

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
- LIGO -

CALIFORNIA INSTITUTE OF TECHNOLOGY  
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<b>PSL CDS Interface Control Document</b>		
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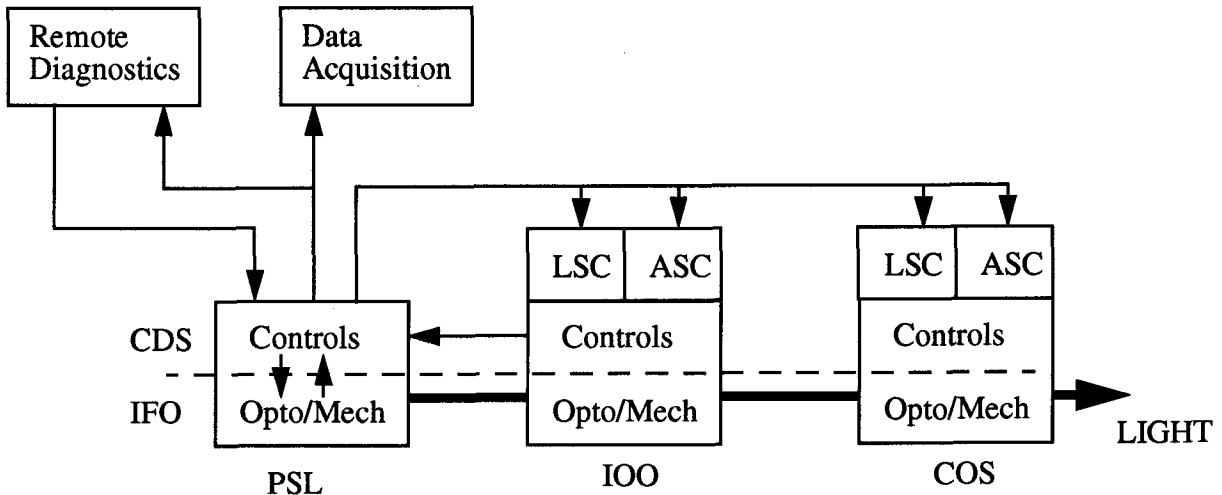
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# 1 INTRODUCTION

## 1.1. Scope

This document covers the interfaces associated with the LIGO Prestabilized Laser Controls. A block diagram showing the PSL Controls and its interface to other systems is shown in Figure 1:



**Figure 1: Block Diagram of PSL Control Interfaces**

## 1.2. Purpose

The purpose of this document is to specify the interfaces between the LIGO Prestabilized Laser Controls and all other systems both inside and outside CDS. These interfaces may be mechanical, electrical and/or software.

This document is to be used in conjunction the PSL Control Design Requirements Document (LIGO-T950001), PSL Software Requirements Specification (LIGO-T950022) and the CDS System schematics and IFO schematics referenced herein. Copies of the CDS system schematics are included in Appendix 1. These schematics are included as reference, but the latest revision of each schematic should be consulted for the most up to date and accurate information.

# 2 INTERFACES TO PSL COMPONENTS

## 2.1. Argon Ion Laser

The interface to the Argon Ion Laser is at the "Remote Control Connector" of the laser power supply. The connector is a 37 pin D-type female connector. All cabling and the mating connector shall be provided by CDS. Connector pin assignments are as specified in Table 5-2 of the laser user's manual. A copy of Table 5-2 is included in Appendix 2.

## 2.2. Phase Modulation

The interface between the PSL Controls Phase Modulation LCU and the PSL optics and mechanics system is at the connector on the modulation Pockels Cell. The characteristics of the interface are shown in Table 1

**Table 1: Phase Modulation LCU to PSL Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Modulation Pockels Cell	Phase Modulation Amplifier	BNC on Pockels Cell Case	Voltage: 0 to 500 Vrms Frequency: 10 MHz Cable: RG58U Connector: BNC	TBD	D95-0099

The Pockels Cell is located on the optics table. All cabling and the matching network to match the input impedance of the Pockels Cell to 50 ohms shall be provided by CDS.

## 2.3. Power Stabilization

The interface between the PSL Controls Power Stabilization LCU and the PSL optics and mechanics system is at the connector on the modulation input of the VCO Deflector Driver and the connector on the Acousto-Optic Modulator. The interfaces are detailed in Table 2.

**Table 2: Power Stabilization LCU to PSL Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
VCO Deflector Driver	Power Stabilization Amplifier	BNC on VCO Deflector Driver (Modulation Input)	Voltage: +/- 1 V Input Impedance: 50 ohms Cable: RG58U Connector: BNC	TBD	D95-0095 D95-0023
Acousto-Optic Modulator	Power Stabilization Amplifier	Acousto-Optic Modulator Input Connector	Per DE-40M manual Cable: RG58U Connector: BNC	TBD	D95-0023

The VCO Deflector Driver is an IntraAction Model DE-40M and the Acousto-Optic Modulator is a Model TBD. Both are provided by the PSL Interferometer subsystem. The cables between the Power Stabilization Amplifier and the VCO Deflector Driver and from the VCO Deflector Driver to the Acousto-Optic Modulator will be provided by CDS.

The VCO Deflector Driver is located in CDS rack B101. The Acousto-Optic Modulator is located on the optics table.

## 2.4. Frequency Stabilization

The interface between the PSL Controls Frequency Stabilization LCU and the PSL optics and mechanics system is shown in Table 3.

**Table 3: Frequency Stabilization LCU to PSL Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Fast PZT Mirror	PZT Driver Module	Fast PZT Mirror input connector	Voltage: 0 to 200 volts Connector: KPT06F8-2S Cable: Twisted Shielded pair	TBD	D95-0025
Slow PZT Mirror	PZT Driver Module	Slow PZT Mirror input connector	Voltage: 0 to 850 volts Connector: KPT06F8-4S Cable: Twisted Shielded pair	TBD	D95-0025
+ Pockels Cell	PC Driver Module	+ Pockels Cell input connector	Voltage: 0 to 400 volts Connector: BNC Cable: RG 58U	TBD	D95-0025
- Pockels Cell	PC Driver Module	- Pockels Cell input connector	Voltage: 0 to 400 volts Connector: BNC Cable: RG 58U	TBD	D95-0025
Reference Cavity Reflected Light	RF Photodetector	Optical Signal at input to Reference Cavity	Power: TBD milliwatts max., TBD milliwatts nom.	TBD	D95-0025

All cabling and mating connectors to interface to the devices shown in the table above shall be provided by CDS.

The reflected light signal from the reference cavity shall be attenuated (by the PSL Optics and Mechanics system) such that the light power on the photodiode is as shown in the table above.

## 2.5. Reference Cavity

### 2.5.1. Reference Cavity Vacuum and Temperature Control Systems

The interface between the PSL Controls Reference Cavity LCU (Vacuum and Temperature Controls only) and the PSL optics and mechanics system is shown in Table 4.

**Table 4: Reference Cavity (Vacuum and Temperature Controls) LCU to PSL Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Ion Pump Controller	Ion Pump Current Monitor ADC	Ion Pump Controller Current Monitor Connector	Voltage: 0 to 100 milli-Volts	TBD	D95-0098
Reference Cavity Control Thermocouple	Thermocouple Signal Conditioner	Thermocouple wire end	Type: J	TBD	D95-0098
Reference Cavity Thermocouple #1	Thermocouple Signal Conditioner	Thermocouple wire end	Type: J	TBD	D95-0098
Reference Cavity Thermocouple #2	Thermocouple Signal Conditioner	Thermocouple wire end	Type: J	TBD	D95-0098
Reference Cavity Thermocouple #3	Thermocouple Signal Conditioner	Thermocouple wire end	Type: J	TBD	D95-0098
Reference Cavity Thermocouple #4	Thermocouple Signal Conditioner	Thermocouple wire end	Type: J	TBD	D95-0098

The reference cavity temperature controller shall be provided by CDS. All thermocouples and the ion pump controller shall be provided by the IFO PSL system.

## 2.5.2. Reference Cavity Steering Mirrors

The interface between the PSL Controls Reference Cavity LCU (Steering Mirrors only) and the PSL optics and mechanics system is shown in Table 5.

**Table 5: Reference Cavity (Steering Mirrors) LCU to PSL Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Mirror 1 X Axis	Steering Mirror Interface Box	Mirror 1 X Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024
Mirror 1 Y Axis	Steering Mirror Interface Box	Mirror 1 Y Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024
Mirror 1 Z Axis	Steering Mirror Interface Box	Mirror 1 Z Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024
Mirror 2 X Axis	Steering Mirror Interface Box	Mirror 2 X Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024
Mirror 2 Y Axis	Steering Mirror Interface Box	Mirror 2 Y Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024
Mirror 2 Z Axis	Steering Mirror Interface Box	Mirror 2 Z Axis Input Connector	Voltage: 0 to 100 volts Connector: LEMO ERA.0S.301	TBD	D95-0024

The interface point is at a CDS provided steering mirror interface box that is located on the optics table. Steering mirror input cables and connectors, provided by the IFO PSL system, are plugged into the appropriate connectors on the interface box.

### 3 INTERFACES TO OTHER IFO SUBSYSTEMS

#### 3.1. Input Output Optics

The signal interfaces between the PSL Controls and the Input Output Optics Controls are shown in Table 6.

**Table 6: PSL to Input Output Optics Control Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Feed-around Signal	Laser Loop Amplifier	BNC on Laser Loop Amplifier	Voltage: +/- 10 V Input Impedance: 1K ohms Cable: RG58U Connector: BNC Response Time: 1 microsecond	TBD	D95-0025
Input Output Optics Controller	Frequency Stabilization LCU	Channel Access/Network	Response Time: 1 second	TBD	TBD

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### 3.2. Length Sensing and Control

The signal interfaces between the PSL Controls and the Length Sensing and Control subsystem are shown in Table 7.

**Table 7: PSL to Length Sensing and Control Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Feed-around Signal	Laser Loop Amplifier	BNC on Laser Loop Amplifier	Voltage: +/- 10 V Input Impedance: 1K ohms Cable: RG58U Connector: BNC Response Time: 1 microsecond	TBD	D95-0025
Length Sensing Controller	Frequency Stabilization LCU	Channel Access/Network	Response Time: 1 second	TBD	TBD

### 3.3. Alignment Sensing and Control

The signal interfaces between the PSL Controls and the Alignment Sensing and Control subsystem are shown in Table 8.

**Table 8: PSL to Alignment Sensing and Control Interfaces**

<i>PSL O/M Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
Alignment Sensing Controller	Frequency Stabilization LCU	Channel Access/Network	Response Time: 1 second	TBD	TBD

### 3.4. CDS Remote Diagnostics

The interface to the CDS remote diagnostics system is at the front or rear panel connector of the respective PSL subsystem module. All cabling and mating connectors to the remote diagnostics

system are the responsibility of the remote diagnostics system. A list of PSL remote diagnostics signals is shown in Table 9.

**Table 9: PSL to Remote Diagnostics Interfaces**

<i>PSL Remote Diagnostics Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
TBD	Power Stabilization Amplifier	Power Stabilization Test Input	Connector: EPL.00.250.NTN	TBD	D95-0023
TBD	Power Stabilization Amplifier	Power Stabilization Test Output	Connector: EPL.00.250.NTN	TBD	D95-0023
TBD	Power Stabilization Amplifier	Power Stabilization Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0023
TBD	Laser Loop Amplifier	LLA Demod Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	Laser Loop Amplifier	PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	Laser Loop Amplifier	LLA Test Input	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PZT Driver	PZT Driver Test Input	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PZT Driver	Fast PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PZT Driver	Slow PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PC Driver	+PC Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PC Driver	-PC Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	Ringdown Photodiode	Ringdown Photodiode Output Monitor	Connector: BNC	TBD	TBD

**Table 9: PSL to Remote Diagnostics Interfaces**

<i>PSL Remote Diagnostics Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
TBD	Optical Spectrum Analyzer	OSA Output	Connector: BNC	TBD	TBD
TBD	Reference Cavity Beam Spot	Projected Beam Spot	TBD	TBD	TBD

The reference cavity beam spot will be projected onto a flat surface using a combination of mirrors and lenses provided by the PSL Interferometer subsystem. The remote diagnostics subsystem will provide the CCD camera and cabling used to provide the operator display.

### 3.5. CDS Data Acquisition

The interface to the CDS Data Acquisition system is at the front or rear panel connector of the respective PSL subsystem module. All cabling and mating connectors to the Data Acquisition system are the responsibility of the Data Acquisition system. A list of PSL data acquisition signals is shown in Table 10 .

**Table 10: PSL to Data Acquisition Interfaces**

<i>PSL Remote Diagnostics Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
TBD	Power Stabilization Amplifier	Power Stabilization Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0023
TBD	Laser Loop Amplifier	LLA Demod Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	Laser Loop Amplifier	PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PZT Driver	Fast PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PZT Driver	Slow PZT Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025

**Table 10: PSL to Data Acquisition Interfaces**

<i>PSL Remote Diagnostics Device</i>	<i>PSL CDS Device</i>	<i>Interface</i>	<i>Characteristics</i>	<i>PSL O/M Drawing/ Doc #</i>	<i>PSL CDS Drawing/ Doc #</i>
TBD	PC Driver	+PC Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025
TBD	PC Driver	-PC Output Monitor	Connector: EPL.00.250.NTN	TBD	D95-0025

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# APPENDIX 1 CDS SYSTEM SCHEMATICS

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**APPENDIX 2      TABLE 5-2 ARGON ION LASER  
USER'S MANUAL**

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