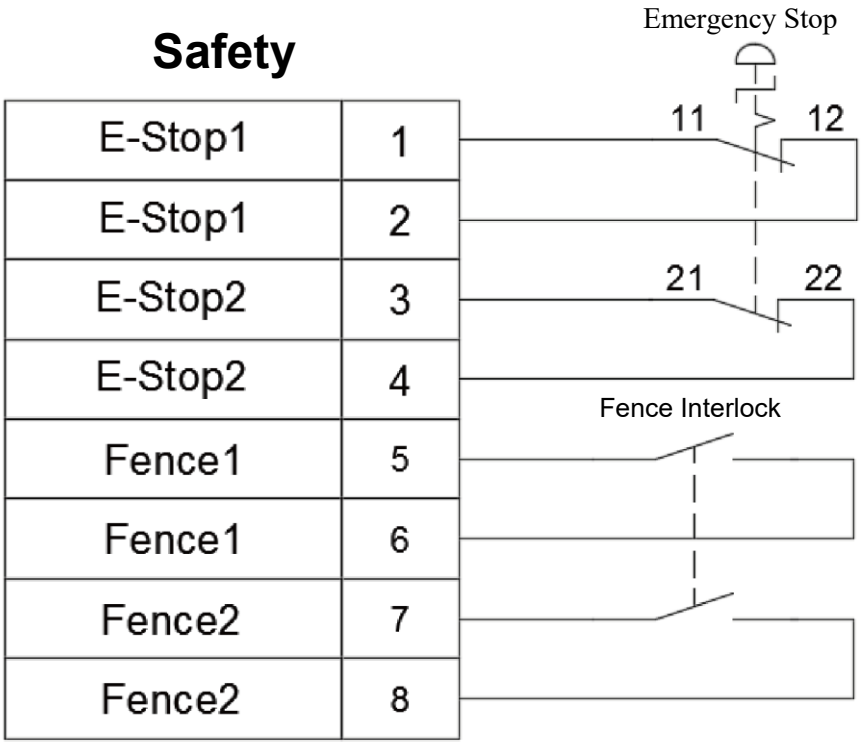


Figure 7.1 Emergency Stop button and safety signal wiring

(3) Correctly connect the handheld teaching pendant to the DCV controller, as shown in Figure 7.2. If you did not purchase the optional handheld teaching pendant, install the teaching pendant short-circuit connector on the DCV controller. The teaching pendant short-circuit connector is included in the accessory pack.

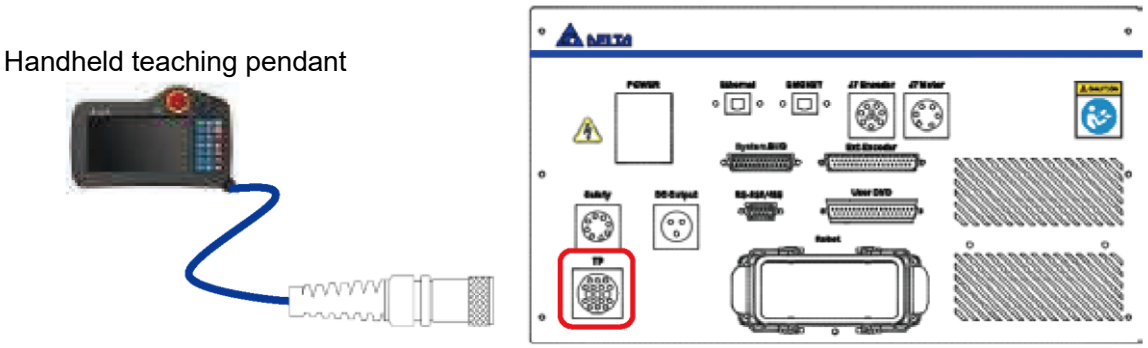


Figure 7.2 Handheld teaching pendant connection location

(4) Correctly connect the cables between the robot and DCV controller, and lock them in place, as shown in Figure 7.3.

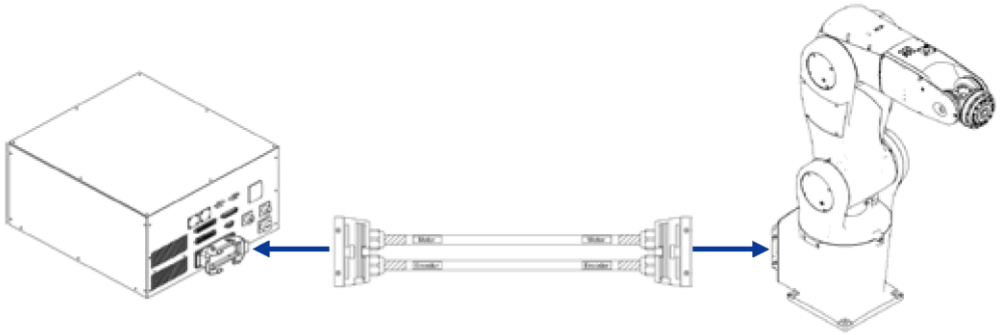


Figure 7.3 Robot and DCV controller cable connection

(5) Mode Selection Wiring

DI4, DI5 Operation Mode Selection 1, 2

Table 7.1 lists the operation modes (Auto, T1 25% and T2 100%). During initial operations when workers are unfamiliar with the robot, use the T1 25% mode to prevent danger to the workers or damage to the machine.

Table 7.1 Operation Mode Selection

Function	DI4	DI5
Auto	0	1
T1 25%	1	0
T2 100%	1	1

Figure 7.4 shows how to wire the System DI/O signals. Short-circuit the DI2 signal (Function Pause) and N24G on the DC output connector. Use a two-stage selection switch that requires a key to connect the DI4 signal.

Notes:

1. You must be able to remove the selection switch key from any setting.
2. The supervisor should keep the key to ensure worker safety and to protect against misuse and unauthorized operation.

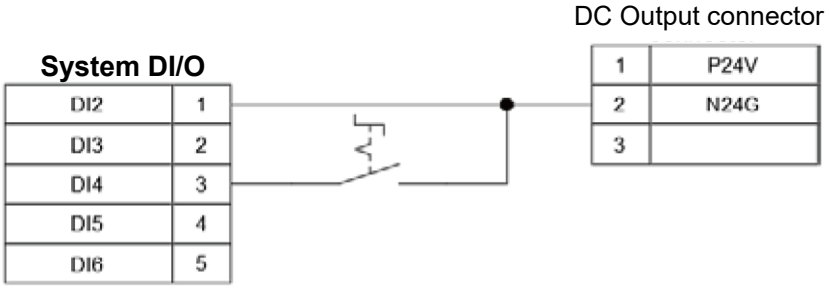


Figure 7.4 Quickstart DI wiring example

(6) Connecting Input Power

Use only single-phase 220–230 Vac, 50/60 Hz input power. The input power must be properly grounded, as shown in Figure 7.5.

L and N are power cables and E is the ground cable.

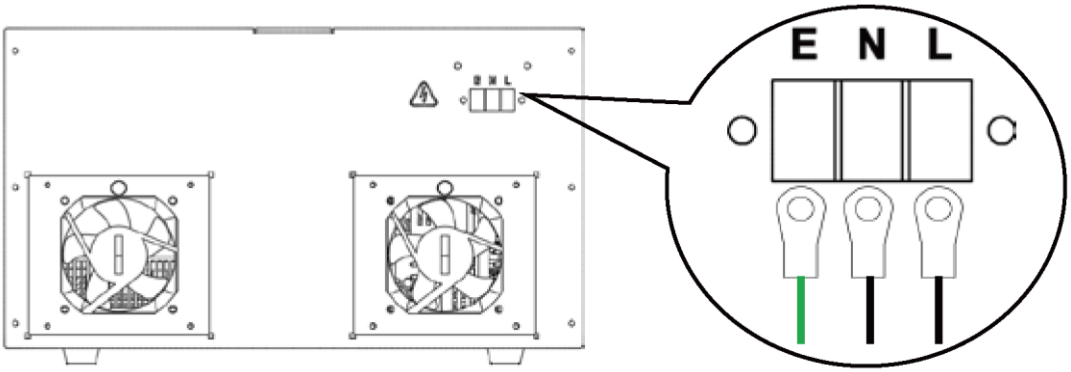


Figure 7.5 Quickstart wiring power wiring example

(7) Turn on the power to the DCV controller and switch the power switch on the DCV controller from OFF to ON, as shown in Figure 7.6.

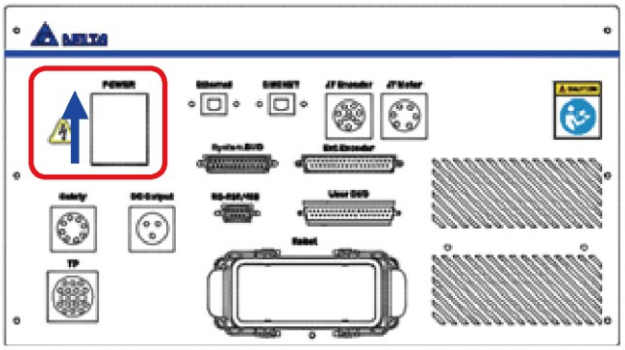


Figure 7.6 Quickstart wiring power switch ON

(8) Refer to the DROE software manual for robot operations.

8. Maintenance

8. Maintenance

Implement maintenance and inspections according to the maintenance table to prolong the DCV controller life.

- Do not maintain or inspect the DCV controller and robot while power is ON to prevent electrical shocks or injuries to the workers.
- Place notices by the power switch and robot not to turn on the power when maintaining and repairing the robot.
- Do not open the DCV controller within 10 minutes of powering it off to prevent electrical shocks from residual voltage in the DCV controller.
- Only properly trained electrical technicians can install, wire, service and maintain this robot.
- Make sure foreign objects do not get attached or enter the DCV controller or robot when performing maintenance or inspection.

8.1 Fan Filter Cleaning

Regularly clean the two DCV controller ventilation filters to maintain the airflow in the DCV controller. If the filters become blocked, the temperature will increase, resulting in DCV controller malfunctions.

- Cleaning Cycle

  At oil and steam-free locations: clean once every six months.

  At locations subject to oil and steam: clean once every two weeks.

  If the DCV controller is placed outside the robot enclosure: clean once every two weeks.

Figure 8.1 shows the locations of the DCV controller ventilation filters. One is located on the front of the DCV controller and the other is located on the side of the DCV controller.

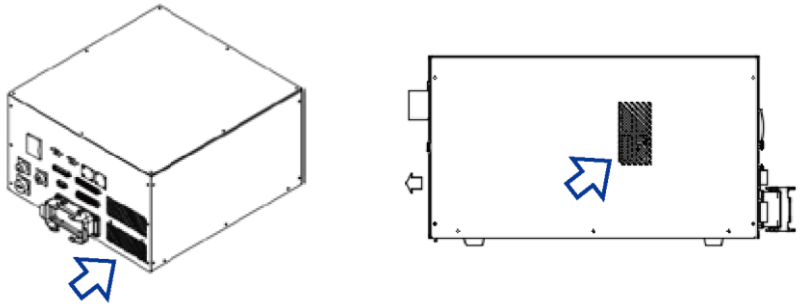


Figure 8.1 Controller ventilation filter locations

Notes:

1. When cleaning, do not aim an air gun directly at the filter to clean it. If there is water inside the air gun, it will cause damage to the DCV controller components, or cause a danger of short circuiting when the power is turned on.
2. The correct cleaning method is to remove the filters and then clean them. Replace the filters into the DCV controller after cleaning is complete.

9. Accessories

9. Accessories

This chapter describes the optional accessories for the DCV controller. You can purchase them as required.

- Turn the power off before installing the optional accessories to prevent damage to the DCV controller or injuries and other danger to the workers.
- Wait 10 minutes after you turn off the power to the DCV controller before you open the DCV controller or perform any wiring because there is residual voltage in the DCV controller that has not yet been fully discharged.
- Only workers with related wiring experience should perform wiring operations. Incorrect wiring can damage the DCV controller or cause injuries and other danger to the workers.

- Do not use another brand of connectors to prevent incorrect connections or poor contact due to incompatible connectors.
- Do not modify the connectors on the DCV controller. Our company is not responsible for any malfunctions or damage that result from doing so.

9.1 Controller Accessory Pack

The robot is a semi-finished product and the robot system must be correctly installed and integrated with safety protection devices according to your applications. Accessories are located in the accessory pack included in each DCV controller. These accessory can assist you in installing and performing the integrated wiring with their upper controller (such as a PLC), as well as the peripheral system and safety protection devices.

Table 9.1 lists the contents of the DCV controller's accessory pack. An accessory pack is included when you initially purchase a DCV controller. If you need additional accessory packs, you can purchase them separately.

Table 9.1 Controller Accessory Pack Contents

Controller Accessory Pack (3534538100)				
Item Number	**Name**	**Specifications**	**Function**	**Quantity**
1	D-type Connector	9-Pin, male, welded	Use for connecting RS-232/485 on the controller	1
2	D-type Connector Cover	Iron case, outlet aperture 8mm	D-type connector for 9-pin use	1
3	D-type Connector	25-Pin, male, welded	Use for connecting System.DI/O on the controller	1
4	D-type Connector Cover	Iron case, outlet aperture 10 mm	D-type connector for 25-pin use	1
5	D-type Connector	37-Pin, male, welded	Use for connecting the external encoder on the controller	1
6	D-type Connector Cover	Iron case, outlet aperture 12 mm	D-type connector for 37-pin use	1
7	D-type Connector	50-Pin, male, welded, three-rows	Use for connecting User. DI/O on the controller	1
8	D-type Connector Cover	Iron case, outlet aperture 13 mm	D-type connector for 50-pin use	1
9	Circular Connector	3-Pos, male, welded	Use for connecting DC power on the controller	1
10	Cable Clamp	Outlet aperture 8mm	DC Power and safety connector cable clamp	2
11	Circular Connector	8-Pos, male, welded	Use for connecting the safety signal to the controller	1
12	Circular Connector	12-Pos, male, welded	Use for connecting the signal connector on the J5 arm of the robot	1
13	Circular Connector	24-Pos, female, welded	Use for connecting the signal connector on the base of the robot	1
14	Cable Clamp	Outlet aperture 10 mm	Cable clamp for connecting the signal connector on the robot base	1
15	Circular Connector	17-Pos	Use the short-circuit connector when the controller's handheld teaching pendant is not connected	1

9.2 Optional Controller Peripheral Accessories

This section describes the peripheral accessories for integrating the various DCV robot controller peripheral systems. You can purchase and use them according to your applications.

9.2.1 EMI Peripheral Accessories

It is recommended that you purchase appropriate optional wave filters to prevent the DCV controller from being affected by interference from surrounding networks and power sources. Figure 9.1 shows the installation dimensions.

Table 9.2 EMI Accessory Specifications

Item Number	Name	Specifications	Function	Order Part Number
1	Wave Filter	115/250 Vac, 16 A, 50/60 Hz Leakage current: 0.8 mA maximum	Filters noise	16DPCG5-1

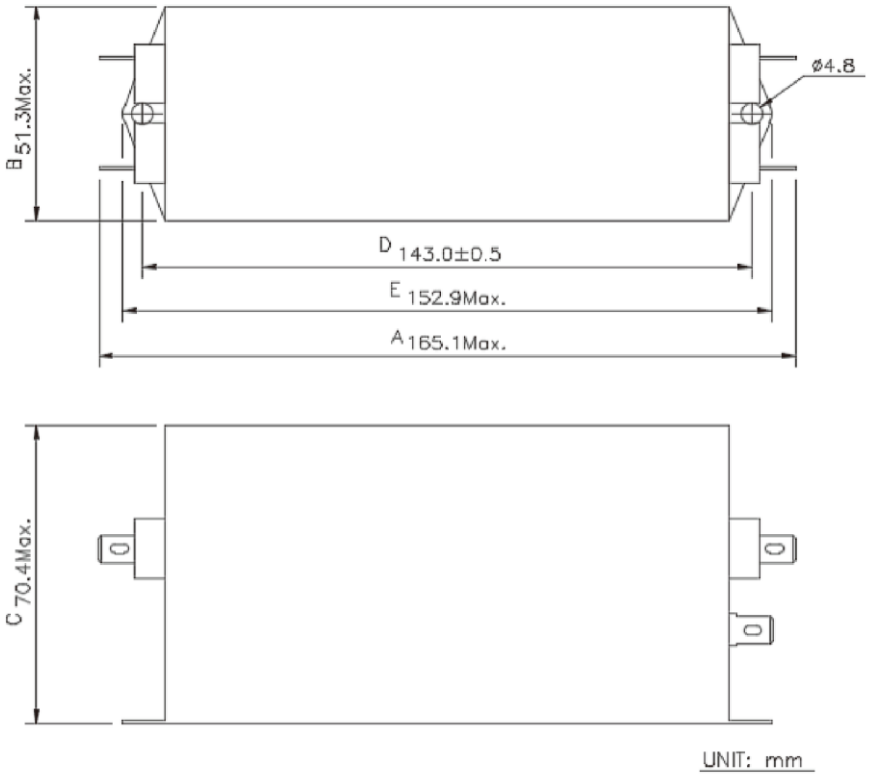


Figure 9.1 Delta wave filter 16DPCG5-1 dimensions

9.2.2 Extension Cord Accessories

We provide optional extension cord accessories if you do not want to perform wiring using the connectors in the accessory pack described in Section 9.1.

Table 9.3 Extension Cord Accessory Specifications

Item Number	Name	Specifications	Order Part Number
1	System DI/O Extension Cord	3 meters, non-flexible	3081425800
2	User. DI/O Extension Cord	3 meters, non-flexible	3081425700
3	Safety Extension Cord	3 meters, non-flexible	3081735000
4	Ext.Encoder Extension Cord	3 meters, non-flexible	3081427000
5	RS-232/485 Extension Cord	3 meters, non-flexible	3081427100
6	Robot Arm Signal Extension Cord	5 meters, non-flexible	3081734700
7	Robot Arm Signal Extension Cord	7 meters, non-flexible	3081734800
8	Robot Arm Signal Extension Cord	12 meters, non-flexible	3081734900

Note: Items 1–5 in Table 9.3 are DCV controller terminal extension cords. Items 6–8 are robot terminal signal extension cords.

9.2.3 DI/O Expansion, Driver Accessories

Figure 9.2 shows the System DI/O extension cord (3081425800) and Table 9.4 lists the cord colors.. You can connect to peripheral components such as an upper controller, buttons or indicators through these extension cords.

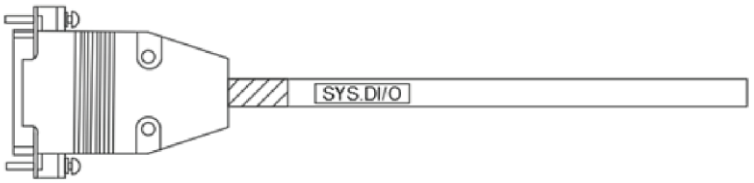


Figure 9.2 System DI/O Extension Cord (3081425800)

Table 9.4 System DI/O Extension Cord (3081425800) Cord Colors

PIN	DI/O	NAME	Color	PIN	DI/O	NAME	Color
1	DI2	Function Pause	Black	2	DI3	Function Pause Release	Brown
3	DI4	Operation Mode Selection 1	Black	4	DI5	Operation Mode Selection 2	Red
5	DI6	Run/Stop Selection 1	Black	6	DI7	Run/Stop Selection 2	Orange
7	DI8	Alarm Release	Black	8	+DO1	Alarm Status	Yellow
9	-DO1	Alarm Status	Black	10	+DO2	Servo Status	Green
11	-DO2	Servo Status	Black	12	+DO3	Robot Position Status	Blue
13	-DO3	Robot Position Status	Black	14	+DO4	Function Pause Status	Purple
15	-DO4	Function Pause Status	Black	16	+DO5	Project Run Status 1	Gray
17	-DO5	Project Run Status 1	Black	18	+DO6	Project Run Status 2	White
19	-DO6	Project Run Status 2	Brown	20	+DO7	Controller Ready	Red
21	-DO7	Controller Ready	Brown	22	+DO8	Reserved	Orange
23	-DO8	Reserved	Brown	24			
25							

Figure 9.3 shows the user-defined DI/O extension cord (3081425700), and Table 9.5 lists the cord colors.. You can connect to peripheral components such as an upper controller, buttons or indicators through these extension cords.

Figure 9.3 User. DI/O Extension Cord (3081425700)

Table 9.5 User. DI/O Extension Cord (3081425700) Cord Colors

PIN	DI/O	NAME	Color	PIN	DI/O	NAME	Color
1	DI1	User. DI1	White	2	DI2	User. DI2	Brown
3	DI3	User. DI3	Green	4	DI4	User. DI4	Yellow
5	DI5	User. DI5	Gray	6	DI6	User. DI6	Pink
7	DI7	User. DI7	Blue	8	DI8	User. DI8	Red
9	DI9	User. DI9	Black	10	DI10	User. DI10	Purple
11	DI11	User. DI11	Gray/Pink	12	DI12	User. DI12	Red/Blue
13	DI13	User. DI13	White/Green	14	DI14	User. DI14	Brown/Green
15	DI15	User. DI15	White/Yellow	16	DI16	User. DI16	Brown/Yellow
17	DI17	User. DI17	White/Gray	18	DI18	User. DI18	Brown/Gray
19	DI19	User. DI19	White/Pink	20	DI20	User. DI20	Brown/Pink
21	DI21	User. DI21	White/Blue	22	DI22	User. DI22	Brown/Blue
23	DI23	User. DI23	White/Red	24	DI24	-User. DI24	Brown/Red
25	+DO1	+User. DO1	White/Black	26	-DO1	-User. DO1	Brown/Black
27	+DO2	+User. DO2	Green/Gray	28	-DO2	-User. DO2	Yellow/Gray
29	+DO3	+User. DO3	Green/Pink	30	-DO3	-User. DO3	Yellow/Pink
31	+DO4	+User. DO4	Green/Blue	32	-DO4	-User. DO4	Yellow/Blue
33	+DO5	+User. DO5	Green/Red	34	-DO5	-User. DO5	Yellow/Red
35	+DO6	+User. DO6	Yellow/Black	36	-DO6	-User. DO6	Green/Black
37	+DO7	+User. DO7	Gray/Blue	38	-DO7	-User. DO7	Pink/Blue
39	+DO8	+User. DO8	Gray/Red	40	-DO8	-User. DO8	Pink/Red
41	+DO9	+User. DO9	Gray/Black	42	-DO9	-User. DO9	Pink/Black
43	+DO10	+User. DO10	Blue/Black	44	-DO10	-User. DO10	Red/Black
45	+DO11	+User. DO11	White	46	-DO11	-User. DO11	Brown
47	+DO12	+User. DO12	Green	48	-DO12	User. DO12	Yellow
49			Gray	50	DICOM	DICOM	Pink

Figure 9.4 shoes the safety extension cord (3081735000), and Table 9.6 lists the cord colors. You can connect to Emergency Stop buttons and safety protection devices installed as part of the integrated safety system.

Figure 9.4 Safety Extension Cord (3081735000)

Table 9.6 Safety Extension Cord (3081735000) Cable Color

PIN	NAME	Color	PIN	NAME	Color
1	Emergency Stop NC1	Black	2	Emergency Stop NC1	Brown
3	Emergency Stop NC2	Black	4	Emergency Stop NC2	Red
5	Safety Protection NO1	Black	6	Safety Protection NO1	Orange
7	Safety Protection NO2	Black	8	Safety Protection NO2	Yellow

Figure 9.5 shows the Ext.Encoder extension cord (3081427000), and Table 9.7 lists the cord colors. You can use this extension cord to connect an encoder signal with the A, B and Z phases for fully closed circuit control or conveyor tracking applications.

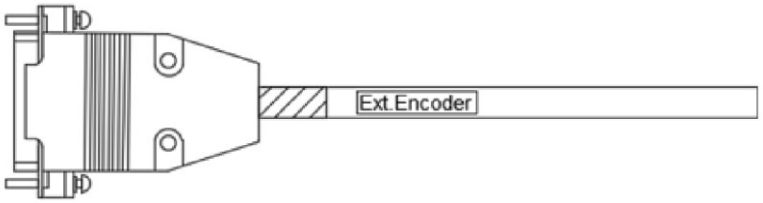


Figure 9.5 Ext.Encoder Extension Cord (3081427000)

Table 9.7 Safety Extension Cord (3081735000) Cord Color

PIN	NAME	Color	PIN	NAME	Color	PIN	NAME	Color
1	Z	Black	2	Z/	Brown	3	B	Black
4	B/	Red	5	A	Black	6	A/	Orange
7	5V	Black	8	0V	Yellow	9		
10			11			12		
13			14			15		
16			17			18		
19			20			21		
22			23			24		
25			26			27		
28			29			30		
31			32			33		
34			35			36		
37								

Figure 9.6 shows the RS-232/485 extension cord (3081421000), and Table 9.8 lists the cord colors. You can use this extension cord to connect communication equipment equipped with RS-232 or RS-485, and then perform connection, control or data transmission with the DCV controller.

Figure 9.6 RS-232/485 Extension Cord (3081427100)

Table 9.8 RS-232/485 Extension Cord (3081427100) Cord Color

PIN	NAME	Color	PIN	NAME	Color	PIN	NAME	Color
1	RS-485+	Black	2	RS-232/RX	Black	3	RS-232/TX	Red
4			5	GND	Orange	6	-RS-485	Brown
7			8			9		

Figure 9.7 shows the robot arm signal extension cord, and Table 9.9 lists the cord colors. You can use this extension cord to connect the 12-position signal and the three sets of built-in solenoid signals on the robot arm to the robot DCV controller or an upper controller for control communications.

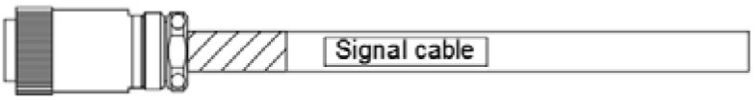


Figure 9.7 RS-232/485 Extension Cord (3081427100)

Table 9.9 Robot Arm Signal Extension Cord (3081734700, 3081734800, 3081734900) Cord Color

PIN	NAME	Color	PIN	NAME	Color	PIN	NAME	Color
1	12Pos-1	Black	2	12Pos-2	Brown	3	12Pos-3	Black
4	12Pos-4	Red	5	12Pos-5	Black	6	12Pos-6	Orange
7	12Pos-7	Black	8	12Pos-7	Yellow	9	12Pos-9	Black
10	12Pos-10	Green	11	12Pos-11	Black	12	12Pos-12	Blue
13	+Sol-1A	Black	14	-Sol-1A	Purple	15	+Sol-2A	Black
16	-Sol-2A	Gray	17	+Sol-3A	Black	18	-Sol-3A	White
19	+Sol-1B	Brown	20	-Sol-1B	Red	21	+Sol-2B	Brown
22	-Sol-2B	Orange	23	+Sol-3B	Brown	24	-Sol-3B	Yellow

If you need more DI/O contacts than the ones provided by the DCV controller, or if you want to use other numbers of axes, Table 9.10 lists additional optional accessories.

Table 9.10 DI/O Expansion, Driver Accessories

Item Number	Name	Specifications	Order Part Number
1	DI Module	32-point input DI	ASD-DMC-RM32MN
2	DI Module	64-point input DI	ASD-DMC-RM64MN
3	DO Module	32-point output DO	ASD-DMC-RM32NT
4	DO Module	64-point output DO	ASD-DMC-RM32NT
5	Isolate network cable	1 meter	3864267000
6	Isolate network cable	3 meters	3864999300
7	Isolate network cable	10 meters	3864896200
8	DMCnet Drive	100W	ASD-A2-0121-FN
9	DMCnet Drive	200W	ASD-A2-0221-FN
10	DMCnet Drive	400W	ASD-A2-0421-FN

9.2.4 Handheld Teaching Pendant

If you want to purchase handheld teaching pendants, we provide them with 5 m and 10 m cables.

Table 9.11 Handheld Teaching Pendant (Optional Purchase)

Item Number	Name	Specifications	Order Part Number
1	Handheld Teaching Pendant	21 keys, 5 meters	DTV-2FM
2	Handheld Teaching Pendant	21 keys, 10 meters	DTV-2GM

9.2.5 Robot Cable

The robot cable connects the DCV controller and the robot. We provide 3 m and 5 m cables.

Table 9.12 Robot Cable Specifications

Item Number	Name	Specifications	Order Part Number
1	Robot Cable	3 meters, non-flexible	DWV-90720300
2	Robot Cable	5 meters, non-flexible	DWV-90720500

Figure 9.8 Robot Cable

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