User documentation

iJC – igus® Joint Control

Version 1.4, February 2025

Version V1.4-EN, February 2025

Contents

1. Safety instructions

- When operating axes and other actuators, always pay attention to the personal safety of the user and other persons.
- All work on voltages >48V may only be carried out by qualified electricians! This is the case, for example, when connecting 220V power supply units.
- CE marking: The iJC is part of a system that must be risk-assessed in its entirety and comply with the applicable safety regulations to ensure personal safety. Depending on the result of the assessment, further safety components have to be integrated. These are usually safety relays and door switches. The commissioning engineer of the entire system is responsible.
- NO hot plugging! This can permanently damage the motor modules. Do not install or remove any modules or plug-in connectors (e.g. emergency stop switches, DIO modules or external relays, motor connections ...) while the power supply is switched on.
- The control system and its drives must be installed on a robust surface and bolted or otherwise secured.
- Use and store the system only in a dry, clean environment.
- Only use the system at room temperature (15° to 35°C).

2. Introduction

2.1 Intended use

The iJC is a compact control system for simple control of up to three motors. It is used in combination with motor control cards and motors with encoders as well as digital input/output cards from the iRC series.

The control system may only be operated with the components and voltages described in section 3.1 The permissible electrical parameters must be observed in particular.

2.2 Target group and qualification

Commissioning

Installation and commissioning may only be carried out by qualified personnel. These persons should fulfil all of the following requirements. They should

- have appropriate training and experience in working with motors and their control systems
- know and understand the contents of this technical manual
- know the applicable regulations

Operation

- System operators must be made aware of the dangers involved

2.3 Regulations

In addition to this technical manual, operation and commissioning are subject to the applicable local regulations, e.g:

• Accident prevention regulations

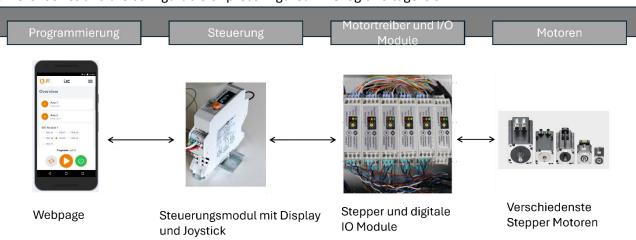• Local regulations on occupational safety

3. Overview of the compact control system

The entire system consists of four basic components:

1. Mechanical axes
2. Motor drivers and IO modules
3. iJC
4. Programming environment via web interface

The control system is used to control the movement of motors. The control system is supplied with 24V, the motors with 48V or 24V. The stepper motor driver modules are designed for bipolar stepper motors of different sizes and are configurable or preconfigured. The logic voltage is 5V.

Programmierung	Steuerung	Motortreiber und I/O Module	Motoren

Webpage	Steuerungsmodul mit Display und Joystick	Stepper und digitale IO Module	Verschiedenste Stepper Motoren

3.1 Specifications of the iJC

Supply logic	24V
Supply motor	24-48V
Inrush current limitation	
Generated logic voltage	5V
Number of stepper motor modules	Max. 3 (of the iRC series, only with encoder)
Number of DIO modules	Max. 3 (of the iRC series)
Updates	Over the air
Programming	Web-based (up to 15 programs)
Program commands	Up to 50 commands per program • Axis movement absolute • Axis movement relative • Wait for time period or input • Setting outputs • If/Else (non-nested)
Further information	• Homing • PLC interface

The axis movements are synchronised, all axes start at the same time and arrive at the end point together.

4. Quick start guide

4.1 Setup and connection

Proceed in the following order for installation and commissioning:

1. Ensure that the control system is disconnected from the mains: Pull out the mains connector.
2. Install the control system and the motors on a suitable base. Make sure that the cables are not under tension.
3. Connect the cables of the motors to the stepper motor modules. All connections are coded to support the process. The following cables each belong to a motor. The affiliation between motor and cable set is also numbered on the connectors:

   • Motor cable (labelled Motor)

   • Encoder cable (2 connections labelled ENC-1 and ENC-2)

   • Reference sensor (labelled End-Stop)

4. Connect the shield and earth wires of the encoder and motor cables, if present.

   • Motor cable earth: green-yellow

   • Encoder shielding (earth): black

5. Connect the supply voltage to the iJC.

Further information on installing the iJC control module can be found in section 5.

4.2 Switch on

1. Connect the control system to the power supply using the mains cable and switch on the power supply.
2. The control system starts up and shows the control system number and initialisation on the display. The main menu is then displayed.
3. The green LEDs on the modules will now light up, as will most of the red LEDs and possibly also some of the yellow LEDs.
4. After the boot process of the control computer has been completed (approx. 60s after switching on the control system), the green LEDs start to flash. This indicates communication with the modules.

4.3 Connect

1. Log into the WLAN with your mobile device or computer: "iJCxxxx" with the password: "123456789".
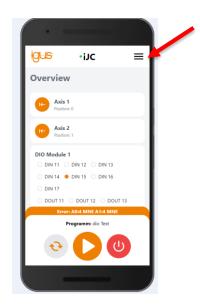2. Open a browser window and enter http://192.168.4.1/ in the address bar or scan the adjacent QR code.

Please note the following:

- Only one device can connect to the control system's WLAN at a time
- Only one browser window/tab can be connected to the control system at a time
- Mobile data must be deactivated, otherwise mobile devices will automatically switch to mobile data when the browser is opened and the WLAN connection does not establish an internet connection.

4.4 Axis configuration
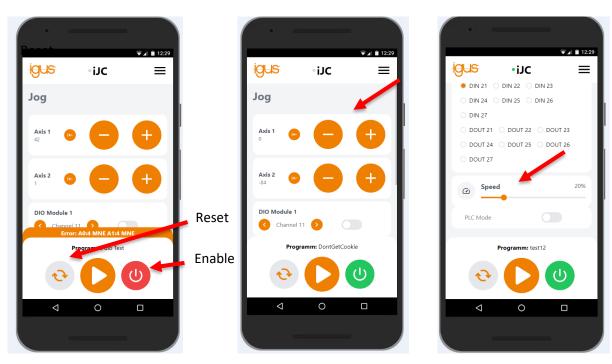
Select AxisConfig from the menu.

Set the parameters valid for your motor here. Then click on the "save" button. This turns green as soon as the values have been sent to the control system. This may take a short moment. Do this for all axes.

4.5 Movement of the axes

To perform a movement, switch to the Jog page. Reset the errors of the axes (Reset) and then activate them (Enable). You can then move the axis forwards and backwards by pressing the "+" and "-" buttons. Reduce the speed beforehand (scroll down the page to do this).

4.6 Referencing the axes

If the axes need to be referenced, you can press the referencing symbol for the respective axis on the Jog or Overview page. The respective axis then starts referencing according to the setting. It moves in the set direction until the reference switch is recognised. The axis then moves back a short distance and hits the reference switch again at an even lower speed. Referencing is completed when the switch is reached.

Note:

To cancel referencing and stop the movement, press Reset. Pressing the program stop button cannot cancel referencing.

5. Installation of iJC control module

Connect to the plug-in connector "Supply" of the control system:

Power supply (Supply)	
Pin 1 (left)	+24V
Pin 2	GND
Pin 3	+24V
Pin 4	GND

The CAN connection is established via the centre 5-pin plug-in connector "OUT-BUS" (from left to right):

CAN connection (OUT BUS)	
Pin 1 (left)	CAN -L
Pin 2	CAN -H
Pin 3	+5V supply voltage for the motor modules
Pin 4	Not connected
Pin 5	Not connected

The bus connection is connected to the DIN top-hat rail modules (digital IO and motor modules) of the control system. A support module is not compatible with this type of connection as it would also feed +5V to the same bus.
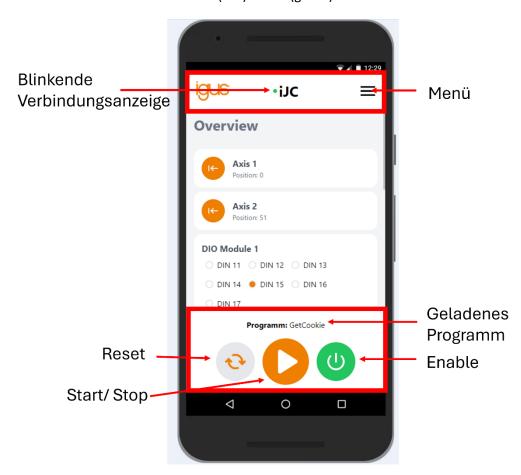
6. Web interface for controlling the iJC

6.1 General structure

The user interface is divided into three areas. There is a green flashing indicator in the header to show that communication with the control system is active. The menu button is located next to it.

The Reset, Enable and Start/Stop controls are located in the lower area. The currently loaded program is also displayed here.

If there is an error, this is displayed at the top of the lower area. The colour of the Enable button also indicates whether there is an error (red) or not (green).
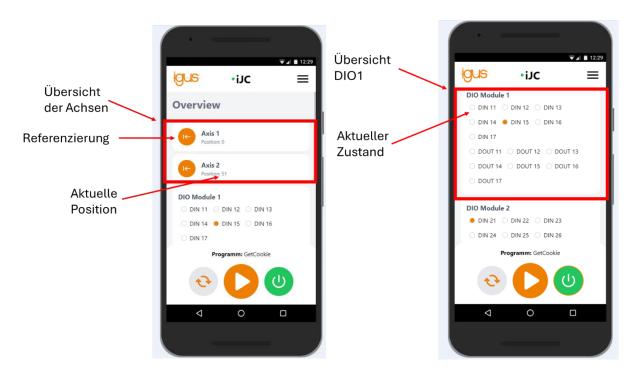

The centre area contains different content depending on the page called up. The individual pages are described below.

6.2 Overview page

The Overview page provides an overview of the status of the control system. All axes with the current positions are displayed in the upper area. A button for referencing the axis is also displayed for each axis.

Übersicht
der Achsen

Referenzierung

Aktuelle
Position

Übersicht
DIO1

Aktueller
Zustand

The IO modules are located underneath. The status of the DINs and DOUTs is displayed here.
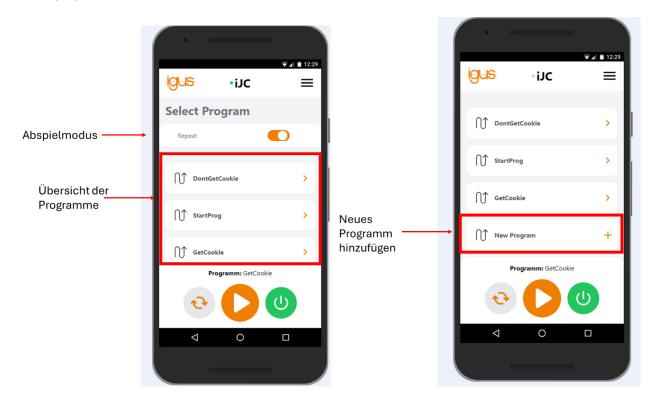
Further down the page there is a controller for the speed. At the bottom of the page there is a toggle button that can be used to activate PLC mode. Further information on PLC mode can be found in section 8.

Geschwindigkeitsoverride
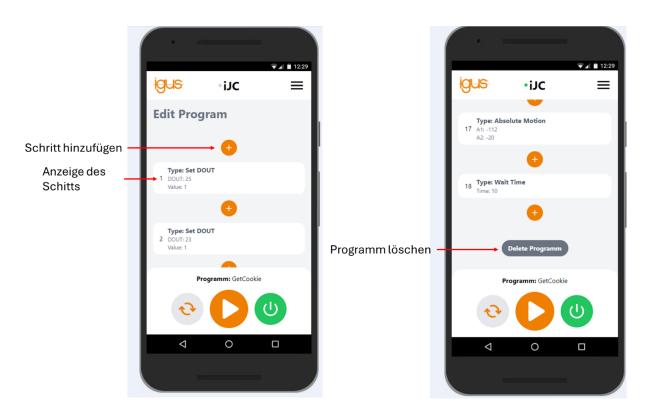
PLC Modus

6.3 Program page

Programs can be managed and edited under the Program menu item. A toggle button can be used to select whether the program should be executed as a continuous loop or only once. All programs loaded on the iJC are displayed below.

Abspielmodus

Übersicht der Programme

Neues Programm hinzufügen

Under the programs there is the item "New Program", with which a new program can be added. By clicking on a program, it is loaded into the control system as an active program and opened for editing. Under the last program step, the program can be deleted using the "Delete Program" button. A maximum of 15 programs can be stored on the control system.

Schritt hinzufügen

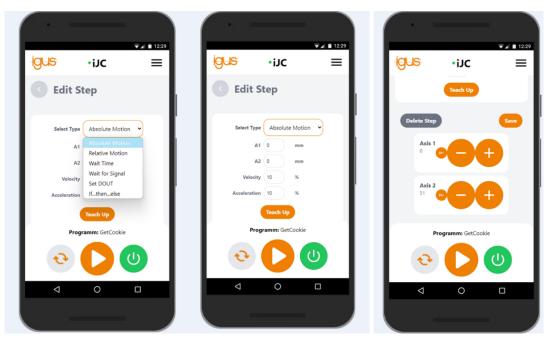Anzeige des Schitts

Programm löschen

Click on a step to edit it. A new step can be added by clicking on the "+". A maximum of 50 steps can be added per program. In the drop-down menu, you can select which step is to be added. The following commands are possible:

- **Absolute Motion**

   Movement to an absolute position. The current position can be saved in the Absolute Motion using the "TeachUp" button. The axis can be moved in jog mode using the "+" and "-" buttons and then the current position can be saved using the "Teach Up" button. The speed and acceleration of the movement are also entered.

- *Relative Motion*

   Relative movement around the registered distance. The acceleration and speed of the step are also indicated.

- *Wait Time*

   The time entered in ms is the wait time before the next step is executed.

- *Wait for Signal*

   Program processing is paused until the signal has reached the value.

- *Set DOUT*

   Sets a digital output to the entered value. Please note that only DIOs that are connected and not configured as a PLC interface can be used. DOUTs 11-17 are located on the first DIO module, DOUTs 21-27 on the second, and so on. If PLC mode is activated, DOTs 11-17 cannot be used.

- *If ... Then ... Else*

   Adds a logical If-statement. Please note that If-statements cannot be nested. Please note that only DINs that are connected and not configured as a PLC interface can be used. DINs 11-17 are located on the first DIO module, DINs 21-27 on the second, and so on. If PLC mode is activated, DINs 11-17 cannot be used.

Click on "Save" to save the step. To edit or delete an existing step, click on it. This can then be edited as required or deleted by clicking on "Delete Step".

Before you switch off the power to the control system, you should end the program execution. Otherwise, some configurations, such as the PLC mode and the repeat setting, may not be saved correctly. Otherwise, the motors may also be damaged.
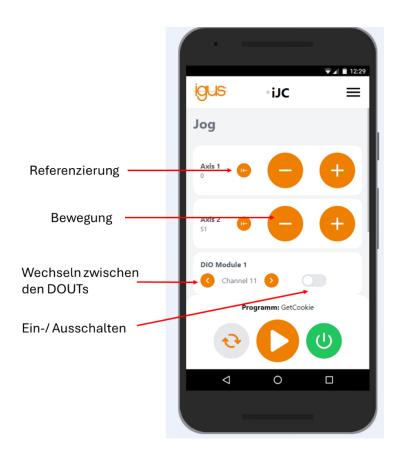
6.4   "Jog" page

All axes are displayed in the upper area. The current position is displayed on the left. Next to it is the button for referencing the axis. There is a "+" and a "-" button on the right-hand side with which the axes can be moved manually.

The IO modules are displayed under the axes. You can switch between the individual output signals by clicking the arrows. The respective output can be set using the Toggle button shown on the right.

Note:

If the modules are in error status, the axes cannot be moved and the DIOs cannot be controlled. After restarting the control system, it is always necessary to reset the module errors via Reset and Activate.

The speed controller is located under the IO modules.

6.5 Status page

The status information of the axes is displayed in the upper area. The error code, the CAN ID and the current temperature are displayed here for each axis. The DIO modules are located underneath. The respective CAN ID of the modules is displayed here.

6.6 Axis Config page

The settings for the respective axes can be made here. You can set whether each axis is linear or rotational. The maximum current, maximum speed, maximum acceleration, gear ratio and reference speed can also be set. Further setting options are the need for referencing, the reference sensor type and the referencing direction. By clicking the "Save" button, the information is saved and sent to the motor modules. The button turns green when the data has been successfully sent to the control system. This may take a short moment.

Important:

The axis configuration can only be changed if no program is running. If the configuration is changed while a program is running, it is terminated. Writing the new parameters causes all modules, including digital inputs and outputs, to switch to error status. This deactivates all DIOs. The inputs and outputs can only be set again after a reset and enable. The speed of referencing is standardised. The lower the value, the lower the referencing speed. It is recommended to start at low speeds.

6.6.1 Example for rotary axis with Nema 17 without gearbox

The data for a Nema 17 without gearbox is shown here as an example. In this example, the motor does not need to be referenced before starting.

Axis type	Rotation
Current	100mA (max. 1100mA according to data sheet)
Max speed	2000°/s
Max acceleration	100°/s²
Transmission	1
Referencing speed	100
Referencing necessary	No
Type reference sensor	Normally closed (not relevant as it is not referenced)
Reference direction	Positive (not relevant)

6.6.2 Example for linear axis ZLW-1080 with NEMA 23

The linear axis ZLW-1080 with a Nema 23 drive is used as an example. The transmission of the linear axis can be found on the following page:

https://www.igus.eu/drive-technology/linear-axes-with-toothed-belts/technical-data

The set maximum values are reduced and set according to the structure.

Axis type	Linear
Current	2700mA (max. 3150mA according to data sheet)
Max speed	2000mm/s (max. 5000mm/s according to data sheet)
Max acceleration	100mm/s²
Transmission	70
Referencing speed	10
Referencing necessary	Yes
Type of reference sensor	Normally closed (depending on sensor type)
Reference direction	Positive (depending on the installation of the sensor)

If further settings need to be made, you can connect to the bus via the PEAK adapter and make further settings using the Module Control software. You should always send the "Shut Down Command" in the Module Control software. Otherwise, the control system and Module Control will send commands to the modules, resulting in undesirable behaviour

6.7 Logs page

The log files are only required if there are problems with the control system. Please download them in the event of a problem and send them together with a description of the issue to support@cpr-robots.com.
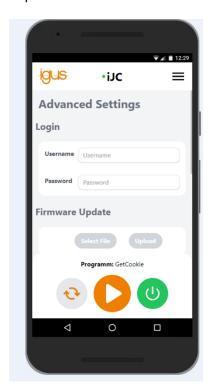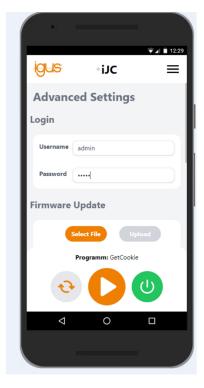
Saving the log files while a program is running can lead to slight delays in positioning. This can lead to errors in the movement. At best, the log files should not be saved while a program is running.

6.8 Advanced Settings page

The WLAN can be changed and the firmware updated on this page. In order to make these changes, you must first log in. The user name is: "admin" and the password is also "admin".

To load a firmware update, the user name and password must first be entered correctly. The "Select File" button then turns orange. This button can be used to select the new firmware. This is then uploaded via "Upload". Please confirm the warning displayed and wait a moment.

To change the WLAN, you must also log in first. You can then assign a new SSID and a new password. Click on "Save" to save the new password. This may take a short moment. Depending on the end device used, both the new and the old WLAN may then be visible. In this case, restart the control system and switch the WLAN on your device off and on again.

The "Reset WLAN settings" button can be used to reset the WLAN to the factory settings. On delivery, the SSID is: "iJCxxxx" and the password is "123456789".
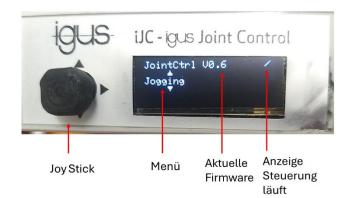
7. Operating the iJC via joystick

The control system can also be operated using the joystick. The menu is divided into a main menu and several submenus.
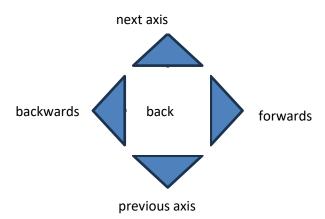
Main menu:

- Jogging
- Referencing
- WLAN settings
- Program

You can navigate up and down through the main menu using the joystick. To navigate to the submenu, press the centre button on the joystick. To exit the submenu, press the centre button again.
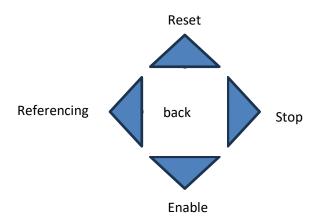

Joy Stick   Menü   Aktuelle   Anzeige
                           Firmware   Steuerung
                                          läuft

In the submenu **Jogging**, you can move manually by axis.

next axis

backwards   back   forwards

previous axis
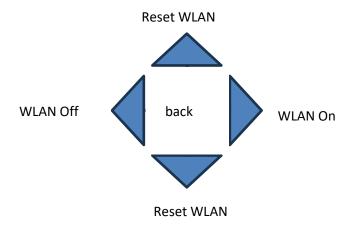
The LEDs on the motor modules can be monitored to see the status of the motor modules. Once the control system has started up, the green LEDs on all modules should flash. The red LEDs of the motor modules are also on. This indicates that the module is still in error status. Before movement is possible, this error must first be reset and the motor activated. This is possible in the Program submenu. After activating the motors, the red LED should be off.

The axes can be referenced in the submenu **Referencing**. To start referencing, the axes must first be enabled. When referencing is started, all axes for which referencing has been activated in the axis settings start referencing at the same time.

```
                        Reset

      Referencing       back        Stop

                        Enable
```
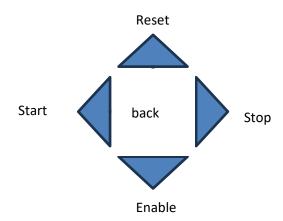
The WLAN can be activated and deactivated in the submenu **WLAN**. The WLAN can also be reset.

```
                      Reset WLAN

      WLAN Off         back        WLAN On

                      Reset WLAN
```

To reset the WLAN, you can navigate upwards or downwards. The reset must then be confirmed.

The currently loaded program can be started and stopped in the submenu **Program**. The motors can also be reset and activated.

```
                        Reset

        Start           back        Stop

                        Enable
```

8. PLC mode

The PLC mode can be used to control the iJC with a Programming Logic Control (PLC). This mode can also be used if, for example, the program is to be started via buttons.

The control system can be set to PLC mode using the "PLC mode" toggle button on the web interface. However, this is only possible if no program is being run. In PLC mode, the inputs and outputs of the first DIO module can no longer be used in the program, as the inputs and outputs are preconfigured. The pin assignment is as follows:

Digital inputs	Digital outputs
DIN 1: Reset/Enable	DOUT 1: Enabled
DIN 2: Referencing	DOUT 2: Error
DIN 3: Start	DOUT 3: Referencing necessary
DIN 4: Stop	DOUT 4: Program running
DIN 5: Program number	DOUT 5: Program not running
DIN 6: Program number	DOUT 6: -
DIN 7: Program number	DOUT 7: -

PLC mode makes it possible to start and stop program via the digital inputs and outputs. DIN 5-7 can be used to select which of the programs 1 to 8 (binary coded) is to be started. The following table shows which program is started when which signals are present.

DIN 7 DIN 6 DIN 5	program
0 0 0	1
0 0 1	2
0 1 0	3
0 1 1	4
1 0 0	5
1 0 1	6
1 1 0	7
1 1 1	8

If the repeat mode is activated in PLC mode, the program that was defined by the inputs at the start is run again and again. If the inputs for selecting the program are then changed, the current program must first be stopped and then restarted with a new program number.
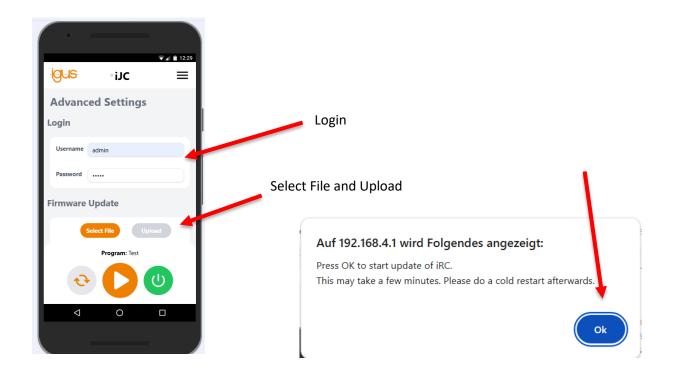
9. Perform update

ATTENTION: An update will reset the WLAN settings, the programs and the axis settings. It is recommended that you save the settings beforehand, for example by taking a screenshot.

The software can be updated via WLAN. To do this, download the new software from our Wiki https://wiki.cpr-robots.com/index.php/Igus_Joint_Control .The .zip folder contains the file LitttleFS.bin and Firmware.bin. Unarchive the folder.

To carry out the update, connect to the control system via WLAN and open the Advanced Settings window. Log in here with the user name and password "admin". The "Select File" button then appears under Firmware Update. Click on the button and then select the LittleFS.bin file first. Then click on "Upload" and confirm the message. It may now take a short moment and the control system will then restart.

The update resets the WLAN settings of the control system. If necessary, you must restart the control system several times until only the default WLAN network iJCxxxx is visible. Connect to the WLAN and navigate to the Advanced Settings page again. Log in and select the "Firmware.bin" file. Click on "Update" again and confirm the message. The control system is then restarted.

If the update was successful, the new software version number is shown on the display.

10. Troubleshooting

Problems with the WLAN connection	
Connection cannot be established	- Check whether another subscriber is already connected to the WLAN. Only one device at a time can connect to the control system's WLAN. - Deactivate mobile data on mobile devices. These must be deactivated, otherwise mobile devices will automatically switch to mobile data when the browser is opened and the WLAN connection does not establish an internet connection
Message: No connection possible	- Check whether another subscriber is already connected to the WLAN. Only one device at a time can connect to the control system's WLAN.
WLAN is not found	- Use the joystick to navigate to the Wi-Fi settings via the display and check whether the Wi-Fi is activated. If necessary, activate the WLAN. - Reset the WLAN settings using the joystick. Then carry out a cold start of the control system.
Problems on/with the webpage	
Green Alive signal no longer flashes	- Reload the website - Check your WLAN status
Message WebSocket connection closed	- Reload the website, your device has briefly disconnected from the WLAN
No axis modules are displayed, although they are connected	- If your modules flash after starting, but are not displayed in the control system, restart the control system - If no LED lights up on the axis module, check the power supply
Motors do not rotate at program start or jog command	- Check whether there is connection to the control system. Is the green Alive signal flashing? Re-establish the WLAN connection to the control system
After changing the WLAN, two WLANs are displayed	- Restart the control system and deactivate and activate the WLAN on your device
Update	
After updating the firmware, the old and the new WLAN are displayed	- Switch the control system off and on again once - Switch the WLAN on your mobile device or PC off and on again once

If this does not solve your problem, please download the log files and send them, if possible with additional screenshots, to support@cpr-robots.com .

Appendix A Commissioning of motor module

Each stepper motor module drives a bipolar stepper motor with a motor encoder. For the iJC to function properly, a motor with a connected encoder must be used and the encoder signals are analysed by an RS422 module. The signals for each axis run via three cables: motor cable, encoder cable and reference switch cable. The motor cable is connected to a connector labelled "Motor", the encoder cable to two connectors labelled "ENC-1" and "ENC-2" and the reference switch cable to the connector labelled "End-Stop". The following figure shows an example of the connectors. The colour of the cables depends on the motor type used and can be looked up in the motor documentation (igus motors).

Diagram 7: Motor module with plug-in connectors

Utilisation	Part of the iJC
Supply voltage logic	5V
Power supply	24 or 48V with up to 10A
Safety class	IP20
Ambient temperature (during operation)	+10. . . +32°C
Ambient temperature (storage)	-10. . . +85°C
Humidity (non-condensed)	0. . . 90%
Installation height above sea level (without current limitation)	1500m

Motor connector	Connects bipolar stepper motor
Pin 1 (left)	B
Pin 2	A
Pin 3	B
Pin 4	A

Encoder connector (ENC-1)	Connects a quadrature encoder to an RS422 module
Pin 1 (left)	A
Pin 2	5V DC
Pin 3	B
Pin 4	0V

Encoder connector (ENC-2)	Connects a quadrature encoder to an RS422 module
Pin 1 (left)	A-N
Pin 2	B-N
Pin 3	Index
Pin 4	Index-N

All eight cores (encoder connections 1 and 2) must be connected in order to read out the encoder.

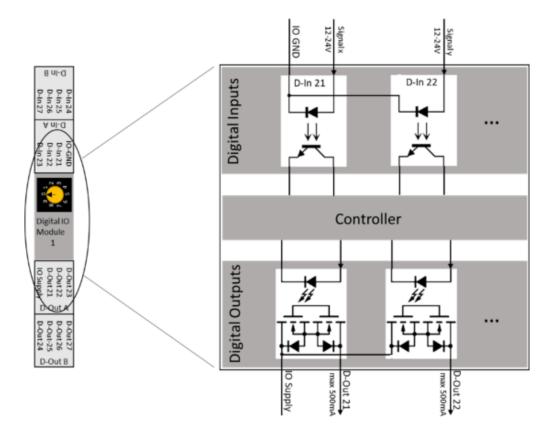| End stop connector	Connected to a limit or reference switch
Pin 1 (left)	24V
Pin 2	Ground (GND)
Pin 3	Signal
Pin 4	Do not connect

The setting of the CAN ID is described in Appendix C.
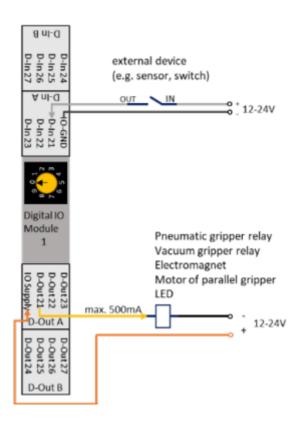
Appendix B Digital I/O module

The DIO module offers input and output channels, e.g. for controlling a valve. The outputs can switch up to 500mA. The inputs use optocouplers and are compatible with input voltages between 12 and 24V

The outputs are controlled via solid state relays. This value must not be exceeded during the switching process (e.g. by charging currents from capacitors) in order to prevent damage to the relays.

A power supply (labelled "IO Supply" in the image above) must be connected. To add DIN rail modules, first install them in the switch cabinet and set the CAN IDs according to Appendix C.
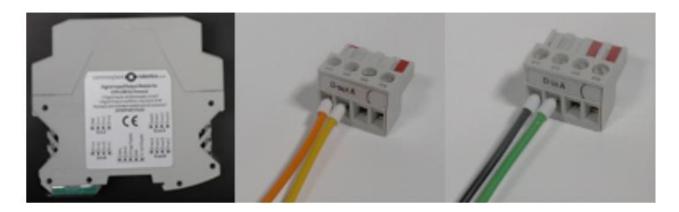
Diagram 8: DIO module with plug-in connectors

Digital Out connector (D-out A)	The output relays connect the power supply pin to the corresponding output pins
Pin 1 (left)	Input voltage (for all 7 channels)
Pin 2	D-Out channel 1 (in software 11)
Pin 3	D-Out channel 2 (in the software 12)
Pin 4	D-Out channel 3 (in the software 13)

Digital Out connector (D-out B)	The D-out B pins are (from left to right) the digital out channels
Pin 1 (left)	D-Out channel 4 (in the software 14)

Pin 2	D-Out channel 5 (in the software 15)
Pin 3	D-Out channel 6 (in the software 16)
Pin 4	D-Out channel 7 (in the software 17)

Digital In connector (D-In A)	Pin 1 of D-In A is the corresponding GND pin for all input pins
Pin 1 (left)	Signal GND (for all 7 channels)
Pin 2	D-Out channel 1 (in software 11)
Pin 3	D-Out channel 2 (in the software 12)
Pin 4	D-Out channel 3 (in the software 13)

Digital In connector (D-In B)	The D-In B pins are (from left to right) the digital-in channels 4-7
Pin 1 (left)	D-Out channel 4 (in the software 14)
Pin 2	D-Out channel 5 (in the software 15)
Pin 3	D-Out channel 6 (in the software 16)
Pin 4	D-Out channel 7 (in the software 17)

In the software, the inputs and outputs of the first DIO module are numbered 11-17, the second DIO module (if installed) is numbered 21-27 and the third is numbered 31-37.

Appendix C CAN IDs

The CAN IDs for the motors and DIO modules must be set in ascending order. This can be set using the yellow wheel on the boards. The following table shows the switch position with the respective ID.

Motor module	Switch position	CAN ID (dec)	CAN ID (hex)
1	0	16	0x10
2	2	32	0x20
3	4	48	0x30

The following table shows the switch position with the CAN ID for the DIO modules.

DIO module	Switch position	CAN ID dec	CAN ID hex
1	0	112	0x70
2	2	128	0x80
3	4	144	0x90