



Module

Programming of mechatronic system with PLC (Programmable Logics Controllers)

MD 09

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Module description

Training module: Programming of mechatronic systems with microcontroller

Module code: MD10	Name of the module: Programming mechatronic system equipped with microcontroller	Duration		
		Theory 30	Practice 90	Total 120
Theoretical basis	<ul style="list-style-type: none"> - This module consists of different exercises on controlling mechatronic subsystem or system. After finishing this practice-oriented module, the trainees are able to make and implement working plans and test mechatronic systems. - Each exercise is closed and includes all training objectives but it often reflects a part of the training contents. - Based on a real mechatronic system, the trainees are able to analyse functional relationship of the mechatronic system elaborate technical documents; assemble, programme, test the mechatronic system, and put it into operation. 			
Prerequisites	After finishing following subjects/modules: <ul style="list-style-type: none"> - MH 12; MH 13; MH 15; MH 16; - MD 04; MD 05; MD 06; MD 08; MD 09. 			
General objectives	The trainees are able to analyse, assemble, programme a mechatronic system equipped with microcontroller and put it into operation; find and fix errors.			
Compare with tasks and activities in the occupational description	<i>Compare with tasks and activities respectively to symbols in the occupational description (Letter: task; number: Activity):</i> A2; A4; A5; B1; B2; B4; B6; B7; C29; C30; C31; C33; C34; C35; C37; C39; D3; D20; D21; D22; D23; D24; D28; D29; D30; D31; E1; E3; E8; E9; F1; F2; F3; F6; G2; G5; G6; G7; G8; H1; H17; H20; H21; H23; H25; H29; H31; I3; I8; J1; J2; J3; J4;			

<p>Learning objectives</p>	<p><i>After finishing this module, the trainees are able to:</i></p> <ul style="list-style-type: none"> - analyse functional relationship in a mechatronic system; - read and create an electric network of a mechatronic system equipped with microcontroller with the aid of a computer; - describe the construction, operating principle and application of electrical/electronic components; - assemble and replace electrical/electronic components of a microcontroller; - programme a mechatronic system by using at least one programming language; - assemble sensors and press buttons of the mechatronic system and connect them into inputs/outputs of the microcontroller; - test and put the mechatronic system into operation; - systematically correct errors of hardwares and softwares of the mechatronic system; - ensure safety during operation of the mechatronic system; - undertake tasks in groups.
<p>Content</p>	<p>Assembly of a mechatronic system, for example:</p> <ul style="list-style-type: none"> - Sensors; - Relays, contactors; - Microcontroller; - Communication ports; - Actuators (magnetic valves, cylinder, air compressor, stepper motor, one-line motor, alternating current motor); - Signaling devices and safety devices. <p>Collection of information:</p> <ul style="list-style-type: none"> - from catalogues; - on the internet. <p>Functional relationship, for example:</p> <ul style="list-style-type: none"> - Motion (cycle, time); - Input signals; - Conditions, under that the machine operates properly; - Mode of operation; - Warnings. <p>Graphical presentation, for example:</p> <ul style="list-style-type: none"> - Operational diagram; - Flow chart; - Status chart. <p>Assembly:</p> <ul style="list-style-type: none"> - Electric circuit of the controlling system. <p>Programming:</p>

	<p>* Programming languages, for example:</p> <ul style="list-style-type: none"> - C programming language - Assembly programming language <p>* Programmes with:</p> <ul style="list-style-type: none"> - Accu, shift register, - Timer - Calculator, comparator - Interruption - Converters such as A/D converter, D/A converter <p>Assembly of a mechatronic system, for example:</p> <ul style="list-style-type: none"> - Controller; - Connection of sensors into controllers; - Connection of electric drive system, mechanical system and pneumatic system; - Connection of signal and voltage converter - Connection of warning devices; <p>Testing a programme, for example:</p> <ul style="list-style-type: none"> - Simulation of the programme; - Loading the programme; - Putting the mechatronic system into operation and monitoring the system; <p>Analysis, finding and correction of errors, for example:</p> <ul style="list-style-type: none"> - Status analysis; - Observation of signals; - Supervision . - Correction errors. <p>Regulations regarding protection and protective devices, for example:</p> <ul style="list-style-type: none"> - Overcurrent protection and overvoltage protection; - Emergency stop switches
<p>Assessment</p>	<p>The assessment of the trainees consists of following parts:</p> <ol style="list-style-type: none"> 1. Continuous assessment through practical exercises relating to content of the module 2. Examination after completion of the module: Within 120 minutes the trainees do a test relating to training objectives; 3. Practical examination: Within 240 minutes, the trainees do the examination on programming, connecting mechatronic system and putting it into operation; 4. Evaluation of the practical examination: The trainees test the above practical examination within 60 minutes. The content includes analysis, finding and correction of an error or many errors of the electric subsystem of the mechatronic system, which are given by the teacher.

	It is necessary to identify the important part of the assessment.
Necessary resources	<p>Workshop: Presumably, there is a group of 16 trainees, two trainees per workplace;</p> <ul style="list-style-type: none"> - The area is at least 80 m²; - 08 workplaces; - Power supply: AC electric power of 220V/ 50Hz and 380V/50Hz, adjustable electric power (0V-24V) and compressed air supply; - Emergency stop switches for each work place; - Workplace for the teacher and cabinet for holding teaching aids; - Magnetic board with dimension of at least 2,5 x 1,2m; - Projector and projections;
	<p>Equipments for each workplace:</p> <ul style="list-style-type: none"> - Tables. - Specialized tools; - 02 chairs per workplace for trainees; - Motors of different types (AC motors, DC motors, etc.); - Personal computers and application softwares; - Programme loader for microcontroller.
	<p>Materials</p> <ul style="list-style-type: none"> - Microcontroller, connector and other electronic components; - Tin for welding, printed circuit boards; - Accessories for assembly;
Teaching and learning aids	<ul style="list-style-type: none"> • Handouts for trainees • Instructions for doing practical exercises • Transparencies for presentation • Simulation softwares

