



## GRIPLINK PLUG-IN FOR FANUC

Version 2.0.0



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# 1 Introduction

With GRIPLINK technology, IO-Link compatible automation components can be connected to robot systems from leading manufacturers via a network connection. The GRIPLINK plug-in for FANUC is the control-side link and enables the simple integration of GRIPLINK technology from WEISS ROBOTICS into robot systems from the manufacturer FANUC.



These instructions describe the functions of the GRIPLINK plug-in. For information on mounting, commissioning and operation of the GRIPLINK controller, refer to the operating instructions of the respective module. These can be found online at [www.griplink.de/manuals](http://www.griplink.de/manuals)

## 1.1 Notation and symbols

For a better overview, the following symbols are used in these instructions:



Function or safety-relevant note. Non-observance may endanger the safety of personnel and plant, damage the device or impair the function of the device.



Additional information for a better understanding of the described facts.



Reference to further information.

## 1.2 Intended use

The "GRIPLINK Plug-in" software is intended for communication between the GRIPLINK Controller from WEISS ROBOTICS and a robot controller. The requirements of the applicable directives and the installation and operating instructions in these instructions must be observed and complied with. Any other use or use beyond the scope of this manual is considered improper use. The manufacturer is not liable for any damage resulting from this.

## 1.3 System requirements

This plug-in is compatible with GRIPLINK from firmware version 2.0.0.

One of the following FANUC robot controllers is required for operation:

- R-30iB with software version 8.30 (or higher)
- R-30iB plus with software version 9.10 (or higher)

The following robot options are required to run the software:

- R632 KAREL
- R648 User Socket Msg



Contact your FANUC distributor to obtain robot options.



The IP address of the GRIPLINK controller must be in the same subnet as that of the robot controller. The GRIPLINK controller manual describes the exact procedure for changing the IP address.

#### **1.4 License terms**

The GRIPLINK plug-in is protected by copyright. The respective valid license terms are included in the software package. With the installation you accept these license terms.

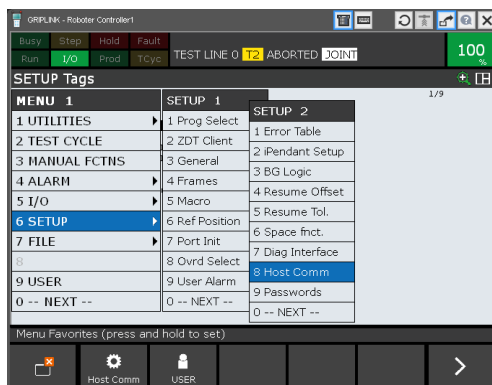
## 2 Installation

### 2.1 Preparation of the robot

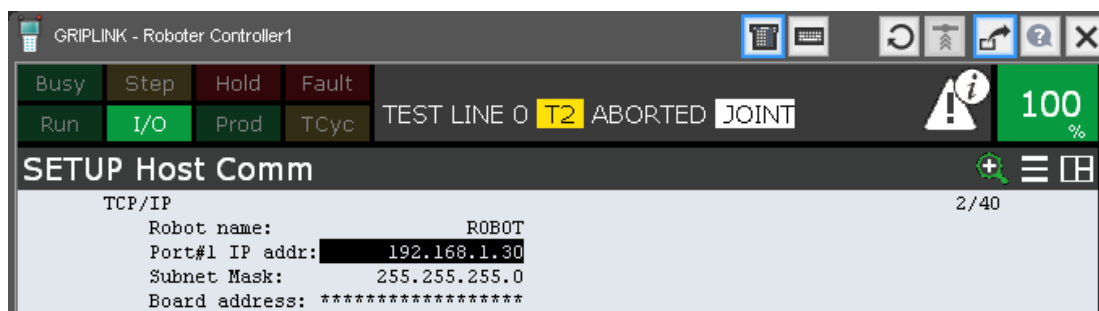
Switch on the robot and set up the IP address (e.g. 192.168.1.30). Make sure that the robot and the GRIPLINK controller are in the same network.

To do this, perform the following steps:

1. Select MENU → 6 (SETUP) → 0 (--NEXT--) → 0 (--NEXT--) → 7 (Host Comm).
2. Select "TCP/IP" and press ENTER.



3. Enter the IP address and the subnet mask of the robot (in the example 192.168.1.30, subnet 255.255.255.0).



### 2.2 Software installation

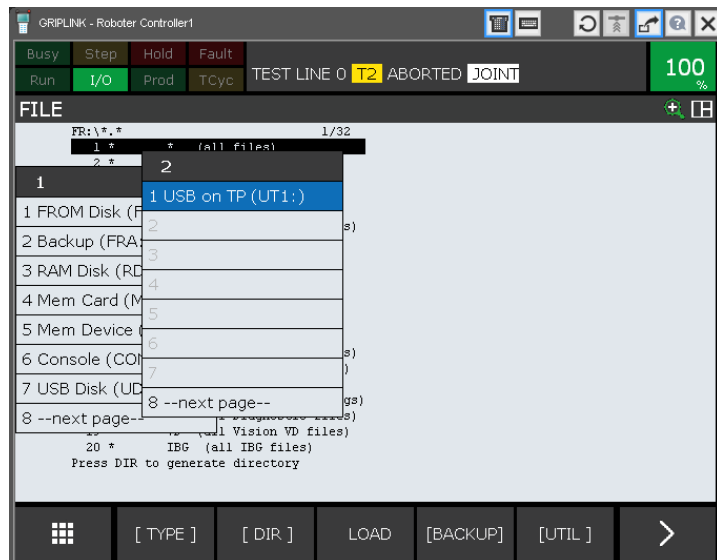


Make sure that you are using the latest version of the GRIPLINK plug-in. The current version can be downloaded from [www.griplink.de/software](http://www.griplink.de/software).

1. Unpack the previously downloaded ZIP archive with the GRIPLINK plug-in into the root directory of a USB stick and insert it into the USB slot of the teach pendant.
2. Press the Menu → 7 (FILE) → 1 (File) button



3. Press the UTIL → 1 (Set Device) softkey.
4. Select 8 (-- next page --) → 1 (USB on TP (UT1:))



5. Select "All Files". You should now see, among other things, the installation file SETUP.CM.
6. Execute the installation file. For controllers of the R-30iB series, you must perform a cold start afterwards to apply the parameters.

### 2.2.1 Checking the installation

After you have finished the installation process, press the SELECT on the teach pendant. You should now see the program "GRIPLINK.PC" and the sample program "GRIPLINK\_DEMO.TP".

## 2.3 Uninstall the software

To remove the GRIPLINK plug-in from your robot again, run the uninstall script. This is also part of the software distribution. To do this, follow the steps in chapter 2.2 and select the uninstall script "UNINSTALL.CM" instead of the installation script "SETUP.CM".

## 2.4 Configuration of the socket messaging interface

The socket messaging interface is required for communication between the robot and the GRIPLINK controller. This must be configured as follows:

1. Press the "MENU" key and navigate to 6 (SETUP) → 0 (NEXT) → 8 (HOST COMM). The "SETUP Protocols" menu appears. In it, select 3 (SM Socket Messaging Device) and press the SHOW softkey. Select 2 (Clients).
2. Socket Messaging offers you eight TAGs for free use. Select the TAG you want to use for communication with the GRIPLINK controller (TAG 1 in the example).
3. Enter the following data in the input mask:

Comment: GRIPLINK  
Startup State: DEFINE  
Server IP/Hostname: (IP address of the GRIPLINK controller, factory setting  
192.168.1.40)  
Port: 10001  
Inactivity Timeout: 15 min

The Remote Path/Share, Username and Password fields are not required and can be left blank.

4. Go back to the overview (SETUP Clients) and select the value 1 (DEFINE) for the tag just set via the ACTION softkey.

## 2.5 Behavior in case of error

If an error occurs within the GRIPLINK plug-in or during communication with the GRIPLINK controller, the running robot program is basically stopped by means of an error. This usually leads to the fact that running movements of the robot are aborted. The same also applies if the addressed device is in FAULT state or changes to this state due to a command.



Errors are also stored in the log file of the robot and can be retrieved via the teach pendant, key MENU → 4 (ALARM) → 4 (Appl Log).

### 3 Command Reference

The GRIPLINK plug-in provides the user with a collection of gripping module-specific functions. Both single and multiple commands are available. The commands are implemented via an interface program (GRIPLINK.PC), which receives the command together with the necessary parameters as transfer values. To execute a command, the interface program GRIPLINK.PC must be inserted into the robot program via a CALL. The command to be executed is selected via a parameter.

#### ***Argument Wizard***

On controllers with software version 9.10 (R-30iB plus series), command and parameters can be selected directly via the Argument Wizard.

On controllers with software version 8.30 (R-30iB series), the command can be selected via the Argument Wizard. The parameter values required for the command must be entered via the generic parameters A, B and C. Parameters that are not required can be set to 0.

#### ***Return values***

The return values of the commands are stored in a register. The index of this register or the start index of the register area can be specified via the RRI parameter (Return Register Index).

#### ***Multiple commands***

With the multiple commands (prefix M), several gripping modules can be addressed simultaneously in parallel. These commands are particularly suitable for handling large or bendable workpieces with several gripping modules.

***The basic program flow with the GRIPLINK plug-in is always as follows:***

1. Establish connection with CONNECT
2. Activate gripping module and connection monitoring with ENABLE
3. For servo gripping modules without absolute encoder: Reference gripping module with HOME
4. Grasp/release with GRIP/MGRIP or RELEASE/MRELEASE

The available commands of the GRIPLINK plug-in are described below.



### 3.1 Establish connection - CONNECT

This command establishes the connection between the GRIPLINK controller and the robot controller. As transfer parameter the TAG of the socket messaging module configured before according to chapter 2.4 transferred. The command waits until the connection is established. If the GRIPLINK controller cannot be reached at the specified address, an error is triggered and the program execution is stopped.

If GRIPLINK commands are executed before a CONNECT, this will trigger an error.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(CONNECT, < COM\_TAG >)  
R-30iB:                CALL GRIPLINK(CONNECT, A=< COM\_TAG > , B=0, C=0)

#### **Parameter**

< COM\_TAG >        Index of the socket messaging TAG (1 to 8)

#### **Return values**

none

#### **Example**

Establish connection between robot and the GRIPLINK via socket messaging TAG 1:

```
CALL GRIPLINK (CONNECT, COM_TAG=1)
```

## 3.2 Switch on device - ENABLE

This command activates the connected device and the connection monitoring. If the connection to the device is disconnected (e.g. due to a cable break), this triggers an error and the robot program is stopped.

### Gripping part monitoring

The gripping part monitoring can be switched on or off via a parameter. If the gripping part monitoring is active and the gripping module loses a previously picked-up workpiece, this triggers an error and the robot program is stopped.

ENABLE must be executed after CONNECT for all gripping modules.

If GRIPLINK commands are executed before an ENABLE, this will trigger an error.

### **Syntax**

R-30iB plus:           CALL GRIPLINK(ENABLE, < INDEX >, < PARTMON >, < RRI > )  
R-30iB:                CALL GRIPLINK(ENABLE, A=< INDEX >, B=< PARTMON >, C=< RRI > )

### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< PARTMON >         Gripping part monitoring: 1 (PM\_EN) = on, 0 (PM\_DIS) = off  
< RRI > Index of     the return value register (1 to 1000)

### **Return values**

R[RRI]               current device state

### **Example**

Activate drive and gripping part monitoring of the gripping module at port 0:

```
CALL GRIPLINK(ENABLE, INDEX=0, PM_EN, RRI=1)
```

### 3.3 Query device state - GET STATE

This command returns the device state of the selected gripping module.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(GET\_STATE, < INDEX >, < RRI >)  
R-30iB:                CALL GRIPLINK(GET\_STATE, A=< INDEX >, B=< RRI >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< RRI >               Index of the return value register (1 to 1000)

#### **Return values**

R[RRI]                current device state

#### **Example**

Wait until the device state of the gripping module at port 2 is "HOLDING" (4):

```
LBL[1]
CALL GRIPLINK(GET_STATE, INDEX=2, RRI=1)
IF R[1]=4, JMP LBL[2]
WAIT 0.01(sec)
JMP LBL[1]
LBL[2]
! Gripper 2 is now in HOLDING state
```

### 3.4 Device state of several gripping modules - GET MSTATE

This command returns the device state of all gripping modules.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(GET\_MSTATE, < RRI >)  
R-30iB:                CALL GRIPLINK(GET\_MSTATE, A=< RRI >, B=0, C=0)

#### **Parameter**

< RRI > Index of       the first return value register (1 to 997)

#### **Return values**

R[RRI + 0]            current device state of gripping module at port 0  
R[RRI + 1]            current device state of gripping module at port 1  
R[RRI + 2]            current device state of gripping module at port 2  
R[RRI + 3]            current device state of gripping module at port 3

#### **Example**

Wait until all gripping modules are in the "RELEASED" state (3):

```
LBL[1]  
CALL GRIPLINK(GET_MSTATE,RRI=1)  
IF (R[1]=3 AND R[2]=3 AND R[3]=3 AND R[4]=3),JMP LBL[2]  
WAIT 0.01(sec)  
JMP LBL[1]  
LBL[2]  
! All grippers are now in RELEASED state
```

### 3.5 Disable device - DISABLE

Deactivates the device connected to the selected device port. This command can be used, for example, to change tools. The device can be reactivated via GRIPLINK\_ENABLE.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(DISABLE, < INDEX >, < RRI >)  
R-30iB:                CALL GRIPLINK(DISABLE, A=< INDEX >, B=< RRI >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< RRI >               Index of the return value register (1 to 1000)

#### **Return values**

R[RRI]               current device state

#### **Example**

Change the gripping module at port 0:

```
! Connect to GRIPLINK controller using ComTAG 1  
CALL GRIPLINK(CONNECT, COMTAG=1)  
! Activate Drive and Part Monitoring of gripper 0  
CALL GRIPLINK(ENABLE, INDEX=0, PM_EN, RRI=1)  
! DO something  
! ...  
! Prepare tool change:  
! Disable gripper 0:  
CALL GRIPLINK(DISABLE, INDEX=0, RRI=1)  
! Now, the gripper can be changed  
!  
! - OPERATE THE TOOL CHANGER HERE -  
!  
!Activate the new gripper:  
CALL GRIPLINK(ENABLE, INDEX=0, RRI=1)
```

### 3.6 Reference gripping module - HOME

References the selected servo gripper. The command executes a reference run of the gripping module and waits until this is completed. After the HOME command has been executed, the fingers of the gripping module are powerless and must be moved to a defined position with a GRIP/MGRIP or RELEASE/MRELEASE.



The reference run can be configured via the web interface of the GRIPLINK controller.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(HOME, < INDEX >, < RRI >)

R-30iB:                CALL GRIPLINK(HOME, A=< INDEX >, B=< RRI >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)

< RRI >               Index of the return value register (1 to 1000)

#### **Return values**

R[RRI]               current device state

#### **Example**

Reference the gripping module to port 2:

```
CALL GRIPLINK (HOME, INDEX=2, RRI=1)
```

### 3.7 Grip a workpiece - GRIP

Grips a workpiece with the selected gripping module and the selected grip recipe. The command waits until the device state changes to either "HOLDING" or "NO PART".



The gripping parameters (so called "recipe") can be configured via the web interface of the GRIPLINK controller.

#### Syntax

R-30iB plus:           CALL GRIPLINK(GRIP, < INDEX >, < PRESET >, < RRI >)  
R-30iB:                CALL GRIPLINK(GRIP, A=< INDEX >, B=< PRESET >, C=< RRI >)

#### Parameter

< INDEX >            Index of the gripping module (0 to 3)  
< PRESET >           Selected handle (0 to 3 or 0 to 7 for CRG gripping modules).  
< RRI >                Index of the return value register (1 to 1000)

#### Return values

R[RRI]                current device state

#### Examples

Gripping module at port 0 is to grip with grip recipe 2. If no workpiece was found, the gripper should open again and try again:

```
LBL[1]
CALL GRIPLINK(GRIP, INDEX=0, PRESET=2, RRI=1)
IF R[1]=4, JMP LBL[2]
CALL GRIPLINK(RELEASE, INDEX=0, PRESET=2, RRI=1)
JMP LBL[1]
LBL[2]
! Part gripped!
```

### 3.8 Simultaneous gripping of workpieces - MGRIP

This command executes a grip with the selected gripping modules. The command waits until all gripping modules have each reached one of the states "HOLDING" or "NO PART".



The gripping parameters can be configured via the web interface of the GRIPLINK controller.

#### Syntax

R-30iB plus:           CALL GRIPLINK(MGRIP, < MASK >, < PRESET >, < RRI > )  
R-30iB:                CALL GRIPLINK(MGRIP, A=< MASK >, B=< PRESET >, C=< RRI > )

#### Parameter

< MASK >               Selected gripping modules as bit vector:  
                          Bit 0: 1 = gripping module selected at port 0, 0 = not selected  
                          Bit 1: 1 = gripping module selected at port 1, 0 = not selected  
                          Bit 2: 1 = gripping module selected at port 2, 0 = not selected  
                          Bit 3: 1 = gripping module selected at port 3, 0 = not selected  
                          Bit 31...4: reserved (set to 0)  
  
< PRESET >             Selected handle (0 to 3 or 0 to 7 for CRG gripping modules).  
< RRI >                 Index of the first return value register (1 to 997)

#### Return values

R[RRI + 0]             current device state of gripping module at port 0  
R[RRI + 1]             current device state of gripping module at port 1  
R[RRI + 2]             current device state of gripping module at port 2  
R[RRI + 3]             current device state of gripping module at port 3

#### Examples

Gripper modules at port 1 and 2 grip workpiece with grip recipe 2:

```
CALL GRIPLINK (MGRIP, MASK=6, PRESET=2, RRI=1)
```



### 3.9 Release a workpiece - RELEASE

Releases the workpiece gripped with the selected gripping module. The command waits until the workpiece has been released.



The gripping parameters can be configured via the web interface of the GRIPLINK controller.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(RELEASE, < INDEX >, < PRESET >, < RRI > )  
R-30iB:                CALL GRIPLINK(RELEASE, A=< INDEX >, B=< PRESET >, C=< RRI > )

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< PRESET >          Selected grip recipe (range depends on selected gripper model).  
< RRI >               Index of the return value register (1 to 1000)

#### **Return values**

R[RRI]               current device state

#### **Examples**

Release the workpiece gripped with the gripping module at port 0 and grip recipe 2:

```
CALL GRIPLINK (RELEASE, INDEX=0, PRESET=2, RRI=1)
```

### 3.10 Simultaneous release of workpieces - MRELEASE

Simultaneously releases the workpiece gripped with the selected gripping modules. The command waits until all gripping modules have each reached the "RELEASED" state.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(MRELEASE, < MASK >, < PRESET >, < RRI >)  
R-30iB:                CALL GRIPLINK(MRELEASE,A=< MASK >, B=< PRESET >, C=< RRI >)

#### **Parameter**

< MASK > Selected gripping modules as bit vector:  
                                  Bit 0: 1 = gripping module selected at port 0, 0 = not selected  
                                  Bit 1: 1 = gripping module selected at port 1, 0 = not selected  
                                  Bit 2: 1 = gripping module selected at port 2, 0 = not selected  
                                  Bit 3: 1 = gripping module selected at port 3, 0 = not selected  
                                  Bit 31...4: reserved (set to 0)  
  
< PRESET >           Selected handle (range depends on selected gripper model).  
< RRI >               Index of the first return value register (1 to 997)

#### **Return values**

R[RRI + 0]           current device state of gripping module at port 0  
R[RRI + 1]           current device state of gripping module at port 1  
R[RRI + 2]           current device state of gripping module at port 2  
R[RRI + 3]           current device state of gripping module at port 3

#### **Examples**

Gripping module at port 1,2 and 3 release workpiece with grip recipe 3:

```
CALL GRIPLINK (MRELEASE, MASK=14, PRESET=3, RRI=1)
```

### 3.11 Read current finger position - GET POSITION

This command returns the current finger position of the selected gripping module.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(GET\_POSITION, < INDEX >, < RRI >)  
R-30iB:                CALL GRIPLINK(GET\_POSITION,A=< INDEX >, B=< RRI >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< RRI >               Index of the return value register (1 to 1000)

#### **Return values**

R[RRI]               Finger position in 0.01 mm steps

#### **Example**

Execute the subroutine "PROG" if the finger position of the gripping module at port 2 is greater than 10.5 mm:

```
CALL GRIPLINK(GET_POSITION, INDEX=2, RRI=42)  
IF R[42]> 1050, CALL PROG  
! If program execution reach here, position is lower than 10.5 mm
```

### 3.12 Control gripping force holding - HOLD

The innovative gripping force safety device developed by WEISS ROBOTICS maintains the gripping force on the workpiece even if the power supply to the gripping module is unexpectedly interrupted. Thanks to the integrated absolute sensor technology, production can continue immediately when the power supply is restored, even without referencing. Furthermore, HOLD enables permanent gripping without the gripping module becoming hot.

This command activates or deactivates the gripping force safety device for the selected gripping module.



HOLD is not available with all gripping modules.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(HOLD, < INDEX >, < ENABLE >)  
R-30iB:                CALL GRIPLINK(HOLD, A=< INDEX >, B=< ENABLE >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< ENABLE >          Gripping force retention: 1 (EN) = on, 0 (DIS) = off

#### **Return values**

none

#### **Example**

Activates mechanical gripping force retention for gripping module at port 2 if the device state is "HOLDING":

```
CALL GRIPLINK (GRIP, INDEX=2, RRI=1)  
IF R[1]=5, CALL GRIPLINK (HOLD, INDEX=2, EN)
```

### 3.13 Control of the LED display - GRIPLINK LED

This command changes the color and pattern of the light ring of a selected CRG gripping module. This function is only available for gripping modules of the CRG series.



Light patterns can be configured via the web interface of the GRIPLINK controller.



A controllable LED display is not available for all gripping modules.

#### **Syntax**

R-30iB plus:           CALL GRIPLINK(LED, < INDEX >, < PATTERN >)  
R-30iB:                CALL GRIPLINK(LED, A=< INDEX >, B=< PATTERN >, C=0)

#### **Parameter**

< INDEX >            Index of the gripping module (0 to 3)  
< PATTERN >         Index of the predefined light pattern (0 to 7)

#### **Return values**

none

#### **Example**

Grasp with the gripping module at port 3 and other the color of the illuminated ring on the illuminated pattern 0, if the finger position is greater than or equal to 8.1 mm afterwards and on illuminated pattern 1, if smaller:

```
CALL GRIPLINK (GRIP, INDEX=3, PRESET=0, RRI=1)
CALL GRIPLINK (GET_POSITION, INDEX=3, RRI=2)
IF (R[2] >= 810) THEN
  CALL GRIPLINK (LED, INDEX=3, PATTERN=0)
ELSE
  CALL GRIPLINK (LED, INDEX=3, PATTERN=1)
ENDIF
```

## Appendix A. Device state

Device state	Code	Description
NOT CONNECTED	0	Gripper module not connected
NOT INITIALIZED	1	Gripper module not initialized
IDLE	2	Ready for operation, not active
RELEASED	3	Workpiece released
NO PART	4	No workpiece found
HOLDING	5	Workpiece is held
OPERATING	6	Sensor ready for operation
FAULT	7	Error condition

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