Mechatronics Technician

Commissioning Protocol GUIDE

Part 1 and 2

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AHK USA-Chicago Final Examination Part 1 and Part 2	First and last name:	Commissioning booklet
Checks - Commissioning Protocols	Mechatronics Technician	

IMPORTANT INFORMATION!

READ all information provided CAREFULLY

During the Part 1 examination you will complete the following commissioning protocol. Once everything is ready and all modification have been made, you will request an exam board member observe your commissioning protocol. You will take them through every single point on this document. The highlighted BLUE instructions shown in this guide are provided to ensure that you know what is expected of you when you take your exam board member through the Commissioning protocol. KEY POINTS: Explain and talk through everything that you are checking. Do not just mention things, actually demonstrate what you are checking to prove that all is ok. Do not skip any steps. Be prepared to independently (without assistance or questions from the exam board) walk through every step.

During the Part 2 examination you will also be expected to independently commission your mechatronics system, doing similar thorough checks of mechanical, pneumatic and electric systems, as well as take appropriate voltage measurements. However, you will not have the commissioning protocol provided. You may prepare your own (highly recommended) in your preparation binder for exam day, but no exam protocol will be provided to you on the day of the exam. To properly prepare for your exam, you should use this Practice Guide prior to the examination to make sure that you are capable of going through each step and taking accurate measurements. You will have to demonstrate this on exam day when you turn your exam project in to your customer (the exam board)!

On exam day you should plan for 1.5-2.5 hours to complete this commissioning with an exam board member present. This time is included in your 6.5 total hours.

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The mechatronic subsystem is to be checked and put into operation in accordance with the commissioning protocol. The following commissioning protocol is to be completed with an exam board member observing. You will walk the exam board member through each step of inspection and measurement checks. Demonstrate to the exam board member that everything is in proper working order. Do not skip any steps or check points. If you come across any issues or problems they are to be fixed independently either before moving to the next checking point on the list or returning to fix them once the entire commissioning is complete and time remains. **Attention! ALL work steps must be carried out under the supervision of the testing committee!**

Steps 1 to 3 should be carried out in a de-energized and de-pressurized state.

Step 1: Inspection of the mechanical system – assembly grid

Perform a visual inspection and decide for each inspection item whether or not there are any defects. Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points!

Check no.	Inspection item	OK	
1	Drawings available and complete	yes □	no □
2	Assembled according to general chute drawing	yes □	no □
3	All components securely fastened	yes □	no □
4	No damage to components	yes □	no □
5	Components deburred	yes □	no □
6	Cylinder runs smoothly	yes □	no □

1. **Physically check and show exam board member that all pages are available.**
2. **Verbally explain what is assembled on the grid, where things are, any changes you have made, show and refer to the available mechanical drawings.**
3. **Actually wiggle multiple mechanical components on the assembly grid, checking screws etc. to demonstrate they are securely fastened.**
4. **Visually look for damage or corrosion. If any exists, point out and explain.**
5. **Use your fingernail to check pieces for sharp edges, explain what you are looking for and if you find anything.**
6. **Actually unhook all air hoses from the cylinders, demonstrate that they operate smoothly as a mechanical component.**

If anything is a "no" mark it "no" to go back to later or fix immediately if it can be done with little delay.

Step 2: Inspection of the pneumatic system

Perform a visual inspection and decide for each inspection item whether or not there are any defects. Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points!

Check no.	Inspection item	OK	
1	Assembled according to installation drawing and labeled	yes □	no □
2	All pneumatic lines securely fastened	yes □	no □
3	Pneumatic lines properly routed	yes □	no □
4	No damage to components	yes □	no □

1. **Refer to drawing, point out the items on the assembly grid and that they are properly labeled.**
2. **Actually pull on all pneumatics lines firmly, demonstrating they are secure.**
3. **Point out proper routing of air lines and check for pinched lines.**
4. **Physically check and inspect all lines for cracks or other damage.**

If anything is a "no" mark it "no" to go back to later or fix immediately if it can be done with little delay.

Step 3: Inspection of the electrical engineering

Perform a visual inspection and decide for each inspection item whether or not there are any defects. Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points!

Check no.	Inspection item	OK	
1	Circuit diagrams available and complete	yes □	no □
2	Proper installation of operating equipment	yes □	no □
3	Ground wire properly connected	yes □	no □
4	Terminal securely fastened	yes □	no □
5	No damaged wiring	yes □	no □
6	Wiring in accordance with wiring diagrams	yes □	no □
7	No damage to operating equipment	yes □	no □

1. **Physically check, count and show pages of schematic diagrams available to supervising exam board member.**
2. **Physically shake, move, all electrical components in the cabinet, on the assembly grid and control box**
3. **Check all earth ground connections with a DMM and by hand, explain your checks**
4. **Remove all covers and look for loose or exposed wires – spot checking and pulling on some wires from the terminal box**
5. **Check for loose or exposed wires in wire ways and on the assembly grid**
6. **Trace 1 wire loop from source to component, then back to incoming power source**
7. **Visually check, pointing to inspected areas looking for cracks, burns, broken parts**

If anything is a "no" mark it "no" to go back to later or fix immediately if it can be done with little delay. Be sure you are talking the exam board through each step that you are taking.

Attention! Reminder - Work steps 4 to 9 must be carried out under the supervision of the testing committee!

Step 4: Resistance measurements

Prior to the start-up of the mechatronic sub system, perform the required resistance measurements and document your measurements.

Identify which specification for measured values and standards you are using. For example, if the standard that you are using is the DIN/VDE-0100-600 (IEC 603364-6 corrigendum 1), then evaluate whether the measurement results meet the required specifications and document your findings. **If you are unable to complete any measurements for safety reasons, or other, explain this and why to your supervising exam board member.** Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points! If the following checks are not safely and correctly completed, the test taker may not move forward to steps 5-9

Attention! The cabinet should not be plugged in. Electronic components must be disconnected prior to the insulation measurement. With the protected extra-low voltage (PELV), the jumper to the ground wire must be removed before the insulation measurement.

	Ground wire continuity	**Calculated resistance value**	**Measured Value**	OK	Not ok
1.1	PE contact on main power cord to electrical cabinet				
1.2	PE contact on main power cord to assembly grid				
1.3	PE contact on main power cord to switch cabinet door				
1.4	PE contact on main power cord to outlet -X13				
1.5	PE contact on main power cord to power supply unit				
1.6	PE contact on main power cord to -X1.7 PELV				
1.7	PE contact on main power cord to control panel				
1.8	PE contact on main power cord to mechanical assembly				
1.9	PE contact on main power cord to -X11				

Calculate the resistance value for 1.9 above:

Continuity and low impedance of the protective earth wire are present: yes ☐ no ☐

Attention: Electronic components must be disconnected prior to the isolation measurement. With the protected extra-low voltage (PELV), the jumper to the ground wire must be removed before any isolation measurements are taken.

Check no.	Measurement	Measurement location	Measured value	Standard value
2a	Isolation resistance 208V	-X2: L1 to PE -X2: L2 to PE -X2: L3 to PE -X2: N to PE -X2: L1 to L2 -X2: L1 to L3 -X2: L2 to L3 -X3: 1 to PE -X3: 3 to PE -X3: 5 to PE		
3a	Isolation resistance 24 V DC	L1 to +24 V L2 to +24 V L3 to +24 V N to +24V		

List specification used: _____

Measured values meet specifications: yes □ no □

1-4 Know where each checking point is and talk the exam board through your measurement process.

Unplug power to the power supply and PLEV to X1

Make sure you know what the specifications/standard values are for your equipment, so that you can explain if the specifications are met in 1-3. You may bring a specification sheet specific to your equipment or devices used.

Ensure that your prob tips are actually in contact when making measurements. If your probs need to be longer, bring longer ones for the exam.

Step 5: Voltage and rotary field measurement

Prior to the start-up of the mechatronic part system, perform and document the required measurements. Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points!

Note: First check that all overload protection elements are switched off!

Check no.	Measurement/activity	Measurement locations	Measured value
1	Supply voltage (main switch -Q1 "ON")		
2	Control voltage 24 V (circuit breaker -F3 "ON")		
3	Control voltage 24 V (circuit breaker -F4 "ON")		
4	Rotary field – X13 (clockwise rotation)		yes □ no □

Step 6: GFCI and Emergency off test

Test whether the GFCI is activated using the test button. GFCI activated: yes □ no □

Test your emergency – stop function. Emergency switches off: yes □ no □

(Explain testing procedure, test lights, e-stop and safety circuits)

Discuss your further procedure with the testing committee!

Be sure you know where your checking points are! Explain your steps to the exam board as you check.

Step 7: Measurements of the service outlet –X11

In the following table, enter the set values according to your standard for the listed measurements. Perform measurements 1 to 4 on -X11.

Demonstrate your checks, explain what you are checking and document your measured values. Do not skip any checking points!

Evaluate whether or not the measurement results are OK.

List the standard used: _____

Check no.	Measurement	Measurement value	Standard Value	Measured value OK
1	Supply voltage			
2	Contact voltage			yes □ no □
3	Time trip			yes □ no □
4	Trip current			yes □ no □

Measurements OK: yes □ no □

Discuss your further procedure with the testing committee!

Be sure you know where your checking points are! Explain your steps to the exam board as you check.

Step 8: Testing by hand

Perform a test by hand and decide for each inspection item whether or not there are any defects. Demonstrate your checks, explain what you are checking and document your results. Do not skip any checking points!

Attention! Follow health and safety regulations and put on your safety goggles.

Check no.	Inspection item	OK	
1	Setting the operating pressure to 5 bar and doing a leak test	yes □	no □
2	Cylinder can be controlled manually via the manual auxiliary actuator	yes □	no □
3	Setting the throttle check valves to a slow, safe cylinder activation	yes □	no □
4	Proximity switches are adapted to the travel of the cylinder and the corresponding inputs on the control system	Yes □	no □
5	Testing and adjusting other sensors and the corresponding inputs at the control system	yes □	no □

1. **Verify and adjust incoming air pressure and manually test for leaks listening for air**
2. **Move cylinders manually using the test buttons on the valves**
3. **Set the speed of each cylinder and move manually to demonstrate slow and safe travel**
4. **Identify and distinguish between proxy cylinder inputs vs inputs to the PLC.**
5. **Demonstrate sensors are connected and function properly**

Step 9: Functional check of the entire system

Perform a functional test and decide for each inspection item, based on the functional description, whether or not there are any defects. Demonstrate your checks, explain what you are checking by reading each function and document your results. Do not skip any checking points! Before submitting final documentation to the the exam board, remaining time may be used to get any function working and change your inspection item from no to yes – a change must be demonstrated to the exam board.

Check no.	Inspection item	OK	
1	Description according to functional description no. I	yes □	no □
2	Description according to functional description no. II	yes □	no □
3	Description according to functional description no. III	yes □	no □
4	Description according to functional description no. IV	yes □	no □
5	Description according to functional description no. V	yes □	no □
6	Description according to functional description no. VI	yes □	no □
7	Description according to functional description no. VII	yes □	no □
8	Description according to functional description no. VIII	yes □	no □

1-8. Read through the functions and show each step! Check every single lamp. Properly select Yes or No according to how the system functions when you are reviewing it with your exam board. Make appropriate notes.

After the functional check, should any time be remaining, you may attempt to correct functional errors and change no to yes. If you are successful, this change should be demonstrated to the exam board.

Hand-off

Submit the documents to the customer (represented by the exam board). Sign below and Hand-off of the work task and the documentation

Apprentice signature _____

Date/time: _____

Received by: _____ (Examiner signature)