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COSYLAB

Stepper Motor Control

Test Plan

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Document History

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0.1	2012-06-11	gjansa		Created.
1.0	2013-07-08	gjansa		Updated and released.
1.1	2013-11-14	gjansa	4.6	Updated.

Confidentiality

This document is classified as a public document. As such, it or parts thereof are openly accessible to anyone listed in the Audience section, either in electronic or in any other form.

Scope

This is test plan for stepper motor control software.

Audience

All users of stepper motor control software.

Table of Contents

Figures

No table of figures entries found.

Tables

References

[1] M.Levicnik et al, M-Box with PDC Motion Control - implementation, 4.1

[2] G. Gaspersic et al., Stepper Motor Control – Local control, 1.0

[3] G. Jansa, Stepper Motor Control – System Design, 1.0

[4] G. Jansa, Stepper Motor Control – Installation and Configuration, 1.0

[5] V. Juvan et al., Stepper Motor Control – LCD, 1.0

1. Introduction

1.1. Overview

This document is test plan for motion control front-end software to be used in FAIR project. MicroIOC-M-Box-PMAC, which is microIOC- based product and hosts powerful PMAC motor controller, is used as front-end controller and Power Drive Case (PDC) is used as power stage [1].

The following software components are tested:

- OS boot sequence
- System mode management
- FESA device classes
- Local control GUI
- System driver
- Local panel LCD

2. Test Environment

2.1. Hardware

All tests in this document are performed on the GSI premises with the test setup described in the table below.

Table 2-1: List of hardware in the test environment

ID	Hardware item
mbox	M-Box, motor controller, Serial number: _____ IP: ___.___.___.___
pdc	PDC, power drive case, Serial number: _____
userPC	User PC or laptop used to run local control GUI and FESA test client program. Running linux.
slit	Test slit (pair of motors)

2.2. Software

Table 2-2: List of software in the test environment

Software component	Version	Where installed
Motion FESA classes		M-Box
Motion system driver		M-Box
Local control GUI		userPC
Local control server		M-Box
Shared memory monitor		M-Box
PMAC software		M-Box

3. Common Test Cases

3.1. Boot sequence [TP-COM-001]

This test case verifies that system can boot either from local flash card or from net boot. Specifically it tests that:

- Default boot is via net boot
- If local flash card is inserted, boot from the local flash card is performed only if user confirms the boot from local flash card

Pre-requisites

1. Test environment to use: see section Test Environment
2. Flash card is inserted into the M-Box
3. Monitor and keyboard connected to the M-Box.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Reboot the M-Box by using power switch on the rear side and observe the boot sequence. When asked if boot from flash card do nothing.	Boot continues to boot over net and login console is displayed.		
2.	When booting completes reboot the M-Box by using power switch on the rear side and observe the boot sequence. Confirm the selection to boot from flash card.	Boot from flash card is performed and login console is displayed.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Comment:

Cleanup after test

N/A

3.2. Reboot [TP-COM-002]

Description

This test case verifies that system is operational upon reboot. That means that:

- All required services on M-Box are running upon reboot, these are:
  - local control server
  - shared memory monitor
  - FESA classes
- Motors can be manipulated from all sources (local control, local LCD panel, FESA classes) respecting the access control rules (the test case Access control [TP-COM-003])

Pre-requisites

1. Test environment to use: see section Test Environment

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Reboot the M-Box by using power switch on the rear side.	M-Box reboots and all services (local control server, shared memory monitor, FESA classes) are running. Local control GUI is connected to local control server. FESA test tool connects to FESA classes.		

Test result: ☐ Not tested ☐ Passed ☐ Failed

Comment:

Cleanup after test

N/A

3.3. Access control [TP-COM-003]

Description

This test case tests the following:

- Read only access is possible from all 'users' of the system regardless of the system mode. Exception is local LCD which is always in the root menu when mode is not lcd control.

- That system prevents motor control from FESA class if system mode is in local control, local configuration or lcd control mode.
- That system prevents motor control from local control GUI if system mode is remote control or LCD control.
- That system allows motor configuration from local GUI only when system mode is local configuration.
- That motors can be controlled from local LCD only when system mode is LCD control.
- That the system mode falls back to remote control if system is in local control or LCD control mode and not used for certain amount of time.
- That the system does NOT fall back to remote control if system is in local configuration mode and not used for certain amount of time.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002]

Test procedure

Check all possible combinations of system mode and verify that the access is granted/ prevented as shown on the table below. In the table below M mean motor manipulation, C mean motor configuration, R mean reading of values.

Step	System mode	Local control GUI	FESA class	local LCD panel	Observation /Comments	Pass /Fail /Skip
1.	Local control	M: Yes C: No R: Yes	M: No C: No R: Yes	M: No C: No R: Yes		
2.	Local configuration	M: Yes C: Yes R: Yes	M: No C: No R: Yes	M: No C: No R: Yes		
3.	Remote control	M: No C: No R: Yes	M: Yes C: No R: Yes	M: No C: No R: Yes		
4.	LCD control	M: No C: No R: Yes	M: No C: No R: Yes	M: Yes C: No R: Yes		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Switch system mode to local control by using local control GUI. Do not use local control GUI for certain amount of time in order to allow system to fallback to remote control. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for more information.	System mode falls back to remote control after the certain amount of time has passed. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for more information		
2.	Switch system mode to LCD control control by using local LCD panel. Do not use local LCD panel for certain amount of time in order to allow system to fallback to remote control. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for more information.	System mode falls back to remote control after the certain amount of time has passed. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for more information		
3.	Switch system mode to local configuration by using local control GUI. Do not use local control GUI for certain amount of time in order to allow system to fallback to remote control if it would be in the local control mode. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for	System mode does not fall back to remote control after the certain amount of time has passed. The timeout for fallback is defined in the configuration file of the shared memory monitor service. Default value is 5 minutes. Consult [4] for more information		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	more information.			

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4. Local Control Test Cases

4.1. Connection to M-Box [TP-LC-001]

Description

This test case tests that the local control can connect to M-Boxes as they are defined in the configuration file. It also tests that problem during connection are properly handled.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003]

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Try to connect to M-Box (IP/hostname of the M-Box is defined in the Test Environment section) by using local control GUI. On the main tab press Connect button. If the IP/hostname of the M-Box does not exist in the dropdown menu add it by using Add M-Box button. See [2] for more information.	Local control GUI connects to the M-Box. Console on the bottom of the local control GUI displays message that local control GUI is connected to the M-Box.		
2.	If connected to M-Box with local control GUI then first disconnect by pressing Disconnect button on the main tab. Use telnet program to connect to the M-Box (IP/hostname of the M-Box is defined in the Test Environment). Try to connect to M-Box (IP/hostname of the M-Box is defined in the Test Environment) by using local control GUI. On the main tab press Connect button. If the IP/hostname of the M-Box does not exist in the dropdown menu add it by using Add M-Box button. See [2]**Error! Reference source ot found.** for more information.	Local control GUI does not connect to the M-Box. Console on the bottom of the local control GUI displays error message saying that some other client is already connected. It also displays IP of this other client.		
3.	Switch off M-Box. Try to connect to M-Box (IP/hostname of the M-Box is defined in the Test Environment) by using local control GUI. On the main tab press Connect button. If the	Local control GUI does not connect to the M-Box. Console on the bottom of the local control GUI displays message that the connection timed out and is		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	IP/hostname of the M-Box does not exist in the dropdown menu add it by using Add M-Box button. See [2] for more information.	trying to reconnect to the M-Box.		
4.	Switch on M-Box and wait 90 seconds to allow M-Box to properly boot.	Local control GUI connects to the M-Box. Console on the bottom of the local control GUI displays message that local control GUI is connected to the M-Box.		
5.	Switch off M-Box and wait for 30 seconds.	Local control GUI will show that the connection to the M-Box was lost.		
6.	Switch on M-Box and wait for 90 seconds.	Local control GUI will reconnect to M-Box.		

Test result: ☐ Not tested ☐ Passed ☐ Failed

Comment:

Cleanup after test

4.2. System mode [TP-LC-002]

Description

This test case tests that the system mode can be changed and is correctly displayed from/on the local control GUI.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001]
3. Local control GUI connected to the local control server.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Switch the system mode to remote by using local control GUI.	System mode switches to remote.		
2.	Switch the system mode to local control by using local control GUI.	System mode switches to local control.		
3.	Switch the system mode to local configuration by using local control GUI.	System mode switch to local configuration.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.3. Display units [TP-LC-003]

Description

This test case tests that the displayed units can be either millimeters or counts.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001]
3. Local control GUI connected to the local control server.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Switch the units to mm by using local control GUI.	On the motor drive tab of the local control GUI confirm that all motor setpoints and readbacks (except raw potentiometer and SSI encoder values) are in mm.		
2.	Switch the units to counts by using local control GUI.	On the motor drive tab of the local control GUI confirm that all motor setpoints and readbacks (except raw potentiometer and SSI encoder values) are in counts. NOTE: To verify that value is correctly converted between counts and mm use Motor counts/mm parameter on motor setup tab.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

Switch the units to mm.

4.4. Motor coupling [TP-LC-004]

Description

This test case tests that the motors can be coupled/decoupled with local control GUI.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Local control GUI connected to the local control server and the system mode is local configuration.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that displayed motor coupling on the main tab of the local control GUI is the same as is defined in the motor properties file on the M-Box (for details on motor properties files see [4])	Displayed motor coupling on the main tab of the local control GUI is the same as is defined in the motor properties file on the M-Box.		
2.	On local control GUI couple all 8 motors.	All 8 motors are coupled into 4 motor pair. The motor drive tab shows motor pair controls and status. The motor setup tab shows motor pair setup.		
3.	Uncouple all 4 motor pairs.	All 8 motors are decoupled. The motor drive tab does not show motor pair controls and status. The motor setup tab does not show motor pair setup.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.5. Spinner step values [TP-LC-005]

Description

This test case tests that the step value for selected spinners can be modified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Local control GUI connected to the local control server and system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	On the main tab of the local control GUI set the following values for the spinner step sizes: Set position bit step: 1 Set position small step: 5 Set position large step: 10 Set relative movement step: 1 Set reset position step: 1 Set center step: 1 Set gap step: 1	On the motor drive tab of the local control server verify spinner step sizes by changing all of the relevant spinners.		
2.	On the main tab of the local control GUI set the following values for the spinner step sizes: Set position bit step: 0.5 Set position small step: 2.5 Set position large step: 5 Set relative movement step: 0.5 Set reset position step: 1 Set center step: 1.5 Set gap step: 2	On the motor drive tab of the local control server verify spinner step sizes by changing all of the relevant spinners.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.6. Motor configuration [TP-LC-006]

Description

This test case tests that all motor configuration parameters can be modified from local control GUI. For each configuration parameter recipe how to test it is given.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties

4. Local control GUI connected to the local control server and system mode is local configuration.

Test procedure

These test steps are written for first motor only.

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	On motor setup tab of local control GUI change the name of the first motor.	The name of the motor is changed. This name appears on the tab name of the motor setup and motor drive names. It is also changed on main tab where controls for coupling the motors are.		
2.	On motor setup tab of local control GUI set HW limits to be enabled for first motors.	HW limits readback shows that HW limits are enabled.		
3.	Manually press first inner HW end switch of first motor and then also the outer HW end switch. To verify that motor is stopped by HW switches drive the motor towards the manually pressed HW end switch.	Status of the HW end switches is displayed on motor drive tab of the local control GUI. If motor is driving towards the pressed switch it will stop the movement.		
4.	On motor setup tab of local control GUI set HW limits to be disabled for first motors.	HW limits readback shows that HW limits are disabled.		
5.	Manually press first inner HW end switch of first motor and then also the outer HW end switch.	Status of the HW end switches does not change.		
6.	On motor setup tab of local control GUI set HW limits to be enabled for first motors.	HW limits readback shows that HW limits are enabled.		
7.	On motor setup tab of local control GUI set high limit to be 100 mm.	High limit readback shows 100 mm.		
8.	Set the high limit to be less than current position of the motor but make sure that it is not the same value as low	Both inner HW and inner SW end limit status led are lit.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	limit.			
9.	Set the high limit back to 100.	High limit readback shows 100 mm.		
10.	On motor setup tab of local control GUI set Low limit to be -100 mm.	Low limit readback shows -100 mm.		
11.	Set the low limit to be more than current position of the motor but make sure that it is not the same value as high limit.	Both outer HW and outer SW end limit status led are lit.		
12.	Set the low limit back to -100.	Low limit readback shows -100 mm.		
13.	On motor setup tab of local control GUI set drive direction to be anticlockwise.	Drive direction changes to anticlockwise.		
14.	Move the motor towards the inner end switch. Observe the direction of movement of the motor.	The motor is turning anticlockwise.		
15.	On motor setup tab of local control GUI set drive direction to be clockwise.	Drive direction changes to clockwise.		
16.	NOTE: Dangerous! Be careful to be far away from the end switches as in this configuration the end switches will NOT stop the motor. Move the motor towards the inner end switch. Observe the direction of movement of the motor.	The motor is turning clockwise.		
17.	On motor setup tab of local control GUI set drive direction to be anticlockwise.	The motor is turning anticlockwise.		
18.	On motor setup tab of local control GUI set the pulse width to 3.05 usec.	The pulse width changes to 3.05 usec.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
19.	On motor setup tab of local control GUI set the pulse width to 6.10 usec.	The pulse width changes to 6.10 usec.		
20.	On motor setup tab of local control GUI set the pulse polarity to positive.	The pulse polarity changes to positive.		
21.	On motor setup tab of local control GUI set the pulse polarity to negative.	The pulse polarity changes to negative.		
22.	On motor setup tab of local control GUI set the velocity to 1 mm/s.	The velocity changes to 1 mm/s.		
23.	Move the motor towards the inner end switch. Observe the velocity of the movement.	The velocity of movement is 1 mm/s.		
24.	On motor setup tab of local control GUI set the velocity to 2 mm/s.	The velocity changes to 2 mm/s.		
25.	Move the motor towards the inner end switch. Observe the velocity of the movement.	The velocity of movement is 2 mm/s.		
26.	On motor setup tab of local control GUI set the velocity to 1 mm/s.	The velocity changes to 1 mm/s.		
27.	On motor setup tab of local control GUI set the acceleration time to 0.2 s.	The acceleration time changes to 0.2 s.		
28.	Move the motor towards the inner end switch. Observe the velocity of the movement.	The acceleration time is 0.2s.		
29.	On motor setup tab of local control GUI set the acceleration time to 3 s.	The acceleration time changes to 3 s.		
30.	Move the motor towards the inner end switch. Observe the velocity of the movement.	The acceleration time is 3 s.		
31.	On motor setup tab of local control GUI set the	The acceleration time changes to 0.2		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	acceleration time to 0.2 s.	s.		
32.	On motor setup tab of local control GUI set the encoder type to pmac.	The encoder type changes to pmac.		
33.	On motor setup tab of local control GUI set the encoder type to ssi. NOTE: this only verifies that encoder type is changed to SSI. No reading from ssi encoder is done.	The encoder type changes to ssi. NOTE: There will be a lot of errors reported in the console that the ssi encoder type is not supported. This is ok. Consult [2] for details.		
34.	On motor setup tab of local control GUI set the encoder type to potentiometer.	The encoder type changes to potentiometer.		
35.	On motor setup tab of local control GUI set the mount orientation to left/down.	The mount orientation changes to left/down.		
36.	On motor setup tab of local control GUI set the mount orientation to right/up.	The mount orientation changes to right/up.		
37.	On motor setup tab of local control GUI set the installation orientation to horizontal.	The installation orientation changes to horizontal.		
38.	On motor setup tab of local control GUI set the installation orientation to vertical.	The installation orientation changes to vertical.		
39.	On motor setup tab of local control GUI set motor counts / mm to 200.	The motor counts /mm changes to 200.		
40.	Move the motor and mind the velocity of the motor. The velocity should be 1 mm/s.	The motor moves with the velocity 1 mm/s.		
41.	On motor setup tab of local control GUI set motor counts / mm to 400.	The motor counts /mm changes to 400.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
42.	Move the motor and mind the velocity of the motor. The velocity should be 0.5 mm/s.	The motor moves with the velocity 0.5 mm/s.		
43.	On motor setup tab of local control GUI set motor counts / mm to 200.	The motor counts /mm changes to 200.		
44.	On motor setup tab of local control GUI set position factor to be 1.	The position factor changes to 1.		
45.	On motor setup tab of local control GUI set position factor to be 2.	The position factor changes to 2.		
46.	On motor setup tab of local control GUI set SSI resolution to be 360. NOTE: this only verifies that SSI resolution is changed to 1024.	The SSI resolution changes to 1024.		
47.	On motor setup tab of local control GUI set SSI resolution to be 720. NOTE: this only verifies that SSI resolution is changed to 2048.	The SSI resolution changes to 2048.		
48.	On motor setup tab of local control GUI set SSI resolution (mm/revolution) to be 5. NOTE: this only verifies that SSI resolution (mm/revolution) parameter is changed to 5.	The SSI values changes to 5.		
49.	On motor setup tab of local control GUI set SSI resolution (mm/revolution) to be 10. NOTE: this only verifies that SSI resolution (mm/revolution) parameter is changed to 10.	The SSI values changes to 10.		
50.	On motor setup tab of local control GUI set reference voltage tolerance to be 20 mV.	The reference voltage tolerance changes to 20 mV.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
51.	On motor setup tab of local control GUI set reference voltage tolerance to be -1 mV. Observe the status of motor 1 on the motor drive tab.	The reference voltage tolerance changes to -1 mV. The potentiometer reference error status led is lit.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

Reload test properties.

4.7. Motor pair configuration [TP-LC-007]

Description

This test case tests that all motor pair configuration parameters can be modified from local control GUI. For each configuration parameter recipe how to test it is given. The effectiveness of the motor pair configuration parameters is tested under test case Motor pair manipulation [TP-LC-010]

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local configuration.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	On motor setup tab of local control GUI change the hardware middle switch to be enabled.	The hardware middle switch changes to enabled.		
2.	On motor setup tab of local control GUI change the hardware middle switch to disabled.	The hardware middle switch changes to disabled.		
3.	On motor setup tab of local control GUI change the minimum spacing to 5 mm.	The minimum spacing changes to 5 mm.		
4.	On motor setup tab of local control GUI change the minimum spacing to **10** mm.	The minimum spacing changes to 10 mm.		

Test result: ☐ Not tested ☐ Passed ☐ Failed

Cleanup after test

Reload test properties.

4.8. Configuration persistency [TP-LC-008]

Description

This test case tests that configuration parameters can be persisted on the M-Box or on the local PC where remote control GUI is running.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local configuration.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Change all motor and motor pair parameters. Change also motor coupling setup on the main tab of local control GUI. Save the configuration into properties file on the PC where local control GUI is running. Open created file in an editor and check that all properties have the same value or meaning as it is set on the local control GUI.	All properties have the same value or meaning as it is set on the local control GUI.		
2.	Load properties (from file saved to in step 1 from PC where local control GUI is running. Open same file in and editor and check that all properties have the same value or meaning as it is set on the local control GUI.	All properties have the same value or meaning as it is set on the local control GUI.		
3.	Change all motor and motor pair parameters. Change also motor coupling setup on the main tab of local control GUI. Save the configuration into properties file on the M-Box. Open created file in an editor and check that all properties have the same value or meaning as it is set on the local control GUI.	All properties have the same value or meaning as it is set on the local control GUI.		
4.	Load properties (from file saved to in step 1 from M-Box). Open same file in and editor and check that all properties have the same value or meaning as it is set on the local control GUI.	All properties have the same value or meaning as it is set on the local control GUI.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.9. Motor manipulation [TP-LC-009]

Description

This test case tests that each properly configured motor can be manipulated by means of available controls from the local control GUI. The following is tested:

- test of end switches
- driving of motor by manually setting of new position
- driving of motor by using slider
- driving of motor to outside/inside limit
- driving of motor relative to its current position
- stopping a motor
- resetting the position of motor
- copy of the readback values to the configuration

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Manually press first inner HW end switch of first motor and then also the outer HW end switch. To verify that motor is stopped by HW switches drive the motor towards the manually pressed HW end switch.	Status of the HW end switches is displayed on motor drive tab of the local control GUI. If motor is driving towards the pressed switch it will stop the movement.		
2.	Manually press first inner HW end switch of second motor and then also the outer HW end switch. To verify that motor is stopped by HW switches drive the motor towards the manually pressed HW end switch.	Status of the HW end switches is displayed on motor drive tab of the local control GUI. If motor is driving towards the pressed switch it will stop the movement.		
3.	Set manually set position for motor 1 to -10 mm and press start button.	Motor moves to -10 mm.		
4.	Set manually set position for motor 2 to 10 mm and press start button.	Motor moves to -10 mm.		
5.	Set set position for motor 1 to -20 by using slider and start button.	Motor moves to -20 mm.		
6.	Set set position for motor 2 to 20 by using slider and start button.	Motor moves to 20 mm.		
7.	Drive motor 1 to inner limit by using to inside limit button.	Motor move to inner limit.		
8.	Drive motor 1 to outer limit by using to outside limit button.	Motor moves to outer limit.		
9.	Drive motor 2 to inner limit by using to inside limit button.	Motor move to inner limit.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
10.	Drive motor 2 to outer limit by using to outside limit button.	Motor moves to outer limit.		
11.	User move relative controls to move motor 1 relative by 5 mm first towards inner end switch and then towards outer end switch.	Motor moves relative by 5 mm first towards inner end switch and then towards outer end switch.		
12.	User move relative controls to move motor 2 relative by 5 mm first towards inner end switch and then towards outer end switch.	Motor moves relative by 5 mm first towards inner end switch and then towards outer end switch.		
13.	Move motor 1 towards inner end switch and the press stop button.	Motor moves towards inner end limit switch and stops when stop button is pressed.		
14.	Move motor 2 towards inner end switch and the press stop button.	Motor moves towards inner end limit switch and stops when stop button is pressed.		
15.	Reset the motor's 1 position to -30 mm.	The set motor position and PMAC readback position are reset to -30 mm.		
16.	Reset the motor's 2 position to 30 mm.	The set motor position and PMAC readback position are reset to 30 mm.		
17.	Use copy actual position buttons to copy the current motor 1 position first to outside limit, second to offset and at last to inside limit. Verify on motor setup tab that the position is copied.	Position is copied to outside limit, offset and inside limit.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
18.	Use copy actual position buttons to copy the current motor 2 position first to outside limit, second to offset and at last to inside limit. Verify on motor setup tab that the position is copied.	Position is copied to outside limit, offset and inside limit.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.10. Motor pair manipulation [TP-LC-010]

Description

This test case tests that each properly configured motor pair can be manipulated by means of available controls from the local control GUI. The following is tested:

- driving pair of motors by manually setting new gap
- driving pair of motors by manually setting new center
- driving of pair of motors to outside/inside limit
- test of hardware middle switch
- test of software minimum distance

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Set manually set gap for motor pair to 40 mm and set center to 0 mm and press start button.	Motor s move so that the end gap is 40 mm and center is 0 mm.		
2.	Set manually set gap for motor pair to 50 mm and leave center at 0 mm.	Motor s move so that the end gap is 50 mm and center stays at 0 mm.		
3.	Set manually set center for motor pair to 10 mm and leave gap at 50 mm.	Motor s move so that the end gap stays at 50 mm and new center is at 10 mm.		
4.	Drive motor pair to inner limit by using to inside limit button.	Motors move to inner limit.		
5.	Drive motor pair to outer limit by using to outside limit button.	Motors move to outer limit.		
6.	On the motor setup tab of local control GUI set hardware middle switch to be disabled and minimum spacing to be 10 mm.	Hardware middle switch is disabled and minimum spacing is 10 mm.		
7.	Set manually set gap for motor pair to 5 mm and press start button.	Motors will be moving towards 5 mm gap but are stopped at 10 mm by software minimum spacing check. Minimum spacing status led is lit.		
8.	On the motor setup tab of local control GUI set hardware middle switch to be enabled. NOTE: Verify that configuration switches on PDC are correctly set.	Hardware middle switch is enabled.		
9.	Move both motors towards the inner limit until the	Middle switch is set and stops the		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	middle switch is set. If necessary change inner soft limits.	motors.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

4.11. Status [TP-LC-011]

Description

This test case tests that motor/pair and general status is correctly displayed.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local configuration.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Manually press first inner HW end switch of first motor and then also the outer HW end switch. To verify that motor is stopped by HW switches drive the motor towards the manually pressed HW end switch.	Status of the HW end switches is displayed on motor drive tab of the local control GUI. If motor is driving towards the pressed switch it will stop the movement.		✓
2.	Change the software limits on the motor setup tab of local control GUI so that the motors current position is below low software limit and above software high limit.	Status of the SW end limits is displayed on the motor drive tab of the local control GUI.		✓
3.	Move the motor towards the inner end switch.	Status is showing that motor is moving and that break is released.		✓
4.	Stop the motor.	Status is showing that motor is not moving and that break is applied.		✓
5.	Fatal following error TODO			Skip
6.	Move motor towards the outer limit switch. During motor movement remove the axis interlock short circuit (All) for motor from the rear side of the PDC.	Status is showing that Amplifier fault and axis interlock are set.		✓
7.	Overheat TODO			
8.	Remove the axis interlock short circuit (All) for motor from the rear side of the PDC.	Status is showing that motor axis interlock is set.		✓
9.	Change the reference voltage tolerance on the motor setup tab of local control GUI to be -1.	Status is showing that potentiometer error has occurred.		✓

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
10.	Amplifier fault on pair of motors. Move pair of motors pair. During motor movement remove the axis interlock short circuit (AII) for motor from the rear side of the PDC.	Status is showing that Amplifier fault of pair of motors and amplifier fault and axis interlock of motor are set.	for 1st motor, display was immediately, for 2nd motor, display on next moving command	
11.	Fatal following error TODO			
12.	Change the hardware middle switch on the motor setup tab of local control GUI to be disabled. Change the minimum spacing to be more than the current gap between the motors.	Status is showing that minimum spacing has been reached.		✓
13.	Change the hardware middle switch on the motor setup tab of local control GUI to be enabled. Use test cable to simulate middle switch.	Status is showing that hw middle switch is set.		✓

Test result: ☐ Not tested ☐ Passed ☒ ☐ Failed

Cleanup after test

N/A

5. Local LCD Test Cases

Description

In the following test cases local LCD is tested. For more info on LCD see [5].

5.1. Motor monitoring and controlling [TP-LCD-001]

Description

This test case tests that motor position, end and middle switches are correctly displayed.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Enable LCD control by pressing fn and enter buttons for at least two seconds.	LCD control is enabled and first motor is displayed.		
2.	Manually press inner end limit switch for first motor and observe LCD.	Inner end limit switch is shown on LCD.		
3.	Manually press outer end limit switch for first motor and observe LCD.	Outer end limit switch is shown on LCD.		
4.	Manually press inner end limit switch for second motor and observe LCD.	Inner end limit switch is shown on LCD.		
5.	Manually press outer end limit switch for second motor and observe LCD.	Outer end limit switch is shown on LCD.		
6.	With LCD move first motor towards the outer end switch.	Motor is moved to outer end switch.		
7.	With LCD move the second motor towards the outer end switch.	Motor is moved to outer end switch.		
8.	With LCD move the first motor towards the inner end limit switch.	Motor is moved to inner end switch.		
9.	With LCD move the first motor towards the outer end limit switch.	Motor is moved to outer end switch.		
10.	With LCD move the second motor towards the inner end limit switch.	Motor is moved to inner end switch.		
11.	With LCD move the second motor towards the outer end limit switch.	Motor is moved to outer end switch.		
12.	With LCD move the first motor towards the inner end limit switch.	Motor is moved to inner end switch.		
13.	With LCD move the second motor towards the inner end	Motor is moved towards inner end		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	limit switch until the middle switch is hit.	switch until middle switch is hit.		
14.	Move both motors towards outer end limit switch.	Both motors are moved to outer end switch.		
15.	By using local control GUI change the setup of HW middle switch to disabled (now the software middle switch is enabled).	HW middle switch is disabled.		
16.	With LCD move the first motor towards inner end limit switch.	Motor is moved till minimum distance is reached.		
17.	Remove All interlock short circuit from rear side of the PDC for first motor.	Interlock indicator is shown on LCD for first motor.		
18.	Remove All interlock short circuit from rear side of the PDC for second motor.	Interlock indicator is shown on LCD for second motor.		
19.	Put back All interlock short circuit for both motors.	Interlock indicator is not shown on LCD.		
20.	Drive the first motor 10 times for a short time towards the outer limit.	Motor is moved each time the button is pressed.		
21.	Drive the first motor 10 times for a short time towards the inner limit.	Motor is moved each time the button is pressed.		
22.	Drive the second motor 10 times for a short time towards the outer limit.	Motor is moved each time the button is pressed.		
23.	Drive the second motor 10 times for a short time towards the inner limit.	Motor is moved each time the button is pressed.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

5.2. Error detection [TP-LCD-002]

Description

This test case tests that errors are correctly detected and transmitted to LCD.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server and the system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Enable LCD control by pressing fn and enter buttons for at least two seconds.	LCD control is enabled and first motor is displayed.		
2.	Remove the serial cable from the back of the M-Box.	ERROR 300 Is displayed on the LCD.		
3.	With local control GUI change system mode to local configuration.	System mode is changed to local configuration and LCD displays root menu.		
4.	Enable LCD control by pressing fn and enter buttons for at least two seconds.	ERROR 301 Is displayed on the LCD.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

6. Motor Pair Commissioning Test Cases

Description

In the following test cases motor pair commissioning procedure with local control GUI is tested.

6.1. Motor pair commissioning [TP-MPC-001]

Description

This test case tests that motor pair can be commissioned.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002], TODO LCD
3. Load default properties
4. Local control GUI connected to the local control server and system mode is local control.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Setup the following parameters for first motor: encoder type, mount orientation, installation orientation, motor counts/mm, potentiometer length. Leave other parameters at default values.	All parameters change to the specified values.		
2.	Setup the following parameters for second motor: encoder type, mount orientation, installation orientation, motor counts/mm, potentiometer length. Leave other parameters at default values.	All parameters change to the specified values.		
3.	Set velocity to be 0.1 mm/s for both motors.	Velocity is changed to 0.1 mm/s for both motors.		
4.	With local control LCD move the first motor for a small amount in the direction of the outer limit switch.	Motor moves in the direction of the outer limit switch.		
5.	If motor did not move in the direction of the outer limit switch, change the motor direction by using local control GUI. If motor moves in the direction of outer limit switch skip this step.	Drive direction changed to new value.		
6.	With local control LCD move the second motor for a small amount in the direction of the outer limit switch.	Motor moves in the direction of the outer limit switch.		
7.	If motor did not move in the direction of outer limit switch, change the motor direction by using local control GUI.	Drive direction change to new value.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	If motor moves in the direction of outer limit switch skip this step.			
8.	Check limit switches for first motor by pushing them manually.	Limit switch status is shown on local control GUI. NOTE: Testing cannot continue if this test fails.		
9.	Check limit switches for second motor by pushing them manually.	Limit switch status is shown on local control GUI. NOTE: Testing cannot continue if this test fails.		
10.	Set velocity to be 3 mm/s for both motors.	Velocity is changed to 3 mm/s for both motors.		
11.	Move first motor towards the outer limit switch and during motor movement press the outer limit switch manually.	Motor stops when limit switch is pressed.		
12.	Move first motor to outer limit switch.	Motor moves to outer limit switch.		
13.	Move second motor towards the outer limit switch and during motor movement press the outer limit switch manually.	Motor stops when limit switch is pressed.		
14.	Move second motor to outer limit switch.	Motor moves to outer limit switch.		
15.	Move first motor towards the inner limit switch and during motor movement press the inner limit switch manually.	Motor stops when limit switch is pressed.		
16.	Move first motor to inner limit switch.	Motor moves to inner limit switch.		
17.	Move first motor to outer limit switch.	Motor moves to outer limit switch.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
18.	Move second motor towards the inner limit switch and during motor movement press the inner limit switch manually.	Motor stops when limit switch is pressed.		
19.	Move second motor to inner limit switch.	Motor moves to outer limit switch.		
20.	Move second motor to outer limit switch.	Motor moves to outer limit switch.		
21.	Move first motor to the position marked as 0 position.	Motor moves to the position marked as 0 position.		
22.	Copy current position to motor offset configuration parameter and reset motor PMAC position to 0.	Current position is copied to offset configuration parameter and motor PMAC position is reset to 0.		
23.	Move the first motor as much as you can to outer position (e.g. 30 mm). Check the readback from potentiometer. If readback is the same number then do nothing. If readback is not ok, drive motor to 0, then adjust position factor so that readback matches set position. Use this form to calculate the factor: New factor = factor * required position/ current position.	If needed position factor is used to adjust readback position of the motor.		
24.	Move first motor to inner limit switch.	Motor moves to inner limit switch.		
25.	Copy readback position to inner limit configuration parameter.	Current readback position is copied to high limit configuration parameter.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
26.	Move first motor to outer limit switch.	Motor moves to outer limit switch.		
27.	Copy readback position to outer limit configuration parameter.	Current readback position is copied to low limit configuration parameter.		
28.	Move second motor to the position marked as 0 position.	Motor moves to the position marked as 0 position.		
29.	Copy current position to motor offset configuration parameter and reset motor PMAC position to 0.	Current position is copied to offset configuration parameter and motor PMAC position is reset to 0.		
30.	Move the second motor as much as you can to outer position (e.g. 30 mm). Check the readback from potentiometer. If readback is the same number then do nothing. If readback is not ok, drive motor to 0, then adjust position factor so that readback matches set position. Use this form to calculate the factor: New factor = factor * required position/ current position.	If needed position factor is used to adjust readback position of the motor.		
31.	Move second motor to inner limit switch.	Motor moves to inner limit switch.		
32.	Copy readback position to inner limit configuration parameter.	Current readback position is copied to high limit configuration parameter.		
33.	Move second motor to outer limit switch.	Motor moves to outer limit switch.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
34.	Copy readback position to outer limit configuration parameter.	Current readback position is copied to low limit configuration parameter.		
35.	Move first motor to the position marked as 0 position.	Motor moves to the position marked as 0 position.		
36.	Move the second motor so that the gap is 5 mm.	Motor moves so that the gap is 5 mm.		
37.	Slowly move second motor (use relative motion commands) towards 0 mm gap. Middle switch should stop the motor. When this happens the gap is not more than 0.5 mm. NOTE: PDC has to be correctly configured for middle switch to work.	Middle switch stops the motor.		
38.	Move first motor to outer limit switch.	Motor moves to outer limit switch.		
39.	Using local control GUI configure HW middle switch to be disabled. Set minimum distance to 5 mm.	HW middle switch is disabled and minimum distance is set to 5 mm.		
40.	Move first motor to inner limit switch.	Motor moves only so far that the gap is 5 mm.		
41.	Move first motor 20 mm towards outer limit switch.	Motor moves 20 mm towards outer limit switch.		
42.	Move second motor 20 mm towards outer limit switch.	Motor moves 20 mm towards outer limit switch.		
43.	Move both motors to inner limit switch.	Motor stop when gap is around 5 mm.		
44.	Move second motor to outer limit switch.	Motor moves to outer limit switch.		

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
45.	Save properties on M-Box and on PC. Check the files and compare the values with the values on the local control GUI.	Files are created and values are the same as on local control GUI.		

Test result: ☐ Not tested ☐ Passed ☐ ☐ Failed

Cleanup after test

N/A

7. FESA Classes Test Cases – Two Decoupled Motors

In the following test cases all properties of Motor FESA class which are listed under chapter 6.2.1 of the system design document [3] are tested.

For all test cases below, two instances of Motor FESA class are used in the deploy unit therefore the motors can be moved independently from one another.

Because test equipment used in all test cases below is pair of coupled motors tester should be careful not to damage the equipment.

7.1. Status property [TP-FTM-001]

Description

This test case tests that motor and general status within status property is correctly retrieved.

Pre-requisites

5. Test environment to use: see section Test Environment
6. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
7. Load test properties
8. Local control GUI connected to the local control server.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	With FESA test tool verify that control-item of status property correctly displays the system mode. Change the mode of the system by using local control GUI.	System mode is correctly displayed.		
2.	Repeat test case Status [TP-LC-011] and verify that status reported is the same as in local control GUI.	Status reported is the same as in local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.2. Power property [TP-FTM-002]

Description

This test case tests that power property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Try to switch the device off by using the power property.	Exception is thrown saying that device cannot be switched off.		✓
2.	Read the power property.	The return value indicates that device is on.	no value provided in test, is fixed in new version	✓

Test result: ☐ Not tested ☐ Passed ☒ ☐ Failed

Cleanup after test

N/A

7.3. Init property [TP-FTM-003]

Description

This test case tests that init property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Invoke init property.	Device is initialized from the configuration files. Motors are not moved. Set points and readbacks are consistent.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

7.4. Reset property [TP-FTM-004]

Description

This test case tests that reset property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Invoke reset property.	Device is initialized from the configuration files. Motors are not moved. Set points and readbacks are consistent.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

7.5. Version property [TP-FTM-005]

Description

This test case tests that version property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Read version property.	Versions of PMAC code, system driver, and FESA class are reported.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

7.6. Setting and Acquisition property [TP-FTM-006]

Description

This test case tests that setting and acquisition property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use Setting property to move the motors. Observe the Acquisition property for readback.	Motors are moved to the set value in the setting property.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.7. PositionRelative property [TP-FTM-007]

Description

This test case tests that PositionRelative property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use PositionRelative property to move motor relative to its current position.	Motor is moved relative for the mount specified in the property.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.8. MoveSteps property [TP-FTM-0008]

Description

This test case tests that MoveSteps property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use MoveSteps property to move motor relative to its current position in steps.	Motor is moved relative for the mount specified in the property.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.9. ToEndPosition property [TP-FTM-009]

Description

This test case tests that ToEndPosition property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use ToEndPosition property to move motor first towards the inner end position and then to outer end position.	Motor moves towards the inner end position and then towards the outer end position.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.10. StopMotor property [TP-FTM-010]

Description

This test case tests that Stop property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use Stop property to stop the motor during movement.	Motor is stopped during movement.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.11. Configuration property [TP-FTM-0011]

Description

This test case tests that Configuration property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that all items in the properties have the same values as are shown on the local control GUI. Note: pairtOfPair has no direct counterpart on the motor setup tab of the local control GUI. Use motor coupling on main tab of the local control GUI to determine this parameter. Setting resolution is inverted counts per millimeter parameter.	All properties have the same values as local control GUI.		
2.	Modify parameters using the local control GUI.	All parameters are updated and have the same values as local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

7.12. Diagnostics property [TP-FTM-012]

Description

This test case tests that Diagnostics property behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that all items in the properties have the same values as are shown on the local control GUI.	All properties have the same values as local control GUI.		
2.	Modify parameters using the local control GUI.	All parameters are updated and have the same values as local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

Test section 7, FESA Classes Two Decoupled Motors:
Test performed 5th November 2014

U. Krause

8. FESA Classes Test Cases – Two Coupled Motors

In the following test cases all properties of Motor FESA class which are listed under chapter 6.2.1 of the system design document [3] are tested. In addition also all properties listed under chapter 6.2.2 of the system design document are tested.

For all test cases below, two instances of Motor FESA class and one instance of Slit class are used in the deploy unit therefore the motors can be either moved independently from one another or as pair of motors.

Because test equipment used in all test cases below is pair of coupled motors tester should be careful not to damage the equipment. Minimum distance check or hardware middle switch can be disabled by changing the configuration on the local control GUI and with configuring PDC. See [1] for details.

8.1. Status property [TP-FCM-001]

Description

This test case tests that motor status, pair status and general status within status property of slit class is correctly retrieved.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	With FESA test tool verify that control-item of status property correctly displays the system mode. Change the mode of the system by using local control GUI.	System mode is correctly displayed.		
2.	Repeat test case Status [TP-LC-011] and verify that status reported is the same as in local control GUI.	Status reported is the same as in local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.2. Power property [TP-FCM-002]

Description

This test case tests that power property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Try to switch the device off by using the power property.	Exception is thrown saying that device cannot be switched off.		✓
2.	Read the power property.	The return value indicates that device is on.	same as with single motors	

Test result: ☐ Not tested ☐ ☒ ☐ Failed

Cleanup after test

N/A

8.3. Init property [TP-FCM-003]

Description

This test case tests that init property of slits class behaves as specified. This test cases tests property for both motor and motor pair FESA classes.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Invoke init property.	Device is initialized from the configuration files. Motors are not moved. Set points and readbacks are consistent.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

8.4. Reset property [TP-FCM-004]

Description

This test case tests that reset property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Invoke reset property.	Device is initialized from the configuration files. Motors are not moved. Set points and readbacks are consistent.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

8.5. Version property [TP-FCM-005]

Description

This test case tests that version property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Read version property.	Versions of PMAC code, system driver, and FESA class are reported.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.6. Setting and Acquisition property [TP-FCM-006]

Description

This test case tests that setting and acquisition property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
2.	Use Setting property to move the motors. Observe the Acquisition property for readback.	Motors are moved to the set value in the setting property.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

8.7. CenterRelative property [TP-FCM-007]

Description

This test case tests that CenterRelative property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use CenterRelative property to move center relative to its current position.	Center is moved relative for the mount specified in the property.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

8.8. WidthRelative property [TP-FCM-008]

Description

This test case tests that WidthRelative property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use WidthRelative property to change width relative to its current value.	Width is changed relative for the mount specified in the property.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.9. ToEndPosition property [TP-FCM-009]

Description

This test case tests that ToEndPosition property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use ToEndPosition property to move motors first towards the inner end position and then to outer end position.	Both motors move towards the inner end position and then towards the outer end position.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.10. StopMotor property [TP-FCM-0010]

Description

This test case tests that Stop property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Use Stop property to stop motors during movement.	Motors are stopped during movement.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.11. Configuration property [TP-FCM-0011]

Description

This test case tests that Configuration property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that all items in the Configuration property have the same values as are shown on the local control GUI. Note: pairtOfPair has no direct counterpart on the motor setup tab of the local control GUI. Use motor coupling on main tab of the local control GUI to determine this parameter. Setting resolution is inverted counts per millimeter parameter.	All properties have the same values as local control GUI.		
2.	Modify parameters using the local control GUI.	All parameters are updated and have the same values as local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ Failed

Cleanup after test

N/A

8.12. Diagnostic property [TP-FCM-0012]

Description

This test case tests that Diagnostic property of slit class behaves as specified.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that all items in the Diagnostic property have the same values as are shown on the local control GUI.	All properties have the same values as local control GUI.		
2.	Modify parameters using the local control GUI.	All parameters are updated and have the same values as local control GUI.		

Test result: ☐ Not tested ☒ Passed ☐ ☐ Failed

Cleanup after test

N/A

8.13. Position values consistency [TP-FCM-0013]

Description

This test case tests that values between motor classes and slit class are consistent.

Pre-requisites

1. Test environment to use: see section Test Environment
2. The following test cases have passed: Reboot [TP-COM-002], Access control [TP-COM-003], Connection to M-Box [TP-LC-001], System mode [TP-LC-002]
3. Load test properties
4. Local control GUI connected to the local control server.
5. System mode is remote.

Test procedure

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
1.	Verify that all items in the Configuration property of individual motors classes and slit class are consistent.	All values are consistent.	exemplarily checked	✓
2.	Verify that all items in the Diagnostic property of individual motors classes and slit class are consistent.	All values are consistent.		
3.	Verify that position value item of Acquisition property of each motor class and center and with value items of Acquisition property of slit class are consistent.	Value item of Acquisition property of each motor class and center and with value items of Acquisition property of slit class are consistent.		✓
4.	Change the position value item of the Setting property of first motor and verify that center and width of both Setting and Acquisition property of slit class changed accordingly to remain consistent.	Center and width of both Setting and Acquisition property of slit class changed accordingly to remain consistent.		✓
5.	Change the position value item of the Setting property of second motor and verify that center and width of both Setting and Acquisition property of slit class changed accordingly to remain consistent.	Center and width of both Setting and Acquisition property of slit class changed accordingly to remain consistent.		✓
6.	Change center value item of the Setting property of slit class and verify that position of both Setting and Acquisition property of each motor class changed accordingly to remain consistent.	Position of both Setting and Acquisition property of each motor class changed accordingly to remain consistent.	Setting of single motors are not updated	fail
7.	Change width value item of the Setting property of slit	Position of both Setting and	same as above	f

Step	Operation action	Expected result	Observation/Comments	Pass /Fail /Skip
	class and verify that position of both Setting and Acquisition property of each motor class changed accordingly to remain consistent.	Acquisition property of each motor class changed accordingly to remain consistent.		
8.	Switch mode to local control by using local control GUI and move both motors from current position.	Motors move. Setpoint values (position value items in Setting property and setPosition value item in acquisition property) are NOT changed in order to remain consistent).		

Test result: ☐ Not tested ☐ Passed ☒ ☐ Failed

Cleanup after test

N/A

Test section 8, FESA Classes Two Coupled Motors
Test performed 5th November 2014
U. Krause

Appendix A. Anomaly traceability matrix

This test plan also covers for testing of anomalies that were hitherto discovered (**regression tests**). For each anomaly, the table below provides an ID with a link to more information about the anomaly, and a reference to the test case section in this document where checking for the anomaly is defined.

Table A-1: Anomaly traceability matrix

ID	Description	Test Case