Application note

FESTO

YHBP - Servopneumatic Balancerkit - Operation

Explanation of the states of operation of the Servo-pneumatic Balancerkit:

- Normal operation
- User-specific special functions:
- Monitoring functions (not safety-oriented)
- Sample applications

YHBP-...

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Table of contents

1 Components/Software used

Type/Name	Software/firmware version	Date of manufacture
Servo-pneumatic balancer kit	General	--
Application software YHBP (GSAY-A8-F0-Z4-1.0)	0.62.0	--
Firmware controller (CECC-D-BA)	1.4.0	--

Table 1.1: 1 Components/Software used

2 Description of the application

This application note explains how the balancer kit works. It also explains various special functions, which can be used with the aid of user-defined inputs.

Finally, to clarify the special functions, a number of different use cases are given to assist you in configuring your own application.

2.1 Additional application notes

Apart from this application note, other application notes on commissioning and safety functions are also available:

Name	Contents
YHBP - Servo-pneumatic Balancer Kit - Saving and Loading of Configurations	Saving and loading a configuration file on the CECC-D-BA Balancer Controller and reading log files
YHBP - Servo-pneumatic Balancer Kit - Commissioning	Explanation of the commissioning steps for the servo-pneumatic balancer kit.
YHBP-Servo pneumatic Balancer Kit - SLS-SSC-PLb-CatB	Application note for the servo-pneumatic kit for implementation of Safely Limited Speed (SLS) and Safely Stop and Close (SSC) with PL b, Category B
YHBP - Servo pneumatic Balancer Kit - SLS-SSC-PLd-Cat3	Application note for the servo-pneumatic kit for implementation of Safely Limited Speed (SLS) and Safely Stop and Close (SSC) with PL d, Category 3

Table 2.1: Additional application notes

3 Basic information

3.1 Access to web visualisation

Web visualisation is accessed with any web browser (Internet Explorer is recommended) via the IP address of the device in the following format: http://‹IP-Adresse›:8080/webvisu.htm.

The default address is http://192.168.2.20:8080/webvisu.htm, but it can be changed with the Festo Field Device Tool if access to multiple balancers in one network is required.

The computer used for access must have a fixed IP address (e.g. 192.168.2.1).

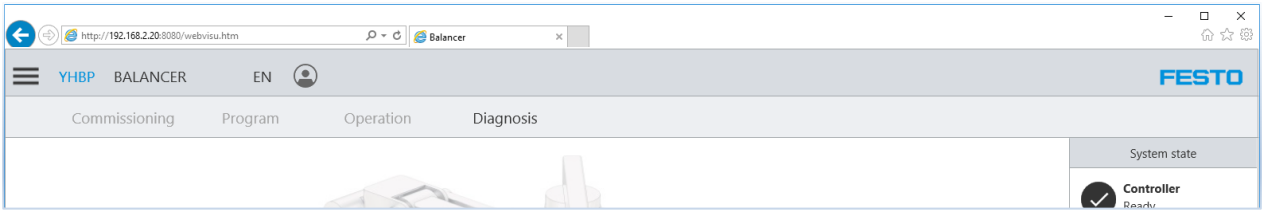


Figure 3.1: Access to web visualisation

After input of the IP address, the start screen opens with some basic information.

Information on diagnostics and the current status of the system can be viewed without having to log in.

Access to other data requires users to log in by clicking on the following symbol:  .

The log-in data for a service technician is:

- User name: Service
- Password: Service (default)

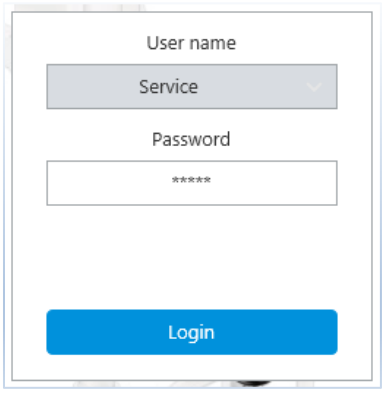


Figure 3.2: Login dialogue

4 Normal operation

4.1 Flow diagram in normal operation

Figure 4.1 presents the flow diagram of the balancer. The individual steps through which the balancer controller runs are on the left and the relevant controller outputs are on the right.

A detailed description of the outputs is provided in the appendix (A.1 Inputs and outputs).

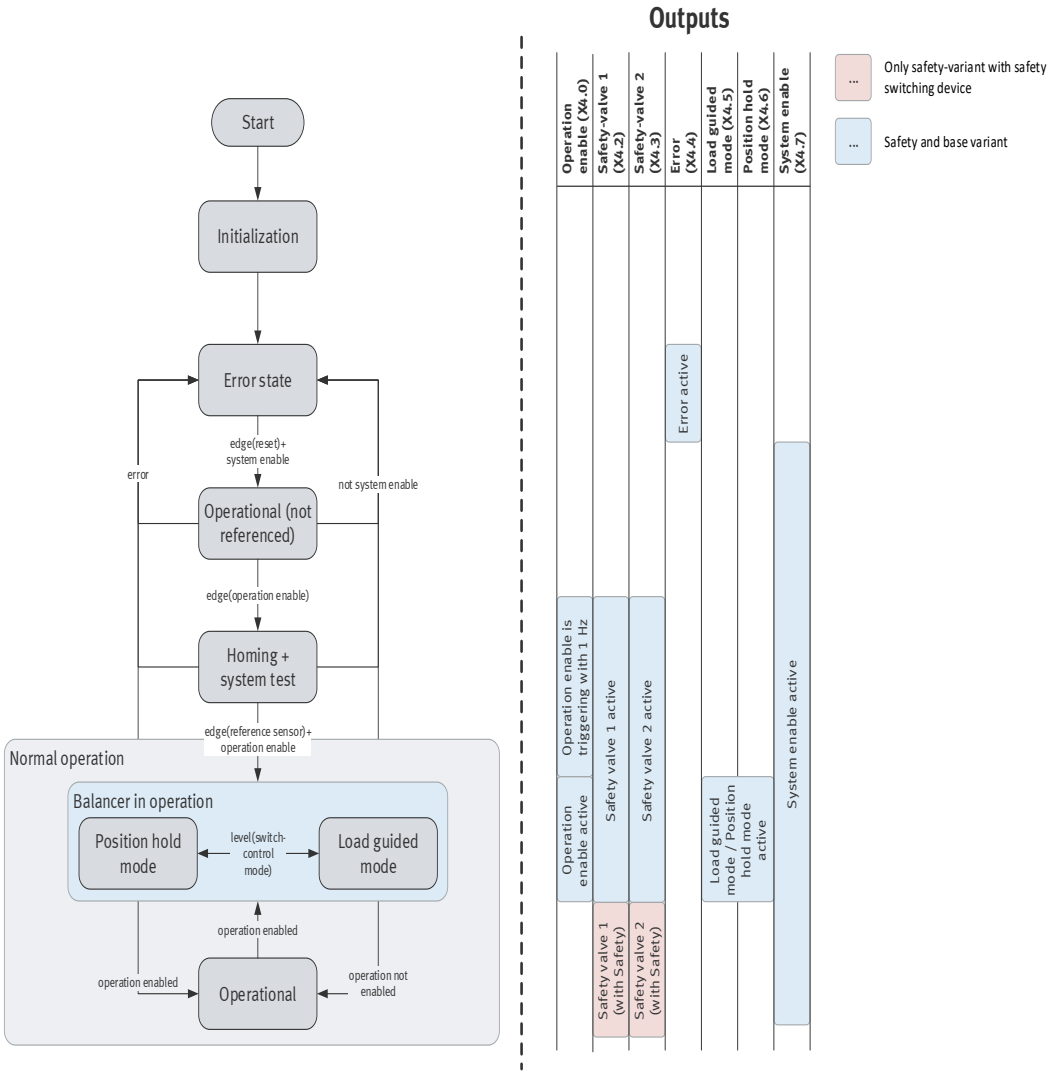


Figure 4.1: Flow diagram of the balancer

The process is as follows:

1. After switching on, the balancer controller switches to the initialisation state and from there automatically into the error state. There the system waits for a rising edge at the reset input and changes to the operational state.
2. After a rising edge at the operation enable input, a system test of both shut-off valves is performed and then homing can take place.
3. After homing, the system switches into the operating mode; either position-hold mode or load-guided mode, depending on the mode selector switch. It is possible to switch between these two modes using the mode selector switch.
4. If operation enable is not set, the balancer switches into the operational state in which the shut-off valves are blocked (in the case of the safety variant, the valves remain open, but the velocity monitor monitors for standstill).
5. In the event of errors or if system enable is not present (emergency stop), the system changes into error state and must be reset.

4.2 Ready for operation

In this operating mode, the handle is not active and the system cannot be moved. Depending on the system variant, the shut-off valves are either switched off (basic variant YHBP-B) or opened with the safety switching device monitoring for standstill (YHBP-S).

After switching the system on and off, a rising edge is expected at operation enable in order to switch into homing. After homing is carried out, the operation enable level is queried.

4.3 System test

In this operating mode, both shut-off valves are tested. To this end, both shut-off valves are opened one after the other and a pressure pulse is sent to the system. This serves to identify a leak or other defect of the shut-off valves.

A lack of operating pressure would also be detected.

4.4 Homing

In this operating mode, homing is performed for the incremental displacement encoder. To this end, the system is moved slowly using the handle, until feedback is received from the reference sensor. The system needs a positive and negative edge from the sensor. After this the system switches automatically into the operational state.

Note

Danger due to moving masses.

For movements at the mass directly, it must be checked that sufficient protective measures have been taken. It cannot be excluded that the mass will lower within the velocity limits.

Note

Danger due to loss of mass.

If there is a loss of mass during homing, no adjustment is made to the mass. This can lead to the balancer abruptly moving upwards.

4.5 Load-guided mode

In this operating mode, the balancer can either be moved friction compensated using the handle or directly at the mass. The pressure is kept constant for this. Only the force which has been specified during commissioning can be generated with the handle. The force is parameterised using the field "Maximum force in load-guided mode" during configuration of the hardware (for further information, please refer to the application note on commissioning).

Automatic adjustment of the mass is not performed in load-guided mode.

Information

When switching from position-hold mode into load-guided mode, the balancer should remain steady in a suspended position. Otherwise, an incorrect mass may be identified and the balancer could move unintentionally.

Example: The operator leans on the load during switching, resulting in an incorrect load being identified.

Note

Danger due to moving masses.

For movements at the mass directly, it must be checked that sufficient protective measures have been taken. It cannot be excluded that the mass will lower within the velocity limits.

Note

Danger due to loss of mass.

If there is a loss of mass in load-guided mode, no adjustment is made to the mass. This can lead to the balancer abruptly moving upwards.

4.6 Position-hold mode

In this operating mode, the balancer can only be moved using the handle directly. Movement directly at the mass is not possible. If the mass is changed in suspended state, the pressure in the cylinder is automatically adjusted.

Likewise, when a resistance is detected while operating with the handle, the pressure in the cylinder is raised/lowered until movement occurs again or the configured maximum/minimum mass is reached.

➔ **Note**

Observe the pneumatic limits of the system.

The pressure change in the cylinder is limited by the maximum flow rate of the valve. In the event of a rapid change in mass, it is possible that the pressure may not change quickly enough and a movement will occur.

- Please check the overtravel, which the load covers after removing or adding a load, in the individual case.
- If the overtravel is too much, increasing the basic mass of the system may help.

➔ **Note**

Danger due to potential high forces.

In the event of resistance against the load, the pressure in the cylinder is increased/lowered until the maximum/minimum parameterised mass has been reached. The controller cannot detect whether an additional mass has been picked up or set down, whether something has become jammed or if the balancer is catching at a pinch point in the working space.

Possible remedies could include:

- Use of load-guided mode where working conditions are restricted with a lot of pinch points or where the work is very precise, e.g. insertion tasks
- Avoid pinch points
- Parameterise the mass limits in order to avoid damage to the workpiece (no safety function)
- Ensure sufficient distance to the danger zone

5 Special functions

Information

Before configuring the special functions, the system must be successfully commissioned.

Using the inputs X3.1 to X3.5 (for pin allocation, see A.1 Inputs and outputs) user-defined special functions can be realised to control the balancer functions.

Configuration is implemented in the web visualisation of the GSAY-A8 application software. The web visualisation is accessed as described in chapter 3.1 Access to web visualisation.

The inputs are configured under Program → Input configuration and can be configured by a service user. Access is blocked for an operator.

The following screen is then displayed:

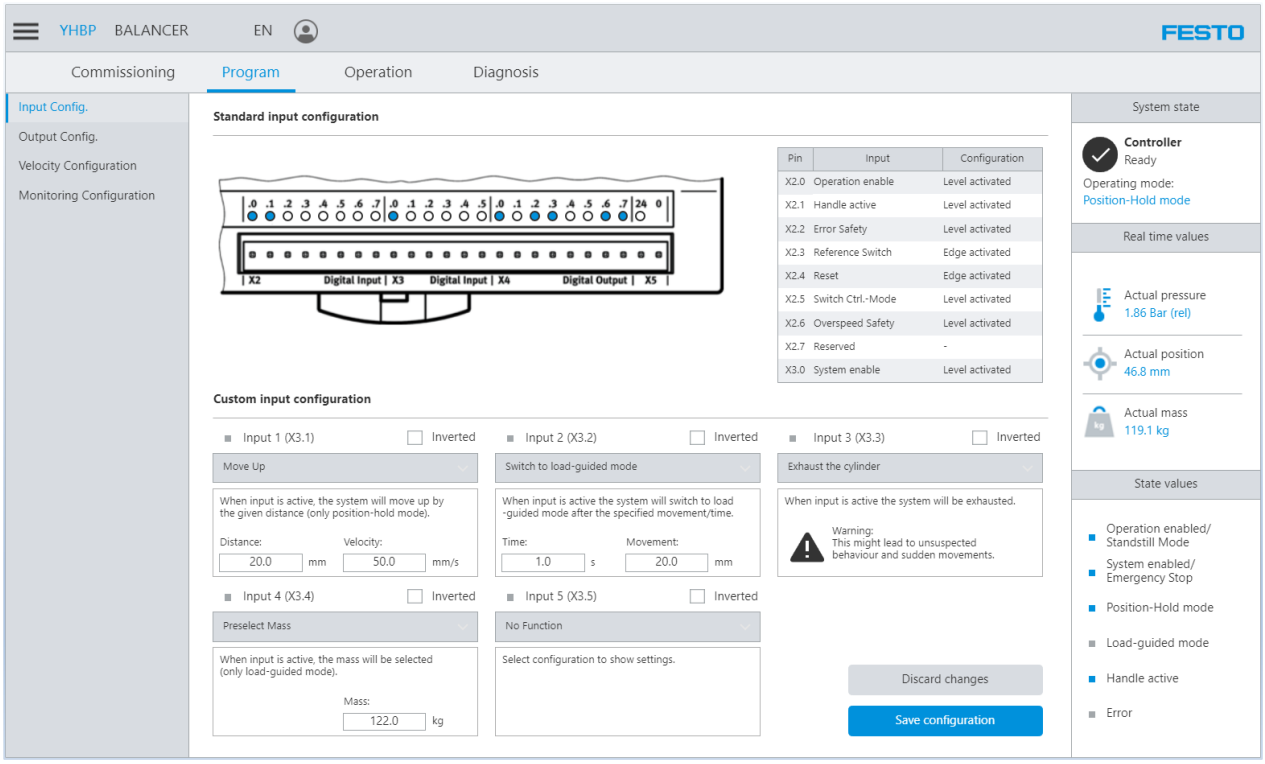


Figure 5.1: Web visualisation of the user-defined inputs

Now various functions can be selected for the individual inputs via the selection menus. Up to 5 different functions are possible. If there are parameters for a function, for example position or velocity, these are displayed and can be parameterised.

Information

The functions are immediately active after selection and can be tested by setting the respective input.

Information

Pressing "Save configuration" saves the configuration permanently, making it available again even after a restart.

Information

If the "Inverted" checkbox is checked, the input response is inverted, i.e. instead of a rising edge there is a falling edge, instead of a high level there is a low level.

This can also be used to test a function without a wired button.

If several inputs are assigned the same function, the following prioritisation applies:

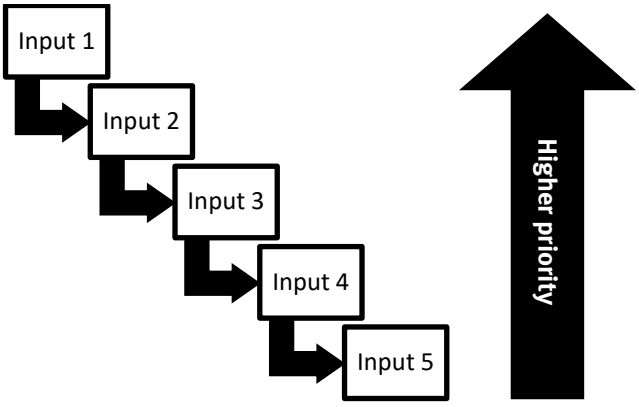


Figure 5.2: Priority ranking of the special functions

Different functions can also be selected simultaneously. The following matrix applies here:

	Velocity limit (edge-activated)	Velocity limit (level-activated)	Preselect mass	Move up	Move down	Move to position	Switch to load-guided mode	Exhaust the cylinder
Velocity limit (edge-activated)	Prio	×	✓	✓	✓	✓	✓	Prio[1]
Velocity limit (level-activated)	×	Prio	✓	✓	✓	✓	✓	Prio[1]
Preselect mass	✓	✓	Prio	✓	✓	✓	✓	Prio[1]
Move up	✓	✓	✓	Prio	×	×	✓	Prio[1]
Move down	✓	✓	✓	×	Prio	×	✓	Prio[1]
Move to position	✓	✓	✓	×	×	Prio	✓	Prio[1]
Switch to load-guided mode	✓	✓	✓	✓	✓	✓	Prio	Prio[1]
Exhaust the cylinder	Prio[1]	Prio[1]	Prio[1]	Prio[1]	Prio[1]	Prio[1]	Prio[1]	Prio[1]

✓: Compatible
×: Not compatible
Prio.: In order of priority (see Figure 5.2)
[1]: "Exhaust the cylinder" always has priority

Table 5.1: Compatibility of different functions in the event of simultaneous selection

5.1 Velocity limit (edge-activated)

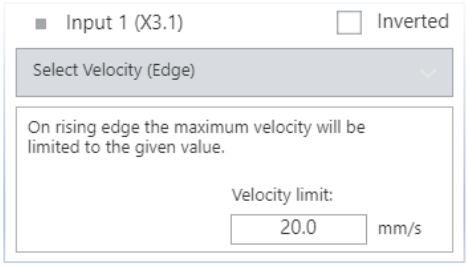


Figure 5.3: "Velocity limit (edge-activated)" configuration

Using this function, the current velocity limit of the balancer can be set. If the input receives a rising edge, the velocity limit is activated. This is deactivated again on the next rising edge.

Information

The lowest velocity limit always applies, i.e. it is not possible to parameterise and set a velocity limit that is higher than the maximum velocity already parameterised.

Information

This is not a safety function. If additional secure monitoring is required, please observe the application notes on PLb and PLd.

5.2 Velocity limit (level-activated)

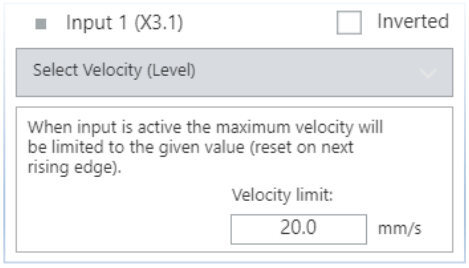


Figure 5.4: "Velocity limit (level-activated)" configuration

Using this function, the current velocity limit of the balancer can be set. If the input is active, the predefined velocity limit is active.

Information

The lowest velocity limit always applies, i.e. it is not possible to parameterise and set a velocity limit that is higher than the maximum velocity already parameterised.

Information

This is not a safety function. If additional secure monitoring is required, please observe the application notes on PLb and PLd.

5.3 Preselect mass

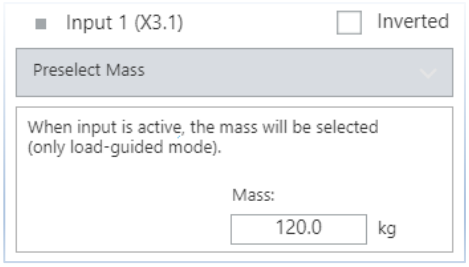


Figure 5.5: "Preselect Mass" configuration

A specific mass can be preselected using this input. If the input is activated, the pressure in the cylinder is increased slowly, until the corresponding mass is achieved.

Information

This function can only be used in load-guided mode. In position-hold mode, the mass is automatically detected.

Note

Incorrect pressure can be set.

If an incorrect mass value is preset, which does not correspond to the real mass, the balancer may move.

- It must be ensured that the load is picked up correctly.
- Unintentional activation must be prevented.

5.4 Move up

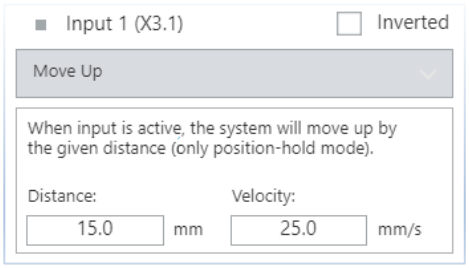


Figure 5.6: "Move Up" configuration

If the input is set, the balancer moves upwards at the predefined velocity until the predefined path has been completed or the input is no longer set.

Information

The following points should be noted:

- Precise positioning does not take place. Depending on the set velocity, a certain overtravel occurs after travelling the specified stroke.
- This function can be used in position-hold mode and in load-guided mode.
- If used when the handle function is active, the handle overrides automatic mode. After releasing the handle, the function must be activated again.
- The monitoring function "Mass deviation" is active by default. If a resistance is detected during the procedure, the balancer switches into error mode. For further information, see 6.3 Mass deviation.

Note

Danger due to self-actuating movement

During automatic positioning, self-actuating movements of the balancer take place and, under certain circumstances, high forces can occur. There are potential risks here that must be taken into account.

Options for reducing the risks:

- Securely monitored low velocity (In the application notes for PLb and PLd there is information on the secure monitoring of the various velocity limits.)
- Ensure sufficient distance to the danger zone

5.5 Move down

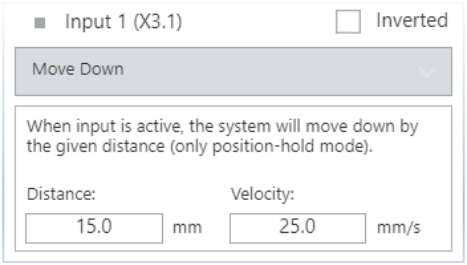


Figure 5.7: "Move Down" configuration

If the input is set, the balancer moves downwards at the predefined velocity until the predefined path has been completed or the input is no longer set.

Information

The following points should be noted:

- Precise positioning does not take place. Depending on the set velocity, a certain overtravel occurs after travelling the specified stroke.
- This function can be used in position-hold mode and in load-guided mode.
- If used when the handle function is active, the handle overrides automatic mode. After releasing the handle, the function must be activated again.
- The monitoring function "Mass deviation" is active by default. If a resistance is detected during the procedure, the balancer switches into error mode. For further information, see 6.3 Mass deviation.

Note

Danger due to self-actuating movement

During automatic positioning, self-actuating movements of the balancer take place and, under certain circumstances, high forces can occur. There are potential risks here that must be taken into account.

Options for reducing the risks:

- Securely monitored low velocity (In the application notes for PLb and PLd there is information on the secure monitoring of the various velocity limits.)
- Ensure sufficient distance to the danger zone

5.6 Move to position

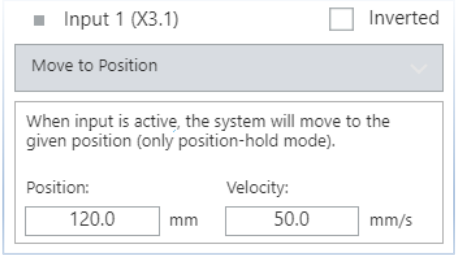


Figure 5.8: "Move to Position" configuration

If the input is set, the balancer moves to the predefined position. If the input is no longer set, the balancer stops immediately even if the position has not yet been reached.

Information

The following points should be noted:

- This function can only be used in position-hold mode. It is not active in load-guided mode.
- If used when the handle function is active, the handle overrides automatic mode. After releasing the handle, automatic positioning must be activated again.
- The monitoring function "Mass deviation" is active by default. If a resistance is detected during the procedure, the balancer switches into error mode. For further information, see 6.3 Mass deviation.
- The difference between the target and actual position must be greater than 10 mm.

Note

Danger due to self-actuating movement

During automatic positioning, self-actuating movements of the balancer take place and, under certain circumstances, high forces can occur. There are potential risks here that must be taken into account.

Options for reducing the risks:

- Securely monitored low velocity (In the application notes for PLb and PLd there is information on the secure monitoring of the various velocity limits.)
- Ensure sufficient distance to the danger zone

5.7 Switch to load-guided mode

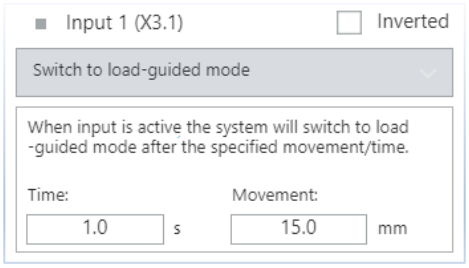


Figure 5.9: "Switch to load-guided mode" configuration

If the input is set, the balancer switches automatically from position-hold mode to load-guided mode, once it was moved by the specified distance and the preset wait time has elapsed. The wait time does not start until the system is at a standstill and the handle is back in neutral.

If a distance of 0 is entered, the balancer switches as soon as the wait time has elapsed. If a time of 0 is entered, the balancer also switches to load-guided mode, as soon as the distance has been exceeded. The prerequisite in both cases is that the balancer is at a standstill and the handle is back in neutral.

Information

In some cases, it can occur that an incorrect mass is identified, and that, as a result, the balancer slowly runs away in load-guided mode. Remedy:

- Longer wait time before switching
- Correct setting of the friction parameters (Commissioning → Position Control)
- The load should be suspended freely

Note

Switchover does not take place.

If the system is moved before the signal is present or the operator does not wait for the specified wait time it could happen that the system does not switch-over to load-guided mode. As a result, the balancer is still in position-hold mode, which can lead to unexpected and possibly dangerous behaviour. Remedy:

- Lock the balancer via the handle active-input before successfully picking up the load. This prevents premature starting.
- Set a shorter waiting time.

5.8 Exhaust the cylinder

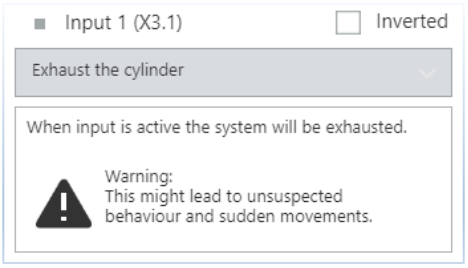


Figure 5.10: "Exhaust the cylinder" configuration

If the "Exhaust the cylinder" function is active, the pressure regulating valve VPCB opens slightly, and exhausts the cylinder volume. This function can be used in position-hold mode or in load-guided mode. If velocity control is not active, this can, under certain circumstances, lead to the velocity being exceeded (depending on the set critical limits and cylinder size/kinematics).

5.9 Velocity profile

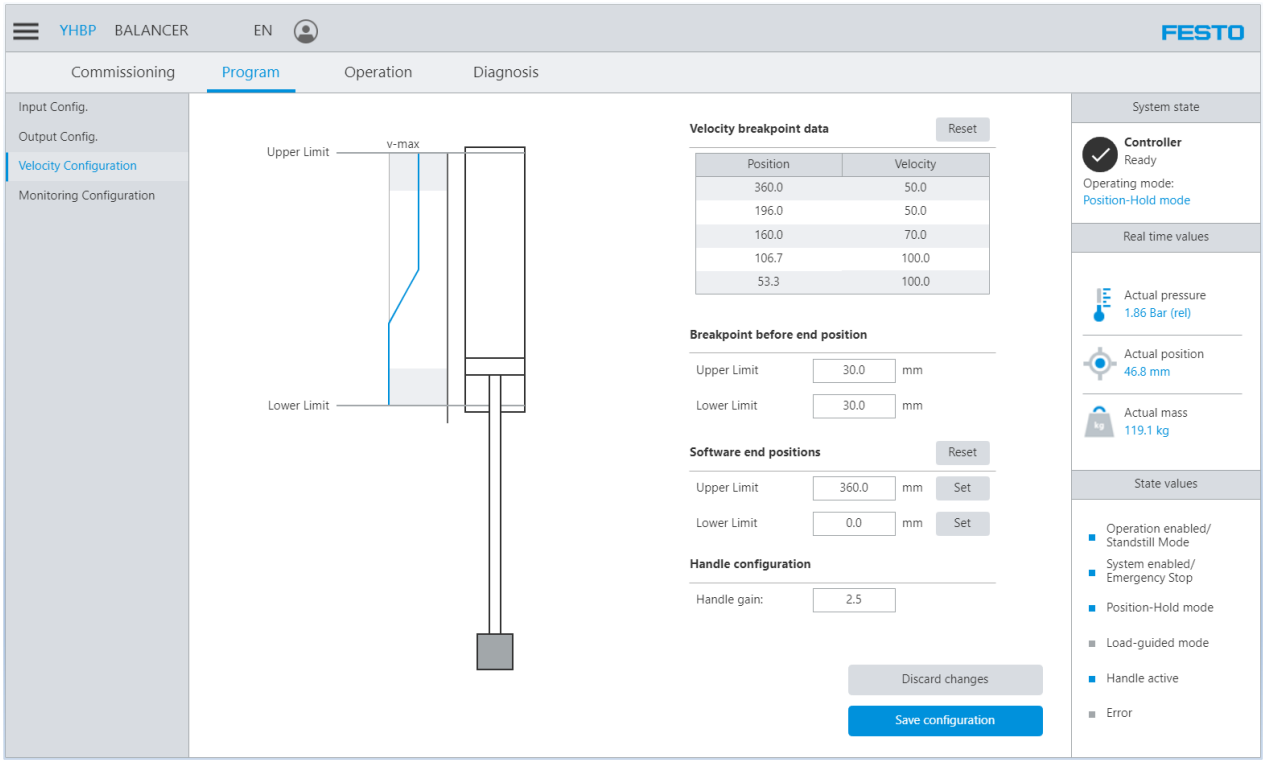


Figure 5.11: Configuration of the velocity profile

The maximum movement velocity over the stroke range of the balancer cylinder can be set using the velocity profile. This makes sense for example, if a sensitive assembly process always takes place at the same working height and thus a more sensitive response behaviour is required from the handle.

Using the "Velocity profile data" table, the velocity data over the stroke can be adjusted within the upper and lower software end positions. The configured velocity curve is displayed directly in the left hand area and can be checked. Thereafter, this is immediately active and can be tested directly.

Using the "Breakpoint before end position", the areas, as of which the velocity before the software end positions is reduced, can be adjusted. This produces a "soft" and reduced movement into the end positions. These values should be adjusted to one's own needs, depending on the mass and kinematics.

Information

Pressing "Save configuration" saves the configuration permanently, making it available again even after a restart.

Information

The functions are immediately active and can be tested by moving the balancer.

Information

Setting the velocity profile has no impact on the safety function of the system (see application notes on PLd or PLb).

Where several velocity limits are active simultaneously (see, for example, chapter 5.1 or 5.2), the smallest limit applies.

5.10 User-specific output

Output X4.1 can be parameterised by the user as a parameterisable output.

Configuration is implemented in the web visualisation of the GSAY-A8 application software. The web visualisation is accessed as described in chapter 3.1 Access to web visualisation.

The output is configured under Program → Output Config. and can be configured as a service user. Access is blocked for an operator.

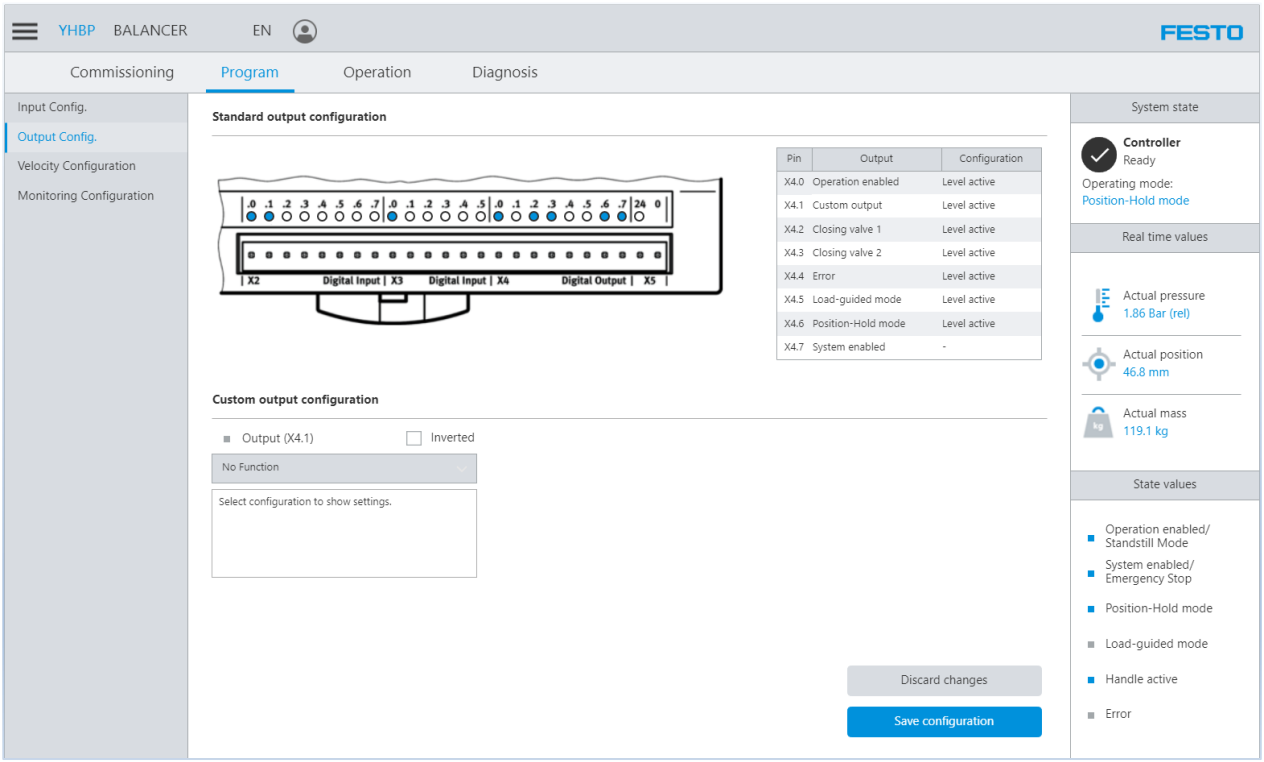


Figure 5.12: Output configuration

The output can be actuated by various switching functions. The following functions are available:

- Mass:
  If the mass is larger than the specified threshold value, the output is switched on. If the output is inverted, the function is precisely the opposite. A hysteresis can be entered.
  E.g.: Threshold value: 150 kg Hysteresis: ±5 kg not inverted
  The output is active as soon as the mass exceeds 155 kg. If the mass falls below 145 kg, the output is inactive again.

- Position:
  If the position is greater than the specified threshold value, the output is switched on. If the output is inverted, the function is precisely the opposite. A hysteresis can be entered.
  E.g..: Threshold value: 50 mm Hysteresis: ±1 mm not inverted
  The output becomes active as soon as the position is greater than 51 mm. If the position falls below 49 mm, the output is inactive again.

- Pressure:
  If the pressure is greater than the specified threshold value, the output is switched on. If the output is inverted, the function is precisely the opposite. A hysteresis can be entered.
  E.g.: Threshold value: 3 bar Hysteresis: ±0.1 bar not inverted
  The output becomes active as soon as the pressure exceeds 3.1 bar. If the pressure falls below 2.9 bar, the output is inactive again.

6 Monitoring functions

Information

Before configuring the monitoring functions, the system must be successfully commissioned.

Various monitoring functions are implemented in the balancer controller. These can be configured as errors, warnings or info, or they can be completely deactivated, depending on the application.

Configuration is implemented in the web visualisation of the GSAY-A8 application software. The web visualisation is accessed as described in chapter 3.1 Access to web visualisation.

The monitoring configuration is configured under Program → Monitoring configuration and can be configured by a service user. Access is blocked for an operator.

The following screen is then displayed:

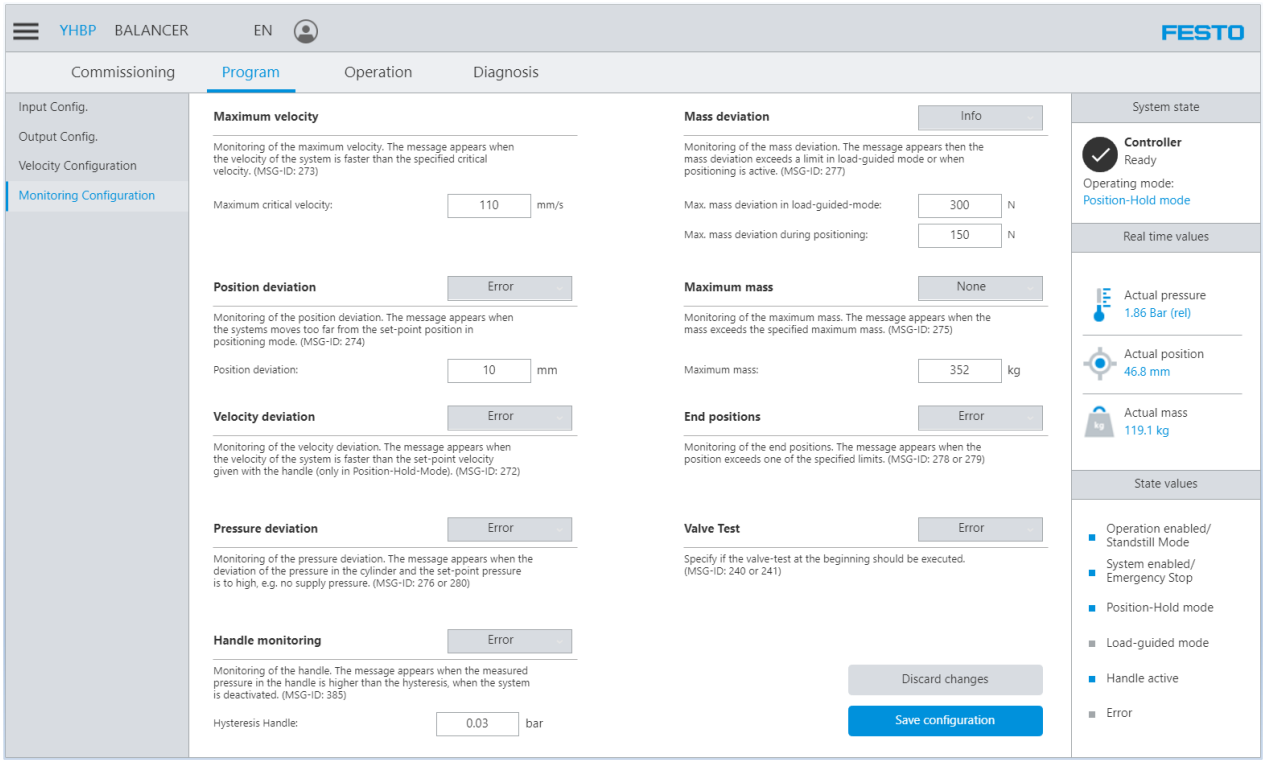


Figure 6.1: Web visualisation of the monitoring functions

If a monitoring function is configured as an error, the system switches into error state as soon as the relevant critical limit is determined. When configured as a warning or as info, an error is simply created in the balancer's log file (dependent on the log level in the PLC configuration - see application note on commissioning).

Note

No safety functions.

The monitoring functions described here are no safety functions; consequently they do not have a safety rating in accordance with the EU Machinery Directive.

For applications with safety requirements, please see the additional application notes on PLb and PLd.

Information

The changes to the monitoring functions are not active until the configuration is saved.

6.1 Velocity monitoring

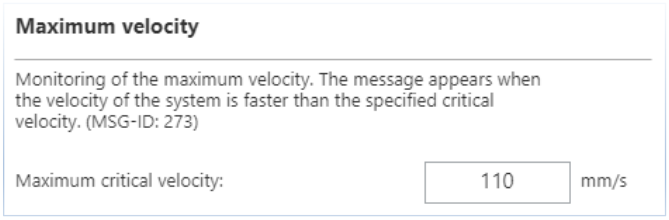


Figure 6.2: Configuring the velocity monitoring

The velocity monitoring monitors the maximum velocity of the system using the maximum velocity entered. Velocity monitoring takes place in the CECC-D-BA controller and in the VPCB pressure regulating valve.

Velocity monitoring cannot be deactivated and is always configured as an error.

6.2 Velocity deviation

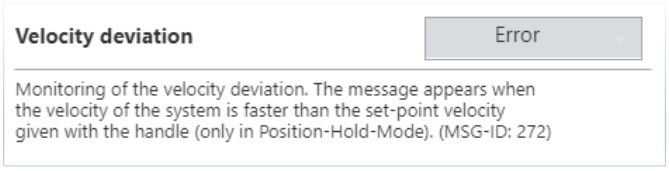


Figure 6.3: Configuring the velocity deviation

For the velocity deviation, the current velocity is compared to the set-point velocity, which is generated by the handle. When the set-point velocity is exceeded and after a specified tolerance, the monitoring is triggered.

6.3 Mass deviation

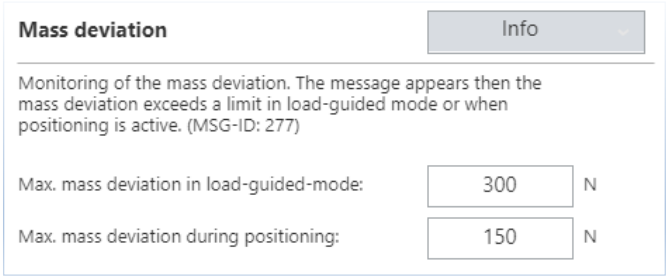


Figure 6.4: Configuring the mass deviation

The mass deviation monitors the mass currently identified by movement and pressure compared to the mass currently set in the balancer. There are two different values here:

- Critical limit in position-hold mode:
  This critical limit applies when using one of the special functions during automatic positioning. If, for example, a resistance of 150 N (approx. 15 kg) is determined during the procedure, the mass is not automatically adjusted, but the balancer goes into error state.
- Critical limit in load-guided mode:
  This critical limit applies in load-guided mode. If, e.g. the mass is lost, or an incorrect mass is set using the "Preselect Mass" special function, the balancer goes into error state. In the example, the deviation is 300 N (approx. 30 kg).

Information

The following points should be noted:

- Under certain circumstances, the error can also occur during movement in load-guided mode, e. g. if the load is moved with too much force. In this case, the critical limit should be adjusted, or user training should take place.
- High friction in the system can likewise lead to the error occurring during positioning. If it is not possible to reduce friction in the system, the critical limit can also be corrected upwards.

If a load should be lifted using the positioning function, the critical limit must be corrected upwards, or the monitoring function deactivated (see 7.4 Automatic weighing without handle).

6.4 Maximum load

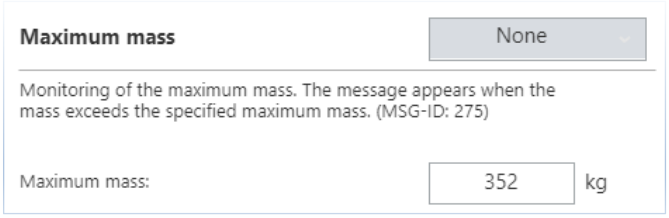


Figure 6.5: Configuring the monitoring of the maximum mass

The behaviour when the maximum specified mass is exceeded can be specified here. If error is selected here, the system switches into error mode and closes both shut-off valves. Thereafter, a little air must be released first via the manual venting mechanism on the valve in order to make the balancer ready for operation again.

Information

The value of the maximum mass should always be set to the maximum expected mass (base mass + heaviest workpiece to be moved) in order to avoid the balancer building up too great a force. Under these circumstances, the configuration can lead as an error to unnecessary system standstills, which is why this is parameterised as a warning by default.

6.5 Position deviation

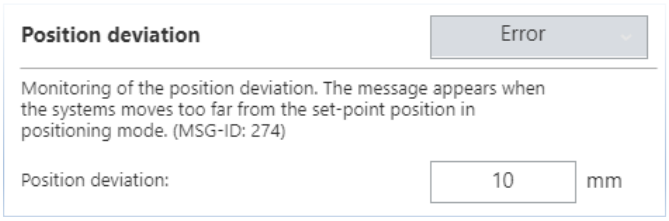


Figure 6.6: Configuring the position deviation

Here the response when a certain position deviation is exceeded in the system can be parameterised. Monitoring is only active in the position-hold mode, as it is only here that positioning to a specific position takes place.

The value of the position deviation can be adjusted here (default is 50 mm at the load mass).

Information

Under certain circumstances, the error can occur when adding or removing a load in suspended state. In this case, the critical limit should be adjusted or the control parameters should be tested during commissioning.

6.6 End-position monitoring

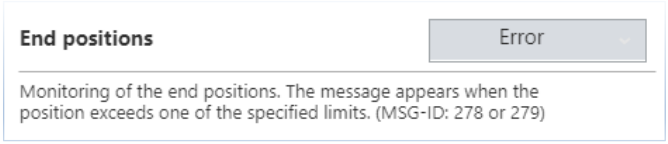


Figure 6.7: Configuring the end-position monitoring

The behaviour when the parameterised software end positions are exceeded can be specified here. The tolerance value for the excess is the same as for the position deviation.

6.7 Pressure deviation

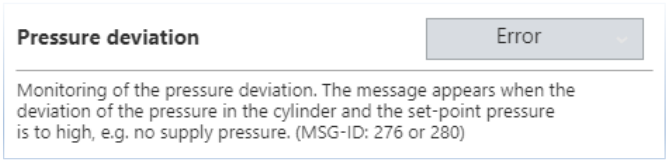


Figure 6.8: Configuring the pressure deviation

The error for the pressure deviation occurs in several cases:

- Pressure deviation and movement direction are not plausible. (Error ID: 276)
- Minimum or maximum pressure was exceeded. The minimum or maximum pressure is calculated from the minimum or maximum mass (±tolerance of 0.05 bar). (Error ID: 276)
- Pressure is outside a pressure window in load-guided mode. The pressure window is determined from the identified pressure and the maximum force, which can be set using the handle (see application note - Commissioning, Configuring hardware). (Error ID: 280)

6.8 Handle monitoring

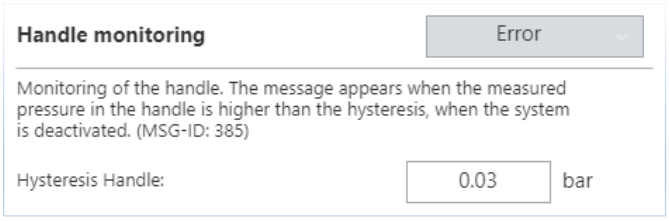


Figure 6.9: Configuring the handle monitoring

With handle monitoring, the value of the handle is checked for its plausibility. If the handle is not set to active, e.g. if the "Activate handle" input is not active or operation enable has not been set, the pressure value of the handle is measured. As no movement should take place at this time, the pressure value to be expected is approximately 0 bar (rel.).

If a pressure is measured now that is larger than the given hysteresis, the error is output.

Information

This message can be an indicator that there is too great of a leak between the handle and the valve. The tubing and fittings should be tested.

A leak will lead to the balancer still executing a movement in some operating statuses, despite the handle being in neutral.

6.9 Valve test

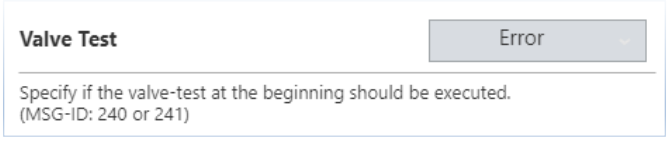


Figure 6.10: Configuring the valve test

The shut-off valves are tested before each switching-on and switching-off process. Both shut-off valves are switched consecutively and their function is tested using a pressure pulse.

What should happen when a test is failed can now be selected here. If "None" is selected, the test is deactivated on start-up.

Information

For operation with the safety function, monitoring is essential. More info, see the application note on PLd.

7 Application examples

This chapter explains some application examples that use the various special functions.

A distinction is made between the following use cases here:

Motion	Type of load	Compatibility with other special functions	Use case
Movement via the handle only	Workpiece weight unknown.	• Automatic pre-positioning (position-hold mode only) • Velocity limits	→ 7.5 Automatic weighing function with handle → 7.6 Manual weighing function
Load is lifted using the handle, thereafter movement directly at the load	Workpiece weight unknown.	• Automatic pre-positioning (position-hold mode only) • Velocity limits • Preselect mass (load-guided mode only)	→ 7.5 Automatic weighing function with handle → 7.6 Manual weighing function
Movement without the handle only	Fewer than 5 different workpieces. Weight of the workpieces is constant and known in advance.	• Velocity limits • Preselect mass (load-guided mode only)	→ 7.3 Load-guided mode with different constant masses
Movement without the handle only	More than 5 different workpieces or unknown workpiece weight.	• Velocity limits • Preselect mass (load-guided mode only)	→ 7.4 Automatic weighing without handle

Table 7.1: Overview of various use cases

7.1 Additional querying of the handle via the light sensor

Use case:

To secure the handle against unintentional activation, an additional hand proximity detection is performed, using a light sensor or an additional button that is to be activated.

If the button is not activated, it is not possible to move the system with the handle. In load-guided mode, the system can still always be moved directly at the load.

Additional components (example):

Festo part number	Type code	Description
537705	SOEG-RTH-M18-NS-K-2L	Diffuse sensor

Table 7.2: Additional components for the application example "Additional sensing of the handle via light sensor"

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

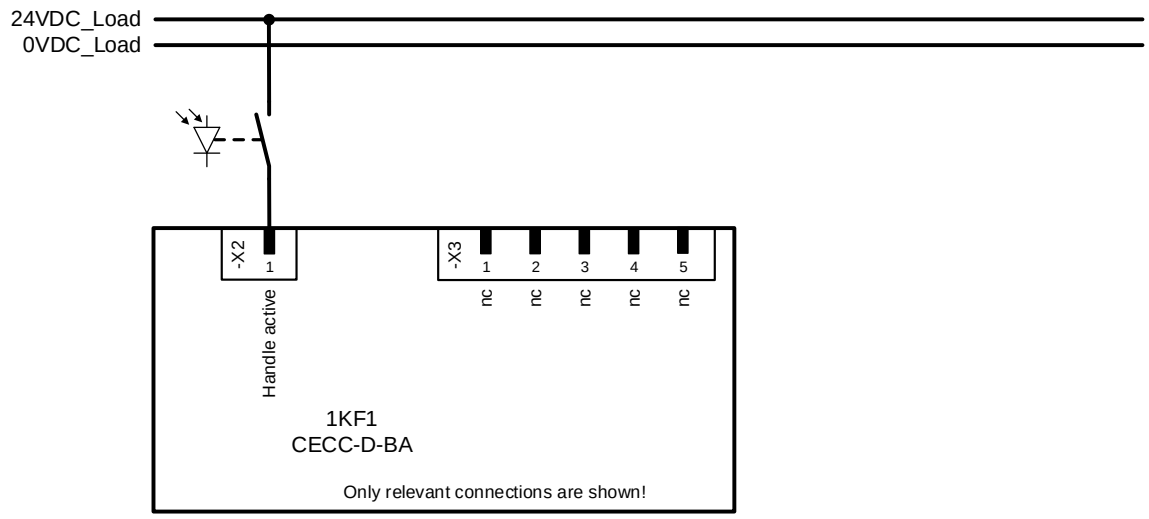


Figure 7.1: Circuitry for the application example "Additional sensing of the handle via light sensor"

7.2 Automatic positioning to a base position

Use case:

In this application, the balancer should move back automatically into a defined base position after assembly of the component. A sensor is provided for this, which tests whether the component is in the gripper or not.

Special functions used:

Input	Special function	Parameterisation (example)
X3.1	Move to position	Position: 100 mm Velocity: 20 mm/s
X3.2-5	Not used	--

Table 7.3: Special functions for the application example "Automatic positioning to a base position"

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

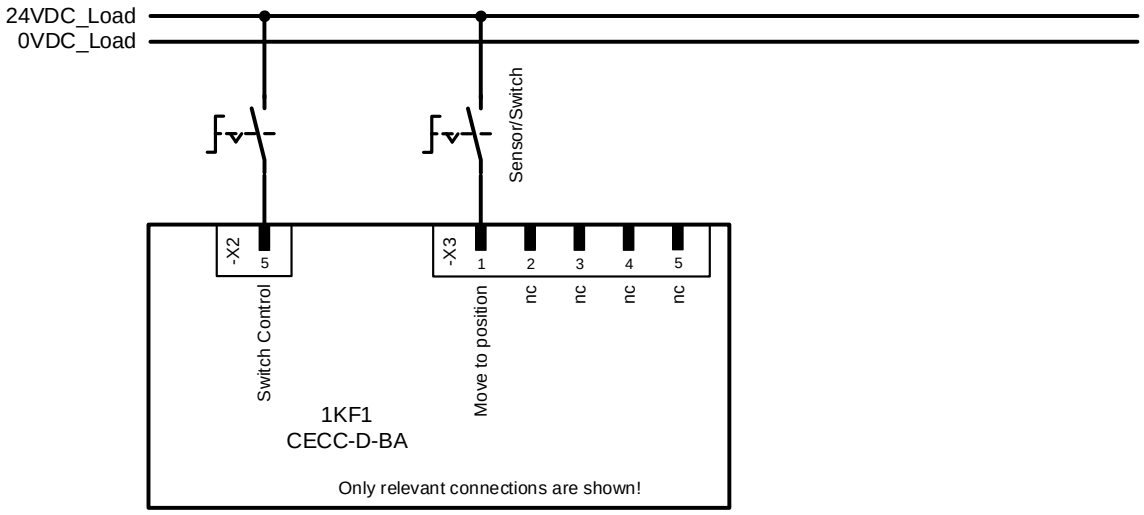


Figure 7.2: Circuitry for the application example "Automatic positioning to a base position"

Configuration in the web visualisation:

In the web visualisation, the required inputs are selected and the relevant values assigned. The base position can be approached and then accepted from the side panel. The velocity value should be determined by testing it. Very low velocities are not possible here.

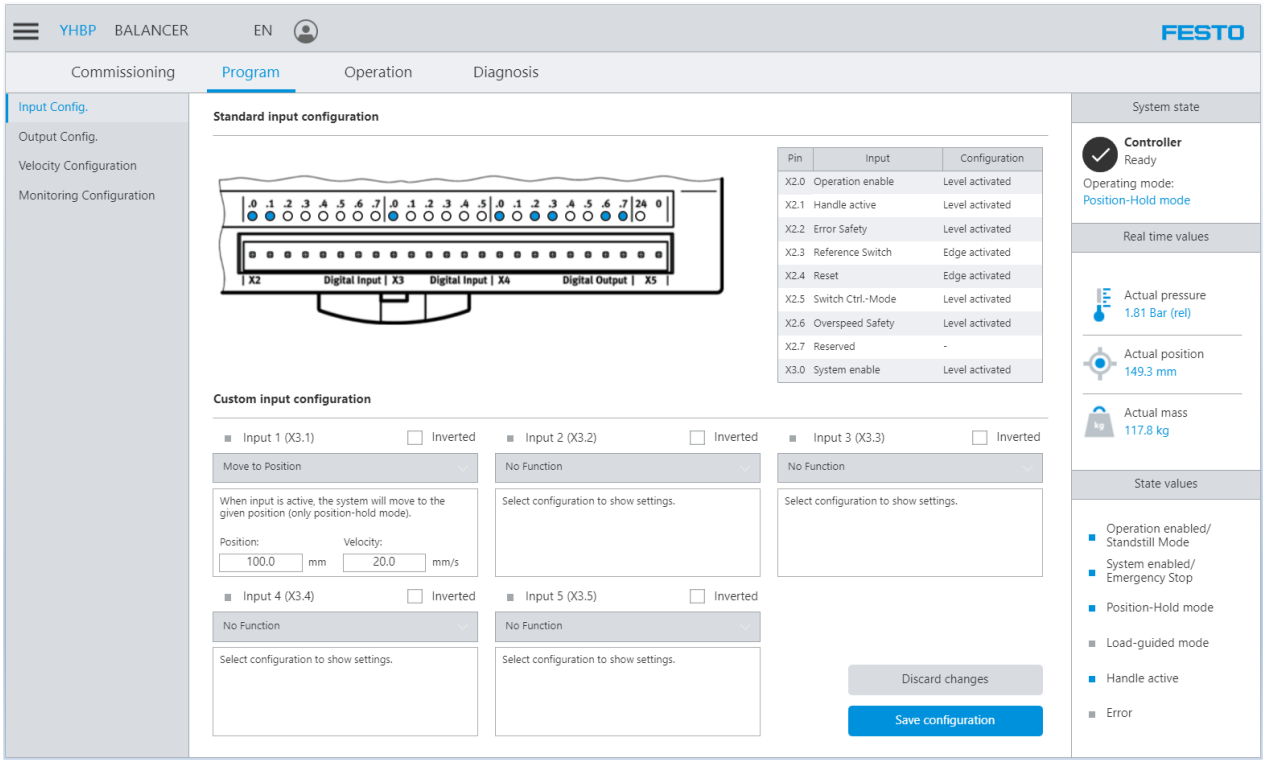


Figure 7.3: Input configuration "Automatic positioning to a base position"

Notes:

Information

The following points should be noted:

- This function can only be used in position-hold mode. It is not active in load-guided mode.
- If used when the handle function is active, the handle overrides automatic mode. After releasing the handle, automatic positioning is automatically activated again.
- The monitoring function "Mass deviation" is active by default. If a resistance is detected during the procedure, the balancer switches into error mode. For further information, see 6.3 Mass deviation.

Note

Danger due to self-actuating movement

During automatic positioning, self-actuating movements of the balancer take place and, under certain circumstances, high forces can occur. There are potential risks here that must be taken into account.

Options for reducing the risks:

- Securely monitored low velocity (In the application notes for PLb and PLd there is information on the secure monitoring of the various velocity limits.)
- Ensure sufficient distance to the danger zone

7.3 Load-guided mode with different constant masses

Use case:

In this use case, the weight of the loads to be moved is known in advance. A selector switch can be used to select the different loads. Here, the balancer is only operated in load-guided mode and can be moved either via the handle or directly at the load. There is the option of parameterising 5 different mass loads in advance.

Example:

Load mass 1: Basic load of the gripper system: 70 kg.

Load mass 2: Basic load of the gripper system and workpiece to be moved 1: 70 kg + 50 kg.

Load mass 3: Basic load of the gripper system and workpiece to be moved 2: 70 kg + 80 kg.

Without a workpiece in the gripper, the selector switch is set to position 1. If workpiece 1 is picked up by a gripper, the selector switch is set to position 2. The pressure is then set to the pressure appropriate for workpiece 1. After setting down workpiece 1, the selector switch is reset to position 1 before opening the gripper. If workpiece 2 is picked up, the selector switch is set accordingly to position 3. The switchover should only happen when the gripper is closed.

Special functions used:

Input	Special function	Parameterisation (example)
X3.1	Preselect mass	Mass: Base mass without mass load
X3.2	Preselect mass	Mass: Base mass + mass load 1
X3.3	Preselect mass	Mass: Base mass + mass load 2
X3.4	Preselect mass	Mass: Base mass + mass load 3
X3.5	Preselect mass	Mass: Base mass + mass load 4

Table 7.4: Special functions for the application example "Load-guided mode with different constant masses"

Configuration in the web visualisation:

In the web visualisation, the required inputs are selected and the relevant mass values assigned. If the mass is not known, this can be picked up in position-hold mode and then the displayed value can be read in the side panel and transferred. To this end, however, the option to switch operating mode must be given.

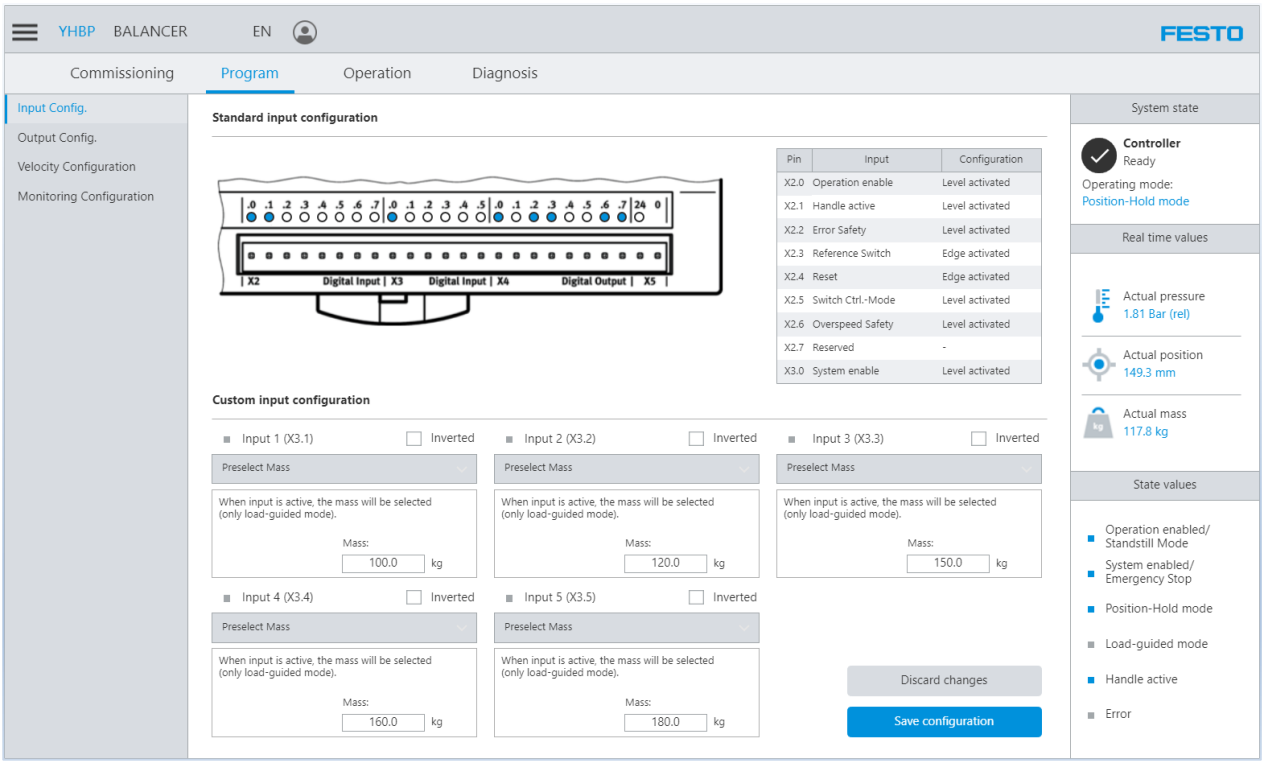


Figure 7.4: Input configuration "Load-guided mode with different constant masses"

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

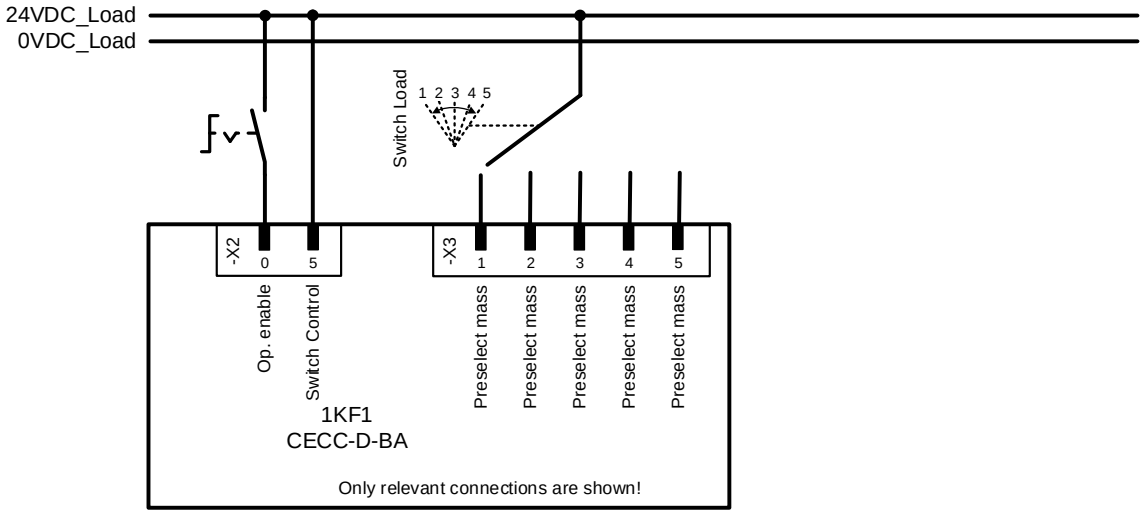


Figure 7.5: Circuitry for the application example "Automatic weighing function without handle"

Notes:

Note

Incorrect pressure can be set.

If an incorrect mass value is preset, which does not correspond to the real mass, the balancer may move quickly.

- It must be ensured that the load is picked up correctly.
- Unintentional activation must be prevented.

7.4 Automatic weighing without handle

Use case:

In this use case, the option to move the balancer entirely without the handle should exist, while still utilising the automatic load adjustment options.

To pick up a load, the balancer is moved to the workpiece either with the handle or directly with the gripper unit. After picking up the workpiece (using a gripper unit or similar) a weighing function is started to determine the weight of the workpiece. This can be started either manually or automatically by setting the inputs X2.5, X3.1, X3.2 and X3.3. With the weighing function, the workpiece is raised by a defined stroke and weighed. Then the workpiece can be moved again, either with the handle or directly.

Actuation takes place in this example via a switch (alternatively also a sensor/pressure switch) with which it is possible to switch between "Without load/gripper open" and "With load/gripper closed". If the switch is open, the base mass of the gripper unit is set. If the switch is closed, the weighing function is started automatically.

Special functions used:

Input	Special function	Parameterisation (example)
X3.1	Preselect mass	Mass: Base mass without mass load
X3.2	Move up	Distance: 15 mm Velocity: 25 mm/s Inverted
X3.3	Switch to load-guided mode	Movement: 15 mm Time: 1 s Inverted
X3.4+5	Not used	--

Table 7.5: Special functions for the application example "Automatic weighing function without handle"

Configuration in the web visualisation:

In the web visualisation, the required inputs are selected and the relevant values assigned. The base mass can, for example, be taken from the side panel after commissioning. As a stroke value, a stroke should be selected at which it is ensured that the load is completely raised. As a time value, a value that is suitable for the application should be selected. It is important to invert Input 2 and Input 3.

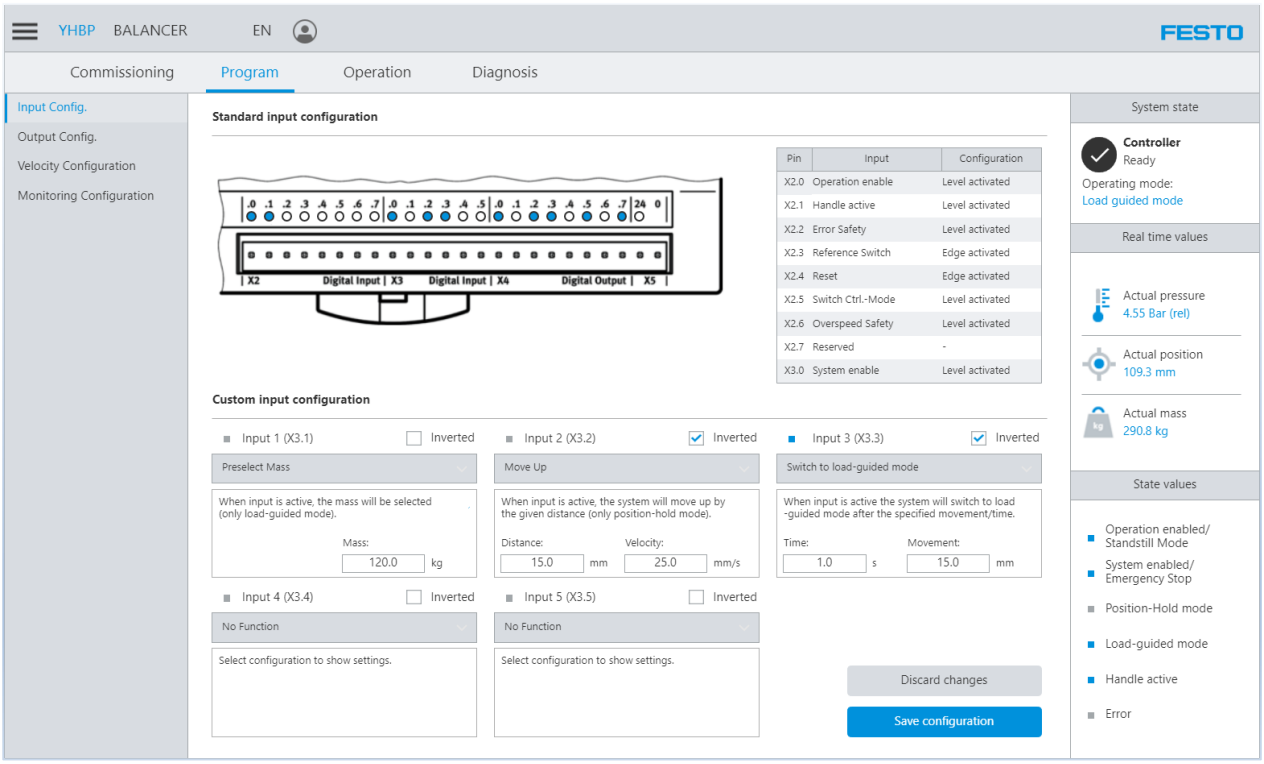


Figure 7.6: Input configuration “Automatic weighing function without handle“

So that the balancer does not switch to error state while lifting the load, the "mass deviation" monitoring function must be deactivated. To this end, either the "Mass limit in positioning mode" can be increased (greater than the expected mass loading) or the monitoring can be parameterised as "warning" or "info".

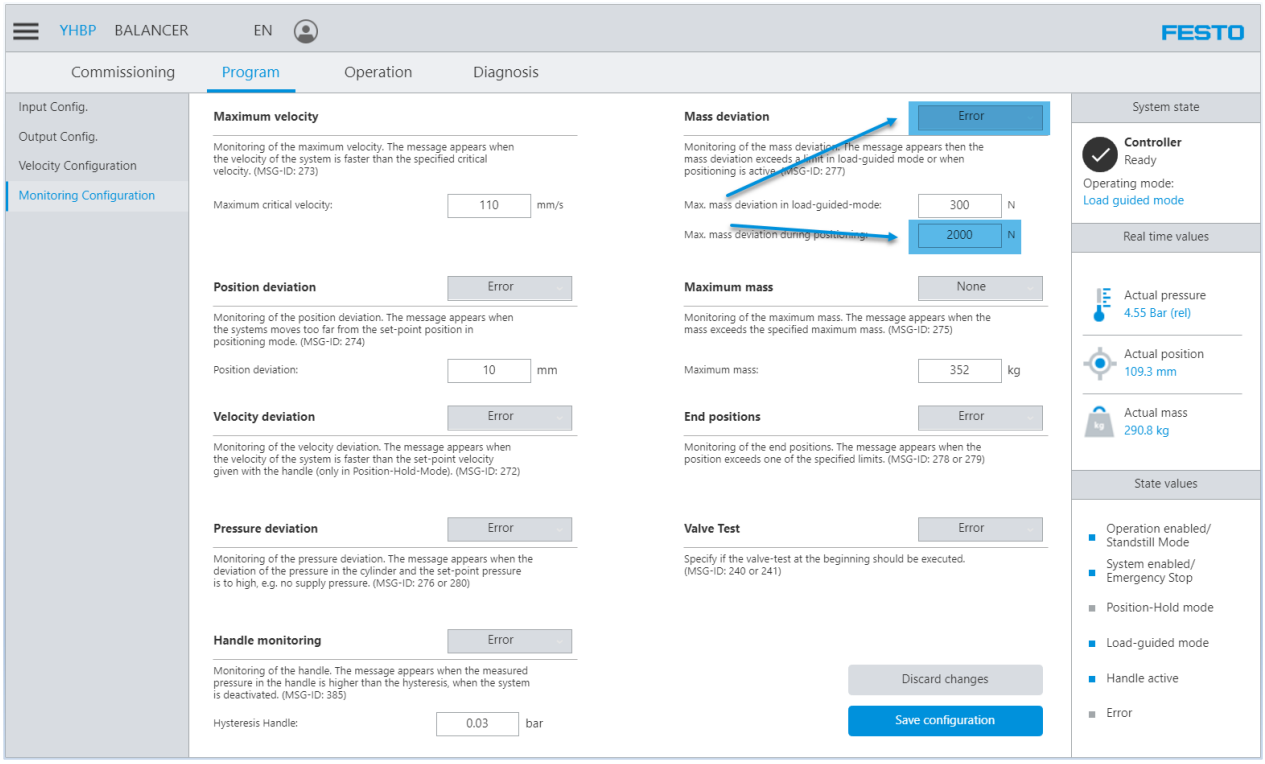


Figure 7.7: Monitoring configuration “Automatic weighing function without handle"

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

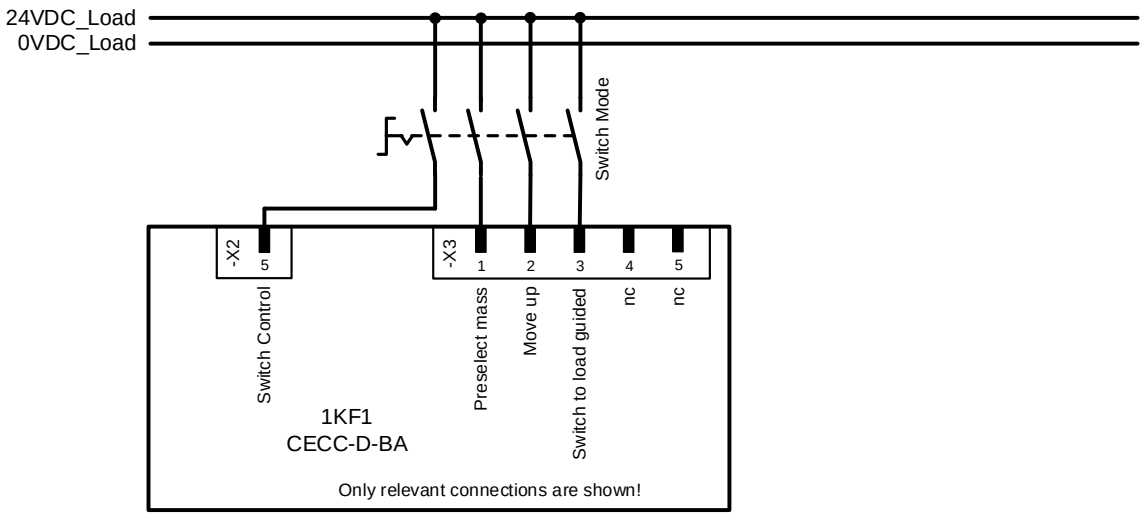


Figure 7.8: Circuitry for the application example "Automatic weighing function without handle"

Notes:

Information

In this example, the balancer can also be used entirely without a handle. However, in this process, no friction compensation takes place via the handle, which is why higher forces are required to move the system, depending on the friction in the system. A handle is likewise essential for commissioning.

Information

In some cases, it can occur that an incorrect mass is identified, and that, as a result, the balancer slowly runs away in load-guided mode. Remedy:

- Longer wait time before switching
- Correct setting of the friction parameters (Commissioning → Position Control)
- The load should be suspended freely

Note

Danger due to self-actuating movement

During automatic positioning, self-actuating movements of the balancer take place and, under certain circumstances, high forces can occur. There are potential risks here that must be taken into account.

Options for reducing the risks:

- Securely monitored low velocity (In the application notes for PLb and PLd there is information on the secure monitoring of the various velocity limits.)
- Ensure sufficient distance to the danger zone

7.5 Automatic weighing function with handle

Use case:

In this use case, the balancer can only be moved with the handle, when no load has been picked up.

To pick up a load, the balancer is moved to the workpiece with the handle. After picking up the workpiece (using a gripper unit, vacuum gripper or similar) a weighing function is started to determine the weight of the workpiece. This can be started either manually or automatically via input X3.1. For the weighing function, unlike the function described in chapter 7.4, the load must be raised with the handle manually by a previously defined stroke. After a defined wait time, the system then switches into load-guided mode, and the workpiece can be moved using the handle or directly.

After assembling or setting down the workpiece, the signal is reset (e.g. by the vacuum no longer being present or by the gripper being open) and the balancer switches back into position-hold mode, whereby movement is again only possible using the handle.

Actuation takes place in this example via a switch (alternatively also a sensor/pressure switch) with which it is possible to switch between "Without load/gripper open" and "With load/gripper closed". If the switch is open, the balancer is in position-hold mode. If the switch is closed, the weighing function is started automatically.

The mode can be switched manually using the additional switch "Switch operating mode". This switch is not essential for the function. If it is not provided, "Switch operating mode" should be permanently set to ground.

Special functions used:

Input	Special function	Parameterisation (example)
X3.1	Switch to load-guided mode	Movement: 20 mm Time: 1 s
X3.2-5	Not used	--

Table 7.6: Special functions for the application example "Automatic weighing function with handle"

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

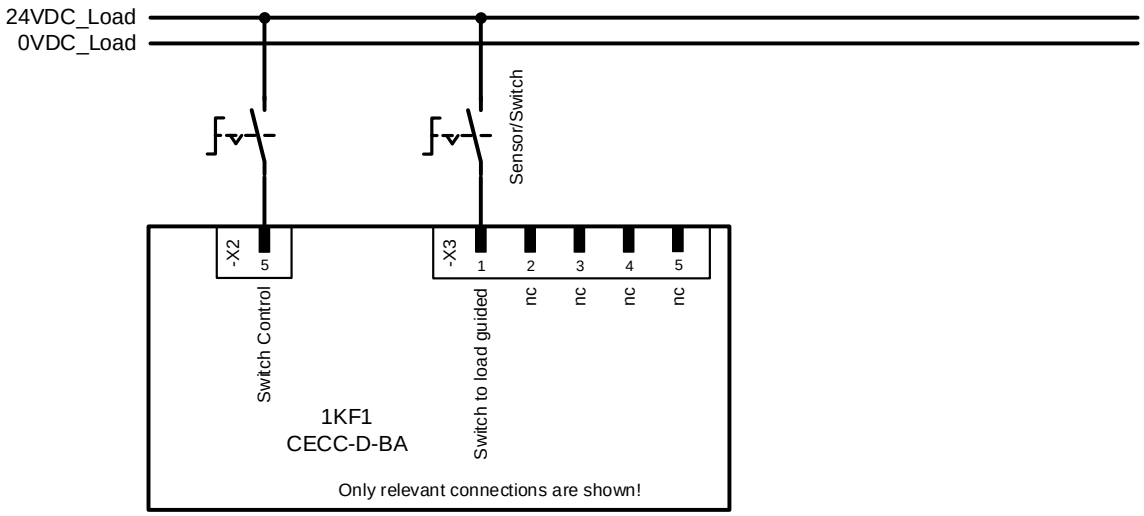


Figure 7.9: Circuitry for the application example "Automatic weighing function with handle"

Configuration in the web visualisation:

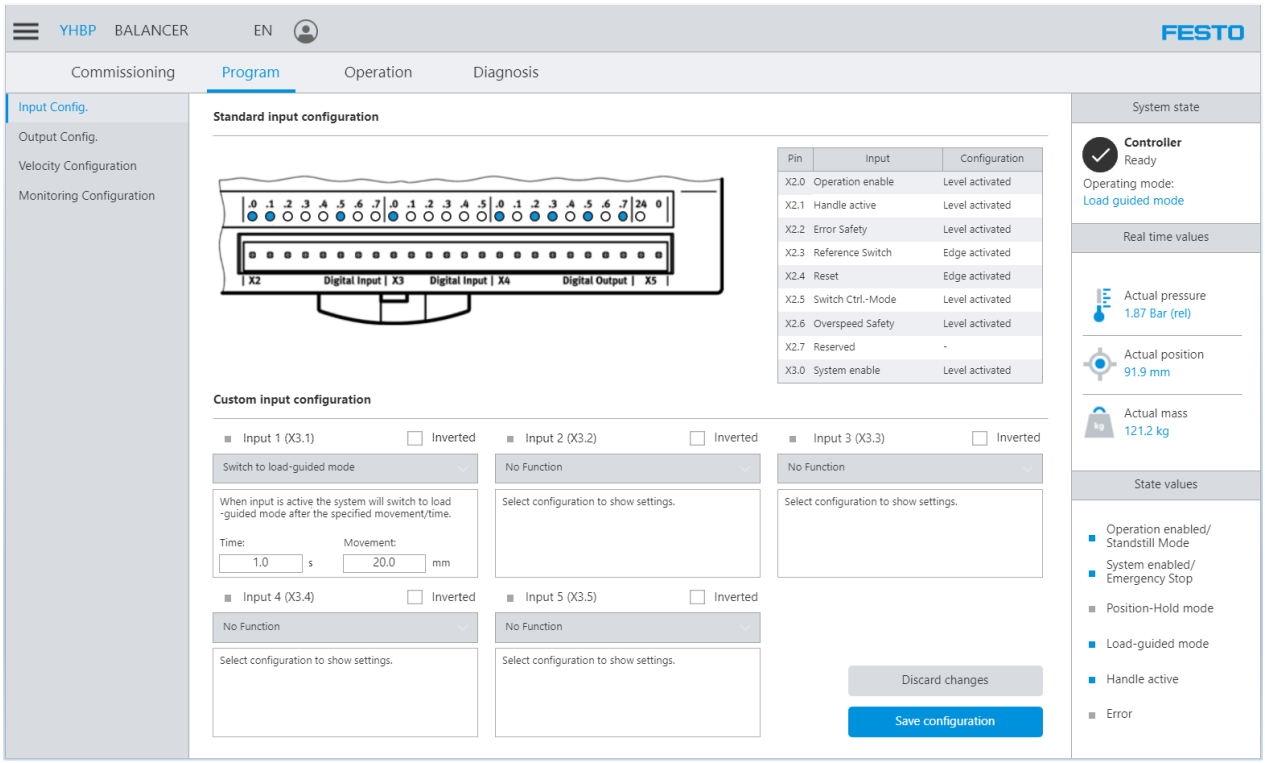


Figure 7.10: Input configuration "Automatic weighing function with handle"

Notes:

Information

In some cases, it can occur that an incorrect mass is identified, and that, as a result, the balancer slowly runs away in load-guided mode. Remedy:

- Longer wait time before switching
- Correct setting of the friction parameters (Commissioning → Position Control)
- The load should be suspended freely (set the needed movement to an appropriate value)

Note

Switchover does not take place.

If the system is moved before the signal is present or the operator does not wait for the specified wait time it could happen that the system does not switch-over to load-guided mode. As a result, the balancer is still in position-hold mode, which can lead to unexpected and possibly dangerous behaviour. Remedy:

- Lock the balancer via the handle active-input before successfully picking up the load. This prevents premature starting.
- Set a shorter waiting time.

7.6 Manual weighing function

Use case:

There are two options for a manual weighing function:

1. The balancer is constantly in the position-hold mode. The load can be picked up and set down with the handle. In principle, it is not possible to move the system at the load. A button or switch to switch the operating mode is not required here. Input X2.5 is permanently set to 0.
2. The balancer is in load-guided mode. Actuating a button switches it into position-hold mode. It is only possible to pick up and set down the load when the button is activated. See the sample circuitry below.

Special functions are not used in either case. It is possible to connect with use case 7.1 or 7.2 or other special functions.

Circuitry:

Information

Only the inputs relevant for the application are shown. For a functioning system, the information in the manual and the sample circuit diagram from the Festo Support Portal must also be observed.

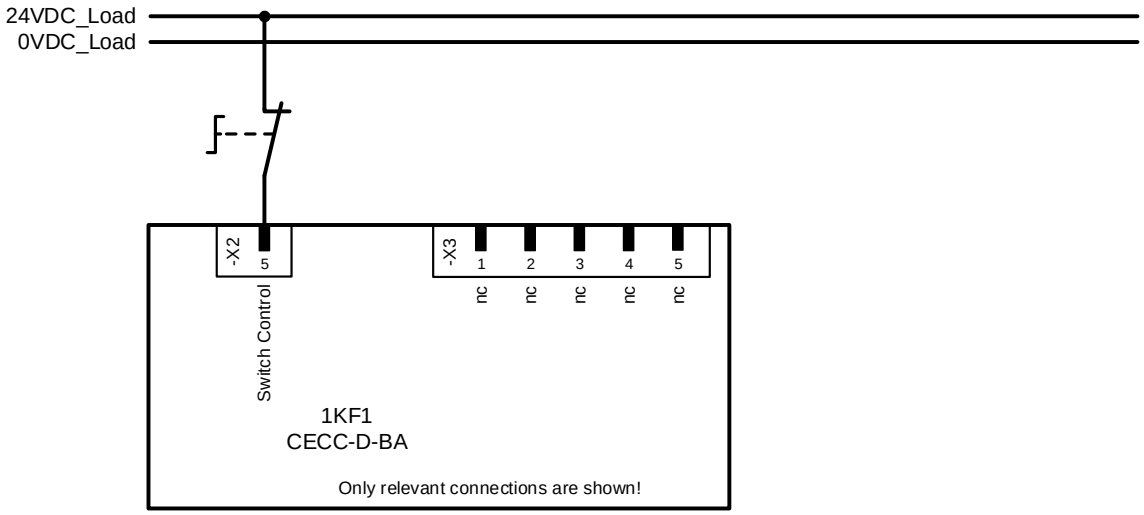


Figure 7.11: Circuitry for the application example "Manual weighing function - use case 2"

Notes:

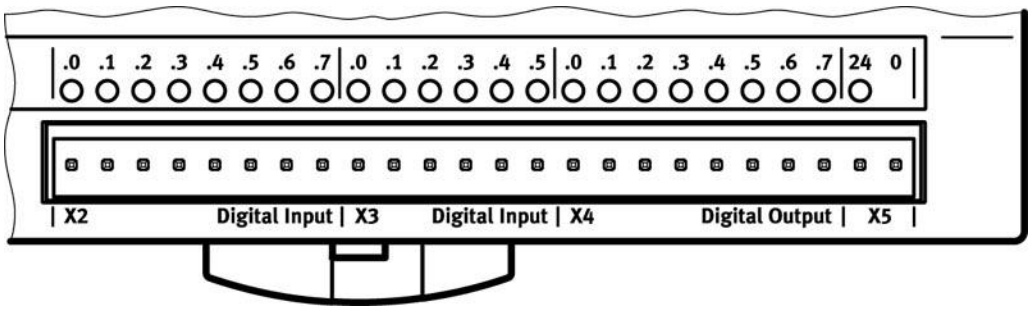
Information

In principle, the following points should be observed:

- Limits for minimum and maximum mass must be set correctly:
  The mass limits should be adjusted accordingly in order to avoid high forces in position-hold mode.

A Technical appendix

A.1 Inputs and outputs



Clamp	Connection	Usage	Control
X2.0	8 digital inputs	Operation enable	**After restart:** Rising edge: operation enabled **Normal operation:** High-level: operation enabled Low-level: operation disabled
X2.1		Handle active	High-level: handle enabled Low-level: handle disabled
X2.2		Error input safety monitor (PLd)	High-level: error at safety monitor Low-level: no error at safety monitor
X2.3		Reference cylinder switch	**During homing:** Rising/ falling edge: apply reference position
X2.4		Error reset	**In case of error:** Rising edge: error reset
X2.5		Switch operating mode	**In operation:** High-level: load-guided mode Low-level: position-hold mode
X2.6		Feedback input safety monitor (PLd)	High-level: overspeed registered at safety monitor Low-level: normal operation
X2.7		Not connected	--
X3.0	1 digital input	System enable / (emergency stop)	**Normal operation:** High-level: system enabled/no emergency stop Low-level: system disabled/emergency stop
X3.1 ... X3.5	5 digital inputs	User specific input configuration	--

Table 7.7: Inputs of CECC-D-BA controller

Clamp	Connection	Usage	Output
X4.0	8 digital outputs	Operation enabled	**Homing:** Output is triggering with 1 Hz **Normal operation:** High-level: operation enabled Low-level: operation disabled
X4.1		Safety monitor active	**Normal operation:** Output active **Error state:** Output is reset for 1 sec
X4.2		Shut-off valve 1	**Normal operation:** Output active **Error state:** Output inactive
X4.3		Shut-off valve 2	**Normal operation:** Output active **Error state:** Output inactive
X4.4		Error	**Normal operation:** Output active **Error state:** Output inactive
X4.5		Load-guided mode active	**Load-guided mode active:** Output active **Load-guided mode inactive:** Output inactive
X4.6		Position-hold mode active	**Position-hold mode active:** Output active **Position-hold mode inactive:** Output inactive
X4.7		System ready and operational	**Normal operation:** Output active **Error state:** Output inactive

Table 7.8: Outputs of CECC-D-BA controller

A.2 Error messages

A.2.1 CAN connection

Error ID	Error message	Error description	Possible causes
192, 200, 201, 202, 203, 204, 205, 206, 207, 208	Different. E.g.: Error in receiving CAN-Process-Data. Check CAN-Connection and restart! / Timeout of the VPCB-Valve. Check CAN-Connection and restart!	Error in the CAN connection between VPCB proportional rule valve and CECC-D-BA.	-VPCB valve is not supplied with voltage (emergency press, false wiring) → Check status LEDs from the VPCB -CAN connection erroneous → Closing resistance at CECC-D-BA not activated, false wiring, screen not properly laid out -VPCB and control are not grounded → to connect grounding connections -ensure EMC-appropriate wiring

Table 7.9: Error table CAN connection

A.2.2 Initialization routine

Error ID	Error message	Error description	Possible causes
213, 214	Error in sending CI-Parameter during Initialization. / Error in receiving CI-Parameter during Initialization.	Errors in parameter transfer to the valve during Initialization.	-Short-term error in communication between valve and controller → Please restart -Incorrect parameter values → commissioning again. -If the error occurs permanently, e.g. after a restart: Possibly incorrect valve software → exchange
215	Timeout in the reset of the VPCB-Valve.	Timeout in the reset of the VPCB-Valve.	-Error in the valve. Are there more error messages? → Please restart -If the error occurs permanently, e.g. after a restart: Possibly incorrect valve software → exchange

Table 7.10: Error table Initialization routine

A.2.3 Balancer state machine

Error ID	Error message	Error description	Possible causes
224	Timeout in the state change of the VPCB-Valve (Balancer-State-Machine).	Timeout in the state change of the VPCB-Valve (Balancer-State-Machine).	-Error in the valve. Are there more error messages? ⇢ Please restart -If the error occurs permanently, e.g. after a restart: Possibly incorrect valve software ⇢ exchange
512	Emergency Break (No System Enable).	Emergency stop is active. There is no voltage at input X3.1 (system enable).	-Emergency stop is pressed -System enable is not connected -No load power supply → terminal X5 with voltage

Table 7.11: Error table Balancer state machine

A.2.4 Closing valves

Error ID	Error message	Error description	Possible causes
240	Safety-Valve 1 Test failed.	Safety valve 1 test failed. During the test, a short pressure pulse is given to the closed valve. There must be no change in the output of the pressure/position.	-During the test, the balancer was moved. -No supply pressure. -Too high leakage on the working cylinder. Does the cylinder or pressure slowly drop when the closing valves are locked? ⇢ Check interconnectors and bolts -If the test fails repeatedly, there may be a defect in the lock valve. → Exchange.
241	Safety-Valve 2 Test failed.	Safety valve 2 test failed. During the test, a short pressure pulse is given to the closed valve. There must be no change in the output of the pressure/position.	see error ID 240
242	Safety-Valve-Test failed. No Supply pressure or valves not opening.	Safety valve test failed. At the beginning, it is tested for existing supply pressure.	- No supply pressure. - Closing valves do not open → check wiring

Table 7.12: Error table closing valves

A.2.5 Monitoring functions

Error ID	Error message	Error description	Possible causes
272	Maximum Velocity-Deviation exceeded (Balancer-Controller).	Maximum speed deviation between setpoint velocity and actual velocity exceeded. Monitoring by CECC-D-BA.	--
273	Maximum critical velocity exceeded (Balancer-Controller).	Parametric critical speed limit was exceeded. Monitoring by CECC-D-BA.	- Jerky movement by the operator. - In load-guided mode, the workpiece was pulled too hard. - Load was detached abruptly. - In position-hold mode the load has gotten stuck at a pinch-point and has detached abruptly. - Other error.
274	Maximum position-deviation exceeded (Balancer-Controller).	In position hold mode the load was deflected too much from its set position.	-Load was loaded or unloaded and the control could not adjust quickly enough -Limit value is too narrow → Select higher limit under program → monitoring configuration → position deviation -Supply pressure failure
275	Maximum mass exceeded (Balancer-Controller).	The maximum mass parameterized in the web-visualization has been exceeded. The mass is determined internally on the base of the movement behaviour of the balancer.	- It was attempted to lift too much weight - Too much load has been added - A disturbance contour is present, and the balancer was moved against the disturbance contour with the maximum force - A maximum mass limit that is too low has been configured

Error ID	Error message	Error description	Possible causes
276	Maximum pressure deviation error (Balancer-Controller).	Maximum pressure deviation between set-point pressure and actual pressure in the working cylinder exceeded.	- Supply pressure failure - Can sometimes occur with rapid changes of direction - Control error in the proportional valve
277	Maximum mass deviation exceeded (Balancer-Controller).	The deviation between the real mass and the currently set mass has exceeded the limits that are parameterized in the webvisualization. The monitoring is only active in load guided mode or during positioning.	- Jerky movement by the operator. - In load-guided mode, the workpiece was pulled too hard. - Load was detached abruptly. - In load guided mode, an attempt was made to set a wrong mass via a special function - While positioning, the mass has changed → If desired, choose higher limit below "Program → Monitoring configuration → Mass deviation" - Limits are parameterized too narrow and are triggered, for example, by excessive friction
278, 279	Upper position limit exceeded (Balancer-Controller). or Lower position limit exceeded (Balancer-Controller).	Upper/Lower parametric software end position have been run over.	- The buffer zone before the end positions was set too low. This makes it possible to pass over the end positions at high speeds - Limits can be in run over in load-guided mode by hand - Other error
280	Maximum pressure deviation in load-guided mode error (Balancer-Controller).	In load-guided mode, the actual pressure has left the pressure range that can be adjusted via the handle. (Parameters for setting the pressure range: "Max force in Last-guided mode")	- Error in the proportional valve - Supply pressure failure - Range is configured too narrow - Other control error
281	Position-Value equals zero. Position sensor is referenced to the wrong value. Check homing position.	Position value is zero. Displacement sensor is referenced to the wrong position. Check reference position and teach the new position.	- Cylinder switch for the reference position is in the wrong position → teach the position again in commissioning - Wrong value for final position entered in step pressure control-commissioning → do commissioning again

Table 7.13: Error table monitoring functions

A.2.6 Commissioning

Error ID	Error message	Error description	Possible causes
288, 289, 290	Timeout in Parameter transmission to VCPB during Commissioning. / Error in sending CI-Parameter during Commissioning. / Wrong CI-Answer from the VPCB-Valve during Commissioning.	Errors in the parameter transfer to the valve during Commissioning.	- Short-term disturbance in the communication between the valve and the controller. Redo the commissioning step. In the event of repeated occurrence of the error: - Check the parameter values ⇢ Possibly wrong parameters, try resetting factory condition and restart commissioning - Exchange the valve

Error ID	Error message	Error description	Possible causes
291	Error in the recipe management.	Error in storing the variables in the internal memory of CECC-D-BA.	- Special characters included in the configuration name - Invalid configuration has been loaded or memory of the control is full → reset to factory settings and try again - Other error
292	Timeout in the state change of the VPCB-Valve (Commissioning-State-Machine).	Timeout in the state change of the VPCB-Valve (Commissioning-State-Machine).	- Error in the valve. Are there other error messages? - Error keeps coming repeatedly. Software errors in the valve. Exchange the valve.

Table 7.14: Error table commissioning

A.2.7 Proportional control valve

Error ID	Error message	Error description	Possible causes
336	General Error in the VPCB-Valve.	General Error in the VPCB-Valve.	Different, see the following errors
337	Low voltage at the VPCB-Valve ‹ 21,6 Volt.	Low voltage at the VPCB-Valve ‹ 21,6 Volt.	- Supply voltage is too low. Increase voltage levels or reduce line length.
338	Control deviation of the piston position control of the VPCB-Valve is too high.	Control deviation of the piston position control of the VPCB-Valve is too high.	- Valve may be stuck - Check friction of the valve - Use filtered compressed air
339	High voltage at the VPCB-Valve › 28 Volt.	High voltage at the VPCB-Valve › 28 Volt.	- Supply voltage is too high → reduce voltage levels.
340	Control deviation of the pressure control of the VPCB-Valve is too high.	Control deviation of the pressure control of the VPCB-Valve is too high.	- Locking valves are closed while the pressure control is active → Check wiring - Filter parameters are incorrectly set → Check commissioning step "Pressure Control" again. - The balancer is often charged alternately in succession
341	Temperature of the piston actuator coil of the VPCB-Valve › 100°C.	Temperature of the piston actuator coil of the VPCB-Valve › 100°C.	- Too high temperature at the coil. Valve is stuck or is operated at too high temperatures.
342	Error in the CAN-Communication of the VPCB-Valve.	Error in the CAN-Communication of the VPCB-Valve.	- CAN connection erroneous → Termination resistance at CECC-D-BA not activated, false wiring, shield not connected properly - VPCB and control are not grounded → connect grounding connections - Ensure EMC-appropriate wiring
343	Error in the supply pressure of the VPCB-Valve.	Error in the supply pressure of the VPCB-Valve.	- No supply pressure. - Locking valves are closed while the pressure control is active → Check wiring

Error ID	Error message	Error description	Possible causes
344	Timeout of the Balancer-Controller (Watchdog of the VPCB-Valve).	Watchdog of the VPCB valve has struck. The time gap between two CAN messages was too great.	- Check CAN connection. - Overload of the balance controller
345	Error in the E2PROM of the VPCB-Valve.	Error in the E2PROM of the VPCB-Valve.	- Internal error of the VPCB valve. Restart. - If the error persists → Exchange
346	Control-Interrupt-Structure of the VPCB-Valve could not be activated.	Control-Interrupt-Structure of the VPCB-Valve could not be activated.	- Internal error of the VPCB valve. Restart. - If the error persists → Exchange
363	Hardware-circuitry of the actuator of the VPCB-Valve is defective.	Hardware-circuitry of the actuator of the VPCB-Valve is defective.	- Internal error of the VPCB valve. Restart. - If the error persists → Exchange
364	Error in the external displacement encoder connected to the VPCB-Valve.	Error in the external displacement encoder connected to the VPCB-Valve.	- Check the connection between the displacement sensor and the VPCB valve
366	Maximum Velocity exceeded (VPCB-Valve).	Parameterized critical speed limit was exceeded. Monitoring by the VPCB valve.	- Jerky movement by the operator. - In load-guided mode, the workpiece was pulled too hard. - Load was detached abruptly. - In position-hold mode the load has gotten stuck at a pinch-point and has detached abruptly. - Other error.

Table 7.15: Error table proportional control valve

A.2.8 Safety relay

Error ID	Error message	Error description	Possible causes
368	Maximum velocity exceeded (Safety Speed-Monitor).	Parameterized critical speed limit was exceeded. Monitoring by the safety relay.	- Jerky movement by the operator. - In load-guided mode, the workpiece was pulled too hard. - Load was detached abruptly. - In position-hold mode the load has gotten stuck at a pinch-point and has detached abruptly. - Other error.
369	Other Error: Encoder error, Reset Error (Safety Speed-Monitor).	Other error at the safety relay.	- Check the error display on the safety relay. - Possible error causes: - Operation enable switch in middle position, no signal on the inputs Y31-34 - Position measuring system connected incorrectly Further information: see Application Note - SSC / SLS PLd.

Error ID	Error message	Error description	Possible causes
370	Wrong maximum velocity parameterized (Safety Speed-Monitor).	Wrong maximum velocity parameterized (Safety Speed-Monitor).	- Safety relay reports error, although the speed is still within the parameterized control range → Check parameterized limits: either change setpoint speed under "Hardware configuration" or check the speed limit of the safety relay.

Table 7.16: Error table safety relay

A.2.9 Controller

Error ID	Error message	Error description	Possible causes
378	Error on one of the outputs (possible short circuit/cross circuit).	Error on one of the outputs (possible short circuit/cross circuit).	- Short circuit / cross-circuit at one of the outputs - Overload of the outputs
379	Low voltage at the power supply (clamp X1) of the CECC.	Low voltage at the power supply (clamp X1) of the CECC.	- Power supply set too low - Power supply designed too small - Too many consumers on a power supply - Cable cross-section too small, cables too long
380	Missing load voltage supply (clamp X5) at the CECC.	Missing load voltage supply (clamp X5) at the CECC.	- Missing load voltage supply - Emergency stop pressed

Table 7.17: Error table controller

A.2.10 Handle

Error ID	Error message	Error description	Possible causes
385	Handle is under pressure, while resting in middle position. Maybe leakage is appearing.	If the operation enable or the handle active input are not set, it is checked if there is no pressure on the handle. If there is pressure this could indicate leakage.	- Handle was deflected from the middle position while the operation was not enabled. - There is leakage between the handle and the valve. Check the connections and seals. - Hysteresis of the handle parameterized too small.

Table 7.18: Error table handle

A.2.11 Info messages (only if PLC-log level Info)

Info ID	Info message	Info description
768	Info: CAN Initialisation done.	Info message is generated after the CAN is successfully initialized after power-on.
769	Info: Configuration file has been loaded.	Info message is generated after the configuration is loaded.
770	Info: Initialisation successfully finished. System is ready.	Info message is generated after initialization is complete.

Table 7.19: Info messages initialisation

Info ID	Info message	Info description
771	Info: Test of the safety valve successfully finished during first start.	Info message is generated when the closing valves are successfully tested after the first startup.
772	Info: Homing successfully finished during first start.	Info message is generated when the homing has been successfully performed after first startup.
773	Info: Switched to load-guided mode.	Info message is generated each time the system is switched to load-guided mode.
774	Info: Switched to position-hold mode.	Info message is generated each time the system is switched to position hold mode.
775	Info: Exhaust function activated.	Info message is generated each time the exhaust function is used.

Table 7.20: Info messages state machine

Info ID	Info message	Info description
784	Info: Hardware configuration is done (Commissioning).	Info message is generated when the hardware configuration has been completed during commissioning.
785	Info: Safety monitor configuration is done (Commissioning).	Info message is generated when the safety switching device has been configured during commissioning.
786	Info: Pressure control configuration is done (Commissioning).	Info message is generated when the pressure control has been configured during commissioning.
787	Info: Position control configuration is done (Commissioning).	Info message is generated when the position control has been configured during commissioning.
788	Info: Limits configuration is done (Commissioning).	Info message is generated when the software limits have been configured during commissioning.
789	Info: Safety valve test is done (Commissioning).	Info message is generated when the closing valves have been tested during commissioning.

Table 7.21: Info messages commissioning