Teaching materials
Assembly Instruction

MISCE project

Mechatronics for Improving and Standardizing Competences in Engineering

Competence: Mechanical systems

Workgroup: RzuT, UNICA, UCLM, UNICAS

This document corresponds to the burnishing tool for the competence 'Mechanical Systems'.

Version: 1.0

Date: December 6th, 2024

Visit https://misceproject.eu/ for more information.

Index of contents

1 The burnishing tool 2
1.1 General Information 2
1.2 Bill of materials 3
1.2.1 Burnishing tool 3
1.2.2 PLC stand 5

Index of figures

Fig. 1 The burnishing tool 2
Fig. 2 The control unit 2

Index of tables

Table I. Burnishing tool components list 3
Table II. Burnishing head components list 4
Table III. PLC stand components list 5

1 The burnishing tool

1.1 General Information

The burnishing tool is designed as a two-part system comprising the mechanical burnishing tool (Fig. 1) and its dedicated control unit (Fig. 2). The mechanical tool, complete with a lathe-mounting bracket, has been modelled in SolidWorks 2024 and is accompanied by CAD data as well as fabrication and assembly drawings.

Its counterpart, the control unit, integrates a Siemens SIMATIC S7-1200 CPU 1215C PLC, PM 1207 power supply and MTP 400 Unified BASIC HMI within a purpose-built enclosure designed in Autodesk Inventor 2022. The enclosure's front panel is CNC-routed 3 mm DiBond plate while the handles and corner connectors are produced via 3D printing. The PLC program is provided alongside the CAD files.

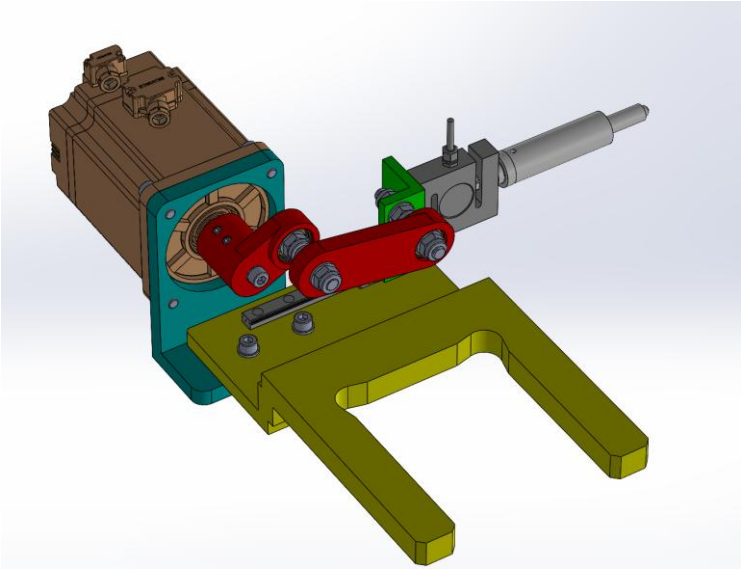

Fig. 1 The burnishing tool

Fig. 2 The control unit

All electrical interconnections are specified. A 2.5 mm² cable is recommended for supplying AC mains to the controller, with 1.5 mm² conductors used for the remaining power circuits. Signal wiring from the EMS110 S-beam load cell, which attaches via a four-pin industrial quick-disconnect on the enclosure's front, employs 0.5 mm² cable, and short Cat 5e patch cords link the PLC to both the servo-drive and the HMI. Overcurrent protection for the PLC supply is achieved with an 8 A fuse, while motor power by an Eaton Z-MS-6.3/2 breaker. The servo motor Inovance MS1H4-75B30CB-A331Z-INT and its drive SV660FS5R5I-FS are connected using manufacturer-supplied cabling.

All components listed in the tables I-III with a "*File:*" designation must be manufactured **strictly** in accordance with their CAD models or technical drawings, using the materials specified in the accompanying documentation. **The base of the burnishing tool must be adapted to the available lathe.** Where no material is called out, assume structural steel. With regard to the PLC stand, every bracket and corner connector is produced by 3D printing in PLA. The parts name highlighted in blue has to be purchased, highlighted in red manufactured and highlighted in green 3D printed.

Assembly of both the burnishing tool and the PLC stand must follow the exploded-view and assembly drawings exactly. All fastenings and cable routings are to be executed as shown in those drawings:

- The full wiring schedule and pin-out reference is shown in the file **„Burnisher electrical".**
- The exploded-view for assembly of the burnishing tool is shown in the file **„Burnishing tool assembly".**
- The exploded-view for assembly of the burnishing head is shown in the file **„Burnisher - assembly".**
- The assembly file for assembly of the PLC stand is shown in the file **„PLC_stand.iam".**

1.2 Bill of materials

1.2.1 Burnishing tool

The burnishing tool consists of burnishing head subassembly which has its own components list.

Table I. Burnishing tool components list

Item No.	Part Name	Part Number / Drawing File	Quantity
1	Base	File: Base	1
2	Cart	File: Cart	1
3	Arm 1	File: Arm 1	1
4	Arm 2	File: Arm 2	1
5	Motor Mount	File: Motor Mount	1
6	Burnisher Head Assembly	File: Burnisher Assembly	1
7	Shaft – Connector 1	File: Shaft – Connector 1	1
8	Shaft – Connector 2	File: Shaft – Connector 2	1

9	Linear Rail Cart	MGN R09R115HM_FILE_1	1
10	Linear Rail	MGN09CZ0HM_EL_FILE_1	1
11	Servo Motor	MS1H1-75B30CB-(x)331Z	1
12	Servo Drive	SV660FS5R5I-FS	1
13	Beam Load Cell	EMS110-0.5	1
14	Screw M3×8 DIN 912	DIN 912	4
15	Screw M3×12 DIN 912	DIN 912	6
16	Screw M5×16 DIN 912	DIN 912	1
17	Screw M6×20 DIN 912	DIN 912	6
18	Screw M6×30 DIN 912	DIN 912	3
19	Screw M5×10 ISO 4026	ISO 4026	2
20	Spring Washer M3 DIN 6798	DIN 6798	4
21	Spring Washer M5 DIN 6798	DIN 6798	1
22	Spring Washer M6 DIN 6798	DIN 6798	7
23	Screw Washer M6 DIN 125	DIN 125	2
24	Circlip Ø24×1.2 DIN 472	DIN 472	2

Table III. Burnishing head components list

No.	Part Name	Part Number / Drawing File	Quantity
1	Burnisher – Threaded Pin	File: Burnisher – Threaded Pin	1
2	Burnisher – Piston	File: Burnisher – Piston	1
3	Burnisher – Cylinder	File: Burnisher – Cylinder	1
4	Spring	Sodemann 22670	1
5	Burnisher – Cover	File: Burnisher – Cover	1
6	Hex Nut M6	DIN 439	1

1.2.2 PLC stand

Table IIIII. PLC stand components list

No.	Part Name	Part Number / Drawing File	Quantity
1	PLC CPU	SIMATIC S7-1200 CPU 1215C DC/DC/DC (6ES7 215-1AG40-0XB0)	1
2	Power Supply	PM 1207 (6EP1 332-1SH71)	1
3	Corner Connectors	File: corner_connector	12
4	DIN-Rail Holders	File: din_mount	2
5	DIN-Rail	35 mm EN 60715	1
6	Enclosure Handle	File: din_handle	1
7	Aluminium extrusion profile 20x20, 455mm	File: Profil_x,	2
8	Aluminium extrusion profile 20x20, 250mm	File: Profil_y	2
9	Aluminium extrusion profile 20x20, 160mm	File: Profil_y_sr	1
10	Aluminium extrusion profile 20x20, 250mm	File: Profil_z	2
11	Screws Ø 3 mm	Fastening screws for profiles and panels	44
12	Hammer-nuts	M4 captive (“hammer”) nuts	42
13	Standard Nuts	M4 hex nuts	2
14	Front Panel 3 mm DiBond plate	File: ramka	1
15	Motor controller mounting panel 3 mm DiBond plate	File: Pod_ster	1
16	Cable Management Trays	PVC cable trays and clips (any type)	1 m in total

17	Logic Power Protection	8 A slow-blow fuse (any type 8A)	1
18	Motor Power Protection	Eaton Z-MS-6.3/2 circuit breaker	1
19	Industrial Connector (Force Sensor)	ZP2 four-pin quick-disconnect (or similar 4 pin) male and female	2
20	Ethernet Patch Cables	Cat 5e, 0.5 m length	2
21	Internal Wiring (power & signal cables)	LiYCY: 2.5 mm² for mains, 1.5 mm² for power, 0.5 mm² sensor	5 m in total
22	Unified BASIC HMI	MTP 400 (6AV2123-3DB32-0AW0)	1
23	Crimp connectors	Ferrule connectors	8