Specification for Flip Coil Bench Parts

6.4.25.1 **Rev. 0**

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REVISION HISTORY

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1.0 INTRODUCTION

1.1 PURPOSE

This specification lists the properties of the linear and rotating stages required for a flip coil bench to be used in the Magnet Measurement Facility [1] at the Canadian Light Source, Inc (CLS), situated on the University of Saskatchewan campus in Saskatoon, Saskatchewan. The bench will be used primarily to measure first- and second field integrals for undulators and wigglers to be used in the CLS electron storage ring for production of synchrotron light.

A flip coil bench is shown in Figure 1. It consists of two x-y-z tables mounted on two concrete blocks. Each table carries a rotating stage, and the coil is wound between the two rotating stages. The end of the coil is connected to an integrator. The tables are connected together in a master-slave arrangement to assure synchronization of the movements.

The linear stages places the coil at the correct position, and the rotating stages then rotates the coil from 0^o to 360^o in four 90^o steps, then back to 0^o. The integrated EMF for each step contains different linear combinations of the horizontal and vertical field integrals. There are eight measurements of two unknown, different conditions can be applied to eliminate electronic drift, and the measurements are very accurate.

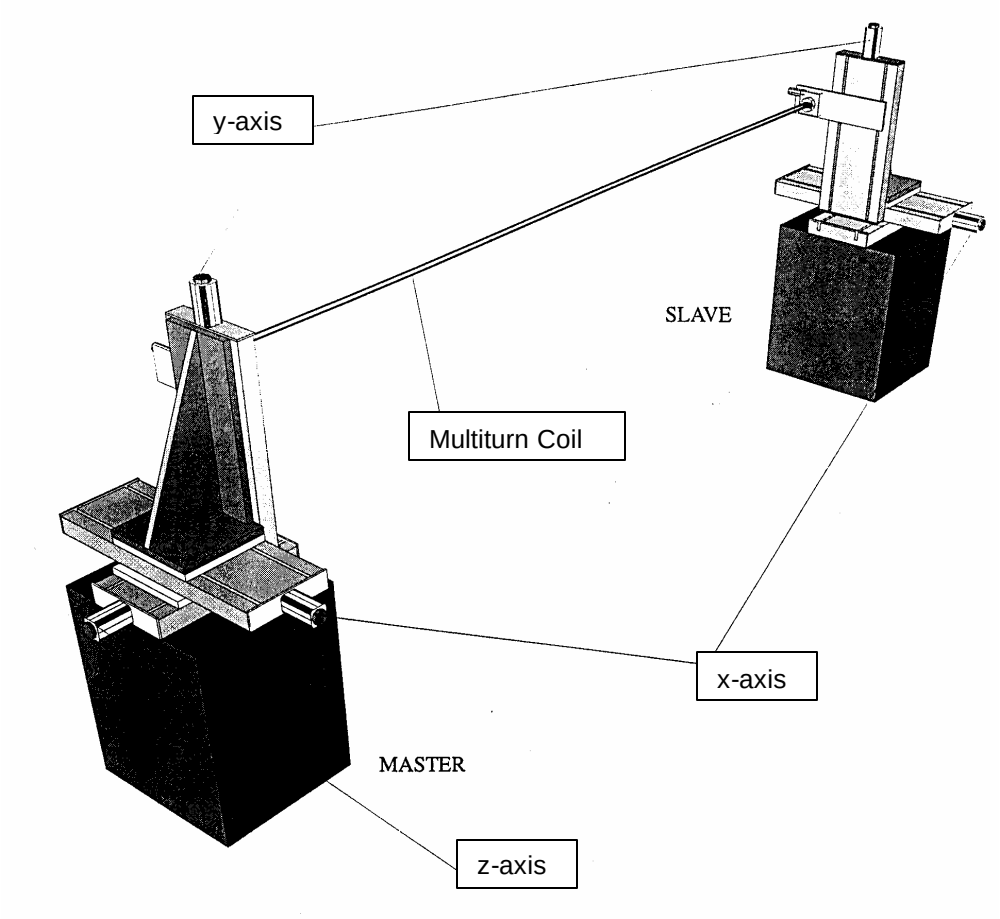

Figure 1. Typical Flip Coil Bench.

1.2 SCOPE

The specification concerns the linear and rotating stages and the mounting brackets needed to connect the stages together. The number of stages needed and their required performance are listed in Table 2.2.1. The concrete blocks, coil bobbins, integrator etc will be supplied by CLS.

1.3 DEFINITION

A coordinate system is used as indicated in Figure 1. The x-axis in horizontal and perpendicular to the coil, the y-axis is vertical and the z-axis horizontal and parallel to the coil. The linear stages will be called the x-, y or z-stage depending on the axis that is parallel to the motion of the stage.

2.0 REQUIREMENTS

2.1 FUNCTION

2.1.1 The z-stages are only used to stretch the coil, and need not to be motorized. The travel should be at least 200 mm.

2.1.2 The x and y-stages are used to position the coil for measurements. They need good resolution and reproducibility. The travel should be at least 300 mm.

2.1.3 The mapping of the field integrals takes a long time, and it is important the rotating stages have a high speed of rotation.

2.1.4 The rotating stages shall have a central hole with at least 25 mm diameter.

2.1.5 The x-, y- and rotating stages shall have a homing switch and limit switches. The rotating stages shall be able to rotate a full 360^{o}.

2.1.6 CLS has developed controllers for stepping motors, and prefer to use this system if possible [3]. The vendor shall give the requirements for the controller, and provide a quote for their own controllers in case the CLS system is not applicable.

2.1.7 The flip coil bench will be computer controlled, and the vendor shall include all interface modules necessary for the computer control. The computer hardware will be provided by CLS.

2.1.8 All computer hardware and software shall meet the requirements of CLS Technical Specification 7.4.39.1, Appendix A-F [4].

2.2 PERFORMANCE

Table 1 summarizes the requirements for the stages.

2.3 SAFETY AND ENVIRONMENTAL

The equipment will be operating in an environment temperature stabilized to +/- 1^{o}C. The relative humidity is expected to vary between 25% and 50% depending on the season.

2.4 APPLICABLE CODES, STANDARDS AND PROCEDURES

Not applicable.

2.5 QUALITY ASSURANCE

The manufacturer shall maintain and apply a quality insurance program compliant with ISO 9001 for the design, manufacture and testing of the equipment.

2.6 INSPECTION, TESTING AND COMMISSIONING

Not applicable.

2.7 RELIABILITY AND MAINTAINABILITY

2.7.1 The expected life time of the flip coil bench is 10 years. The vendor shall supply instructions for maintaining the stages and a recommended spare parts list.

2.7.2 The load from the coil is expected to be maximum about 100 N.

2.8 LAYOUT

The six linear slides will be assembled to form a x-y-z table with the z-slide on the bottom, then the x-slide and on top the y-slide. The rotating stage will be mounted with an offset on the y-slide as shown in Figure 1.

The position of the flip coil bench in relation to the other equipment in the magnet measurement area is shown in [1].

2.9 VIBRATION AND ACOUSTIC NOISE

The coil will be about 4 meters long, and is sensitive to vibration. It is important the rotating stages rotate smoothly.

2.10 SERVICES

Not applicable.

2.11 OTHER REQUIREMENTS AND CONSTRAINTS

Not applicable.

3.0 REFERENCES

[1] I.Blomqvist, Canadian Light Source, Saskatoon, SK. CLS Design Note 6.2.25.5, CLS Magnet Measurement Facility.

[2] CLS Documentation Specification, Note 0.4.1.1 Rev 2.

[3] CLS Report, CLS Microstep Motor Driver, August 21, 2000.

[4] CLS Technical Specification 7.4.39.1. Control System Technical Specification.

Table 1 Requirements on the linear and rotating stages.

	x-stage	y-stage	z-stage	Rotating stage
Number required	2	2	2	2
Stepping motor driven	Yes	Yes	No	Yes
Length of travel	> 300 mm	> 300 mm	> 200 mm	N/A
Straightness	+/- 10 μm	+/- 10 μm	+/- 10 μm	N/A
Flatness	+/- 10 μm	+/- 10 μm	+/- 10 μm	N/A
Position resolution	+/- 2 μm	+/- 2 μm	N/A	+/- 2 minutes of arc
Repeatability	+/- 1 μm	+/- 1 μm	N/A	
Speed	0.1 m/s	0.1 m/s	N/A	>15 RPM
Concentricity	N/A	N/A	N/A	+/- 5 μm
Position resolution of homing switch	+/- 5 μm	+/- 5 μm	N/A	+/- 2 minutes of arc