Application
"Opening of the protective door regarding PA-CONTROL with servoTEC S2 axes"

Short Version: The process
- Stopping the machine process
- Opening the protective doors
- Manual manipulation by operating staff
- Closing the protective door again
- Restarting the machine process

refers to the deactivation and activation of the axes. This process is not a task with a high degree of difficulty.

However, it is more difficult to make a decision on how the axes can or may be moved on after being switched off.

To solve this task, there are axis parameters, system-R-register, system markers and commands in the PA-CONTROL for which sensible application is discussed in this application document.

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6 Example 2-axis loading system (horizontal and vertical axis)

6.1 Axis parameters for "2-axis loading system (horizontal and vertical axis)"

6.2 Programme for "2-axis loading system (horizontal and vertical axis)"

6.2.1 Explanation of the programme
# 1 Modifications

Document modifications and life cycle

<table>
<thead>
<tr>
<th>Document Code</th>
<th>Date</th>
<th>Generation and modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>APP5016_EN_1117813_PAC_OpeningProtectiveDoor_servoTEC_S2_R1a.doc</td>
<td>October 2013</td>
<td>Release of the English document. Translation of the original German document: APP5016_DE_1076280_PAC_OeffnenDerSchutzue_ServoTEC_S2_R1_c.doc</td>
</tr>
</tbody>
</table>

...
2 Preface

During the process "Stop machine process - open protective door - manual action by operating staff - close protective door again - restart machine process", deactivating and activating the axes is the task with the lower difficulty. However, it is much more difficult to make a decision on how the axes are to be moved on again once they were moved in the deactivated condition. To solve this task, the PA-CONTROL axis parameter, system-R-register, system markers and commands.

<table>
<thead>
<tr>
<th>Axis parameters</th>
<th>System-R-Register (SR)</th>
<th>System-Marker (SM)</th>
<th>Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Release mode</td>
<td>▪ SR51 – SR66 : Position at axis IDLE/SAFE switching</td>
<td>▪ SM191 – SM206 : Axis was moved too much in the IDLE/SAFE condition</td>
<td>▪ ABORT.An</td>
</tr>
<tr>
<td>▪ Activation method</td>
<td>▪ SR71 – SR86 : Target position of the axis</td>
<td></td>
<td>▪ OFF.An / ON.An</td>
</tr>
<tr>
<td>▪ Maximum position deviation</td>
<td></td>
<td></td>
<td>▪ STOP.An / START.An</td>
</tr>
<tr>
<td>▪ Group assignment when the axis is moved</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When deactivating and activating the axis, two general possibilities are differentiated:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis standing</td>
<td>- The axis is deactivated (IDLE/SAFE).</td>
</tr>
<tr>
<td>Condition</td>
<td>- After activation, the axis is returned to its old position (if moved).</td>
</tr>
<tr>
<td>OPERATIONAL</td>
<td></td>
</tr>
<tr>
<td>Axis running</td>
<td>- The axis is stopped (HALT) and then switched off (IDLE/SAFE).</td>
</tr>
<tr>
<td>Condition</td>
<td>- After deactivation, the interrupted running command is continued.</td>
</tr>
<tr>
<td>ACTIVE</td>
<td></td>
</tr>
</tbody>
</table>

Use the axis parameters "Activation movement mode" to set the described manner of work (on this, see chapter Axis parameters activation movement mode, page 7).
### 2.1 Axis parameters activation movement mode

<table>
<thead>
<tr>
<th>Value</th>
<th>Description of the mode</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The axis stops and is not moved, even if it was moved or a running command was interrupted.</td>
<td>In this mode, you have to run the application programme, correct the position and/or continue the running command (see example: Deactivation of axes by the operating system, page 9 by a command).</td>
</tr>
<tr>
<td>1</td>
<td>(DEFAULT) A running command that was interrupted by the function &quot;STOP&quot; is continued. Otherwise, the axis stops where it just is and the current position is assumed.</td>
<td>If opening of the protective door is permitted only at the pre-defined positions in the sequence (release of the door lock) where the axis positions are uncritical (waiting position), this mode is a version that can be handled simply.</td>
</tr>
<tr>
<td>2</td>
<td>The operating system runs the axis to the position in which the axis was located before it was switched to the condition &quot;IDLE / SAFE&quot;. A running command that was interrupted by the function &quot;OFF AXIS&quot; is continued.</td>
<td>If opening of the protective door is permitted only at the pre-defined positions in the sequence (release of the door lock) where the axis positions are uncritical (waiting position), this mode is a version that can be handled simply.</td>
</tr>
<tr>
<td>3</td>
<td>The operating system checks if the axis was moved in the status &quot;IDLE / SAFE&quot;. If the difference exceeds the specification of the axis parameter &quot;Maximum position deviation&quot;, the system error (E582) is generated. Otherwise, the axis is moved to the position before switching to status &quot;IDLE / SAFE&quot; or the interrupted running operation is continued.</td>
<td>The protective door may be opened at any time of the machine process. The axis parameter &quot;Maximum position deviation&quot; can or may determine a threshold by how much the axis may be moved in the condition IDLE/SAFE without this having any negative effect on the further machine sequence. If this prerequisite is present, the axes can be deactivated and activated with very little effort by the operating system (release mode) of the inputs. If an axis was moved too far in the condition IDLE/SAFE, the system error E582 is generated and AUTOMATIC mode of the PA-CONTROL must be left.</td>
</tr>
</tbody>
</table>
Continuation table axis parameter activation movement mode

<table>
<thead>
<tr>
<th>Value</th>
<th>Description of the mode</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The operating system checks if the axis was moved in the status &quot;IDLE / SAFE&quot;. If the difference exceeds the specification of the &quot;maximum position deviation&quot;, the system marker (SM191, SM192, ... ) is set. Otherwise, the axis is moved to the position before switching to status &quot;IDLE / SAFE&quot; or the interrupted running operation is continued. If the system marker assigned to the axis is set, the axis cannot be moved and a system error is generated. If this option was selected, the system marker must be requested in the application (LD SM191, G21 SM191, ... ). The system marker is reset in these queries.</td>
<td>The protective door may be opened at any time of the machine process. The axis parameter &quot;Maximum position deviation&quot; can or may determine a threshold by how much the axis may be moved in the condition IDLE/SAFE without this having any negative effect on the further machine sequence. If this prerequisite is present, the axes can be deactivated and activated with very little effort by the operating system (release mode) of the inputs. If an axis was moved too far in the condition IDLE/SAFE, the corresponding system marker (SM191, ... ) is set and the axis is not moved. Now corrective measures can be activated in the application programme and then the machine sequence can be continued.</td>
</tr>
</tbody>
</table>
3 Deactivation of axes by the operating system

3.1 Setup

See Figure 1, page 10.

- PA-CONTROL with 2 servoTEC-axes (axis 1 and axis 2)
- Protective enclosure of the entire plant with a protective door
- Operating elements:
  - Main switch (supply)
  - ON, OFF, EMERGENCY OFF for power supply to the drives (servoTEC)
  - PA-CONTROL "START" "STOP" via the front panel of the PA-CONTROL or (optional) via the button "external start" and "external stop".

3.2 Functions

3.2.1 Open protective door (protective door is to be opened)

AUTOMATIC operation of the PA-CONTROL is stopped (STOP button / button external STOP). This means that the current positionings are stopped and lead to a HALT condition. Then the axes are deactivated and the condition switches to IDLE. Use the axis parameter "PUT-SAFE" to activate the personally safe restart lock (KSI+/−) in the servoTEC-amplifier via the outputs 4 and 5. It then bridges the door switches with the contacts "KSO". From the point of view of the axes, the work space is safe and the door can be opened.

Before continuing via the function "Start-after stop" in AUTOMATIC mode, the protective door must be closed again first.

3.2.2 EMERGENCY OFF

In the EMERGENCY STOP case, the axes are switched off via the input I4 (HALT → IDLE → SAFE) and the mains supply (400VAC) of the drives must be deactivated with a time delay of 0.5 seconds via K2.

If the axes are to be activated again after EMERGENCY STOP, this should be done via input I1.
3.3  Wiring principle of the application "Deactivation of axes by the operating system"

Figure 1: PA-CONTROL with 2 servoTEC-axes, setting of the parameters for "Deactivating the axes by the operating system"
3.3.1 System parameters

External start, input no. = 1

External stop, input no. = 2
3.3.2 Axis parameters

Release mode = 4

The axis is switched into the condition OPERATIONAL when switching to the operating mode "AUTOMATIC", at STOP and when leaving the operating mode AUTOMATIC, the axis is switched back to the condition IDLE/SAFE.

If START is activated again after STOP (START-after-STOP), the axis is first switched back to the condition OPERATIONAL or ACTIVE before the programmes can be processed further.

When leaving the operating mode AUTOMATIC, the axis is always switched to the condition IDLE/SAFE.

Activation mode = 3

The operating system verifies whether the axis was moved in the condition IDLE/SAFE. If the difference is larger than specified in the axis parameter "Maximum position deviation (100 mm, see below), the system error (E582) is generated.

Otherwise, the axis is moved to the position before switching to status "IDLER / SAFE" or the interrupted running operation is continued.

Maximum position deviation = 100,000
OFF axis input no. = 4

In the "EMERGENCY STOP CASE", the input I4 switches the axis into the condition IDLE/SAFE.
(Axis 2: OFF axis input no. = 4, same input)

ON axis input no. = 1

After an EMERGENCY STOP case, the axis can be switched back to OPERATIONAL or ACTIVE via input I1 (axis 2: ON axis input no. = 1, same input)

Axis PUT-SAFE = 4

In this case, the output O4 is used to activate the option AS (personally safe restart lock) at the servoTEC-amplifier.
For axis 2, a different output must be used, e.g. O5
If a drive amplifier has no AS function and instead the power supply must be deactivated, the parameter Axis-PUT-SAFE = 0 is set

OFF axis delay time = 100

When deactivating the axis, there will be a 100 ms waiting time before the axis is actually deactivated. This waiting time is to cause the kinetic energy of the axis to be consumed when the axis is deactivated during a run.
This delay time must be considered if the power supply is deactivated.

ON axis delay time = 300

This delay time is inserted when activating the axis. This is to achieve the interim circuit voltage in full.
3.4 Notes on the function and generation of the PA-CONTROL programme (application programme)

The application programme does not require any programme parts to deactivate and activate the axis. The settings "Release mode = 4" and "Activation movement mode = 3" executes all functions of the operating system.

If the protective door is to be opened, AUTOMATIC operation of the PA-CONTROL is stopped (external STOP-input, ...). and the axes are deactivated (SAFE). If the axes have reached the condition SAFE, the protective door can be opened.

In case of EMERGENCY STOP, the setting of the axis parameter "OFF axis = 4" (input 4) is deactivated and then (K2 drop-delayed) the mains supply is deactivated with a delay. This setting leads to the axis being stopped targeted in case of EMERGENCY OFF and does not run out uncontrolled.

When the EMERGENCY STOP has been removed, the setting of the axis parameter "ON axis = 1" (input 1) can be activated again by pushing the "external START button".
4 Deactivation of axes through the input

See Figure 2, page 16.

4.1 Setup

- PA-CONTROL with 2 servoTEC-axes (axis 1 and axis 2)
- Protective enclosure of the entire plant with a protective door
- Operating elements:
  - Main switch (supply)
  - ON, OFF, EMERGENCY OFF for power supply to the drives (servoTEC)
  - PA-CONTROL "START" "STOP" via the front panel of the PA-CONTROL or (optional) via the button "external start" and "external stop"
  - Switch "Axis ON"

4.2 Functions

4.2.1 Open protective door (protective door is to be opened)

The switch "Axis ON" is opened (input I4 = 0 → axes IDLE/SAFE). First, the current positionings are stopped (HALT). Then the axes are deactivated (IDLE). Use the axis parameter "PUT-SAFE" to activate the personally safe restart lock (KSI+/−) in the servoTEC-amplifier via the outputs O4 and O5. It then bridges the door switches with the contacts "KSO". From the point of view of the axes, the work space is safe and the door can be opened (SAFE).

Before continuing via the function "Start-after stop" in AUTOMATIC mode, the protective door must be closed again first.

4.2.2 EMERGENCY OFF

In the EMERGENCY STOP case, the axes are switched off via the input I4 (IDLE/SAFE) and the mains supply (400VAC) of the drives must be deactivated with a time delay of 0.5 seconds via K2.
4.3 Wiring principle of the application "Deactivation of axes by an input"

Figure 2: PA-CONTROL with 2 servoTEC-axes, setting of the parameters for "Deactivating the axes by an input"
4.4 Setting the parameters for "Deactivation of axes by an input"

4.4.1 System parameters

External start, input no. = 1
This setting is optional and not required for the function activate/deactivate axes.

External stop, input no. = 2
This setting is optional and not required for the function activate/deactivate axes.
4.4.2 Axis parameters

Release mode = 2

The axis is activated and deactivated in AUTOMATIC operation depending on the inputs OFF axis and ON axis (axis 1 = input I4, axis 5 = inputs I5) (OPERATIONAL/ACTIVE, IDLE/SAFE). When leaving the AUTOMATIC operation, the axis is deactivated at all times (IDLE/SAFE).

Activation mode = 3

The operating system verifies whether the axis was moved in the condition IDLE/SAFE. If the difference is larger than specified in the axis parameter "Maximum position deviation (100 mm, see below), the system error (E582) is generated.

Otherwise, the axis is moved to the position before switching to status "IDLE / SAFE" or the interrupted running operation is continued.

Maximum position deviation = 100
**OFF axis input no. = 4**

When the input I4 is not live, the axis is deactivated (IDLE/SAFE) in AUTOMATIC mode.

**ON axis input no. = 4**

When the input I4 is not live, the axis is activated (OPERATIONAL/ACTIVE) in AUTOMATIC mode.

**OFF axis delay time = 100**

When deactivating the axis, there will be a 100 msec waiting time before the axis is actually deactivated. This waiting time is to cause the kinetic energy of the axis to be consumed when the axis is deactivated during a run.

This delay time must be considered if the power supply is deactivated.

**ON-axis delay time = 300**

This delay time is inserted when activating the axis. This is to achieve the interim circuit voltage in full.

**Axis PUT-SAFE = 4**

In this case, the output 4 (O4) activates the option AS (personally secure restart lock) at the servoTEC-amplifier. For axis 2, a different output, e.g. O5, must be used.

If a drive amplifier has no AS function and instead the power supply must be deactivated, the parameter **axis PUT-SAFE = 0** is set.
4.5 Notes on generation of the PA-CONTROL programmes for "Axis deactivation through an input"

The application programme does not require any programme parts to deactivate and activate the axis. The settings axis parameter "Release mode = 2", "Activation movement mode = 3", "OFF axis = 4", "ON axis = 4" and "PUT-SAFE = 4 (5)" executes all functions of the operating system.

When switching the PA-CONTROL to the operating mode "AUTOMATIC operation", the axes are not activated yet. Only when the PA-CONTROL is in the operating mode AUTOMATIC, the axis is activated according to the input I4.

In case of EMERGENCY STOP, the setting of the axis parameter "OFF axis = 4" (input I4) is deactivated and then (K2 drop-delayed) the mains supply is deactivated with a delay. This setting leads to the axis being stopped targeted in case of EMERGENCY OFF and does not run out slowly.

When the EMERGENCY STOP has been removed, the setting of the axis parameter "ON axis = 4" (input 4) can be activated again by pushing the switch Axis On.
5 Deactivation of axes through a command

See Figure 3, page 23.

5.1 Setup

- PA-CONTROL with 2 servoTEC-axes (axis 1 and axis 2)
- Protective enclosure of the entire plant with a protective door
- Operating elements:
  - Main switch (supply)
  - ON, OFF, EMERGENCY OFF for power supply to the drives (servoTEC)
  - PA-CONTROL "START" "STOP" via the front panel of the PA-CONTROL or (optional) via the button "external start" and "external stop".
5.2 Functions

5.2.1 Open protective door (protective door is to be opened)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$WAIT_UNTIL_ON I3.1 G21 I4.0 WAIT_UNTIL_ON ON.A1 ON.A2 ; $WAIT_UNTIL_OFF G21 I3.0 SWITCH_OFF G21 I4.0 SWITCH_OFF JMP WAIT_UNTIL_OFF ; $SWITCH_OFF OFF.A1 OFF.A2 JMP WAIT_UNTIL_ON</td>
<td>In AUTOMATIC operation, a parallel programme that monitors input 3 is running. If the input is not live, the commands &quot;OFF.A1&quot; and &quot;OFF.A2&quot; switch off the axes (IDLE/SAFE). These commands lead to the current positioning being stopped first and the axes then being deactivated (IDLE). Use the axis parameter &quot;PUT-SAFE&quot; to activate the personally safe restart lock (KSI+/-) in the servoTEC-amplifier via the outputs 4 and 5. It then bridges the door switches with the contacts &quot;KSO&quot;. From the point of view of the axes, the work space is safe and the door can be opened (SAFE).</td>
</tr>
</tbody>
</table>

5.2.2 EMERGENCY OFF

In the EMERGENCY STOP case, the axes are switched off via the input I4 and the mains supply (400VAC) of the drives must be deactivated with a time delay of 0.5 seconds via K2. If the axes are to be activated again after EMERGENCY STOP, this should be done through a programme part via O1/I5.
5.3 Wiring principle of the application "Deactivation of axes by a command"

Figure 3: PA-CONTROL with 2 servoTEC-axes, setting of the parameters for "Deactivating the axes by a command"
5.4 Setting the parameters for system parameter "Deactivation of axes by a command"

External start, input no. = 1
This setting is optional and not required for the function activate/deactivate axes.

External stop, input no. = 2
This setting is optional and not required for the function activate/deactivate axes.
5.5 Axis parameters

**Release mode = 2**

The axis is switched on and off in AUTOMATIC mode by the commands ON.A1 and OFF.A1.

The axis is always deactivated when leaving AUTOMATIC mode.

**Activation mode = 3**

The operating system verifies whether the axis was moved in the condition IDLE/SAFE. If the difference is larger than specified in the axis parameter "Maximum position deviation (100 mm, see below), the system error (E582) is generated. Otherwise, the axis is moved to the position before switching to status "IDLE / SAFE" or the interrupted running operation is continued.

**Maximum position deviation = 100**
OFF axis input no. = 4

In the "EMERGENCY STOP CASE", the input I4 switches the axis into the condition (IDLE/SAFE).
(Axis 2: OFF axis input no. = 4, same input)

ON axis input no. = 5

After EMERGENCY STOP, the axis can be switched on again (OPERATIONAL/ACTIVE) via input I5
(Axis 2: ON axis input no. = 5, same input)

OFF axis delay time = 100

When deactivating the axis, there will be a 100 msec waiting time before the axis is actually deactivated. This waiting time is to cause the kinetic energy of the axis to be consumed when the axis is deactivated during a run.

This delay time must be considered if the power supply is deactivated.

ON axis delay time = 300

This delay time is inserted when activating the axis. This is to achieve the interim circuit voltage in full.

Axis-PUT-SAFE = 4

In this case, the output 4 (O4) is used to activate the option AS (personally safe restart lock) at the servoTEC amplifier. For axis 2, another output must be used, e.g. O5.

If a drive amplifier has no AS function and instead the power supply must be deactivated, the parameter axis PUT-SAFE = 0 is set...
6 Example 2-axis loading system (horizontal and vertical axis)

The electro-mechanical setup corresponding to the chapter 3.3 "Deactivation of axes by the operating system", page 10.

The protective door can be opened at any part of the process if the operating mode AUTOMATIC was stopped first.

If the protective door is now opened during lowering of axis 2, axis 1 is to be returned to the "old position" when the protective door is closed again. Continuation is only permitted when axis 2 is lowered.

Implementation of this requirement is explained below.

| 1.0 | 07.10.06 | Bg | Software generation
|---|---|---|---
| • Use axis 1 to move to position via "Collect part"
| • Open gripper
| • Lower axis 2
| • Part gripping and axis 2 upwards
| • Use axis 1 to move to position via "Deposit part"
| • Lower axis 2
| • Open gripper and axis 2 up

Example 2-axis loading system (horizontal and vertical axis)
6.1Axis parameters for "2-axis loading system (horizontal and vertical axis)"

<table>
<thead>
<tr>
<th>Axis parameter</th>
<th>Travers Parameters</th>
<th>Limit-switch / Homing</th>
<th>Axes/01</th>
<th>Motor</th>
<th>Gantry</th>
<th>Load cell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axis - 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release mode:</td>
<td>(4) with change to a motion mode and start/stop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn on advance mode:</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max position deviation:</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group number, if axis is moved:</td>
<td>Group 1: SM207</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronisation on encoder:</td>
<td>Activate brake in the state IDLE / SAFE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get position from encoder:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit:</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gear Factor:</td>
<td>100.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range (min):</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range (max):</td>
<td>100.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Release mode = (4) When changing to a movement mode and start/stop
Activation mode = 4
Maximum position deviation= 0.5
Group assignment when the axis is moved = group 1 SM207

<table>
<thead>
<tr>
<th>Axis parameter</th>
<th>Travers Parameters</th>
<th>Limit-switch / Homing</th>
<th>Axes/01</th>
<th>Motor</th>
<th>Gantry</th>
<th>Load cell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axis - 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release mode:</td>
<td>(4) with change to a motion mode and start/stop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn on advance mode:</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max position deviation:</td>
<td>100.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group number, if axis is moved:</td>
<td>Group 1: SM207</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronisation on encoder:</td>
<td>Activate brake in the state IDLE / SAFE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get position from encoder:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit:</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gear Factor:</td>
<td>100.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range (min):</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travers Range (max):</td>
<td>100.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Release mode = (4) When changing to a movement mode and start/stop
Activation mode = 4
Maximum position deviation = 100
Group assignment when the axis is moved = group 1 SM207
### Axis - 1

<table>
<thead>
<tr>
<th>Axis I/O with digital inputs / outputs</th>
<th>Input No.</th>
<th>Delay time [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP AXIS</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>START AXIS</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>OFF AXIS</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>ON AXIS</td>
<td>1</td>
<td>300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Axis I/O with digital inputs / outputs</th>
<th>Output No.</th>
<th>Delay time [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>IDLE / SAFE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AXIS PUT SAFE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### Axis - 2

<table>
<thead>
<tr>
<th>Axis I/O with digital inputs / outputs</th>
<th>Input No.</th>
<th>Delay time [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP AXIS</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>START AXIS</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>OFF AXIS</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>ON AXIS</td>
<td>1</td>
<td>300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Axis I/O with digital inputs / outputs</th>
<th>Output No.</th>
<th>Delay time [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>IDLE / SAFE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AXIS PUT SAFE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
6.2 Programme for "2-axis loading system (horizontal and vertical axis)"

Figure 4: Programme for "2-axis loading system (horizontal and vertical axis)"
### 6.2.1 Explanation of the programme

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$GetPiece</td>
<td>Axis 1 moves to the position for collection of the part with the command “A1:=10”. Afterwards the gripper will be lowered with the command “A2:=40”.</td>
</tr>
<tr>
<td>ABORT.A1 ABORT.A2 A1:=10 ; move to position for get $GetWaitInPos</td>
<td>If the protective door will be opened during the gripper is lowering and if the axis 1 was displaced/moved more than the “maximum position deviation” allows, the SM191 and the associated group marker 1 SM207 are set when activating the axis (see axis parameters 1 and 2, group assignment when axis is moved = group 1 SM207).</td>
</tr>
<tr>
<td>G21 SM191.1 GetPiece</td>
<td>Because the marker “axis was moved” is set and the “activation movement mode (release mode) = 4”, both axes are not corrected by the operating system and will be moved on after activation. The both axes are locked for further operating commands.</td>
</tr>
<tr>
<td>G21 SM192.1 GetPiece</td>
<td>Because of the query “G21 SM191.1 GetPiece” in the loop, the program recognizes this condition and jumps to marker “$GetPiece”.</td>
</tr>
<tr>
<td>G211.A1.0 GetWaitInPos A2:=40 ; gripper down $GetWaitForDown</td>
<td>Because of the command “ABORT.A1” the current position will be taken as actual position and the axis 1 switches to the condition “OPERATIONAL”.</td>
</tr>
<tr>
<td>G21 SM191.1 GetPiece</td>
<td>Because of the command “ABORT.A2” the stopped operating command “A2:=40” will be aborted, the current position will be assumed as actual position and the axis 2 switches to the condition “OPERATIONAL”.</td>
</tr>
<tr>
<td>G21 SM192.1 GetPiece</td>
<td>Afterwards the position for collecting the piece will be driven to with the command “A1:=10” first.</td>
</tr>
<tr>
<td>G211.A2.0 GetWaitForDown SUB GripperClose $GetGripperUp</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>END</td>
<td></td>
</tr>
</tbody>
</table>