

Documentation

GripLAB Setup

FANUC

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1. Supported robot controllers and available interfaces

- RJ3 and newer with software version starting from V7.20

Available Interfaces:

- RS232
- Ethernet (Software option “User Socket Msg” is required)
- Fieldbus via protocol converter (on request)

2. Scope of delivery

The following parts are included in GripLAB delivery:

- GripLAB measuring system
- Base plate for mounting GripLAB
- Robot programs for operation (on USB-Stick)
- Documentation of GripLAB setup and application (on USB-Stick and hardcopy)
- Optional: measuring device for base measurement

3. Mechanical installation

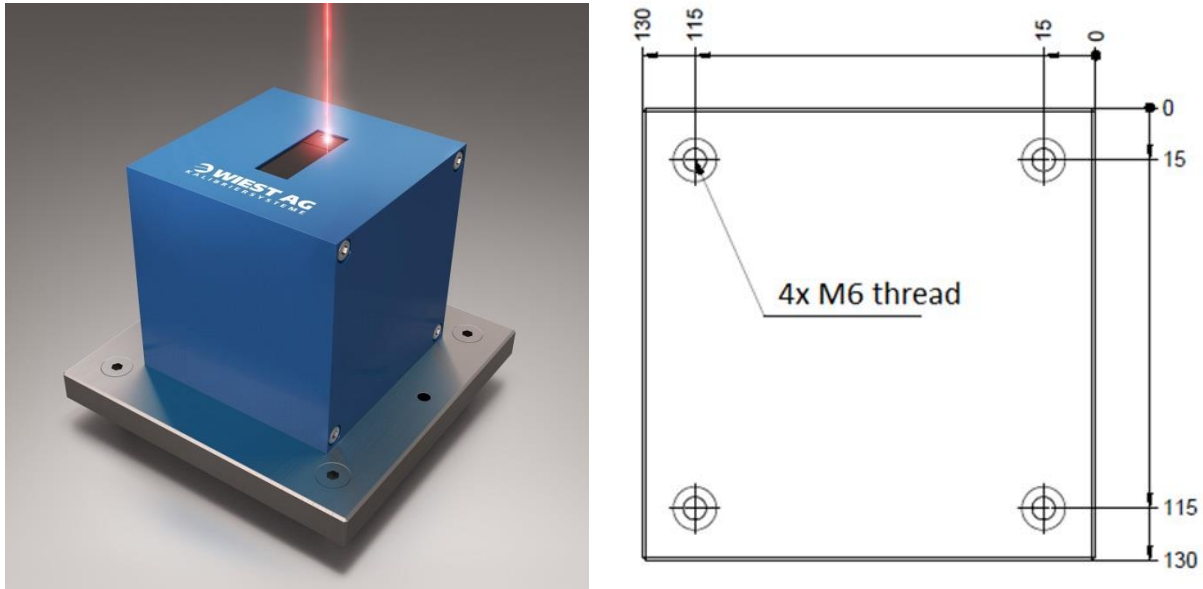


Figure 1: GripLAB and base plate drilling pattern

The GripLAB location has to be chosen so that optimal accessibility by the gripper is guaranteed. The measurement points are taught in a distance of about 120 mm above the GripLAB sensor.

Hint!

Mount GripLAB laterally to avoid dust deposits on the sensor.

For mounting GripLAB four M6 tapped holes at a distance of 100 mm are required (see Figure 1).

4. Electrical installation

4.1. RS232 interface

4.1.1. Robot

Connect the supplied power/data cable with the JD17 labelled interface of the robot (see Figure 2).

4.1.2. GripLAB

Connect both the power supply and the RS232 connector of the power/data cable (see Figure 2) with GripLAB.

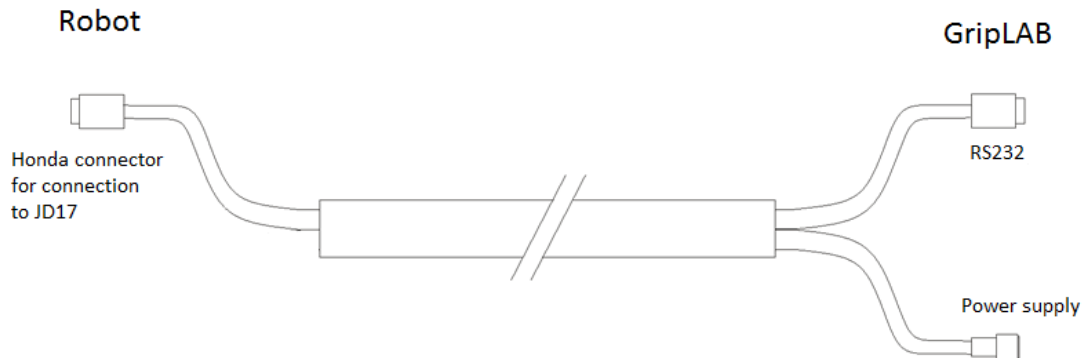


Figure 2: Combined power/data cable

4.2. Ethernet interface

4.2.1. Power supply

GripLAB features a M12 a-coded flange connector for the power supply (see Figure 3). +24V required.

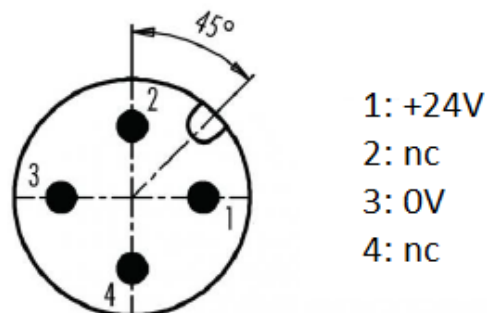


Figure 3: Pin assignment flange connector

4.2.2. Ethernet

GripLAB features a M12 d-coded flange socket for Ethernet connections. Either connect GripLAB directly to the robot controller or via the local network with the robot controller.

Important:

The slot ETHERNET CD38A (Ethernet Port#1) must be used to connect the GripLAB.

5. Software installation

5.1. Overview of supplied files

File	Description
GL_MAIN.TP	The 9 measuring points are taught there.
GL_CHECK.TP	Routine to check up to 50 measuring points on the gripper (see section 14)
GL_LIB.PC	This file contains the measurement routine and is called by GL_MAIN.TP or GL_CHECK.TP. All parameters for measurement are declared here.
GL_TEXT.PC	The message texts are included in this file.
GL_COM.PC	File for the communication with GripLAB. The Parameters for communication are declared here.
GL_SHIFT.TP	Routine to shift the USER FRAME of the GripLAB to the origin of the laser.

Table 1: Files for GripLAB

5.2. Robot program loading

Copy the robot programs from the USB stick onto the robot controller.

5.3. Change Karel variables

All variables for measurement are declared in the program GL_LIB.PC. The variables for communication are declared in the program GL_COM.PC.

In order to change variables for example in the program GL_LIB.PC, you have to proceed as follows:

- Activate Karel: [MENU 2] → [SYSTEM] → [Variables]
→ set variable “\$KAREL_ENB” to TRUE
- Display all programs in the overview: [TYPE] → All
- Select program GL_LIB with ENTER → press DATA button → [TYPE] → [KAREL Vars] → All variables from GL_LIB.PC are displayed and can be edited.

5.4. Language selection

The variable “GL_LANGUAGE” defines the language for message texts. To change language, modify the value of the variable “GL_LANGUAGE”. Default is 1 (German). For English message texts set the value to 2.

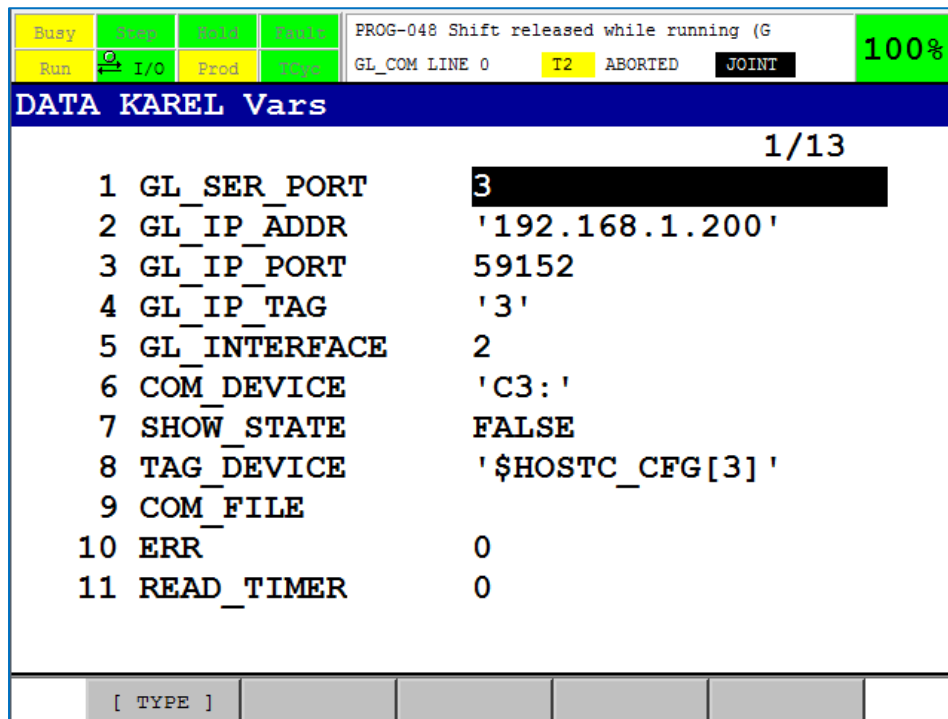
5.5. Define data register

For the communication between GL_MAIN.TP and GL_LIB.PC one data registers are necessary. For the routine GL_CHECK.TP (see section 14) a second data register is required. In delivery state the registers 91 and 92 are used. If you want to use other registers, all register instructions in GL_MAIN.TP and GL_CHECK.TP have to be adjusted to match the new registers. In addition the variables "GL_REG_STATE" and "GL_REG_NUM" have to be changed to the new register numbers.

6. Communication interface setup

Hint!

All variables for communication are declared in the program GL_COM.PC.



The screenshot shows a Karel data register window titled "DATA KAREL Vars" with a progress indicator of 100%. The window displays a list of 11 variables and their values:

Var	Value
1 GL_SER_PORT	3
2 GL_IP_ADDR	'192.168.1.200'
3 GL_IP_PORT	59152
4 GL_IP_TAG	'3'
5 GL_INTERFACE	2
6 COM_DEVICE	'C3:'
7 SHOW_STATE	FALSE
8 TAG_DEVICE	'\$HOSTC_CFG[3]'
9 COM_FILE	
10 ERR	0
11 READ_TIMER	0

At the bottom of the window, there is a field labeled "[TYPE]" and several empty input fields.

Figure 4: Variables for communication

6.1. RS232 interface

GripLAB communicates with the robot over the RS232C interface on the JD17 connector. The variable "GL_INTERFACE" must be changed to 1. In delivery state this is already the case.

Important:

The according interface must be set to "No Use". To apply the changes the controller must be restarted.

For this select the menu point [MENU]→[SETUP]→[PORT INIT] and set the interface to "No Use" (see Figure 5).

Note the port number that the interface JD17 uses. If port 3 is not used, the variable "GL_COMPORT" must be changed accordingly.

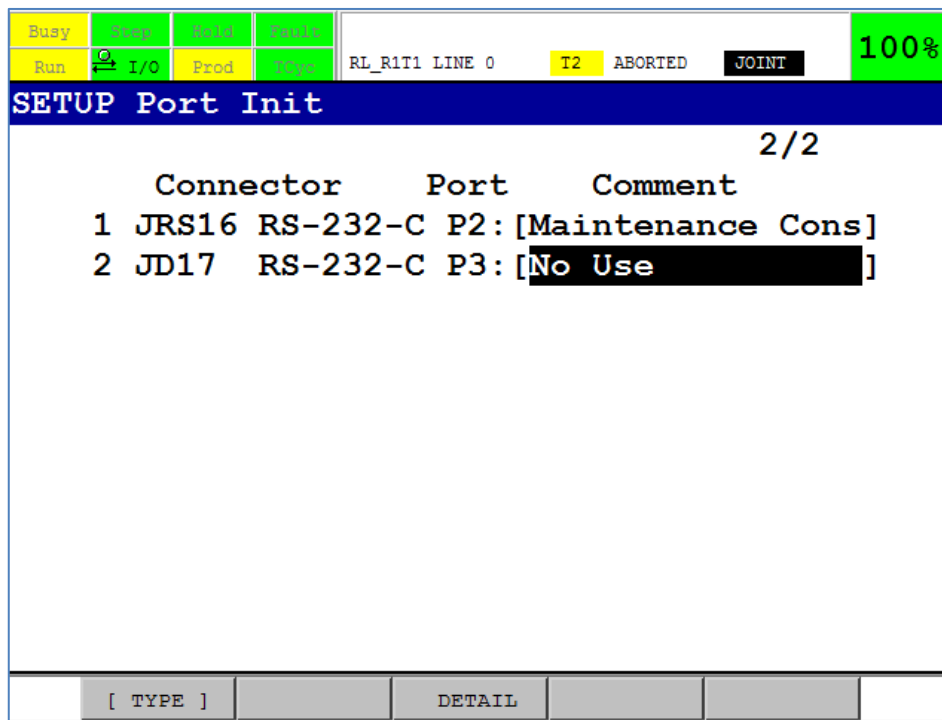


Figure 5: JD17 interface

6.2. Ethernet interface

Important:

For this communication interface the software option "User Socket Msg" is required.

6.2.1. GripLAB network settings

GripLABs default IP-address is 192.168.1.200 with subnet mask 255.255.255.0. Network settings can be changed via GripLABs web-interface. Use any web browser to access it in delivery state at the address 192.168.1.200. Make sure that your computer is in the same IP-address range with the same subnet mask as GripLAB.

Important:

In delivery state the user is “admin” and the password is “griplab” to apply changes.

Hint!

You can reset the GripLAB to factory defaults (e.g. in case of an unknown IP-address). For this remove the connection panel and press the button on the circuit board until the LEDs on the connection panel switch of. Afterwards the GripLAB is again reachable of the IP-address 192.168.1.200.

6.2.2. Robot controller

The variable “GL_INTERFACE” has to be changed to 2. In addition a “Client Tag” is required on the robot controller. To show the overview of the Client Tags, you have to proceed as follows:

[MENU]→[SETUP]→[Host Comm]. Move the cursor to SM (Socket Messaging Device) and select [SHOW]→[Clients].

The number of the to be used Client Tag has to be assigned to the variable “GL_IP_TAG”. In delivery state Client Tag 3 is used.

In addition, the IP-address of GripLAB and the port for communication has to be defined. Change variables “GL_IP_ADDR” and “GL_IP_PORT” to match your settings. In delivery state the variable “GL_IP_ADDR” is set to value “192.168.1.200” and the variable “GL_IP_PORT” to value “59152”.

7. GripLAB operation principles

GripLAB checks and calibrates robot grippers in 6 dimensions. The measuring points can either be set directly on the gripper or on the managed object. GripLAB ensures that TCP changes are detected and corrected. However, it cannot determine the initial TCP data. During correction of the TCP, the geometric changes of the gripper are detected. The tool data on the robot controller are adapted accordingly.

Important:

GripLAB exclusively compensates TCP changes of the gripper. Incorrect adjustment of the robot axes cannot be compensated and will result in a wrong measurement result. Therefore, ensure that the robot adjustment has not changed prior to each measuring process.

Nine measuring points are required for the measurement in total. Three points for each spatial plane (see section 8.3 and Figure 6).

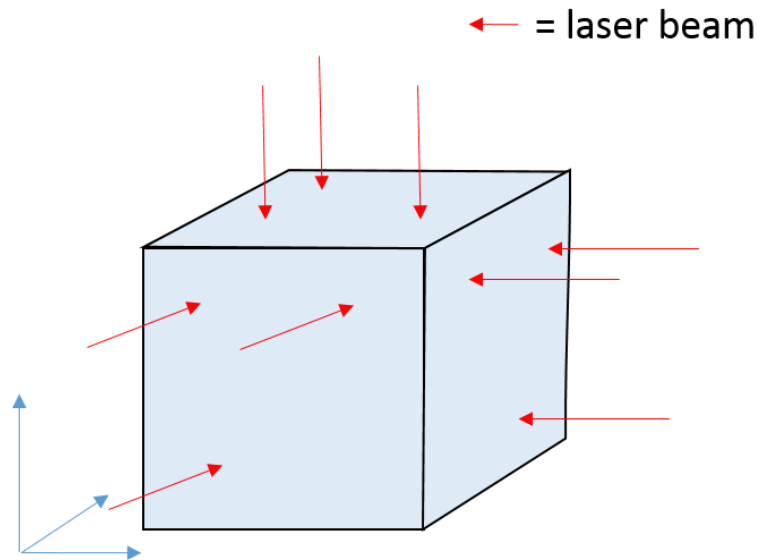


Figure 6: GripLAB measuring points

7.1. Test duration

The test duration is primarily determined by the measurement run and therefore by the speed of the robot.

If the defined threshold is exceeded, the tool will be corrected. For a correction several measurement runs are necessary. Usually an optimal measurement result is reached within 3 iterations.

7.2. Power up

Important:

To achieve optimal measurement results GripLAB has to be powered up at least 30 minutes prior to the measurement. During this time the laser can be switched off.

8. Initial setup

As soon as GripLAB is mounted and connected to the power supply, setup can commence.

8.1. User Frame measurement

First step in the setup is the measurement of the GripLAB User Frame.

8.1.1. Preparation

For measuring the GripLAB User Frame, the measuring device for base measurement will be mounted on the base plate (see Figure 7). An already measured measuring tip is required on the robot (The tip can be measured with the 3-point method).

Hint!

By reorienting of the robot around the measuring tip you can verify that the measuring tip is correctly measured.

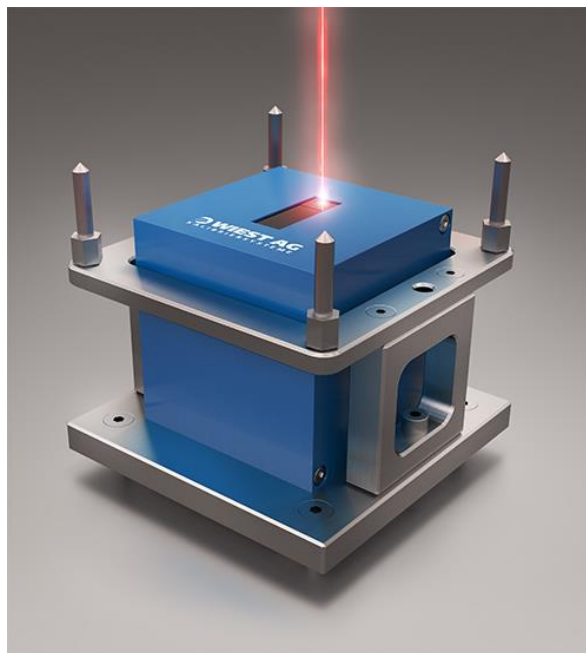


Figure 7: Measuring device for base measurement

8.1.2. Execution

Select the menu point on the Teach Pendant [MENU]→[SETUP]→[FRAMES]. Then select [OTHER]→[User Frame]. Name a free User Frame “GripLAB”. Select the tool which is determined in section 8.1.1 and measure the User Frame with the three point method [METHOD]→[Three Point].

Move the measuring tip to the first tip of the measuring device for base measurement and define this point as “Orient Origin Point“. For the “X Direction Point” move to the second tip and define it. Finally move to the fourth tip and define “Y Direction Point“. Afterwards the User Frame measurement is completed.

Important:

Subsequently the User Frame must be shifted to the origin of the laser beam. Therefore, run the program “GL_SHIFT.TP“. The robot moves to the current origin of the User Frame (tip 1 of the measuring device for base measurement). When the shifting was done, the robot moves to the new origin of the User Frame (120 mm above the GripLAB onto the laser beam).

8.2. Preparation of robot program

In the main program (e.g. GL_MAIN.TP) all measuring points are taught. At the beginning of the program the “UTOOL_NUM” and “UFRAME_NUM” are assigned (see Figure 8). In line 5 assign to “UTOOL_NUM” the number of the tool to be corrected. In line 6 assign to “UFRAME_NUM” the number of the GripLAB User Frame. In line 14 the program GL_LIB.PC is called with four parameters (see 8.2.2 and 8.2.3).

Busy	Stop	Hold	Reset	PROG-048 Shift released while running (G	100%
Run	Weld	Estab	Power	GL_MAIN LINE 0 T2 ABORTED JOINT	

```

GL_MAIN
1/79
1: !Assign GL UTool!
2: !Assign GL UFrame!
3: !UFRAME Shift executed?
4: PAUSE
5: UTOOL_NUM=1
6: UFRAME_NUM=0
7:
8: LBL[20:SEL]
9: !FIRST PARAMETER: Job
10: !SECOND PARAMETER: Axisgroup
11: !THIRD PARAMETER: GL_ToolID
12: !GL_ToolID = UTOOL_NUM!
13: !FOURTH PARAMETER: GL_ObjectID
14: CALL GL_LIB('MAIN',1,1,1)
15: IF R[91]=20,JMP LBL[20]

```

[INST] [EDCMD] >

Figure 8: Program “GL_MAIN.TP“

8.2.1. Job and Axis group

As first parameter (Job) "MAIN" is passed. As second parameter the axis group of the used robot is passed. This parameter only has to be modified if multiple robots are on one controller.

8.2.2. GL ToolID

The third parameter is the "GL_ToolID". The "GL_ToolID" tells GripLAB which tool should be corrected. Change this value to the correct tool number (equal value as "UTOOL_NUM" in line 1). For every tool to be measured, a new measuring program with matching "GL_ToolID" and "UTOOL_NUM" has to be created (see section 8.6).

8.2.3. GL ObjectID

The fourth parameter is the "GL_ObjectID". For each "GL_ToolID" a "GL_ObjectID" is required. The "GL_ObjectID" defines the object on which the measuring points are set. If there is only one measuring program, the "GL_ObjectID" always remains 1. If multiple measuring programs are created for a single Tool (see section 8.6.1), the "GL_ObjectID" has to be different in each measuring program.

Important: The "GL_ObjectID" has to be greater than 0.

8.3. Defining of measuring points

The measuring points are either set directly on the gripper or on the managed object. For each spatial plane three measuring points are necessary (see Figure 6). The position of the coordinate system of the spatial planes should account the structural condition of the gripper. The spatial planes can be captured from both sides.

8.3.1. Required characteristics of measuring points

- The measuring point is located in a distance of about 120 mm to GripLAB (measuring range of the sensor: 120 mm +/- 60mm).
- The laser beam has to be perpendicular on the surface to be measured in the measuring point (see Figure 9).
- The laser beam must not to be obstructed by any edge (see Figure 9).
- The surface to be measured may be inclined up to 15° to the respective spatial plane.
- The measuring point has to be repeatable. Do not place the measuring points on movable elements or move these elements to a defined position.
- The measuring point must be reachable by the robot.

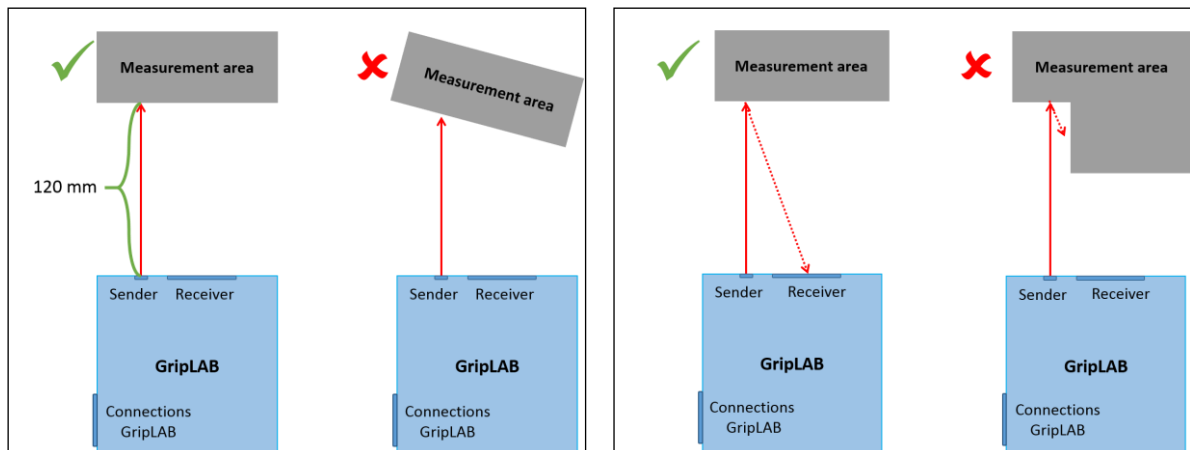


Figure 9: Regulations for measuring points

8.3.2. Recommended characteristics of measuring points

- Distribute the measuring points evenly over the object to be measured.
- Place the measuring points near the critical points of the handling application. The measurement result will improve in relation to these critical points.
- Select a surface as large as possible for the measuring point. The measuring point should still point on this surface in case of a fault. (Where does the measuring point drift in the event of a fault?)
- Don't teach the measuring points near the axes limits of the robot. After a tool correction the measuring point may no longer be reachable.

Important:

You can mark the measuring points with a permanent marker to facilitate the teaching (see section 8.4). Make sure that the laser beam does not hit the mark, as this would corrupt the measurement result. For example, mark the points with a circle around the laser beam.

8.4. Teaching of measurement program

To teach the measurement program, the correct robot program (e.g. GL_MAIN.TP) must be selected and executed. Run the program from the beginning and select "TEACH" in the option menu (see Figure 10). The laser beam switches on for 60 minutes. Now continue the program in step mode and teach the measuring points defined in section 8.3 including the auxiliary points.

Important:

All nine measuring points have to be taught with the tool to be measured and in the GripLAB User Frame! Also pay attention to the distance to GripLAB of approximately 120 mm.

Hint!

The robot moves to the point “pStart” before the first and after the ninth auxiliary point. This ensures that several iterations can be performed consecutively without a collision. To verify smooth operation, execute the program once in teach-mode.

Hint!

Move to all points of a spatial plane one after another. So, the reorientation of the gripper will be minimized.

Hint!

In TEACH-MODE, the current distance will be displayed with both LEDs of the connection panel. Lights up one LED, the distance is in the range of 120+/- 50 mm (in measurement range). Light up both LEDs, the distance is in the range of 120+/- 10 mm (optimal measurement range).

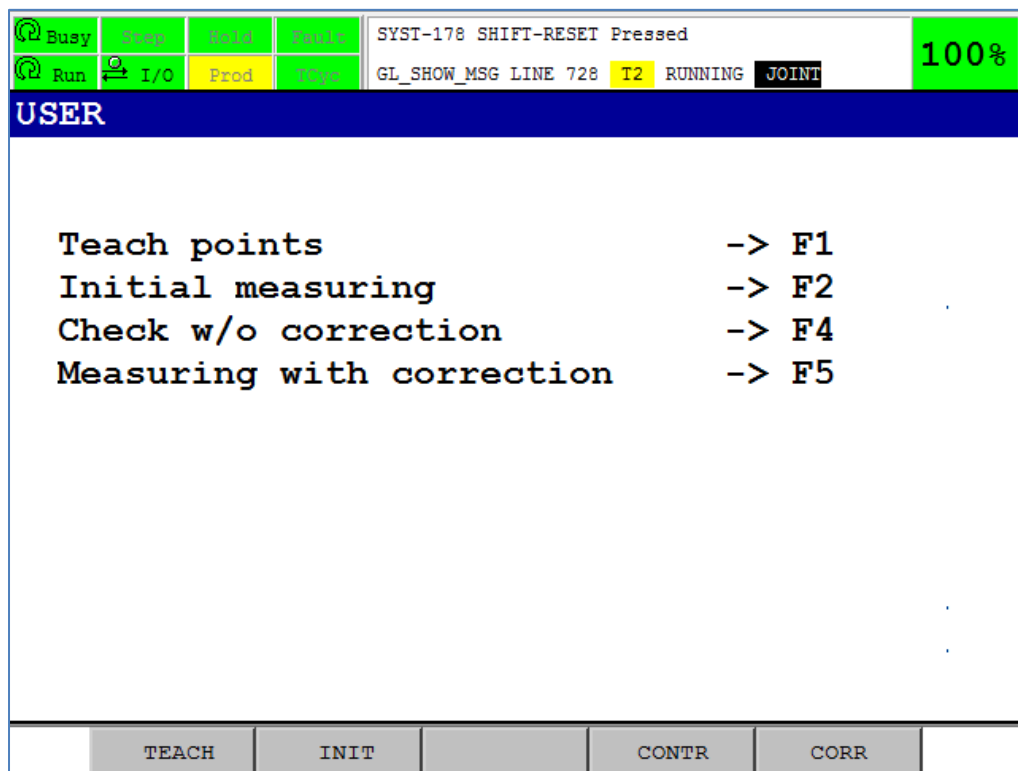


Figure 10: The option menu

8.5. Initial measuring process

The measuring points have to be initially stored before a gripper can be corrected with GripLAB. Start the measuring program and select "INIT" in the option menu (see Figure 10). The measuring points will now be saved in GripLAB. The distance of the measuring points will be displayed and should have a value of about 60 mm. (Calculated from the beginning of the laser measuring range).

Important:

Prerequisite for the initial measurement process is an intact gripper and a functioning application. The tool correction will always refer to the initial measurement.

Important:

In case the gripper oscillates after reaching a measuring point, the dwell time at the measuring points has to be increased. This is set with the variable "GL_WAIT" and is 1.5 seconds in delivery state. This is especially important at higher speeds (e.g. automatic operation).

Hint!

To verify the function of GripLAB, carry out a control measurement after the initial measurement (see section 9.1). The measured failure should be very small (<0.1 mm).

8.6. Creation of additional measuring programs

With GripLAB several grippers and tools can be measured.

8.6.1. Multiple measuring programs for one tool

Duplicate the measuring program GL_MAIN.TP and change the "GL_ObjectID" (see section 8.2.3) in the new program to a not yet used number. Then carry out the steps 8.3 to 8.5.

Hint!

This is useful if the measuring points are set on the managed object and different objects are managed. In this scenario no specific object has to be gripped for the measuring program. Instead, the matching measuring program is executed for the respective object.

8.6.2. Measuring of additional Tools

Duplicate the measuring program GL_MAIN.TP and change the "UTOOL_NUM" and "GL_ToolID" (see section 8.2) in the new program to match the tool number to be measured. Carry out the steps 8.3 to 8.5 for the new tool.

Hint!

This is useful if a gripper has several TCPs or several grippers with different TCPs are used.

8.6.3. Using additional robots

Important:

GripLAB with Ethernet interface can be used with up to 4 robots. All robots have to reside on the same network.

To use additional robots with one GripLAB, the full initial setup has to be carried out as described in this documentation. If the robot is connected to the same robot controller, you may have to change the axes group (see section 8.2).

9. Standard measurement procedure

To perform a standard test, the measurement program (e.g. GL_MAIN.TP) will be selected.

Important:

It has to be ensured that the same conditions as for the initial measurement are met. This may concern:

- current docked gripper
- gripper condition (open, closed)
- gripped object

Important:

In case the gripper oscillates after reaching a measuring point, the dwell time at the measuring points has to be increased. This is set with the variable "GL_WAIT" and is 1.5 seconds in delivery condition. This is especially important at higher speeds (e.g. automatic operation).

9.1. Manual operation

9.1.1. Measurement without correction

If "CONTR" is selected in the option menu (see Figure 10), a measurement without correction is carried out. The determined deviation will be displayed on the Teach Pendant at the end of the measurement.

9.1.2. Measurement with correction

If "CORR" is selected in the option menu (see Figure 10), a measurement with correction of the tool data is carried out.

9.2. Automatic operation

A measurement with correction is carried out at once. No dialog messages need to be answered.

9.3. Measurement data

Several data are displayed during the measuring process.

9.3.1. Measuring distances difference

The difference in distance of the current measuring point compared to the initial measurement will be displayed during the standard measurement.

Important:

These values are an indication for a misalignment or a damage of the gripper. Pay attention on how the individual surfaces have changed.

Positive values indicate that the measuring point is closer to GripLAB versus the initial measurement.

9.3.2. Correction values

The correction values for translation (X, Y, Z) and rotation (A, B, C) in reference to the used tool will be displayed at the end of a standard measurement. Based on these values the total deviation is determined and displayed. These deviations are used to evaluate the measuring result (see section 9.4).

9.3.3. Error value

The error value of the result calculation is displayed in addition to the correction values. This value indicates how well the two measured point clouds (initial measurement and current measurement) could be layered over each other.

Important:

If after several iterations the error value is greater than 0.3, this might be an indication that the gripper has changed in itself. The point clouds can no longer exactly layered over each other, because the measuring points have changed the relation to each other. This may be due to a damage of the gripper.

9.4. Evaluation of the measurement results

9.4.1. Tool OK

If the deviation is in the OK range (see section 11.1), the tool is correct. No correction will be done and the program will be terminated.

9.4.2. Automatic correction

If the deviation is within the automatic correction range (see section 11.2), the tool is automatically corrected. Subsequently a new measurement process will be started.

If the deviation is still not in the OK range after the set maximum number of iterations (defined by the variable "GL_ITE_MAX" in program GL_LIB.PC), an error message is displayed. After confirmation of this message, the program is terminated. Error cause is possibly a damage of the gripper. Check the distance differences and the error value of the measuring result (see section 9.3).

9.4.3. Manual correction

If the deviation is in the manual correction range (see section 11.3), the user is asked if a correction should be carried out (see Figure 11).

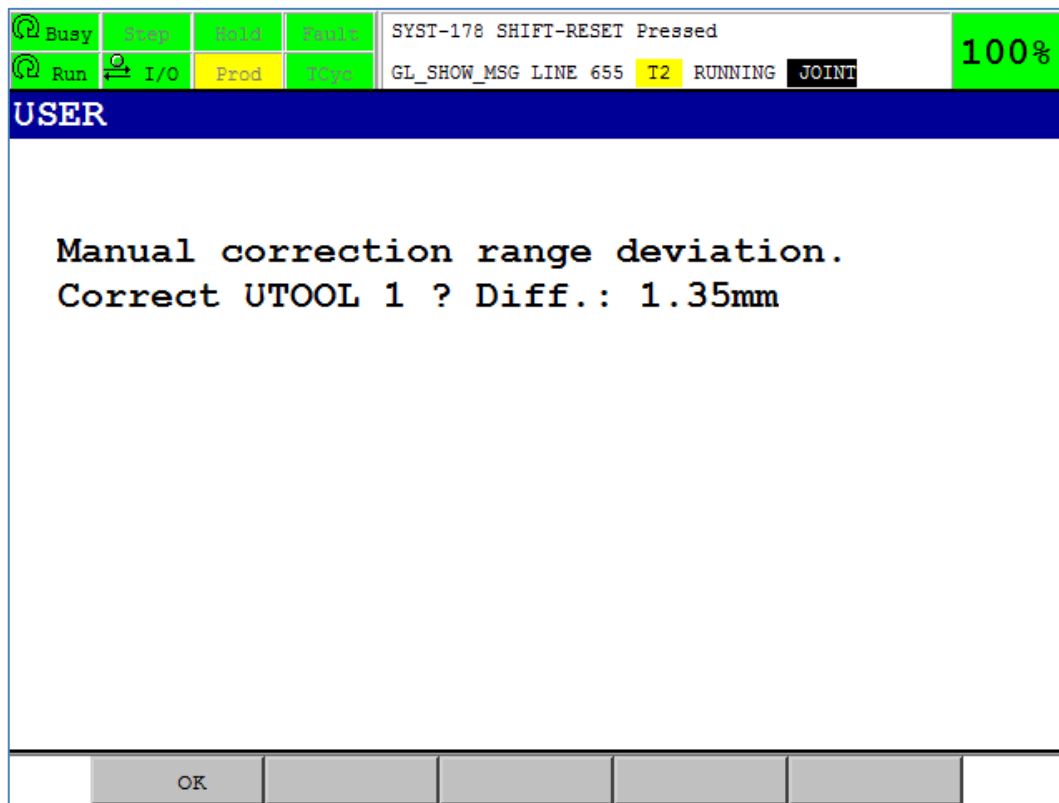


Figure 11: Deviation in the manual correction range

- Answer yes: The tool will be corrected. Afterwards a new measuring process will be started. If the maximum number of iterations has already been exceeded an error message appears. Error cause is possibly a damage of the gripper. Check the distance differences and the error value of the measuring result (see section 9.3).
- Answer no: The tool will not be correct. Afterwards the program is terminated.

9.4.4. No correction allowed

If the absolute deviation in regards to the initial measurement is above the absolute threshold (see section 11.4), no correction is allowed. This prevents a stepwise drifting of the gripper. An error message appears (see Figure 12). After confirmation of this message, the program is terminated. The gripper has to be inspected.

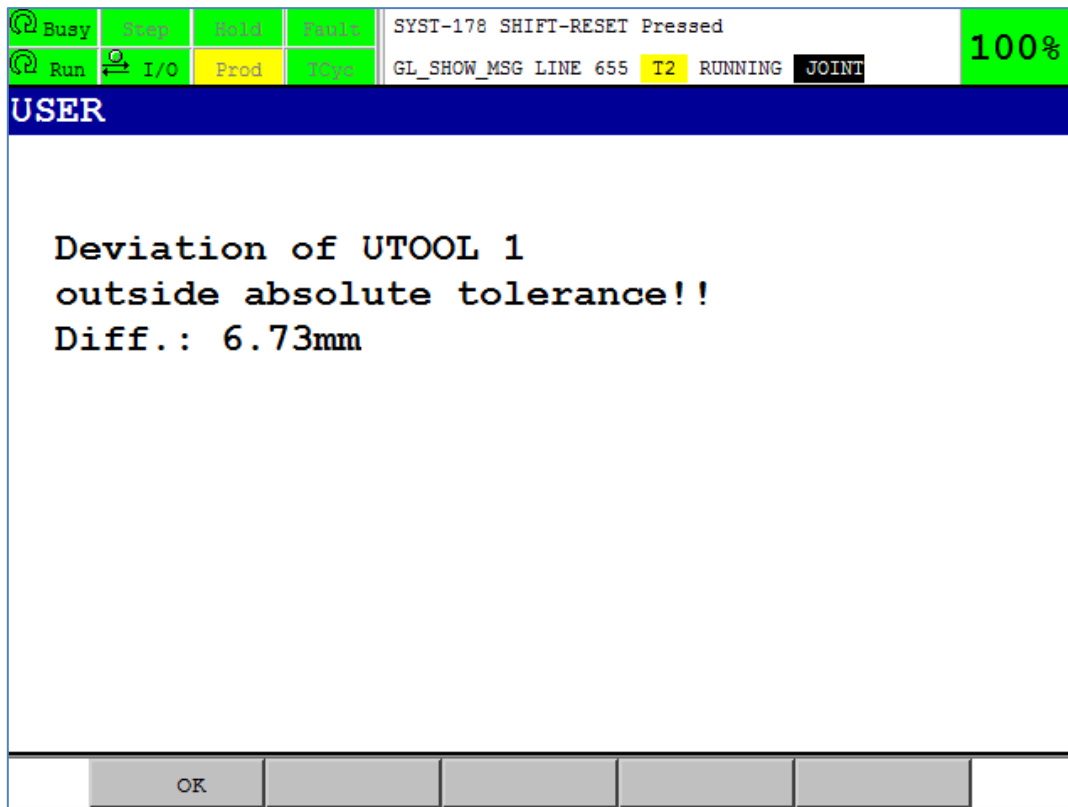


Figure 12: Error message: absolute deviation too high

9.5. Measuring point out of range

If the measuring point is no longer in the detection range of the GripLAB, the error message “measuring point not in the range of the sensor!” is displayed (see Figure 13). This failure occurs when the laser beam no longer points on the surface of the gripper. Possible cause is a misalignment of the gripper. Acknowledge this message with OK. Subsequently the robot halts in GL_MAIN.TP after the measuring point in a WAIT command. Move the robot manually so that the measuring point is back on the correct position on the gripper. Afterwards a line selection above the WAIT command on „CALL GL_LIB“ is mandatory.

The line selection prevents that the robot moves back to his original position.

Important:

Don't teach the measuring point! Subsequently continue the program.

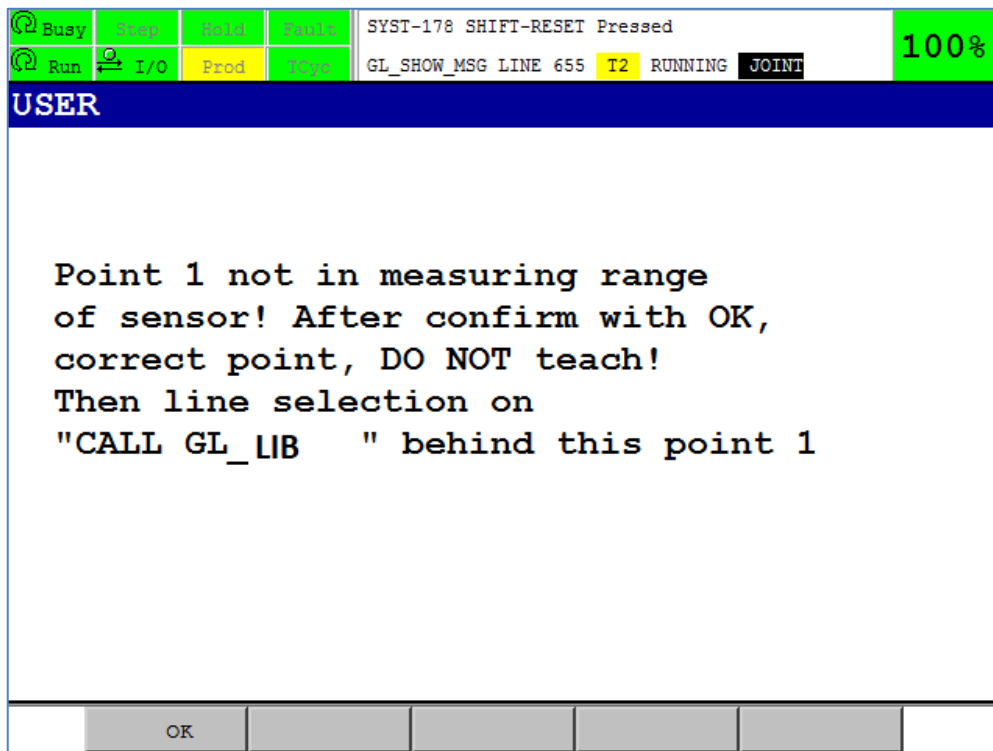


Figure 13: Measuring point out of range

10. GripLAB integration into the production process

To integrate GripLAB into the production process, the measurement program (e.g. GL_MAIN.TP) has to be called within the production program. In automatic operation a measurement with correction is started immediately. No dialog messages need to be answered. The acknowledgement of the message texts can be done by the PLC (see section 12).

10.1. Routine gl_main

In the routine “gl_main” all measuring points are taught. The routine GL_START is called by the routine “gl_main”. Before label 20 (LBL[20]) and after label 23 (LBL[23]) auxiliary points can be taught.

10.2. GL_ERROR_STATE

The variable “GL_ERROR_STATE” provides information on whether the measurement process with GripLAB was successful or not.

At the end of the measuring program (e.g. GL_MAIN.TP) the value is stored into the register specified in section 5.5 (R[91] in delivery state) and can then be evaluated. Depending on the state, e.g. a service position can be approached to check the gripper.

Value	Description
0	The measurement process has successfully been completed (possibly with correction).
1	The manual correction was not carried out.
2	Deviation is outside the absolute tolerance.
3	Maximum number of iterations exceeded.
4	Result calculation was not possible (exception error).
10	In the check run “gl_check.tp” a too big deviation was detected at least in one measure point.

Table 2: Variable GL_ERROR_STATE

11. Configuration of thresholds

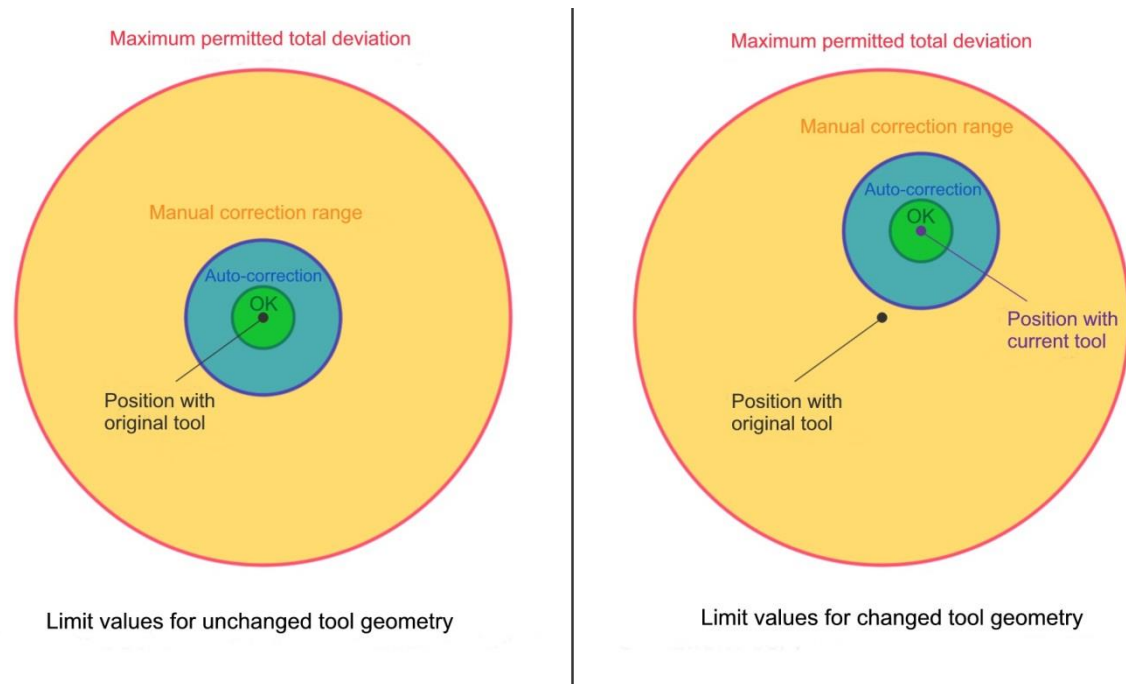


Figure 14: Limit values for tool measurement

The thresholds are declared in the program GL_LIB.PC. Here they can be viewed and edited (see section 5.3).

Figure 14 shows a schematic representation in two dimensions.

Designation	Description
GL_REL_OK	Upper threshold of the OK range (reference: current tool)
GL_REL_AUTO	Upper threshold of the automatic correction range (reference: current tool)
GL_ABS_MAX	Maximum total deviation of the current tool data regarding the original tool data (reference: original tool)

Table 3: Limit values

11.1. OK range

Mathematical definition: $[0, GL_REL_OK [$

This range is defined by the threshold "GL_REL_OK". It constitutes the upper limit to the range within which the tool deviation is considered OK and is not corrected.

11.2. Automatic correction range

Mathematical definition: [GL_REL_OK, GL_REL_AUTO [

This range is defined by the threshold “GL_REL_OK” and “GL_REL_AUTO”. If the tool deviation is in this range, an automatic correction of the tool data takes place without any user input being required.

Hint!

If an automatic correction is not required, it is possible to simply disable this range. In this case, set the value of “GL_REL_AUTO” equal to that of “GL_REL_OK”.

11.3. Manual correction range

Mathematical definition: [GL_REL_AUTO, ∞ [ohne [GL_ABS_MAX, ∞ [

This range is defined on the one hand by the threshold “GL_REL_AUTO”, which refers to the currently measured deviation.

On the other hand the threshold “GL_ABS_MAX” (this refers to the absolute deviation in relation to the original tool) constitutes the upper limit to the permitted correctable deviation. If the deviation is within this range the user is prompted to confirm the correction of the tool data (see Figure 11). If the user confirms with “Yes”, the tool data are updated. If the user rejects the correction, the tool data are not changed.

The corresponding PLC signal is set in this range (see section 12).

11.4. No correction allowed

Mathematical definition: [GL_ABS_MAX, ∞ [

In this range no correction is carried out. An error message is displayed (see Figure 13). The gripper has to be replaced or repaired.

If the deviation is in this range, the corresponding PLC signal is set (see section 12).

12. PLC Interface

All messages requiring acknowledgment can be forwarded to the PLC by means of three digital outputs. The messages will be acknowledged with two digital inputs and, if necessary, answered with yes or no.

To use the PLC interface, the variable "GL_USE_PLC" in gl_text.dat has to be set to TRUE.

12.1. Signal description

The output signal "GL_PLC_RETURNVAL" [bit2, bit1, bit0] consists of three binary coded output signals. Messages requiring acknowledgement which result in a stop of the robot, are hereby forwarded to the PLC.

Value	Description	Dialog at the PLC
0	Measurement OK	-
1	Deviation in the manual correction range	Deviation in the manual correction range. Should a correction of the tool data be carried out? (yes/no)
2	Deviation outside absolute tolerance	Deviation outside absolute tolerance. No correction allowed! Check the gripper and restart the measurement. (quit)
3	Maximum number of iterations exceeded	Maximum number of iterations exceeded. Check gripper! For error analysis check the measuring differences of the measuring points on the Teach Pendant. (quit)
4	Current measuring point not in the range of the sensor!	Current measuring point not in range of the sensor! Troubleshooting will be displayed on the Teach Pendant after acknowledge. (quit)
5	Error communicating with GripLAB	Timeout during communication with GripLAB! Move the robot away to avoid collision, resolve the error and restart the measurement. (quit)
6	Collection of other errors (seldom)	Pay attention to the display on the Teach Pendant. (quit)

Table 4: Signal GL_PLC_RET

Acknowledgement of messages takes place by the input signal "GL_MSG_QUITT". As soon as this signal is set, the dialog is closed at the Teach Pendant. The YES/NO selection for a dialog will be set by the input signal "GL_MSG_ANSWER".

Important:

The signal "GL_MSG_ANSWER" has to be set before the acknowledgement. High means YES. Low means NO.

Signal	Description
GL_MSG_QUITT	As soon as the signal is set, the dialog is acknowledged at the Teach Pendant.
GL_MSG_ANSW	If the signal is set, the dialog is answered with yes. Otherwise with no. Has to be set before the signal "GL_MSG_QUITT"!

Table 5: Signals GL_MSG_QUITT & GL_MSG_ANSW

Important:

The signal "GL_PLC_RET" is always reset to 0 at the beginning of a standard measurement with correction.

Hint!

It is possible to disable the dialog messages on the robot controller during automatic operation. Thus the dialog messages can only be acknowledged with the PLC. For this, the variable "GL_SHOWDIALOG" defined in the module gl_text.sys has to be set to FALSE.

12.2. Set inputs and outputs

The inputs and outputs are assigned in module gl_text.dat. Change the numbers of the inputs and outputs to match your values (\$IN[...], \$OUT[...]).

13. Create log file

In delivery state no log file will be created. To create a log file for every tool, the variable "GL_LOGFILE" has to be set to TRUE. The variable "GL_LOG_PATH" determines the directory and is set to 'MC:' in delivery state. A maximum of 100 entries are written to a log file.

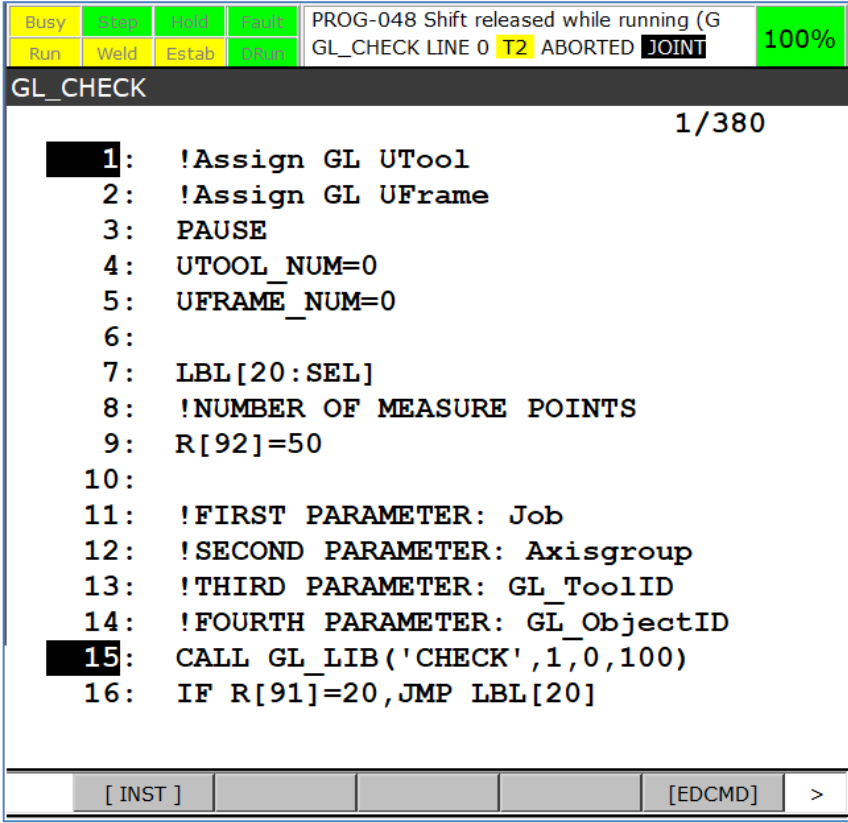
14. Program “GL_CHECK.TP”

The program “GL_CHECK.TP” (see Figure 15) is used for a simplified checking of measuring points on the gripper. By this, misalignments of the gripper can be detected but will not be corrected. Up to 50 measuring points can be taught (Requirements of the measuring points see section 8.3.1).

14.1. The robot program

The “UTOOL_NUM” and “UFRAME_NUM” in line 4 and 5 can be freely chosen. In line 9 the number of used measuring points has to be assigned to data register 92. In line 15 the program GL_LIB.PC is called with four parameters.

As first parameter (Job) “CHECK” is passed. As second parameter the axis group of the used robot is passed. This parameter only has to be modified if multiple robots are on one controller. The third parameter is “GL_ToolID”. This has to be equal with “UFRAME_NUM” in line 1. The fourth parameter is “GL_ObjectID” has to be greater than 0.



```

Busy Stop Hold Fault PROG-048 Shift released while running (G
Run Weld Estab JOINT 100%
GL_CHECK 1/380
1: !Assign GL UTool
2: !Assign GL UFrame
3: PAUSE
4: UTOOL_NUM=0
5: UFRAME_NUM=0
6:
7: LBL[20:SEL]
8: !NUMBER OF MEASURE POINTS
9: R[92]=50
10:
11: !FIRST PARAMETER: Job
12: !SECOND PARAMETER: Axisgroup
13: !THIRD PARAMETER: GL_ToolID
14: !FOURTH PARAMETER: GL_ObjectID
15: CALL GL_LIB('CHECK',1,0,100)
16: IF R[91]=20,JMP LBL[20]
[ INST ] [EDCMD] >

```

Figure 15: Program “GL_CHECK.TP”

The variable “GL_DIST_TH” determines at what point a warning is issued. In delivery state the value is 1 mm. At the end of the routine execution all critical measuring points will be displayed again. A log file is created as well (see section 13). In automatic operation no dialog messages must be answered. If a measure point exceeds the “GL_DIST_TH”, the GL_ERROR_STATE is set to 10 (see section 10.2).

Important:

The “GL_ObjectID” has to be greater than 0.

Important:

Keep attention that the combination of “GL_ToolID” and “GL_ObjectID” is not yet used. Otherwise the stored measuring point will be overwritten.

15. Cleaning of the sensor and the measuring points

To ensure failure-free operation, the transmitter and receiver of the sensor have to be kept clean. Transmitter and receiver have to be free from soiling which can break or block the light. Watch out, for e.g., water stains, oil, fingerprints or dust deposits.

Small dust particles or fingerprints can be carefully wiped off with a microfiber cloth or lens cleaning paper.

For persistent dirt, carefully wipe the surface with an alcohol-soaked cloth.

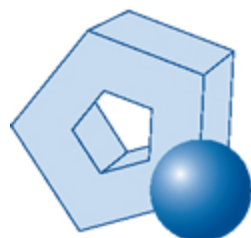
Important:

GripLAB is an optical measurement system. For optimal measurement results the surfaces of the measuring points have to be free of coarse soiling.

16. Technical data

Measuring procedure	6D measurement procedure
Relative repeat accuracy	< +/- 0,1 mm
Mean measuring distance	120 mm
Measuring range	+/- 60 mm
Measurable grippers	All gripper or objects with sufficient surfaces for the nine measuring points
Tool test procedure	TCP test in 6D
Tool test duration	Is determined by the duration of a measurement run
Tool calibration procedure	TCP alignment
Tool calibration duration	Is determined by the duration of about three measurement runs
Tool calibration accuracy	< +/- 0.2 mm
Input voltage	24 V
Max. power consumption	200 mA
Data transfer	RS232 / Ethernet
Housing	Splash proof aluminium housing
Dimensions	85 x 85 x 85 mm (WxDxH)
Mounting	Freely selectable
Laser data	Class 2 Laser Product (IEC60825-1 2007) Maximum: Output 1mW Pulse Duration: 2ms Max. Medium: Semiconductor Laser Wavelength: 655nm

Table 6: Technical data



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