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Sistema Laser 1 (SL-1) Basic Training - Precitec Welding Head

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INTRODUCTION:

This document outlines the training which one must go through to be capable and allowed to operate the SL-1 with the YW-52 Precitec welding head installed. By its conclusion, one should be able to:

- Install or uninstall the Precitec welding head;
- Independently operate the SL-1 to perform all laser processes which exclusively depend on the Precitec welding head, for example, laser remelting or laser autogenous welding;
- Prepare an experiment or process to be performed with the previously mentioned configuration;
- Basic machine maintenance;
- Manually write and simulate basic G-Code programs for laser processing in the SL-1;
- Schedule sections at SL-1's agenda.

Further training is required for the operation of other SL-1 configurations, thus, the knowledge provided here is also necessary for the execution of specific manufacturing processes, such as:

- Laser metal deposition with powder;
- Laser metal deposition with wire;
- Laser hybrid welding (Arc-Laser);
- Etc.

DESCRIPTION:

The training is divided is three stages or steps, to be performed in a group and under the coach's supervision. At the coach's discretion, a candidate can skip steps 1 and 2, however, step 3 – the supervised processing – is essential to assure operator qualification. Although unlikely, at any moment along the training's course, a candidate can be said unfit for operation. Thereon, a candidate may be required to repeat a stage or even be excluded from training. Such decision will only be taken after inquiry and discussion with the responsible professor.

Bellow, the three main training stages are described. Note that a number of documents is related and required to each stage's proper attendance. Thus, if the reader characterizes as an operation candidate, please be aware if the latest versions of the documents listed ahead are at hand before training start.

- SL-1 Basic Commands;
- Programming Manual - Fundamentals - 840D sl;
- Simulating Programs for the SL-1.

1. Introduction to the SL-1 and G-Code:

Prerequisites: Professor's authorization
Estimated duration: A single work shift (2-3h)
Recommended number of students: max. 6
Predicted Activities:

- System and subsystems introduction and general description;
- SL-1 documentation and manuals presentation;
- Introduction to G-Code and program standardization;
- How to write, simulate and verify codes in SL-1's console;
- G-Code programming exercises assignment:
    - (Alternative 1) Three commented Sub Program Functions (SPF) and a single commented Main Program Function (MPF);
    - (Alternative 2) A commented MPF designed for the execution of an experiment.

2. Exercises Correction and Processing:

Prerequisites: Previous stage completion or programming experience in G-code
Estimated duration: One to two work shifts (6-8h), which may be divided in two encounters
Recommended number of students: 2-3
Predicted Activities:

- Description of SL-1 safety rules and procedures;
- Step-by-step of SL-1's star-up and shutdown;
- Programming exercises revision and evaluation;
- Process set-up (gas, sample alignment, etc.);
- Machine basic operation by the students (at coach's discrection);
- Optional: Laser processing (with or without laser) from the written exercise(s).

3. Supervised Processing:

Prerequisites: Previous stages completion; or extensive programming experience (including in G-code), experience in CNC operation and readout of SL-1's Operation Manual.
Estimated duration: One to four work shifts (3-16h)

Recommended number of students: Preferably individual (1-2)

Predicted Activities:

- Final test: a complete experiment or process preparation and execution by the student under coach's supervision.

RELATED TRAININGS:

As mentioned before, further training is required for complete use of SL-1's capabilities. Please consult your coach for more information. Some available trainings are listed below:

- Laser Metal Deposition-powder - LMP-ISI cladding head and GTV powder feeder maintenance and operation;
- Laser Metal Deposition-powder - Fraunhofer Coax-50-S cladding head and the GTV powder feeder maintenance and operation;
- IMC Digiplus A-7 operation, arc welding set-up and wire feeder installation – Continuous feed.
- IMC Digiplus A-7 operation, arc welding set-up and wire feeder installation – Dynamic feed.
- LMP's Slic3r-to-Sinumerik CAM software for additive manufacturing;