

WSG Series of intelligent mechatronic gripping modules
Interfacing to Universal Robots

Firmware Version 4.0.0
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www.weiss-robotics.com

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1 Introduction

This document describes how to set up, mount and use a WSG series gripper with a robot arm of the UR series from Universal Robots. It is assumed in this manual, that you have set up your robot as described in the user manual of your robot arm and have read the “Mounting and Operating Manual” of the gripper. The robot controller uses the Modbus/TCP interface of the gripper. For detailed information on controlling the gripper with this interface, please read the “WSG Fieldbus Manual”.

2 Preparation

2.1 Configuration of the Gripper

The following steps have to be made on the gripper to setup the communication interface on the gripper.

 **If your gripper is part of a “Collaborative Robot Kit”, these steps have already been done for you.**

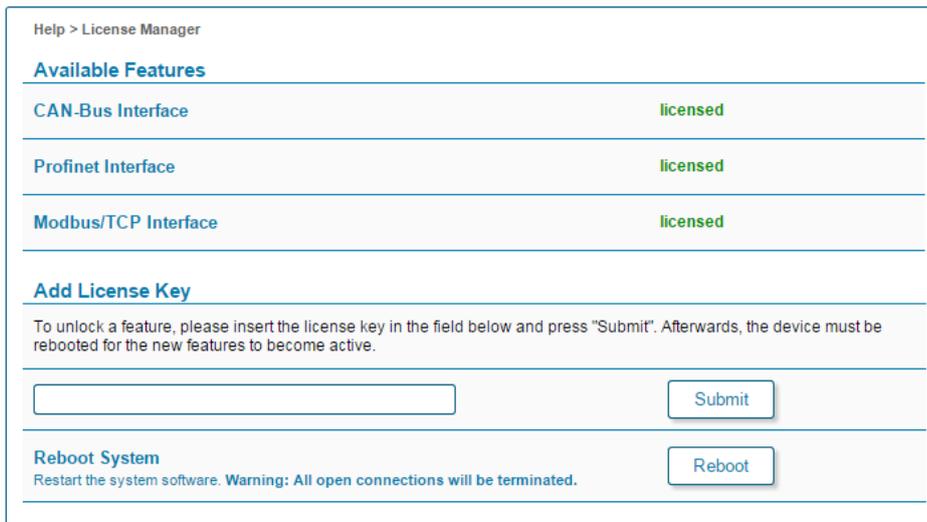
1. Using the Ethernet/Power cable, connect the module to the existing Ethernet network of alternatively to the network card in your PC or laptop.

 **The gripper’s IP address is factory-set to a static value of 192.168.1.20. For more information about connecting to the gripper or changing the IP address, please refer to the gripper manual. To directly operate the module on your computer’s network connection, you may have to alter your computer’s network configuration. If in doubt, contact your system administrator.**

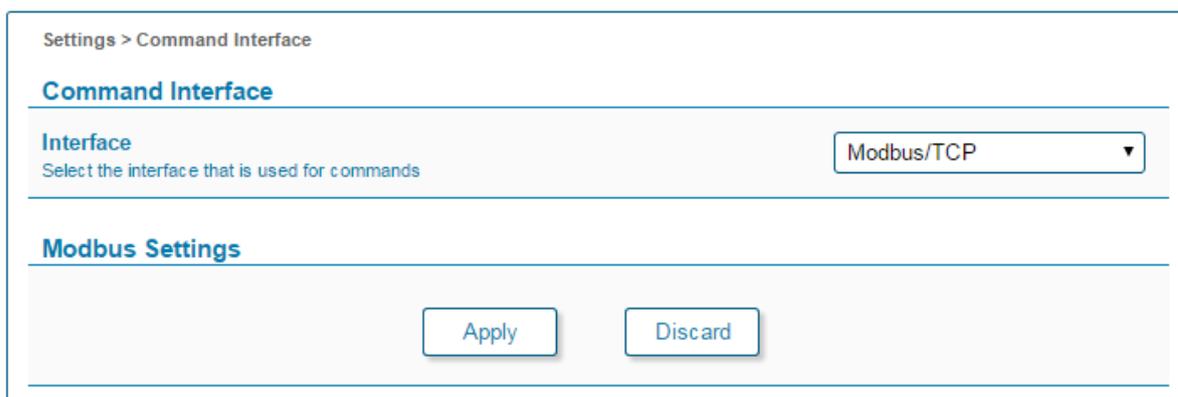
2. Connect your module with a power supply (24 V).
3. The gripper will now start up. The indicator for the operating state will light up blue and after about 5 seconds it will start flashing quickly blue. This signals that the gripper is booting. After about 15 seconds the indicator will slowly flash white. The gripper is ready for use.
4. On your computer, open the Internet browser and enter the address `http://192.168.1.20`
5. Open the page “Help → License Manager”. Enter the Modbus/TCP license key in the license key field and click “Submit”.

 **Modbus/TCP is an optional feature for the WSG gripping modules. A license key can be obtained separately. Please contact your local sales representative.**

6. Click on “Reboot” to restart the gripper. After the gripper has rebooted reload the page. On the page “Help → License Manager” the option “Modbus/TCP Interface” should now be show “licensed”.



7. Open the "Settings → Command Interface" page.
8. Select "Modbus/TCP" as interface.



9. Click on Apply.

2.2 Network Configuration of the Robot Controller

The Ethernet interface of the robot has to be activated and configured by performing the following steps:

1. On the teach panel of the robot, click on "Setup Robot".
2. Click on "Setup Network".
3. Choose "Static Address".
4. Enter the following settings:
IP address: 192.168.1.10
Subnet mask: 255.255.255.0
Default gateway: 0.0.0.0
Preferred DNS server: 0.0.0.0

Alternative DNS Server: 0.0.0.0

5. Click "Apply"

 If you want to use a different IP address, make sure that the robot can connect to the gripper. Refer to the gripper manual to change the network settings of the gripper and contact your system administrator for the correct network settings.

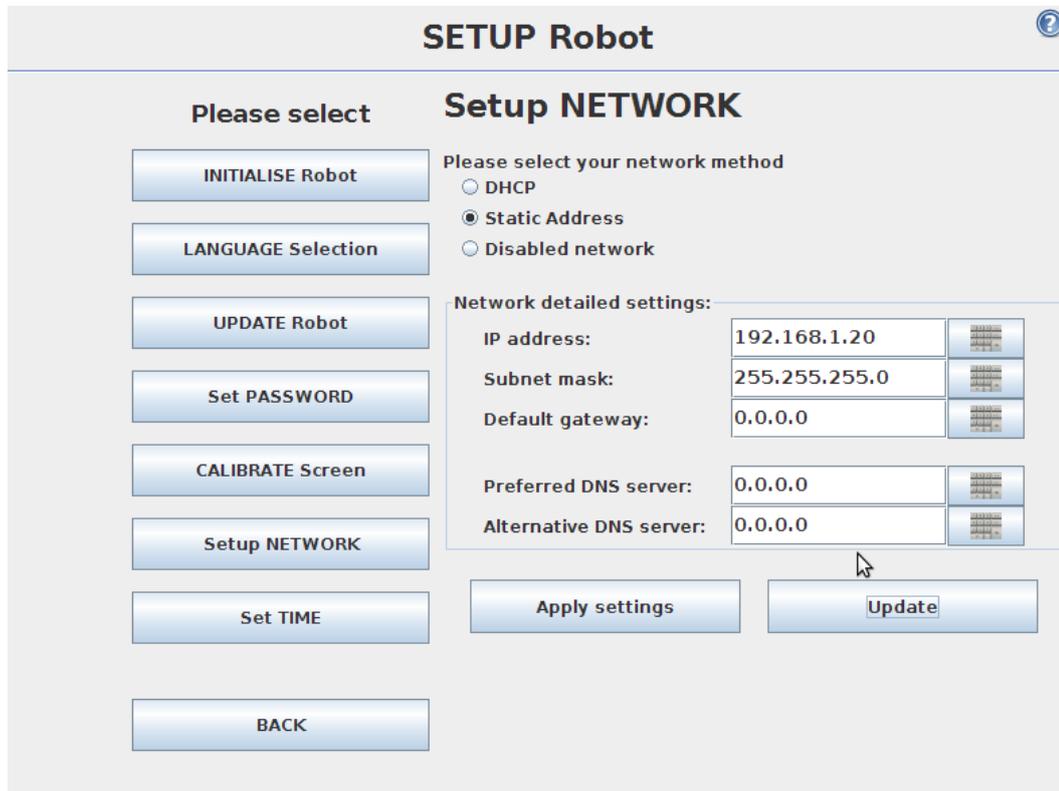


Fig. 1: Network settings on Universal Robot

2.3 Hardware Installation

1. Mount the adapter plate to the tool output flange of the robot using the provided screws.
2. Mount the Gripper to the adapter plate.
3. Plug in the power supply and Ethernet wires on the gripper.
4. Connect the power supply wire to the 24V of the robot controller.
5. Connect the gripper to the Ethernet Interface of the robot controller. If the port is already used, use a network switch.

 Please refer to the manual of your robot arm for details on how to connect the power supply and the Ethernet connection.

Secure the wires with tie straps. Make sure, that the wires are long enough to let the robot move freely.

2.4 Software Installation

1. Plug the provided USB Drive into the USB port on the right hand side of the teach panel.
2. Wait until the message “WSG Installation finished” appears on the display.
3. Unplug the USB drive from the teach panel.

3 Getting Started

The delivered software consists of script files for the actual control of the gripper, an installation file, which defines the variables and the Modbus/TCP configuration, an example program and a program template file, which can be used for your own implementations.

To run the example program follow the following steps:

1. On the teach panel click "Program Robot".
2. Click on "Load Program".
3. Select the subfolder "Weiss Robotics".
4. Select the File "WSG-example-CB2.urp" if you have a CB2 controller or "WSG-example-CB3" if you have a CB3 controller, respectively.
5. Click "Open".
6. If you are asked if the installation file should be loaded, click on "Load installation".
7. Start the program by clicking the "Play" button.

The gripper should now move. The gripper is referenced and then moved to a defined position. Afterwards a grip command is executed and the status of the gripper is read. If the gripper reports the state "Holding" the part is held for 1 sec, before it is released again. If the state is different from "Holding" the grip is released again.

To implement a new program follow these steps:

1. On the teach panel click "Program Robot".
2. Click on "Load Program".
3. Select the subfolder "Weiss Robotics".
4. Select the File "WSG-template.urp".
5. Click "Open".
6. If you are asked if the installation file should be loaded, click on "Load installation".
7. Put your commands in the main loop in the template.
8. Start the program by clicking the "Play" button.

4 Software Description

In the following section you can find a description of the provided software modules.

4.1 Program Files

There are two program files provided for each type of robot controller (CB2 and CB3) by the program package:

WSG_template.urp:

This file provides the required subprograms and initialization for using the gripper. The gripper is referenced and the variables are initialized. Then a loop is started running the user code.

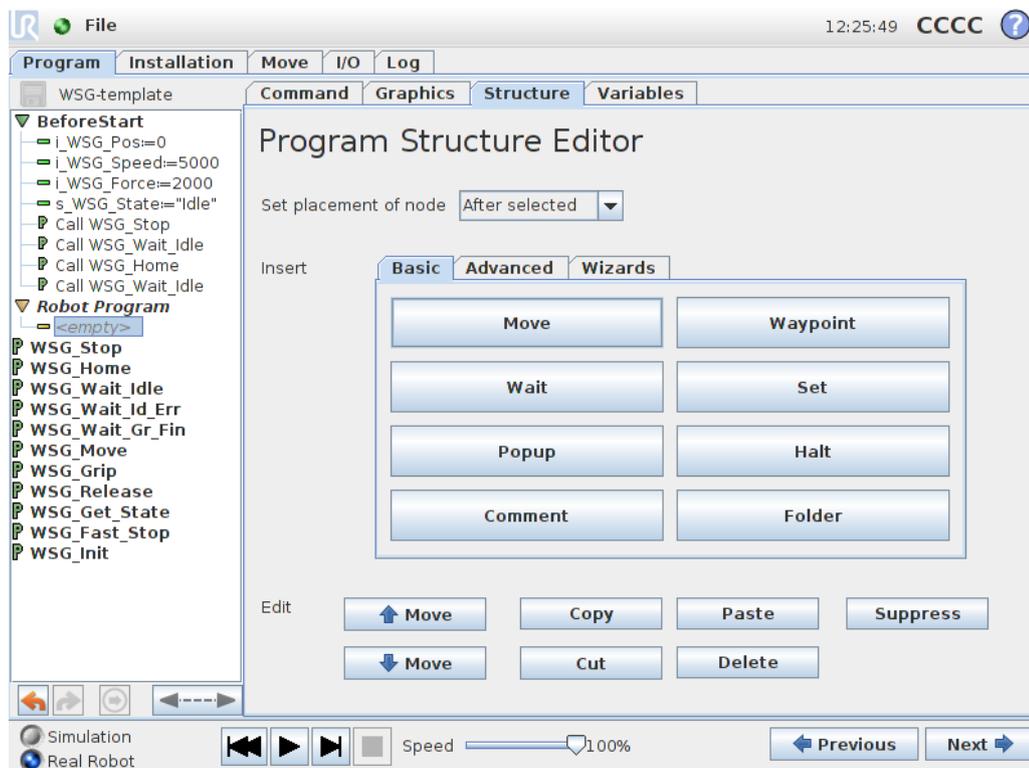


Fig. 2: Program template

WSG_example.urp

Provides a basic example to show how the subprograms can be used to control the gripper and evaluate the status of the gripper. The gripper is referenced and then moved to a defined position. Afterwards a grip command is executed and the status of the gripper is read. If the gripper reports the state "Holding" the part is held for 1 sec, before it is released again. If the state is different from "Holding" the grip is released again.

4.2 Scripts and Sub-Programs

The scripts are located in the subfolder “WSG_scripts” and are called by the sub-programs defined in the template program.

Sub-Program	Script Filename	Description
WSG_Stop	wsg_stop.script	Stops the current action and sets the gripper in IDLE state
WSG_Home	wsg_home.script	Starts a reference movement. Has to be executed at least once.
WSG_Wait_Idle	wsg_wait_for_idle.script	Waits until the gripper state is “Idle”
WSG_Wait_Id_Err	wsg_wait_for_idle_or_error.script	Waits until the gripper state is “Idle” or “Error”.
WSG_Move	wsg_move.script	Pre-positions the gripper to the position set by i_WSG_Pos with the speed set in i_WSG_Speed.
WSG_Grip	wsg_grip.script	Starts a grip using the position, speed and force set by i_WSG_Pos, i_WSG_Speed and i_WSG_Force.
WSG_Wait_Gr_Fin	wsg_wait_for_grip_finished.script	Waits until the grip is finished and the gripper state is “Holding”, “No Part” or “Part Lost”
WSG_Get_State	wsg_get_state.script	Reads the gripper state and stores it in s_WSG_state
WSG_Release	wsg_release.script	Opens the gripper to the position set by i_WSG_Pos.
WSG_Fast_Stop	wsg_fast_stop.script	Issues a fast stop.
WSG_Init	wsg_init.script	Initializes the Modbus interface and the variables. Can be used on CB3 instead of an installation file.

The basic usage is to issue a command and then wait with “WSG_Wait_Idle” until the gripper has finished the issued command and returned to the “Idle” state. For waiting after “WSG_Grip” is issued, use the sub-program “WSG_Gr_Fin”.

After a grip is performed, you can read the state with “WSG_Get_State” and react depending on the value of the variable “s_WSG_State”.

 For more detailed information on the gripper commands and states please refer to the “WSG Fieldbus Interface Manual”.

4.3 Installation File

We provide an installation file, which defines the Modbus/TCP connections. You can use this file or create your own installation file. If you want to create an installation file yourself, please set the following settings. Instead of using an installation file, you can also run the “WSG_Init” sub-program, which sets the Modbus/TCP configuration from within the robot program.

4.3.1 Modbus client

Add a Modbus client with the following settings:

IP: the IP address of the gripper. Default is 192.168.1.20

Type	ID	Frequency	Name
Register Input	0	25 Hz	RI_WSG_STATE
Register Output	0	25 Hz	RO_WSG_COMMAND_FLAGS
Register Output	1	25 Hz	RO_WSG_WIDTH
Register Output	2	25 Hz	RO_WSG_SPEED
Register Output	3	25 Hz	RO_WSG_FORCELIM

 The frequency can be set when activating the option “Show advanced settings”.

 If you want to read out more process data, such as position, speed and force from the gripper, you can add more Register Inputs. For further information on the Modbus/TCP communication interface please refer to the “WSG Fieldbus Interface Manual”.

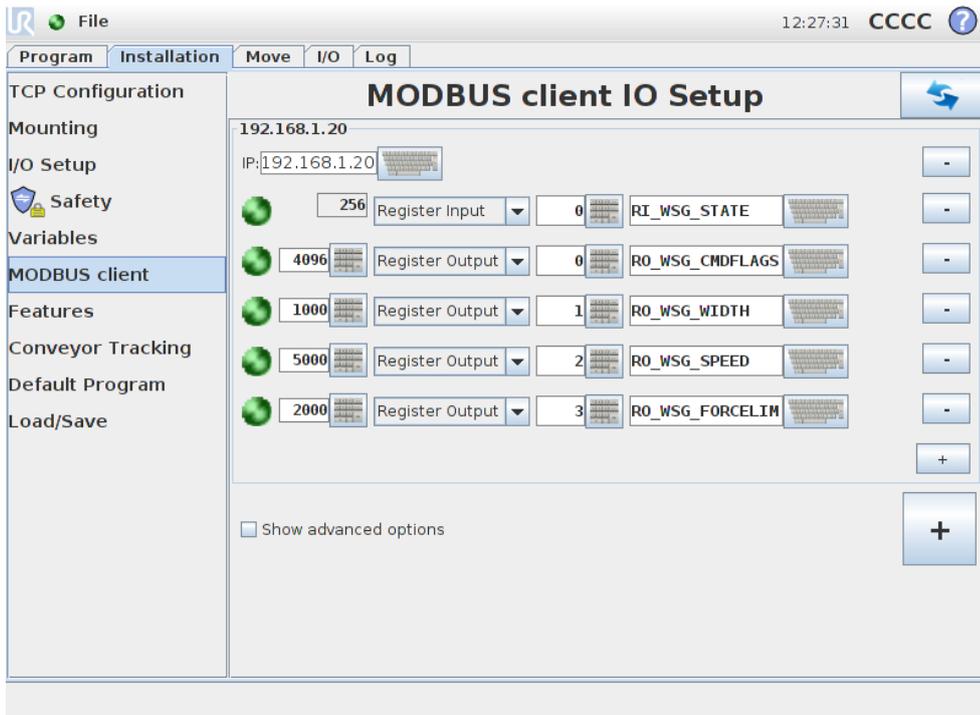


Fig. 3: Modbus Setup on Universal Robot

4.3.2 Variables

The following variables are used by the scripts and have to be defined either in the installation or the program:

Variable	Default value	Description																		
i_WSG_Force	1000	<p><i>Command parameter "Force Limit"</i></p> <p>New gripping force limit in 1/100 Newton (i.e. a value of 1050 means 10.50 N). The gripping force is twice the nominal force that is applied to the part to be gripped.</p> <p><i>Please note:</i></p> <p>Setting this parameter to a value beyond the system limits and triggering a motion-related function using it raises a FAST STOP.</p>																		
i_WSG_Speed	5000	<p><i>Command parameter "Speed"</i></p> <p>Current movement speed in 1/100 millimeters per second (i.e. a value of 3005 means 30.05 mm/s), given as finger speed relative to each other.</p> <p><i>Please note:</i></p> <p>Setting this parameter to a value beyond the system limits and triggering a motion-related function using it raises a FAST STOP.</p>																		
i_WSG_Pos	0	<p><i>Command parameter "Position"</i></p> <p>New finger opening width in 1/100 millimeters (i.e. a value of 1220 means 12.20 mm).</p>																		
s_WSG_State	"Idle"	<p><i>Gripper State</i></p> <p>This variable contains a string describing the gripper state. It is only update by the "WSG_get_state" sub-program and script.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>"Idle"</td> <td>Waiting for new command</td> </tr> <tr> <td>"Gripping"</td> <td>Fingers moving towards the part</td> </tr> <tr> <td>"No Part"</td> <td>No part found</td> </tr> <tr> <td>"Part Lost"</td> <td>Part was gripped but then lost</td> </tr> <tr> <td>"Holding"</td> <td>Holding a part</td> </tr> <tr> <td>"Releasing"</td> <td>Fingers moving away from the part</td> </tr> <tr> <td>"Positioning"</td> <td>Fingers moving due to a pre-position command (WSG_MOVE)</td> </tr> <tr> <td>"Error"</td> <td>An error occurred</td> </tr> </tbody> </table>	Value	Description	"Idle"	Waiting for new command	"Gripping"	Fingers moving towards the part	"No Part"	No part found	"Part Lost"	Part was gripped but then lost	"Holding"	Holding a part	"Releasing"	Fingers moving away from the part	"Positioning"	Fingers moving due to a pre-position command (WSG_MOVE)	"Error"	An error occurred
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