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Chameleon Discovery Introduction

The purpose of this document gives details about installation requirements and procedures on the Chameleon Discovery laser system. The document reflects current procedures for the Chameleon Discovery. This document does not replace the Discovery Operator's manual. Users must refer to the Operator's manual before turning ON the laser system. The document is intended for Coherent Field Service.

NOTICE
This document must be used with the operator's manual. Refer to the Chameleon Discovery Operator's manual before turning ON the laser.

Figure 1.2-1. Discovery Laser Head

Installation Checklist

[ ] Inspect and unpack the laser system

[ ] Move system to installation location

[ ] Verify PSU fuses

[ ] Connect the two umbilicals to the PSU and laser head

[ ] Connect the MRU interlock to the PSU and MRU

[ ] Connect the MRU hoses to the MRU and laser head

[ ] Install the door override connector to the MRU

[ ] Connect the chiller hoses to the chiller and laser head

[ ] Fill chiller with CoolFlow

[ ] Verify chiller setpoint

[ ] Verify the correct service and customer software is installed

[ ] Start the MRU, chiller and PSU

[ ] Start service GUI

[ ] Take EEPROM data

[ ] Connect the WaveScan and PowerMaxUSB tools to service GUI

[ ] Run pump map routine

[ ] Perform data run and verify specifications

[ ] Complete installation

System Configuration

The power supply contains all of electrical controls and DC supplies to the head. The connections are military style electrical cables that are 3 m in length. There are no optical connections from the PSU to the head.

Maximum electrical consumption of the system is in the range of 2300 W with a typical output of 1000 W

Table 1.2-1. System Dimensions and Weight

	LENGTH	WIDTH	HEIGHT	WEIGHT
STANDARD HEAD[A]	820.8 mm (32.31 in.)	445.2 mm (17.53 in.)	286.7 mm (11.29 in.)	90 kg (198.42 lb.)
TPC HEAD[A]	1010.8 mm (39.80 in)	445.2 mm (17.53 in)	286.7 mm (11.29 in)	98 kg (216.05 lb.)
POWER SUPPLY	417.7 mm (16.45 in.)	483.0 mm (19.02 in)	132.3 mm (5.21 in.)	11 kg (24.25 lb.)

Table 1.2-1. System Dimensions and Weight

	LENGTH	WIDTH	HEIGHT	WEIGHT
MRU X1	450.09 mm (17.75 in.)	431.8 mm (17.00 in.)	95.4 mm (3.76 in.)	12 kg (26.5 lb.)
CHILLER[B]	400 mm (15.75 in.)	484 mm (19.06 in.)	267 mm (10.51 in.)	31 kg (68.[illegible]b.)

a. The Chameleon Discovery is available in two versions, Standard or TPC. Verify the version for the correct head dimensions.
b. Dimension values are of the recommended chiller SMC HECR Series.

System Utility and Environmental Requirements

Refer to the datasheet and user manual for specifications.

The system requires 3 single-phase power outlets:

90-250 Vac auto-ranging, 50-60 Hz.

Shipping Containers

The laser system shipment is sent with five pieces. The information below gives the details of the shipping containers

Table 1.2-2. Container Type, Dimension and Weight

SHIPPING CONTAINER INFORMATION			
Item	Container Type	Weight, kg	Dimensions (LxWxH), mm
Laser Head[a]	Wooden Crate (See Figure 1.2-2)	173	1230 x 840 x 730
Power Supply	Cardboard Box	12	580 x 550 x 210
MRU	Cardboard Box	12	580 x 550 x 210
Chiller	Cardboard Box	24	650 x 600 x 300
CoolFlow	Small Cardboard Box	6	200 x 200 x 300
Total Weight		227	

a. The laser head weight listed is for the Discovery TPC. If the laser does out include the TPC option, the head weight is 165 kg.

Unpacking the Laser Head

1. Remove the top cover of the wooden crate.
   - The top cover will be used to form a ramp.
2. Remove the short end (840 mm) of the crate labeled with “BRAKES THIS SIDE”, “FRONT THIS SIDE”.

Figure 1.2-2. Laser Head Crate and Label

3. Remove the top foam insert and accessories.

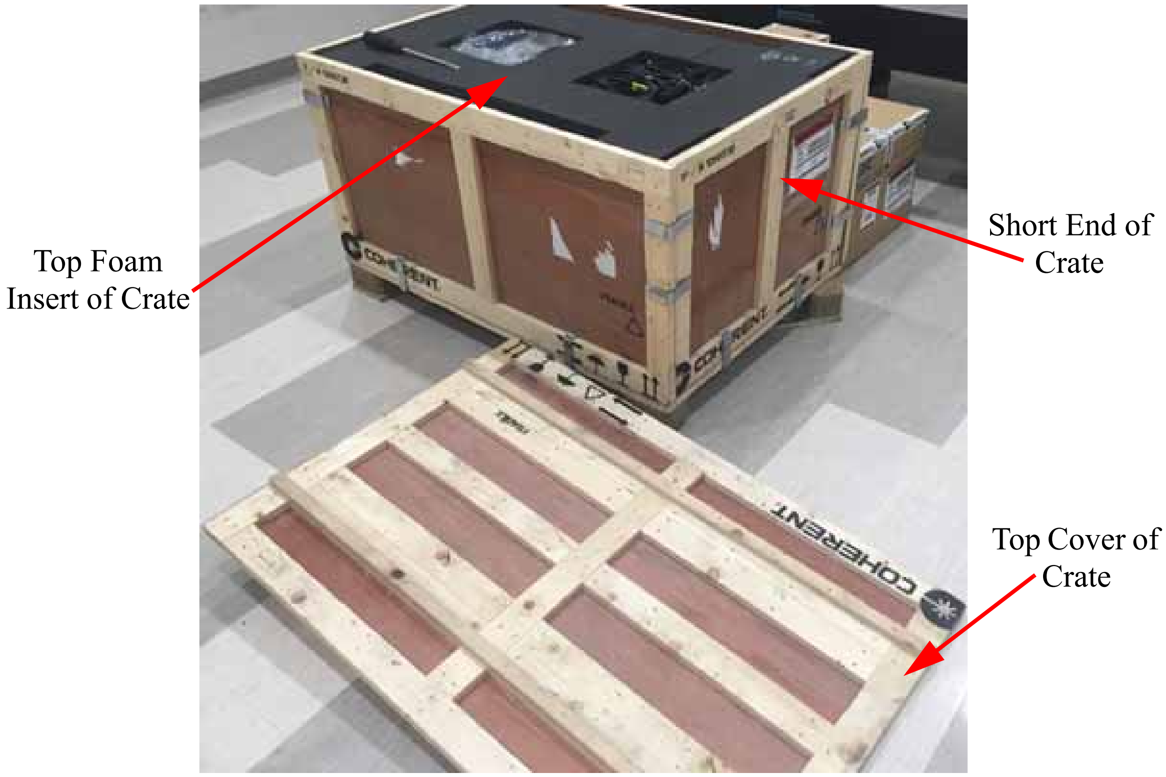


Figure 1.2-3. Laser Crate with Top Cover Removed

4. Turn the top cover over and fit into the crate form a ramp as shown in Figure 1.2-4. The two clips (shown with arrows in Figure 1.2-4) on the side panels must be removed for the ramp to fit.

5. Remove any accessories located under the laser head cart.

6. Release the brakes on the wheeled cart and carefully roll the laser head down on to the floor.

NOTICE
Do not bump the laser head while rolling down and off the ramp.

---

7. Roll the laser head on the wheeled cart to the install location.

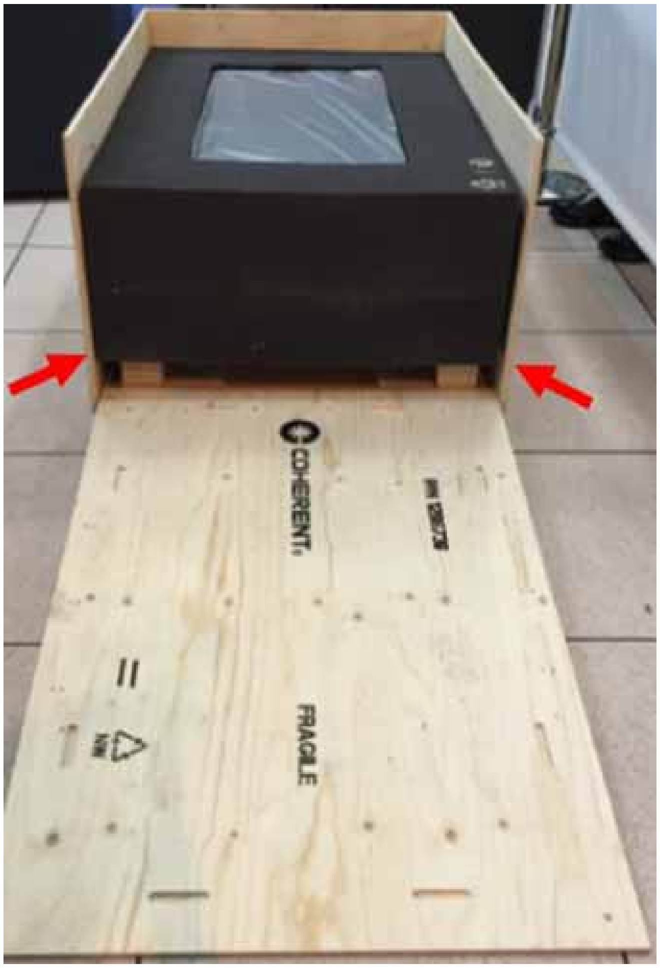


Figure 1.2-4. Crate Ramp

CAUTION!
Coherent recommends that multiple personnel transport and lift the Chameleon Discovery Laser System.

Removable Handles

Removable handles are provided to help the final lifting of the laser head on to the optical table. The handles are attached to the front and rear bulkheads using the M8 bolts supplied in the accessory kit.

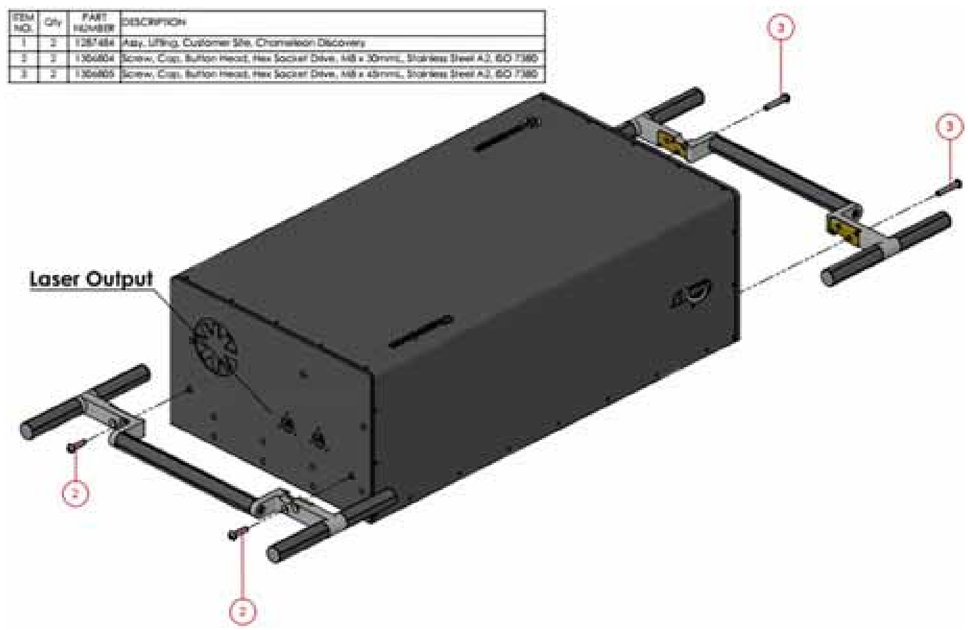


Figure 1.2-5. Laser Head with Handles

Installation Procedure

Tooling

- APE WaveScan Spectrometer

- Coherent PowerMaxUSB power meter (min. 10W)

- 1 % pick-off beam sampler
  - Thorlabs PN BSF10-C
  - Thorlabs PN WW41050
- Assorted standard laser installation hand-tools
- Discovery Service GUI
- Discovery Customer GUI
  Available at:

http://www.coherent.com/products/?2171/Chameleon-Discovery

System Connections

Fuses for PSU

Confirm the operating voltage and fuse type by checking that the white arrow is pointed toward the white mark for the needed voltage range. The arrow indicates the contact end for the fuses. The lasers are sent with both 4 A and 8 A fuses inserted into the holder or with the 8 A fuses enclosed in the PSU accessory kit. See Figure 1.2-6 for an operating voltage range of 220-240Vac (4 A fuses).

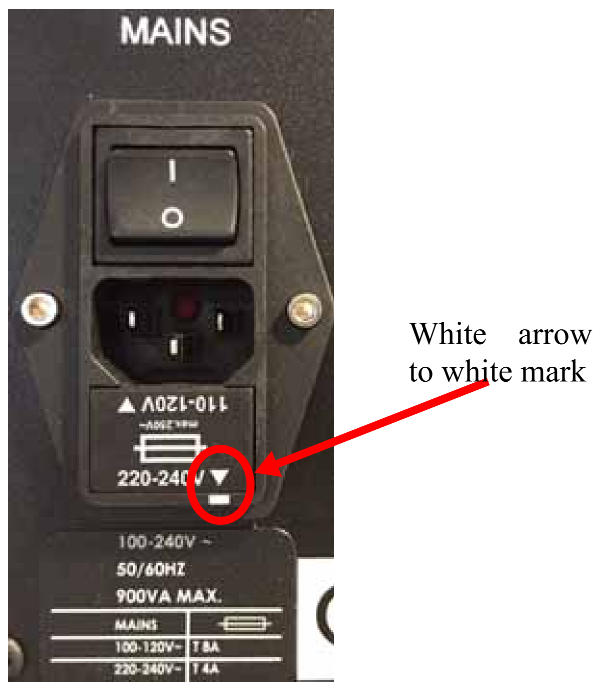


Figure 1.2-6. Fuse Verification

PSU Connections

The two electrical umbilicals have different pin-configurations that are directional and keyed to assist with connections. When the umbilical position is aligned to the PSU, turn the umbilical connection to hear an audible locking click noise.

The MRU interlock cable is supplied within the Discovery accessory kit. This cable must be fitted between the MRU and PSU to prevent the user from running the Discovery with the MRU turned off.

Figure 1.2-7. PSU Connections - Rear View

If the MRU has a power failure, the user interface will display an interlock error and the PSU fault LED will illuminate. Refer to “MRU Connections” below.

MRU Connections

1. Connect the MRU X1 hoses. (The Discovery MRU hoses are the same type used on the Chameleon Laser Systems.)
2. Install the supplied MRU interlock cable as shown in Figure 1.2-8. The interlock cable is found in the accessory kit.
3. Install the door contact override connector as shown in Figure 1.2-8. The connector is found in the MRU shipping box.

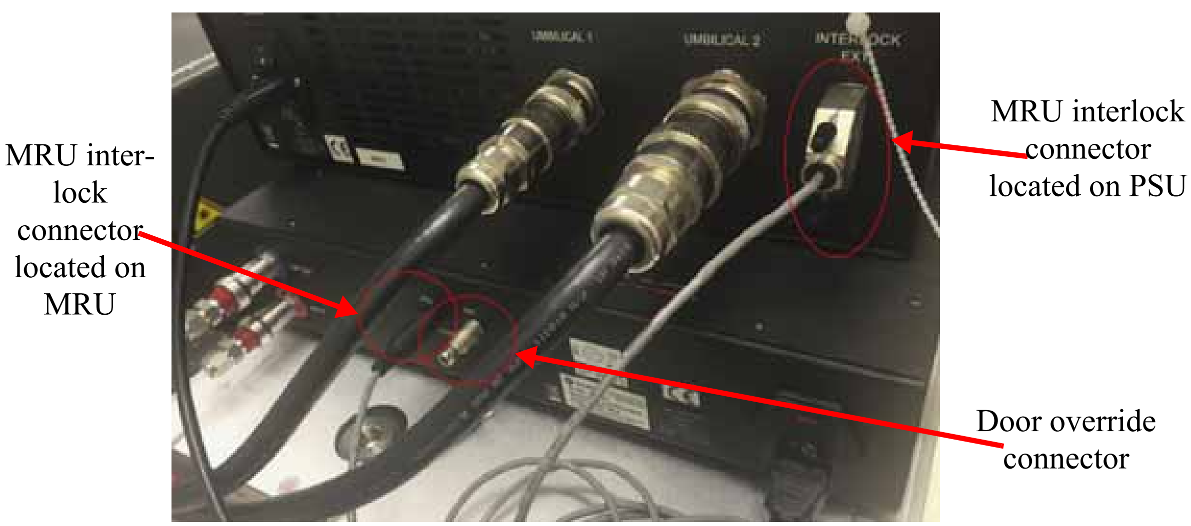


Figure 1.2-8. PSU to MRU Interlock Connection

Chiller Connections

1. Connect the chiller hoses. The Chiller label identifies the IN and OUT connectors as shown in Figure 1.2-9.(The Discovery chiller hoses are the same type used on a Chameleon System.)

Chiller Label

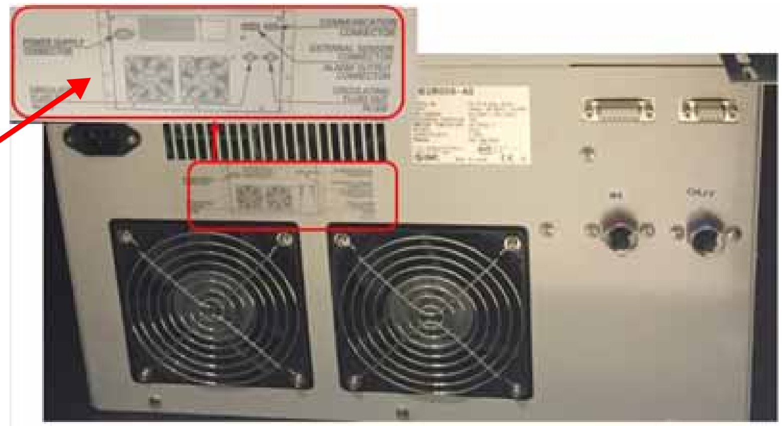


Figure 1.2-9. Chiller - Rear View

2. Use the funnel and short red hose supplied with the Discovery accessory kit to fill the chiller with CoolFlow between the H (high) and L (low) indicators. See Figure 1.2-10.

Funnel and Red Hose

H and L Water Level

Figure 1.2-10. Chiller - CoolFlow Filling

3. Connect the chiller hoses to the laser head.

NOTICE
Continue to "Laser Head Connections" for the orientation of the chiller hoses at the laser head.

4. After connecting the chiller hoses to the head, turn ON the chiller. CoolFlow is pumped through the hoses to the head and will require refilling at least one more time.
   - Turn the chiller OFF.
   - Refill to above the L indicator.
   - Turn ON the chiller again to restart the pump. The CoolFlow must not go above the H line.

Chiller Setpoint Temperature

- Press **SEL** to move the < down to **SV**.
- Use the up and down arrow buttons to adjust the chiller setpoint temperature for 20 °C.

NOTICE
The chiller could be delivered with a setpoint temperature of 25 °C. Verify the setpoint temperature is set to 20 °C.

- Press **RET** to finish.

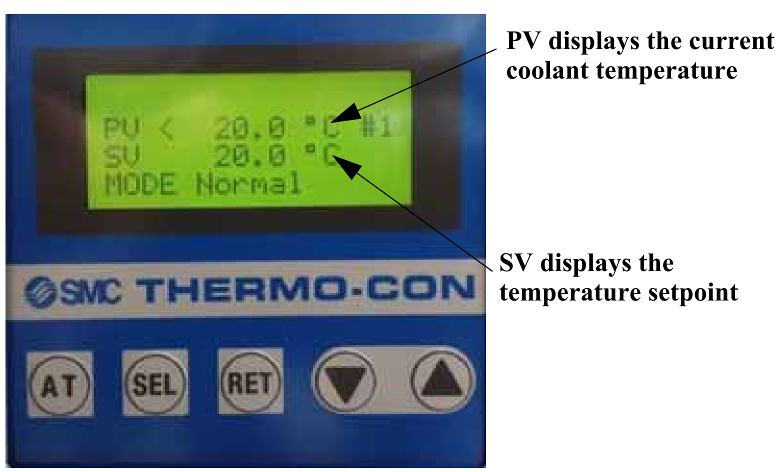


Figure 1.2-11. Chiller Display

Laser Head Connections

1. Position the Umbilical 1 and Umbilical 2 into their locating sockets and turn to hear the contact click-lock.

Figure 1.2-12. Laser Head Connections - Rear View

2. Connect the MRU hoses. (The connections are the same type used on a Chameleon System).

3. Connect the chiller hoses:
   - **COOLING IN** (head) to **OUT** (chiller),
   - **COOLING OUT** (head) to **IN** (chiller).

NOTICE
Confirm the chiller hose connections for the correct orientation! Incorrect orientation of the chiller hoses can damage the laser.

---

4. Make the laser (and if needed, attenuator) USB connections.

Power ON

Make sure that the correct Service and Customer software is installed **BEFORE** connecting the laser USB communication cable to a suitable PC.

Initialize

1. Make sure that all connections are securely made. Start the MRU, chiller, and PSU.
2. When the mains are switched ON, the fault LED on the PSU will flash as the laser modules initialize. This continues for approximately 10 minutes until the laser is ready for the key ON position.

Service GUI

The Service GUI is required to perform the installation, take data and calibrate the laser. More detail on the Service GUI is located in “Service GUI” on page 4.1-1.

1. Open the Service GUI and establish communications through the Connection Menu.See Figure 1.2-13.

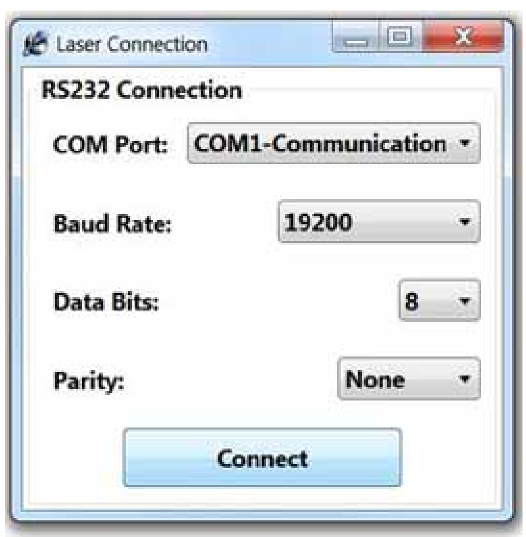


Figure 1.2-13. Connections Menu

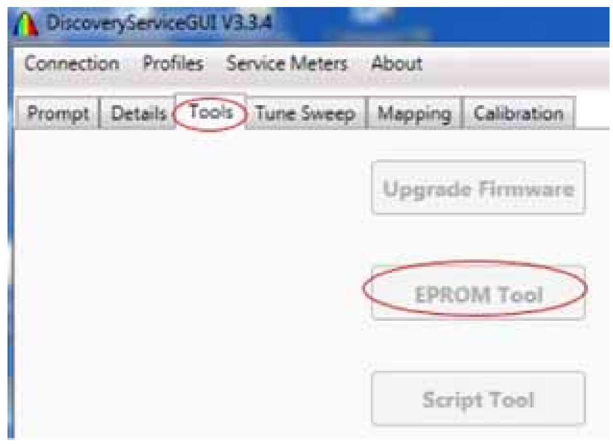
2. From the Prompt tab send the commands:
   - `?ST` and `?F`

The commands will confirm that there are no faults and the laser is in Standby mode.

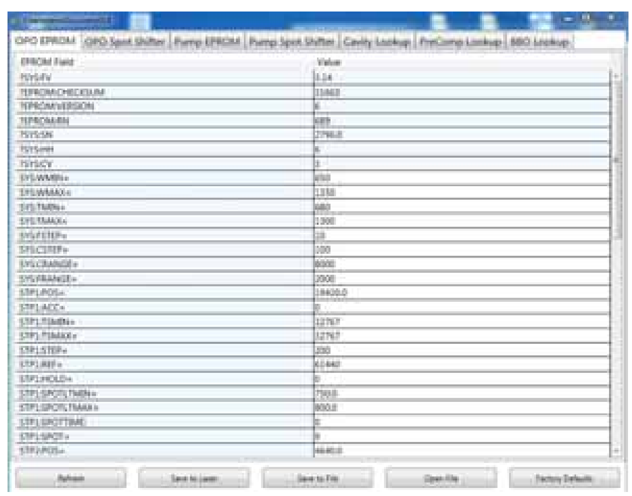
3. To access service mode:
   - send command: `access=service`
   - enter the password: `clg5182`

EEPROM Tool

1. Open the Tools Tab to select the EEPROM tool.



Tools



EPPROM System Values

Figure 1.2-14. EEPROM Menu

2. Wait for the system values to load.

3. Save the initial EEPROM to a suitable file location. The EEPROM data fields will automatically save to the header tab when the initial save is performed.

NOTICE
Any system calibration changes will require a new EEPROM save.

4. Key ON the laser. The laser will take approximately 2 minutes to fully turn on.
5. Tune the laser to 680 nm.

DANGER!
All personnel in the area of the laser system must wear the appropriate laser safety glasses to prevent injury. Refer to "Laser Safety" on page 1.1-1 to learn the correct laser safety practices.

APE WaveScan

1. When the laser is ready, open the tuneable shutter by sending commands `s=1`, or `svar=1`.

CAUTION!
Make sure the beam path is safe before opening the shutter.

2. Open the APE WaveScan software and confirm or change to the following settings:
   - TCP Autostart box checked
   - TCP/IP port set to 51123
3. Press the **Start** button. It can take some minutes for the display to register a signal.
4. Check/uncheck the Autoscale Y. Make sure the Autoscale is checked when aligning.

5. Pick off a small portion of the tuneable beam and align into the WaveScan head, using the pinhole guides for initial alignment. Once a peak can be seen amidst the noise, fine-tune alignment for strongest signal (> 40000 at 680 nm).

   On the TPC model, transmission must be enabled in the GUI “AOM Control” tab. Check the internal box and turn transmission on by 2 %.

For TPC models, the attenuation function must be used instead of alignment mode.

- Verify the signal is not saturated or the peak detection may be difficult to determine. The WaveScan signal saturates at approximately 60,000.

Figure 1.2-15. Tuning with APE WaveScan GUI

6. Tune to 1300 nm. Confirm the WaveScan can register and measure the wavelength and bandwidth at the longest wavelength.

PowerMaxUSB

1. Connect the USB power meter through the PowerMax software. Confirm that the PC recognizes the PowerMaxUSB.
2. Close the power meter software.

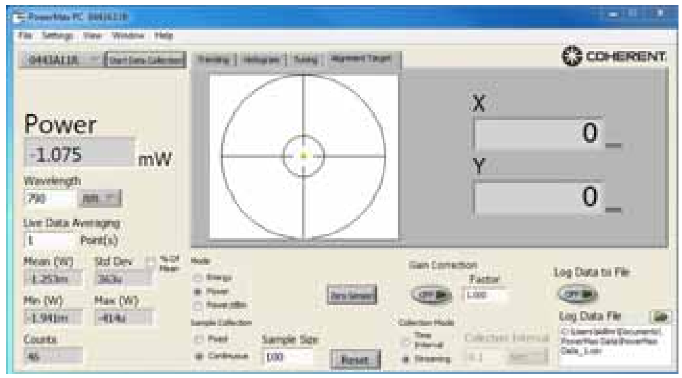


Figure 1.2-16. PowerMax GUI

BP209 Beam Profiler

1. Start the BP209 beam profiler using the Thorlabs GUI for alignment.
2. When the beam is aligned with the center of the profiler, ensure the it is striking normally to the face of the profiler.

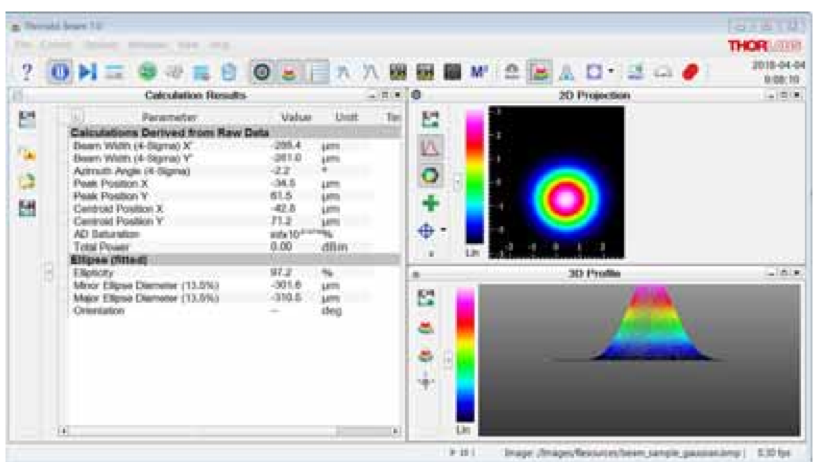


Figure 1.2-17. Thorlabs Beam 7.0 GUI

Connect Measurement Devices within Service GUI

The external meters will need to be connected to the Service GUI for the automated routines to operate. See "Service Meters Menu" on page 4.1-6 if additional details are needed for connecting the meters.

NOTICE
It is important to start the software in the correct order in for the Service GUI to communicate with the external meters/WaveScan and to operate with the automated routines.

---

1. External software and Service GUI:
   a. Step 1:
      - APE WaveScan software Open, with TCP/IP checked and port set to 51123
      - PowerMax Stopped and PowerMax software Closed
      - Discovery Service GUI Closed
      - Beam profiler software Closed
   b. Step 2:
      - APE WaveScan software Open, with TCP/IP checked and port set to 51123
      - PowerMax software Closed
      - Discovery Service GUI Open
2. Connect the PowerMax power meter, BP209 beam profiler and WaveScan through the Service Meters menu. See Figure 1.2-18.

NOTICE
The Service GUI closes the shutter when reconnected. Reopen the shutter before starting any optimization procedures.

---

3. If the meters are not recognized, it can be necessary to close and reopen the GUI again.
   - Confirm the APE software is connected and running.

- Confirm the PowerMax software is closed before reopening the Service GUI.

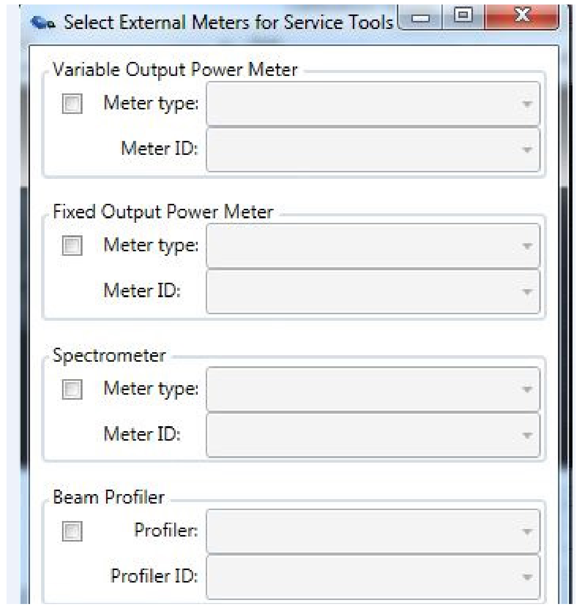


Figure 1.2-18. External Meters Menu

Pump Map Routine

1. Record pump mirror starting positions for Px & Py.

Figure 1.2-19. Pump Mirror Commands

2. In the AOM tab, change the transmission value to 100 %.
3. In the Mapping Tab:
   a. Set the wavelength to 1000 nm.
   b. Set the Step size at 4000.
   c. Browse to a desktop location to save the map.
   d. Confirm the power meter is connected to the Service GUI before starting the procedure.

e. Begin the procedure by clicking the Start button. See Figure 1.2-20.

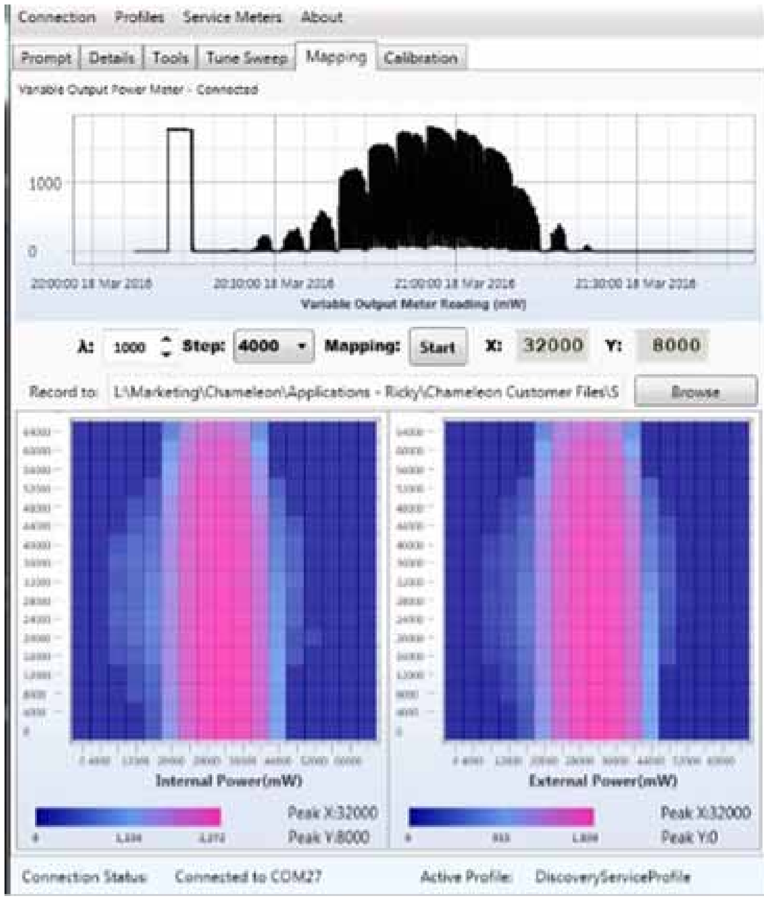


Figure 1.2-20. Mapping Menu

4. The pump map will complete and move Px & Py to their current optimal positions at the end of the procedure.

AOM Calibration File

See "AOM Calibration File" on page 5.9-1

Data Run

1. Make sure the power meter and WaveScan are connected in Service Meters menu.
2. Tune the laser to 680 nm and open the tuneable shutter.

3. Go to the Tune Sweep tab and select a desktop location to save the file. See Figure 1.2-21.

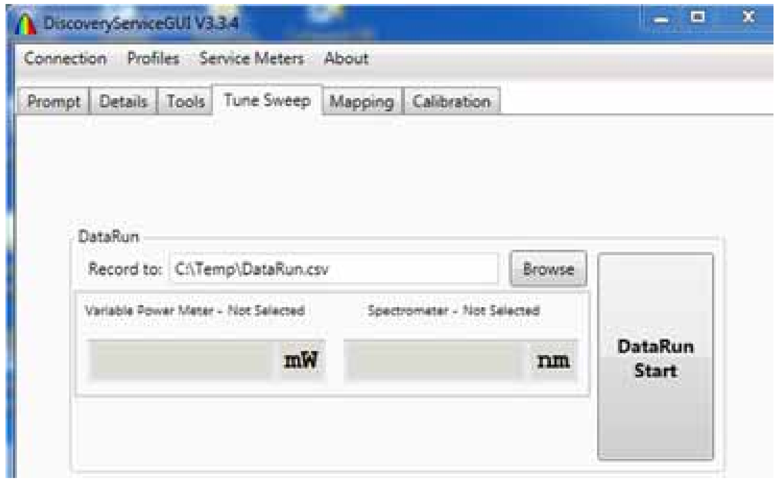


Figure 1.2-21. Tune Sweep Menu

4. Before starting the data run program, have all required information available. When the data run is started, a prompt will appear requesting the serial number for the MRU, PSU, chiller and requesting the measured fixed IR output power.

5. Start the data run. The procedure will take approximately 30 minutes to complete.

   - The program runs from the shortest to longest wavelength in 10 nm steps. It records measured power from the external power meter and wavelength accuracy on the WaveScan spectrometer.

   - When complete review the data by checking power and wavelength accuracy against the datasheet specifications. Wavelength accuracy must be within ± 5 nm. See "Wavelength Calibration" on page 5.2-1 and "Photodiode Calibration" on page 5.3-1 if calibration is required.

6. If specifications are achieved and confirmed see "Complete Installation" to train the customer and complete the installation.

Complete Installation

1. If a wavelength or PD calibration was required, the EPPROM data will need to be saved and sent to factory. Reference “Wavelength Calibration” on page 5.2-1 and “Photodiode Calibration” on page 5.3-1 for additional information on calibration procedures.
2. Return laser to customer mode with the `access=0` command.
3. Before the customer training, refer to the GUI Operator's manual to become familiar with the user controls.
4. Start Customer GUI and regular maintenance training:
   - Place the key switch into STANDBY when the system is not in use (i.e. overnight)
   - CoolFlow 6 month replacement cycle
   - MRU cartridge inspection & replacement
   - Open the customer GUI and demonstrate the connection and control options

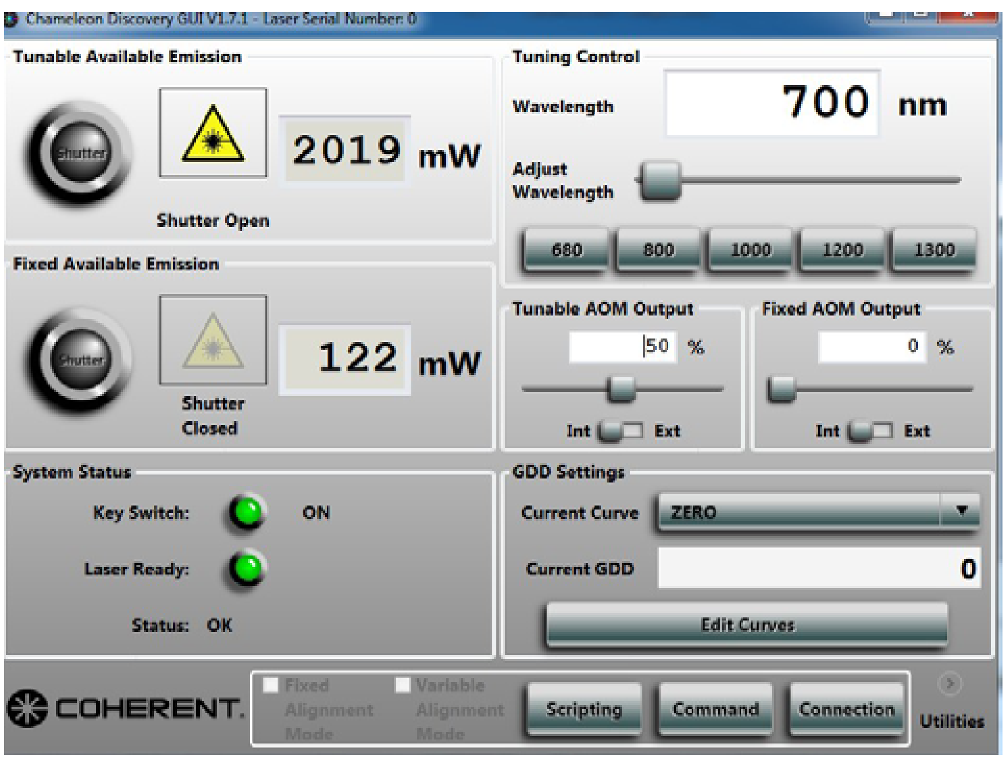


Figure 1.2-22. Customer GUI

CPC 1040 Introduction

The CPC 1040 module is an accessory for the Chameleon Discovery laser system. If the customer received the CPC 1040, continue with the installation on page 1.3-3.

This procedure will assist with the alignment of the CPC 1040 module and reflects the current information available for the module. This document does not replace the CPC 1040 Operator's Manual. Users must refer to the operator's manual before operation of the module. This document is intended for Coherent Field Service.

NOTICE
The CPC 1040 installation must be performed by Coherent Field Service.

Figure 1.3-1. CPC 1040

The CPC 1040 is a passive device designed for use with Class 4 laser beams, specifically the fixed 1040 nm output of the Chameleon Discovery. In normal operation, the housing prevents access to radiation in excess of Class 1, except for the input/output beams. However, during initial alignment the housing must be removed.

Inside the tilting mirror assembly, laser beams are reflected at angles that are not parallel to the table top. If adjusted incorrectly, there is the potential for these beams to exit the CPC above table height. The following precautions are recommended to maintain a safe environment.

DANGER!
All personnel in the area of the laser system must wear the appropriate laser safety glasses to prevent injury. Refer to "Laser Safety" on page 1.1-1 to learn the correct laser safety practices.

- Use appropriate laser safety eyewear.
- Use suitable IR viewers/IR viewing cards during alignment.
- If possible, install beam blocks at either end and at the beam output as shown.
- Avoid standing at either end of the CPC. Adjustment should be done from either side as shown below.

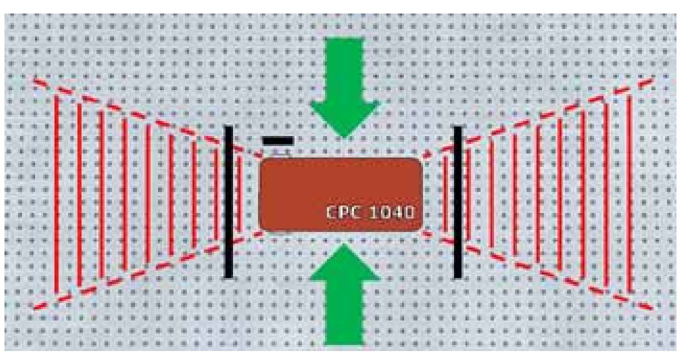


Figure 1.3-2. CPC 1040 Adjustment Area

Installation

Cover Removal

Remove the thumbscrews (A) and lift off the top cover. The main cover (B) should now slide up and off.

Figure 1.3-3. CPC 1040 Cover Removal

Alignment

The beam follows a circular path into and out of the CPC. Input/output prism → NDM assembly → Retro reflecting mirrors → NDM assembly → Input/output prism. See Figure 1.3-4. The input path is shown in red and output path is shown in yellow.

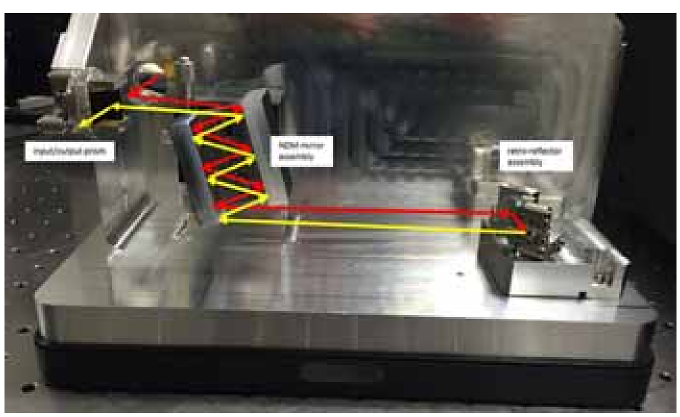


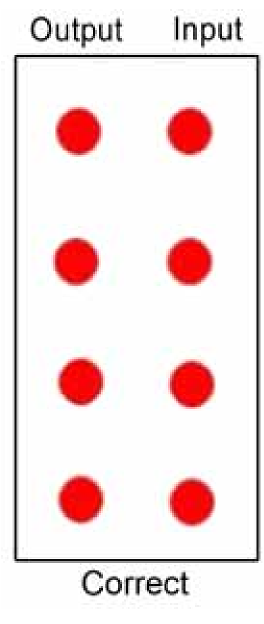
Figure 1.3-4. CPC 1040 Internal Alignment Path

1. The CPC should be approximately positioned on the table in front of the laser source.
2. Move the CPC left ↔ right so that the beam hits the input prism approximately center.
3. Rotate the CPC until a series of spots can be seen on the NDM.
4. Fine-tune the alignment as much as possible by moving the CPC body, before attempting to adjust any of the mirrors or clamping the module to the table.

The CPC 1040 is factory set for 3 steps = 12 bounces in total on the NDM mirrors, as shown in Figure 1.3-4.

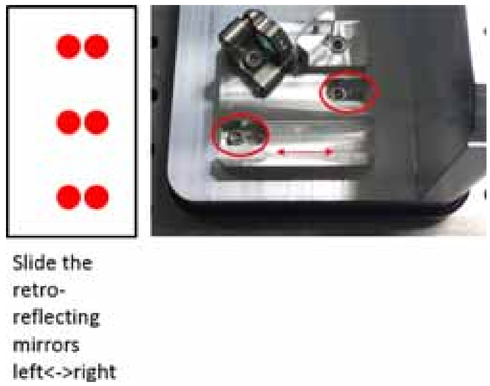
When the CPC is aligned correctly, a series of 6 spots should be visible on each mirror.

See Figure 1.3-5 for examples of the alignment.

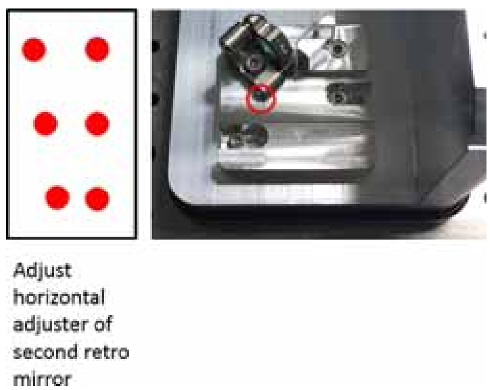


Correct Alignment

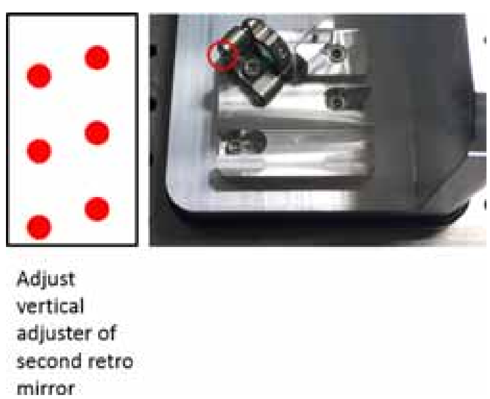
Figure 1.3-5. Alignment Examples



Adjustment of the retro-reflecting mirrors needed

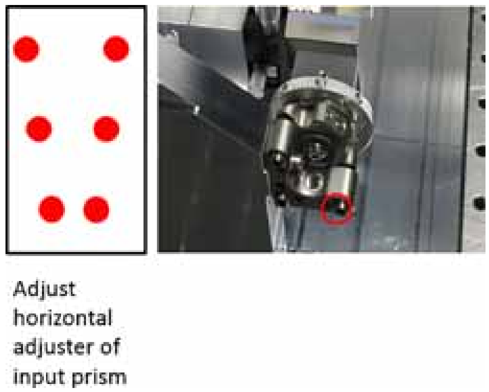


Adjustment of the horizontal second retro mirror needed



Adjustment of the vertical second retro mirror needed

Figure 1.3-5. Alignment Examples (Continued)



Adjustment of the horizontal input prism

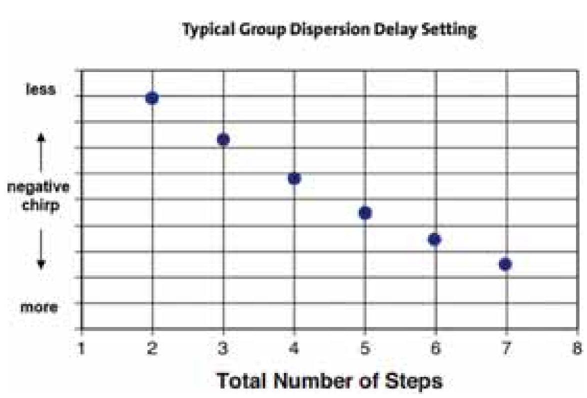
Figure 1.3-5. Alignment Examples (Continued)

Adjustment of the Precompensation

The CPC1040 is factory set for 3-step (12 bounces) on the NDM mirrors. This causes a specified amount of negative dispersion to the pulse. Refer to the product datasheet at coherent.com for the current specifications.

The factory set configuration should be correct for most customer situations. However, it is possible to adjust the negative dispersion setting by changing the number of bounces on the mirrors. The adjustment is not continuous, but step-wise with the number of bounces, as shown below in Table 1.3-1 where 2-step = 8 bounces, 3-step = 12 bounces and etc...

Table 1.3-1. Dispersion Delay Setting



The procedure to change the number of steps (bounces):

1. First align the unit in the factory configuration,
2. Then rotate the NDM mirror assembly using the rotary stage.

Figure 1.3-6. CPC 1040 Rotary Stage

The approximate angle settings for different step/bounce settings are shown in Table 1.3-2.

Table 1.3-2. Angle Setting for Steps or Bounces

ROTATION STAGE ANGLE	NUMBER OF STEPS	NUMBER OF BOUNCES
29°	2	8
19°	3	12
14°	4	16
11°	5	20
9°	6	24
8°	7	28

3. The in/out alignment should then be checked as instructed in the previous section.

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Introduction

This section gives troubleshooting information for the specified numerical listing of the Chameleon Discovery software fault messages.

NOTICE
In general with any fault code or troubleshooting process, commands `?f` and `?fh` should be sent BEFORE a key-cycle.

Laser Powered Up in Keyed ON Position, Fault 1

General Description: The PSU has been switched on when the key switch is in the ON position.

Action: Move the key to OFF position and the fault will clear. The system can then be turned on as normal.

If the fault is persistent contact Coherent Scotland.

Laser Diode 1 Driver Over Current, Fault 2

General Description: This is a hardware fault and indicates that the seed pump diode (within the seed module) has exceeded the hardware current limit and hardware shutdown has occurred.

Action:

- Make sure the connection between the seed module and pump board is secure.
- If the fault is persistent contact Coherent Scotland.

Laser Diode 1 Driver Over Temperature, Fault 3

General Description: This is a hardware fault that indicates the seed pump diode (within the seed module) has exceeded its safe operating temperature.

Action:

- Make sure the temperature of the oscillator pump diode is valid by sending query `?PUMP:ATDL:1`.

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

OSC TEC 1 Driver Over Current, Fault 4

General Description: This is a hardware fault that indicates the TEC on the seed pump diode is being driven too hard, causing the TEC to go over current.

Action:

- Make sure the connection between seed module and pump board is secure.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

OSC TEC 1 Driver OverTemperature, Fault 5

General Description: This is a hardware fault that indicates the TEC on the seed pump diode is over temperature.

Action:

- Make sure the connection between seed module and pump board is secure.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

Unknown Fault, Fault 7 to 9

General Description: Not implemented.

OSC Threshold Over Voltage, Fault 10

General Description: This is a software generated fault and occurs when the oscillator photodiode value `?PUMP:PD1VADC` goes above the set over voltage value `?PUMP:PD1OVPADC`. If this fault occurs, there is an immediate shut down of the system to prevent damage to the pump laser.

Action: Make sure the over voltage threshold values are correct. To check if the PD1 over voltage threshold value is correct, follow the procedure below:

a.) Key OFF the system

b.) Type command PUMP:ON=1 to switch only the oscillator on

c.) Query ?PUMP:PD1VADC and take a note of the response PD1VADC(OFF)

d.) Key ON the system and wait until the oscillator is in light-loop. Query ?PUMP:STATE

e.) Query ?PUMP:PD1VADC and ?PUMP:PD1OVADC

f.) Key OFF the system

g.) The over voltage value should be calculated to:

PD1OVADC = PD1VADC(ON) + ((PD1VADC(ON)-PD1VADC(OFF)) x 0.15)

- If PD1OVADC is not correct, the value must be updated. To update, change PUMP:PD1OVP=xxx until the over voltage ?PUMP:PD1OVADC is correct.

h.) Type command PUMP:ON=4 to switch all modules on.

OSC Threshold Under Voltage, Fault 11

General Description: This is a software generated fault and occurs when the oscillator photodiode value ?PUMP:PD1VADC goes below the set under voltage value ?PUMP:PD1UVADC. If this fault occurs there is an immediate shut down of the system to prevent damage to the pump laser.

Action: Make sure the under voltage threshold values are correct. To check if the PD1 over voltage threshold value is correct, follow the procedure below:

a.) Key OFF the system

b.) Type command PUMP:ON=1 to switch only the oscillator on

c.) Query ?PUMP:PD1VADC and take a note of the response PD1VADC(OFF)

d.) Key on the system and wait until the oscillator is in light-loop. Query ?PUMP:STATE

e.) Query ?PUMP:PD1VADC and ?PUMP:PD1UVADC

f.) Key OFF the system

g.) The over voltage value should be calculated to:

PD1UVADC = PD1VADC(ON) - ((PD1VADC(ON)-PD1VADC(OFF)) x 0.15)

- If `PD1UVADC` is not correct, the value must be updated. To update, change `PUMP:PD1UVP=xxx` until the over voltage `?PUMP:PD1UVADC` is correct.

h.) Type command `PUMP:ON=4` to switch all modules back on.

OSC Light-loop Out of Lock, Fault 12

General Description: This is a software generated fault. It occurs when the oscillator pump diode (within the seed module) fails to lock to the light-loop setpoint `?PUMP:LLSP:1`. This fault only occurs when it comes out of lock from being in light-loop. The fault occurs if the laser comes out of lock for 20 ms.

If the system is turned on and cannot lock, the status will remain in a ramp-up state.

Action: Check that the connection between seed module and pump board is secure.

OSC Current Loop Out of Lock, Fault 13

General Description: This is a software generated fault. It occurs when the oscillator pump diode (within the seed module) fails to lock to the set current `?PUMP:IDL:1`. The fault occurs if the current falls out of lock for 2 seconds.

Action: Check that the connection between seed module and pump board is secure.

OSC Diode Current Exceeds IDL1MAX, Fault 14

General Description: This is a software generated fault. It occurs if the oscillator pump diode tries to exceed the maximum current limit that is set in the EEPROM `?PUMP:IDLMAX:1`.

Action: This is a fault that generally occurs when the seed is in light-loop. Here, the diode current is dependent on the photodiode voltage `?PUMP:APD:1` reaching the light-loop setpoint `?PUMP:LLSP:1`.

If there is no signal or voltage measured on the photodiode, the current will continue to ramp-up until it reaches the limit. The photodiode signal can be checked by putting the seed into current loop and measuring the photodiode signal at the expected operating current.

a.) Key OFF the system

b.) Allow only the oscillator to turn on `PUMP:ON=1`

c.) Put the oscillator into current mode `PUMP:MODE:1=1`

d.) Send query `?PUMP:IDL:1` to check the set current - the value ~120 mA

e.) Key system on and query the seed photodiode `?PUMP:APD:1`

f.) Compare this value with the light-loop setpoint `?PUMP:LLSP:1`

g.) The values should be approximately equal

h.) Key OFF the system

i.) Place the oscillator back into light-loop and turn on all the modules `PUMP:MODE:1=2` and `PUMP:ON=4`

OSC Diode Temperature Out of Lock, Fault 15

General Description: This is a software generated fault. It occurs when the TEC on the oscillator pump diode (within the seed module) fails to lock to the set temperature. The fault occurs if the temperature falls out of lock for 2 seconds.

Action:

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

Requires Seed Upgrade for Module 1 Compatibility, Fault 16

General Description: This is a software generated fault. It occurs if the seed has been configured using a newer firmware version than is currently on the pump board.

Action: Upgrade the PUMP and OPO head boards firmware to the latest build.

AMP1 Diode Driver Over Current, Fault 17

General Description: This is a hardware fault that indicates the pre-amp 1 pump diode (within the seed module) has exceeded the hardware current limit.

Actions:

- Make sure the connection between seed module and pump board is secure.
- If fault is persistent contact Coherent Scotland.

AMP1 Diode Driver OverTemperature, Fault 18

General Description: This is a hardware fault that indicates the pre-amp 1 pump diode (within the seed module) has exceeded its safe operating temperature.

Action:

- Make sure the temperature of the pre-amp 1 pump diode is valid by sending query `?PUMP:ATDL:2`.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP1 TEC Driver Over Current, Fault 19

General Description: This is a hardware fault that indicates the TEC on the pre-amp 1 pump diode is being driven too hard, causing the TEC to go over current.

Action:

- Make sure the connection between seed module and pump board is secure.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP1 TEC Driver OverTemperature, Fault 20

General Description: This is a hardware fault that indicates the TEC on the pre-amp 1 pump diode is over temperature.

Action:

- Make sure the connection between seed module and pump board is secure.

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP1 TEC Driver Under Voltage, Fault 21

General Description: This is a hardware fault that indicates the TEC on the pre-amp 1 pump diode is under voltage.

Action:

- Make sure the connection between the seed module and pump board is secure.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP1 Light-loop Out of Lock, Fault 22

General Description: This is a software generated fault. It occurs when the pre-amp 1 pump diode (within the seed module) fails to lock to the light-loop setpoint `?PUMP:LLSP:2`. This fault only occurs when it comes out of lock from being in light-loop. The fault occurs if the laser comes out of lock for 20 ms.

If the system is turned on and cannot lock, the status will remain in a ramp-up state.

Action: Make sure the connection between the seed module and pump board is secure.

AMP1 Current Loop Out of Lock, Fault 23

General Description: This is a software generated fault. It occurs when the pre-amp 1 pump diode (within the seed module) fails to lock to the set current `?PUMP:IDL:2`. The fault occurs if the current falls out of lock for 2 seconds.

Action: Make sure the connection between the seed module and pump board is secure.

AMP1 Diode Current exceeds IDL2MAX, Fault 24

General Description: This is a software generated fault. It occurs if the pre-amp 1 pump diode tries to exceed the maximum current limit that is set in the EEPROM `?PUMP:IDLMAX:1`.

Action: This is a fault that generally occurs when the pre-amp 1 is in light-loop. The diode current is dependent on the photodiode voltage `?PUMP:APD:2` reaching the light-loop setpoint `?PUMP:LLSP:2`.

If there is no signal or voltage measured on the photodiode, the current will ramp up until it reaches the limit. The photodiode signal can be checked by putting the pre-amp 1 into current loop and measuring the photodiode signal at the expected operating current.

a.) Key OFF the system

b.) Allow only the oscillator and pre-amp 1 to turn on `PUMP:ON=2`

c.) Put the pre-amp 1 into current mode `PUMP:MODE:2=1`

d.) Check the set current`?PUMP:IDL:2` - the value ~760 mA

e.) Key the system ON and query the pre-amp 1 photodiode `?PUMP:APD:2`

f.) Compare this value with the light-loop setpoint `?PUMP:LLSP:2`

g.) The values should be approximately equal

h.) Key OFF the system

i.) Place the pre-amp 1 into light-loop and turn on all the modules `PUMP:MODE:2=2` and `PUMP:ON=4`

AMP1 Diode Temperature Out of Lock, Fault 25

General Description: This is a software generated fault. It occurs when the TEC on the pre-amp 1 pump diode (within the seed module) fails to lock to the set temperature. The fault occurs if the set temperature falls out of lock for 2 seconds. This fault does not occur when the system is in standby mode.

Action: Make sure the chiller is switched on and operating at 20°C.

OSC Seed Output Low, Fault 26

General Description: This is a software generated fault. The fault occurs when the oscillator pump diode ramps up and moves into current loop. The oscillator photodiode `?PUMP:APD:1` is compared against the EEPROM value `?PUMP:PD1MIN`. If the current photodiode value is less than this minimum value, this fault is created.

Action: Make sure that `?PUMP:PD1MIN` is set to the correct value.

AMP1 Open Circuit, Fault 27

General Description: This is a software generated fault. Before pre-amp 1 pump diode starts to ramp, there is a safety check to make sure the output from the oscillator is sent through pre-amp 1. The safety check is performed by detecting light on the pre-amp 1 photodiode `?PUMP:APD:2` and verifying it is above a threshold that is defined by the EEPROM value `?PUMP:PDMIN:2`.

Actions:

- `PUMP:PDMIN:2` is set as half way between the value read by pre-amp 1 photodiode when the system is keyed OFF, and the value read when the system is keyed ON.
  Set the system to `PUMP:ON=1` and check the value of `?PUMP:PDMIN:2` and compare it to the value calculated using: a + (a-b).

  Where:

  a=`?PUMP:APD:2` [when the laser is keyed OFF]
  b=`?PUMP:APD:2` [when the laser is keyed ON]

  - Key OFF the system. Send command `ON=1` (to only switch oscillator on) and key back on.
  - Measure the pre-amp 1 photodiode signal `?PUMP:APD:2` and compare with the EEPROM value `?PUMP:PDMIN:2`.
  - The photodiode signal should be greater than the EEPROM value to operate.
  - Key OFF the system and send command `ON=4` to switch all the modules on.

AMP2 Diode Driver Over Current, Fault 28

General Description: This is a hardware fault that indicates the pre-amp 2 pump diode (within the power-amp module) has exceeded the hardware current limit.

Actions:

- Check the connections between the power-amp module and the pump head board.
- Try replacing pump board.

AMP2 Diode Driver Over Temperature, Fault 29

General Description: This is a hardware fault that indicates the pre-amp 2 pump diode (within the power-amp module) has exceeded its safe operating temperature.

Action:

- Check the temperature of the pre-amp 2 pump diode is valid `?PUMP:ATDL:3`.
- Check the connections between the power-amp module and the pump head board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.
- Try replacing pump board.

AMP2 TEC Driver Over Current, Fault 30

General Description: This is a hardware fault that indicates the TEC on the pre-amp 2 pump diode is being driven too hard, causing the TEC to go over current.

Action:

- Check the connections between the power-amp module and the pump head board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.
- Try replacing pump board.

AMP2 TEC Driver OverTemperature, Fault 31

General Description: This is a hardware fault that indicates the TEC on the pre-amp 1 pump diode is over temperature.

Action:

- Check the connections between the power-amp module and the pump head board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP2 TEC Driver Under Voltage, Fault 32

General Description: This is a hardware fault that indicates the TEC on the pre-amp 1 pump diode is under voltage.

Actions:

- Check the connections between the power-amp module and the pump head board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

AMP2 Light-loop Out of Lock, Fault 33

General Description: This is a software generated fault. It occurs when the pre-amp 2 pump diode (within the power-amp module) fails to lock to the light-loop setpoint `?PUMP:LLSP:3`. This fault only occurs when it comes out of lock from being in light-loop. The fault occurs if the laser comes out of lock for 20 ms.

If the system is turned on and cannot lock, the status will remain in a ramp-up state.

Action:

- Check the connections between the power-amp module and the pump head board.
- Try replacing pump head board.

AMP2 Current Loop Out of Lock, Fault 34

General Description: This is a software generated fault. It occurs when the pre-amp 2 pump diode (within power-amp module) fails to lock to the set current `?PUMP:IDL:3`. The fault occurs if the current falls out of lock for 2 seconds.

Action:

- Check the connections between the power-amp module and the pump head board.
- Try to replace pump head board.

AMP2 Diode Current exceeds IDL3MAX, Fault 35

General Description: This is a software generated fault. It occurs if the pre-amp 2 pump diode tries to exceed the maximum current limit that is set in the EEPROM `?PUMP:IDLMAX:3`.

Action: This is a fault that normally occurs when pre-amp 2 is in light-loop. The pump diode current is dependent on the photodiode voltage `?PUMP:APD:3` to reach the light-loop setpoint `?PUMP:LLSP:3`.

If there is no signal or voltage measured on the photodiode, the current will continue to ramp up until it reaches the limit. The photodiode signal can be checked by putting the pre-amp 2 into current loop and measuring the photodiode signal at the expected operating current.

a.) Key OFF the system

b.) Allow only the oscillator, pre-amp 1 and pre-amp 2 to turn on `PUMP:ON=3`

c.) Put the pre-amp 2 into current mode `PUMP:MODE:3=1`

d.) Check the set current `?PUMP:IDL:2` - the value ~760 mA

e.) Key the system on and query the pre-amp 2 photodiode `?PUMP:APD:3`

f.) Compare this value with the light-loop setpoint `?PUMP:LLSP:3`

g.) The values should be approximately equal

h.) Key OFF the system

i.) Place the pre-amp 2 into light-loop and turn on all the modules `PUMP:MODE:3=2` and `PUMP:ON=4`

AMP2 Diode Temperature Out of Lock, Fault 36

General Description: This is a software generated fault. It occurs when the TEC on the pre-amp 2 pump diode (within the power-amp module) fails to lock to the set temperature. The fault occurs if the set temperature falls out of lock for 2 seconds. This fault does not occur when the system is in standby mode.

Action:

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.
- Try to replace pump board.

Not Used, Fault 37

Not used.

AMP2 Open Circuit, Fault 38

General Description: This is a software generated fault. Before pre-amp 2 pump diode starts to ramp, there is a safety check to make sure the output from pre-amp 1 is sent through the pre-amp 2. The safety check is performed by detecting some light at pre-amp 2 photodiode `?PUMP:APD:3` and verifying it is above a threshold that is defined by the EEPROM value `?PUMP:PDMIN:3`.

Actions:

- `PUMP:PDMIN:3` is set as half way between the value read by pre-amp 2 photodiode when the system is at `ON=1`, and the value read when the system is `ON=2`.
  Set the system to `PUMP:ON=2` and check the value of `?PUMP:PDMIN:2` and compare it to the value calculated using: a + (a-b).

  Where:

  a=`?PUMP:APD:3` [when the laser is keyed OFF]
  b=`?PUMP:APD:3` [when the laser is keyed ON]

  - Key OFF the system. Send command `ON=2` (to only switch oscillator on and pre-amp 1) and key back on.
  - Measure the pre-amp 2 photodiode signal `?PUMP:APD:3` and compare with the EEPROM value `?PUMP:PDMIN:3`.

- The photodiode signal should be greater than the EEPROM value to operate.
- Key OFF the system and send command `ON=4` to switch all the modules on.

PowerAMP Diode Driver Over Current, Fault 39

General Description: This is a hardware generated fault that occurs if the Wavelength Electronics driver reaches its set maximum current, defined by an adjustable pot on the side of the driver.

Action: If the Diode driver is set up correctly, this fault should not be seen as the software current limit `IDLMAX:4` is set less than the hardware limit.

If this fault occurs, the Limit O ADJ multi-turn potentiometer must be verified that it is turned fully clockwise. Rotate the potentiometer clockwise until a clicking sound is heard.

Figure 2.1-1. Wavelength Electronics Diode Driver

PowerAMP Diode Driver Over Temperature, Fault 40

General Description: This fault has not been implemented in the firmware and will never be generated.

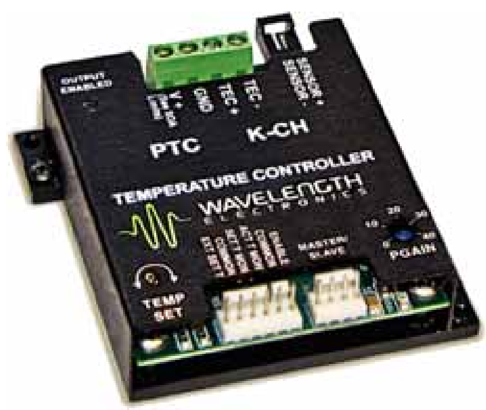
PowerAMP TEC 1 Driver Over Current, Fault 41

General Description: This fault has not been implemented in the firmware and will never be generated.

PowerAMP TEC 1 Driver Over Temperature, Fault 42

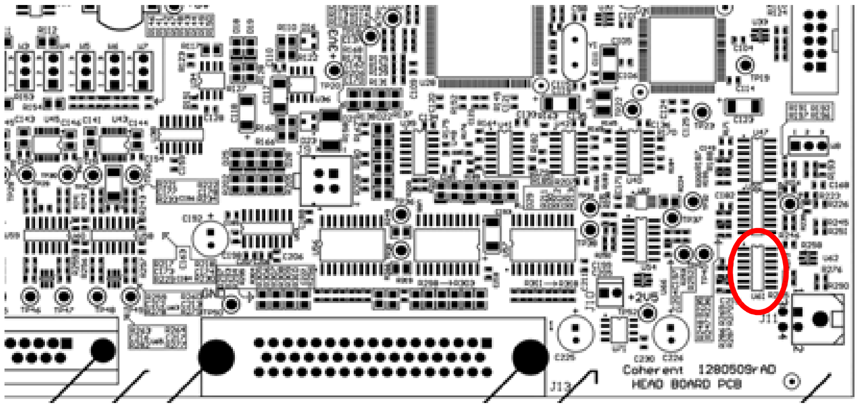
General Description: This is hardware generated fault that indicates that the power-amp pump diode 1 is overheating.

The temperature of the power-amp pump diode 1 is controlled by the externally-mounted Wavelength Electronics TEC driver.

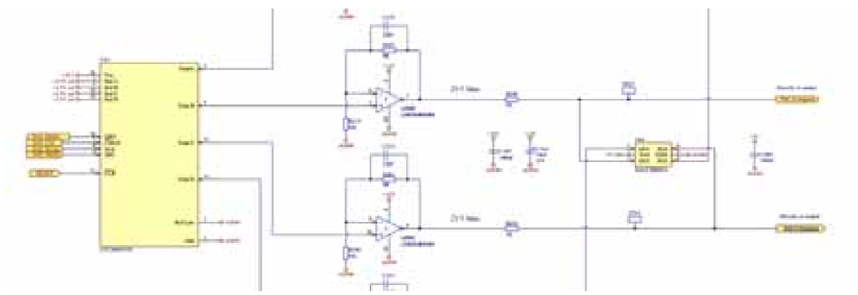


PowerAMP Pump TEC Driver

Figure 2.1-2. PowerAMP Pump TEC Driver and Test Points



Headboard - U61



Test Points for U61

Figure 2.1-2. PowerAMP Pump TEC Driver and Test Points (Continued)

Action:

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.
- Look at the applicable test points.

Test Points: There is no specified test point to check the temperature reading from the TEC driver. Although it is possible to look at the signal on U61 pins 4 or 7.

This value on U61 pins 4 or 7 can then be compared with the max and min (pins 5 and 6 on U61). The voltage from the thermistor should be between the max and min voltage.

Another test point to check is TP44, the setpoint going to the TEC driver (defined as TEC 5 setpoint). See Figure 2.1-2. This should be the same voltage measured at Therm 5 Meas IN that was previously measured at U61 pins 4 or 7. See Figure 2.1-2.

PowerAMP TEC 1 Driver Under Voltage, Fault 43

General Description: This fault has not been implemented in the firmware and will never be generated.

PowerAMP TEC 2 Driver Over Current, Fault 44

General Description: This fault has not been implemented in the firmware and will never be generated.

PowerAMP TEC 2 Driver Over Temperature, Fault 45

General Description: This is hardware generated fault that indicates that the power-amp pump diode 2 is overheating.

The temperature of the power-amp pump diode 2 is controlled by the externally mounted Wavelength Electronics TEC driver. See Figure 2.1-2.

Action:

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.
- Look at the appropriate test points.

Test Points: There is no specified test point to check the temperature reading from the TEC driver. Although it is possible to look at the signal at U61 pins 8 or 11. See Figure 2.1-2.

The value at U61 pins 8 or 11 can be compared with the max and min (U61 pins 9 and 10). The voltage from the thermistor should be between the max and min voltage.

Another test point to check is TP27, the setpoint going to the TEC driver (defined as TEC 6 setpoint). See Figure 2.1-2. This should be the same voltage measured at Therm 6 Meas IN that was previously measured at U61 pins 8 or 11.

PowerAmp TEC 2 Driver Under Voltage, Fault 46

General Description: This fault has not been implemented in the firmware and will never be generated.

PowerAmp Threshold Over Voltage, Fault 47

General Description: To prevent damage to the laser system, there are various fail safe mechanisms. One of these safety mechanisms is linked with the power-amp photodiode (PD4).

Once activated (using the RS-232 command `PD4=1`) and when the system has ramped up and locked successfully, the photodiode will be continuously monitored. If the voltage decreases/increases a specified amount, the system will switch off and a fault is generated.

Action:

- Check that the PD4OVP is set correctly.
  - a.) Set `IDL:4` to a value that gives 8000 mw of SHG light `?P2`.
  - b.) Measure TP11 (see Figure 2.1-2) when the laser system is on and working normally.
  - c.) Measure TP5 (see Figure 2.1-2). If required, adjust VR2 to set at 140 % of the voltage measured from TP11.
- This can be caused by SHG crystal degradation, try shifting to a new spot.

PowerAmp Threshold Under Voltage, Fault 48

General Description: To prevent damage to the laser system, there are various fail safe mechanisms. One of these safety mechanisms is linked with the power-amp photodiode (PD4).

Once activated (using the RS-232 command `PD4=1`) and when the system has ramped up and locked successfully, the photodiode will be continuously monitored. If the voltage decreases/increases a specified amount, the system will switch off and a fault is generated.

Action:

- Check the PD4UVP is set correctly.
  - a.) Measure TP11 (see Figure 2.1-2) when the laser system is on and working normally.
  - b.) Measure TP2 (see Figure 2.1-2). If required adjust VR1 to set to 85 % of the voltage measured from TP11.

PowerAmp Light-loop Out Of Lock, Fault 49

General Description: This is a software generated fault. It occurs when the power-amp fails to lock to the light-loop setpoint `?PUMP:LLSP:5`. This fault only occurs when it comes out of lock from being in light-loop. The fault occurs if the laser comes out of lock for 20 ms.

If the system is turned on and cannot lock, the status will remain in a ramp up state.

Action: Make sure the connection between power-amp module and pump board is secure.

PowerAmp Current Loop Out Of Lock, Fault 50

General Description: This is a software generated fault. It occurs when the power-amp fails to lock to the set current `?PUMP:IDL:4`. The fault occurs if the current falls out of lock for 2 seconds.

Action: Make sure the connection between power-amp module and pump board is secure.

PowerAmp Diode current exceeds IDL4MAX, Fault 51

General Description: This is a software generated fault. It occurs if the power-amp pump diodes try to exceed the maximum current limit that is set in the EEPROM `?PUMP:IDLMAX:4`.

Action: This is a fault that normally occurs when power-amp is in light-loop. Here, the pump diode current is dependent on the photodiode voltage `?PUMP:APD:4` to reach the light-loop setpoint `?PUMP:LLSP:4`.

If there is no signal or voltage measured on the photodiode, the current will continue to ramp up until it reaches the limit. The photodiode signal can be checked by placing the power-amp into current loop and measuring the photodiode signal at the expected operating current.

a.) Key OFF the system

b.) Make sure all modules will turn on `PUMP:ON=4`

c.) Put the power-amp into current mode `PUMP:MODE:4=1`

d.) Check the set current `?PUMP:IDL:4` - the value ~8 A ± 1.5

e.) Key the system on and query the power-amp photodiode `?PUMP:APD:5` f.) Compare this value with the light-loop setpoint `?PUMP:LLSP:5`

g.) The values should be approximately equal

h.) Key OFF the system

i.) Place the power amp into Green light-loop `PUMP:MODE:4=3`

- Change SHG spot and verify if the system returns to normal operation.

Another cause of this fault is the seed is double pulsing. If this occurs, the SHG efficiency will significantly drop making it impossible for the SHG power level to reach the light-loop setpoint. The current will ramp up to its maximum and fault. To see if the problem is occurring:

- Try repeatedly keying the system off and on (5-10 times). If the system generally works but occasionally faults after ramp up, it can indicate double pulsing.

PowerAmp Diode 1 Temperature Out Of Lock, Fault 52

General Description: This is a software generated fault. It occurs when the TEC for the power-amp pump diode 1 (within the pump diode module) fails to lock to the set temperature. The fault occurs if the set temperature falls out of lock for 2 seconds. This fault does not occur when the system is in standby mode.

Action:

- Check the electrical connections between pump diode module, pump head board and power distribution board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

PowerAmp Diode 2 Temperature Out Of Lock, Fault 53

General Description: This is a software generated fault. It occurs when the TEC for the power-amp pump diode 2 (within the pump diode module) fails to lock to the set temperature. The fault occurs if the set temperature falls out of lock for 2 seconds. This fault does not occur when the system is in standby mode.

Action:

- Check the electrical connections between pump diode module, pump head board and power distribution board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

PowerAmp Base Plate Temperature Out Of Range, Fault 54

Description: This fault should not occur because there is no specified measurement of the baseplate at this time.

Not Used, Fault 55

Not used.

PowerAmp Open Circuit, Fault 56

General Description: This is a software generated fault. Before the power-amp pump diode starts to ramp, there is a safety check to verify the output from pre-amp 2 is sent through the power-amp. The safety check is performed by detecting light on the power-amp photodiode `?PUMP:APD:4` and verifying it is above the threshold that is defined by the EEPROM value `?PUMP:PDMIN:4`.

Action:

- Key OFF the system. Send command `ON=3` (to only switch oscillator and pre-amp 1 + 2 on) and key the system ON.
- Measure the power-amp photodiode signal `?PUMP:APD:4` and compare with the EEPROM value `?PUMP:PDMIN:4`.
- The photodiode signal must be more than the EEPROM value to operate.
- Key OFF the system and send command `ON=4` to switch all the modules on.

SHG Heater Over Current, Fault 57

General Description: This fault has not been implemented in the firmware and will never be generated.

SHG Heater Drive Over Temperature, Fault 58

General Description: This is a software generated fault that will shut the system down if the temperature of the SHG crystal `?PUMP:ATLBO` goes above a set maximum temperature that is defined by `?TLMAX`.

Actions:

- Query `?PUMP:ATLBO`.
- Query `?PUMP:TLMAX` and compare with the original EEPROM value.
- Query `?PUMP:TLBO` and compare with the original EEPROM value.

If the system is operating correctly, the actual temperature `ATLBO` should equal the set temperature `TLBO` and should not be above the maximum set temperature `TLMAX`.

- Check the ribbon cable from pump headboard to OPO headboard.
- Check the ribbon cable from OPO headboard to bulkhead connector.

SHG Heater Supply Under voltage, Fault 59

General Description: This fault has not been implemented in the firmware and will never be generated.

SHG Oven Temperature Out Of Lock, Fault 60

General Description: This is a software generated fault. After the initial warm-up state when the SHG assembly has locked to the set temperature `?TLBO`, the LBO is continuously monitored. If its actual temperature `?ATLBO` deviates away from the set temperature by ± 2 °C for more than 2 seconds it is defined as being out of lock. A fault is generated and the system will shut down.

Action:

- Query `?PUMP:ATLBO`.
- Query `?PUMP:TLMAX` and compare with the original EEPROM value.
- Query `?PUMP:TLBO` and compare with the original EEPROM value.

If the system is operating correctly, the actual temperature `ATLBO` should equal the set temperature `TLBO` and should not be above the maximum set temperature `TLMAX`.

- Query
  `?PUMP:LBOTP`
  `?PUMP:LBOTI`
  `?PUMP:LBOTD`
  and compare with the original EEPROM settings.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

SHG Light-loop Out Of Lock, Fault 61

General Description: This fault has not been implemented in the firmware and will never be generated.

I2C Read Retry Fail, Fault 62

General Description: This is a software generated fault. The fault occurs after a communication with the I2C bus 5 times in a row.

Action:

The components that communicate by I2C are:

a.) The SHG stepper

b.) EEPROM (both head boards)

c.) Digipots (Seed module)

d.) ADC (both head boards)

Possible causes of this fault include:

1. **Damaged ribbon cable:** This can be any one of the four ribbon cables that are used in the Discovery.

   a.) Seed to pump board

   b.) Power-amp module to pump board

   c.) Pump headboard to OPO pump headboard

   d.) OPO headboard to cavity

2. **The SHG stepper assembly:** The daughter-board connected to the pump headboard controls the SHG stepper assembly. If the board is damaged, there is a potential for this fault to be generated. To confirm the stage is in operation, move the SHG spot and listen for a distinctive high-pitched noise from the stage. If there is no noise, make sure that the daughter-board is installed correctly on the pump head board.

CPLD Fault #xxxxxxxx, Fault 63

Description: This fault has not been implemented in the firmware and will never be generated. If there is a need to look at the CPLD fault, it is possible to use the RS-232 command `?CPLD`.

Supply Seed Over Voltage, Fault 64

Description: This is a hardware generated fault that causes a software shutdown. It occurs if the voltage regulator detects over voltage.

Action: Contact the Scotland factory.

Supply Seed Under Voltage, Fault 65

Description: This is a hardware generated fault that causes a software shutdown. It occurs if the voltage regulator detects under voltage.

Action: Contact the Scotland factory.

OSC Tec1 Drive, Fault 66

General Description: This is a software generated fault. It occurs if thermo-electric controller PID servo for the seed pump diode reaches a maximum or minimum (0 or 65535).

Action:

- Monitor the seed TEC drive using the query `?PUMP:AITEC:1`. When the laser is first powered on and is in the warm-up state, the value will oscillate slightly until the set temperature is reached. When in standby mode, the value should be stable and in between the maximum and minimum values.
- Monitor the seed temperature using the query `?PUMP:ATDL:1`. This value needs to be stable and locked at the set temperature `PUMP:TDL:1`.

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

OSC Tec2 Drive, Fault 67

General Description: This is a software generated fault. It occurs if thermo-electric controller PID servo for the pre-amp 1 pump diode reaches maximum or minimum (0 or 65535).

Action:

- Monitor the pre-amp 1 TEC drive using the query `?PUMP:AITEC:2`. When the laser is first powered on and is in the warm-up state, the value will oscillate slightly until the set temperature is reached. When in standby mode, the value should be stable and in between the maximum and minimum values.
- Monitor the pre-amp 2 temperature using the command `?PUMP:ATDL:2`. This value needs to be stable and locked at the set temperature `PUMP:TDL:2`.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

OSC SBR Drive, Fault 68

General Description: This fault has not been implemented in the firmware and will never be generated.

AMP2 Tec1 Drive, Fault 69

General Description: This is a software generated fault. It occurs if thermo-electric controller PID servo for the power-amp pump diode 1 reaches maximum or minimum (0 or 65535). It should be noted that the PID control

Action:

- Monitor the power-amp pump diode 1 TEC drive using the query `?PUMP:AITEC:4`. When the laser is first powered on and is in a warm-up state, this value should oscillate slightly until the set temperature is reached. When in standby mode, the value should be stable and within the maximum and minimum values.

- Monitor the power-amp pump diode 1 temperature using the query `?PUMP:ATDL:4`. This value needs to be stable and locked at the set temperature `PUMP:TDL:4`.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

PWR Tec1 Drive, Fault 70

General Description: This is a software generated fault. It will occur if the drive to the external Wavelength Electronics TEC driver 1 is set to 0 or 65535. In practice, this will never occur given that TEC drive is only for control of the temperature setpoint going into Wavelength Electronics TEC driver. This value is a constant and when set will not change.

PWR Tec2 Drive, Fault 71

General Description: This is a software generated fault. It will occur if the drive to the external Wavelength Electronics TEC driver 2 is set to 0 or 65535. In practice, this will never occur given that TEC drive is only for control of the temperature setpoint going into Wavelength Electronics TEC driver. This value is a constant and when set will not change.

OSC Diode Drive, Fault 72

General Description: This is a software generated fault. It occurs if oscillator drive voltage reaches a maximum (not minimum). This fault can occur in both current loop and light-loop.

Action: Contact the Scotland factory.

AMP1 Diode Drive, Fault 73

General Description: This is a software generated fault. It occurs if the pre-amp 1 drive reaches maximum or minimum value (65536 and 0). This fault can occur in both current loop and light-loop.

Action: Contact the Scotland factory.

AMP2 Diode Drive, Fault 74

General Description: This is a software generated fault. It occurs if the pre-amp 2 drive reaches maximum or minimum value (65536 and 0). This fault can occur in both current loop and light-loop.

Action: Contact the Scotland factory.

PWR Diode Drive, Fault 75

General Description: This is a software generated fault. It occurs if the power-amp drive reaches maximum or minimum value (65536 and 0).

Action:

- Check fuses on the power distribution board.
- Replace the pump module.
- Contact the Scotland factory.

CPLD Write IO, Fault 76

General Description: This is a software generated fault. It occurs if the firmware cannot get a CPLD fault code from the CPLD. It is the internal equivalent of querying `?CPLD` and not getting a response.

Action: Replace the pump head board.

Supply Head Over Voltage, Fault 77

General Description: This is a hardware generated fault that occurs when the headboard detects that the supply voltage is more than the specified value.

Actions: There are voltage regulators on both headboards and on the OVP/ UVP of the power supply. If only the fault 77 occurs, the problem is probably located at the pump head board and/or the power distribution board. Confirm the following:

- Check the cables between the power distribution board to the fiber board.
- Probe the voltages on the power distribution board to make sure the correct voltages are present. See Table 2.1-1. If the voltages are with in range, then it would suggest there is an issue with pump head board.
- If all voltages look normal, replace pump headboard.

Table 2.1-1. Test Point Voltages

TEST POINT	VOLTAGE (V)
TP13	12
TP12	24

Supply Head Under Voltage, Fault 78

General Description: This is a hardware generated fault and occurs if the headboard detects that the supply voltage is lower than it should be.

Actions: There are voltage regulators on both headboards and on the OVP/ UVP of the power supply. If only the fault 78 occurs, the problem is probably located at the pump head board and/or the power distribution board. Confirm the following:

- Check the cables between the power distribution board to the fiber board.
- Probe the voltages on the power distribution board to make sure the correct voltages are present. See Figure 2.1-1. If the voltages are with in range, then it can suggest there is an issue with pump head board.
- If all voltages look normal, replace pump headboard.

SHG Oven Drive, Fault 79

General Description: This fault has not been implemented in the firmware and will never be generated.

Seed TEC HW, Fault 80

General Description: This is normally a hardware fault which occurs when the TEC on the seed pump diode is more than the hardware defined maximum level of 50 °C. Software limits the setpoint temperature between the ranges of 10 to 40 °C. This fault is for both the oscillator and the pre-amp 1.

Action:

- Check the temperature of the oscillator pump diode is true by querying `?PUMP:ATDL:1`. This should be near the value `?PUMP:TDL:1`.
    - If actual temperature is different, check the connection between the oscillator module and the pump head board.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

Test Points: There are no test points for the thermistor inputs but U47 pins 4 or 7 can be probed.

This value can then be compared with the max and min on U47 pins 5 and 6. The voltage from the thermistor should be between the max and min voltage.

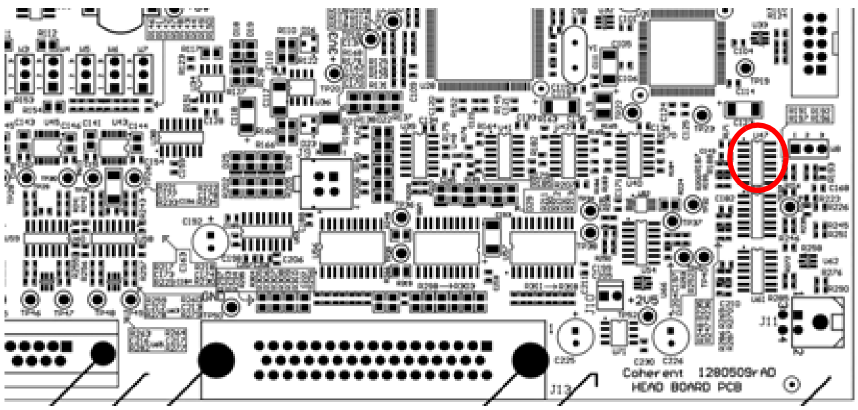


Figure 2.1-3. Headboard - U47

AMP2 TEC HW, Fault 81

General Description: This is a hardware fault which occurs when the TEC on the pre-amp 2 pump diode is over the hardware defined maximum level of 50 °C. Software restricts the setpoint temperature between the ranges of 10 to 40 °C.

Action:

- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

Test Points: TP33 on the pump headboard can be used to measure the voltage from the pre-amp 2 thermistor. This value can then be compared with the max and min U50 pins 8 and 10. The voltage from the thermistor should be between the max and min voltage. See Figure 2.1-4.

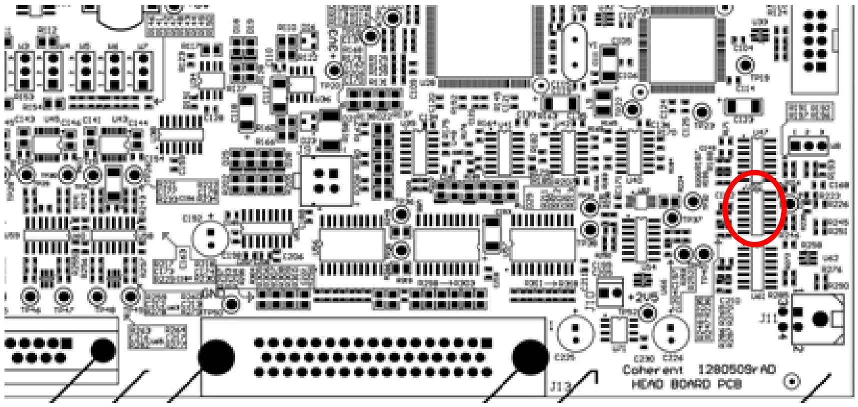


Figure 2.1-4. Headboard - U50

PWR TEC HW, Fault 82

General Description: **Needs a new description**

SHG Oven HW, Fault 83

General Description: This is a hardware fault which occurs when the SHG oven is out of the normal operating temperature (0 °C to 100 °C).

Action:

- See “SHG Heater Drive Over Temperature, Fault 58” on page 2.1-22.This fault will occur before Fault 83.
- Check the ribbon cable from the pump headboard to OPO headboard.
- Check the ribbon cable from the OPO headboard to bulkhead connector.
- Make sure the chiller is switched on and operating at 20 °C.
- Make sure flow IN and flow OUT are connected the correct direction.

Pump Interlock, Fault 84

Description: This is a hardware generated fault that occurs if the pump headboard detects an interlock fault. There are two interlock switches that are part of the pump interlocks.

- The cover over the pump fiber connectors.

- The cover over the seed module output fiber port.

Action:

1. Check both fiber connector covers are secure.
2. Check the interlock loom is connected correctly to the pump head board.
3. Use a multimeter to verify the micro-switches are operating correctly. Check the integrity between:
   a.) pins 1 and 3 while the cover is removed for the pump fiber connectors.
   b.) pins 2 and 4 while the cover is removed for the seed connectors.

Head Interlock, Fault 85

Description: This is a hardware generated fault. It is generated by the pump headboard when it detects the OPO headboard has an interlock fault.

The head interlock fault originates from the OPO headboard. It is the combination of a number of interlock faults that can occur and require an immediate hardware shutdown. The interlock faults are:

- Emission LED fault
- PSU Emission LED fault
- External interlock
- PSU supply fault
- Shutter fault
- OPO headboard has been reset by the watchdog

Action: If this fault occurs, it will normally come with a secondary fault from the OPO headboard (a fault >1000). This is the fault that should be investigated.

Head, Fault 86

Description: This is a software generated fault that occurs if pump board receives information through the CAN bus that a fault has occurred on the OPO headboard. If this occurs, a controlled software shutdown will occur.

Action: Check for a fault originating from the OPO head board using `?F` or `?FH`.

Pump Service Required, Fault 87

Description: This fault occurs when all SHG spots have been marked as bad. This should only occur on systems that have been running for a long period of time. The system will still operate, but indicates to the user that the system can start to slowly degrade if there is no intervention from service.

Action: Contact the Scotland factory.

Pump Not Available, Fault 1001

General Description: If the CAN messages are not returned from the pump headboard for 5 seconds, then the OPO head board will send this fault.

Action:

- Check the pump board is powered up.
- Check the software baseline versions match: possible failure in CAN communication if the versions are different.
- Make sure OPO board J11 and pump board J4 are connected.
- Change the cable between pump headboard and OPO headboard.

Key State Mismatch, Fault 1002

General Description: Not implemented.

Tuning Stepper Home Fail, Fault 1003

General Description: The fault indicates that the tuning stepper has not correctly completed the home procedure.

Action: Perform an absolute home procedure.

- Query `?STP1SPOT` – this indicates the current OPO spot position.
- Perform an absolute home `STP1HMABS=1`. The status `?st` should read **Please Wait** while the tuning stepper is homing.
- An absolute home procedure has the potential to require 15 minutes if the system is at a large spot number. After 2 to 3 minutes, the stepper can be checked for movement by sending the query `?STP1POSABS`. This is the absolute position and should change after the stepper has completed the home procedure.

If the procedure does not work, it is possible to probe the home switch using R269 on the OPO board. If the signal is high, it is an indication that the stepper is not moving.

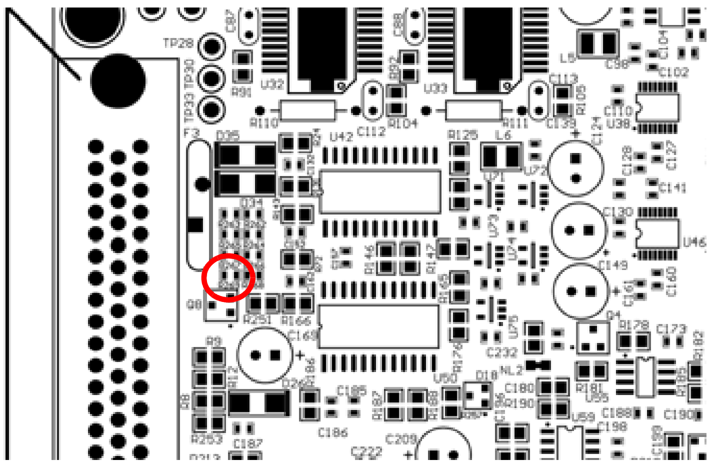


Figure 2.1-5. OPO Board - R269

GDD Stepper Home Fail, Fault 1004

General Description: The fault indicates that the GDD stepper has not correctly completed the home procedure.

Action: Manually home the stepper by sending the command `STP2HM=1`.

Seed Wrong Version, Fault 1005

General Description: This fault has not been implemented by the firmware and will never be generated.

Failed to Read PCBA, Fault 1006

General Description: This fault has not been implemented in the firmware and will never be generated.

PID Last Limit (check), Fault 1008

Description: This is a software generated warning that only appears when the OPO board is in Service mode. **The USER should never see this fault.** It occurs when the OPO can not lock at the 95 % power level and the system has automatically done a rescan to find the new 95 % power level.

Action: This is a warning that the system had to rescan itself. Normally a rescan will only occur if the output power of the system has decreased. If the power drop by 5 %, then it is impossible for the OPO to lock at the original 95 % level and results in the system needing to rescan to find a new lower 95 % level. Below are some reasons why this can occur.

Environmental changes:

- If the ambient temperature has rapidly changed, there is a potential of the OPO power to fluctuate.
- Chiller is not operating correctly.

Pump mirror not optimized:

- If the pump mirrors are optimized correctly, an increase in power should be seen. This is why rescanning/retuning the system 30 minutes after keying the system ON should result in the 95 % power being reset to a higher power.
- If the power decreases while the system is in warm-up, it can indicate the pump mirrors are not optimized. This indicates that the pump map optimization routing should be performed when the system is stable.

Lid interlock, Fault 1009

Description: This fault has not been implemented in the firmware and will never be generated.

External Interlock, Fault 1010

Description: This is a hardware driven fault caused by the OPO headboard detecting an external interlock fault.

Action:

- Make sure the interlock defeat is fully inserted into the back of the MRU.
- Make sure the MRU is switched on.
- Make sure the interlock cable between the MRU and the PSU are connected correctly.
- If the USER supplies their own interlock, confirm that the interlock is not causing the problem. Insert the Coherent supplied interlock defeat into the back of the MRU.

- Check there is continuity between pins 1 and 4 of the MRU interlock defeat.

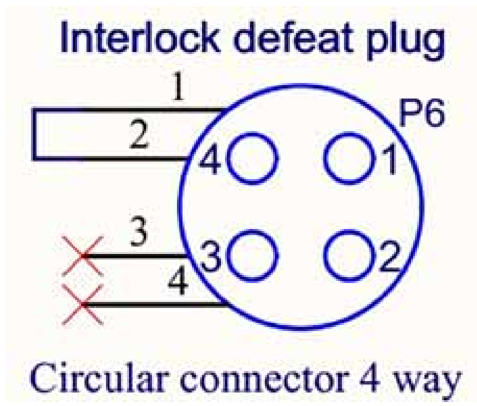


Figure 2.1-6. Interlock Defeat

PSU Supply Fault, Fault 1011

Description: This is a hardware generated fault which occurs if the PSU detects a problem. The fault can be caused by the following issues:

- Problem with shutter 1 LED (the actual light on the shutter button).
- Problem with shutter 2 LED (the actual light on the shutter button).
- Problem with the fault LED.
- PSU is gives an over voltage warning (OVP).
- PSU is gives an under voltage warning (UVP).

Action: The PSU headboard has test points to troubleshoot the 5 possible issues for the fault. See Table 2.1-2 for the different test points.

PSU Emission LED, Fault 1012

General Description: This is a hardware generated fault that occurs if there is a problem with the emission LED that is on the PSU.

Action: Replace the PSU.

Table 2.1-2. PSU Headboard - Test Points

FAULT	TEST POINT	NORMAL OPERATION	ACTIVE FAULT
Shutter LED 1 Fault	TP8	High	Low
Shutter LED 1 Fault	TP7	High	Low
Fault LED	TP2	High	Low
OVP	TP4	High	Low
UVP	TP6	High	Low

Emission LED1, Fault 1013

General Description: This is a hardware generated fault that occurs if a problem is detected with the head emission LED.

Action: Make sure the emission LED is correctly connected to J9. If the fault continues to occur, the emission LED may need to be changed.

Emission LED2, Fault 1014

General Description: This fault should never occur because a second emission LED is not on Chameleon Discovery.

Illegal Code Restart, Fault 1015

General Description: This fault indicates that the OPO firmware has unexpectedly crashed and has restarted.

Action: Send feedback to the Coherent Scotland on the status of laser system when the fault occurred.

Key On at Power Up, Fault 1016

General Description: This fault has not been implemented in the firmware and will never be generated. Fault 1 should appear if the Key is left in the ON position during power up.

Low Power, Fault 1017

General Description: This is a software generated warning which occurs after the system had 5 attempts to make the OPO lase. One attempted scan is specified as a fine scan, followed by a coarse scan with the last step being a complete scan of the OPO piezo stage. If the system is retuned and lasing is found, the fault is moved to the fault history.

Action:

- Make sure the pump is producing the correct power (`?P2` should equal ~8000).
- Change SHG spot and retune. Use `PUMP:SHG:SPOTCH+` to move to the next good spot when the system is keyed off.
- Change BBO spot and retune. Use `STP1SPOT+` to move to the next good spot when the system is keyed off.
- Perform a pump map to check the pump position is optimized.

Wavelength Setup Error, Fault 1018

General description: This is a software generated fault that can occur for two reasons:

1. The firmware tries to interpolate corrupted data from the cavity look-up table.
2. The OPO piezo stage cannot lock properly to the requested strain gauge position.

Action:

- Use the Service GUI EEPROM tool to check for corrupted data within the cavity look-up table. If necessary, reload the cavity look-up table from a previous EEPROM image.
- Recalibrate the piezo stage using `STAGESGCAL`. Before this is done, the watchdog jumper (W1) on the OPO headboard must be removed (only required for Release builds 2, 3 and 4).

Service required, Fault 1019

General Description: This is a software generated warning prompt for the user to contact Coherent support. The warning indicates that all spots on the OPO crystal are used. This should only occur on systems that run for long periods of time. The system will operate, but this an indication to the user that the system can start to slowly degrade of there is no intervention from service.

Action: Contact the Coherent Scotland Factory Support.

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COHERENT.	TROUBLESHOOTING FLOWCHARTS	SVC-CHDY-2.2 REV. AB
Factory Support Engineer: IAIN MACPHEE	Effective: PRELIMINARY 4/4/18	Page: 1 OF 2

Flowchart Introduction

The flowcharts provide troubleshooting steps for data collection and reduced variable output power. See “Initial Data Collection” and “Reduction in Variable Output Power” detailed information on both procedures.

Initial Data Collection

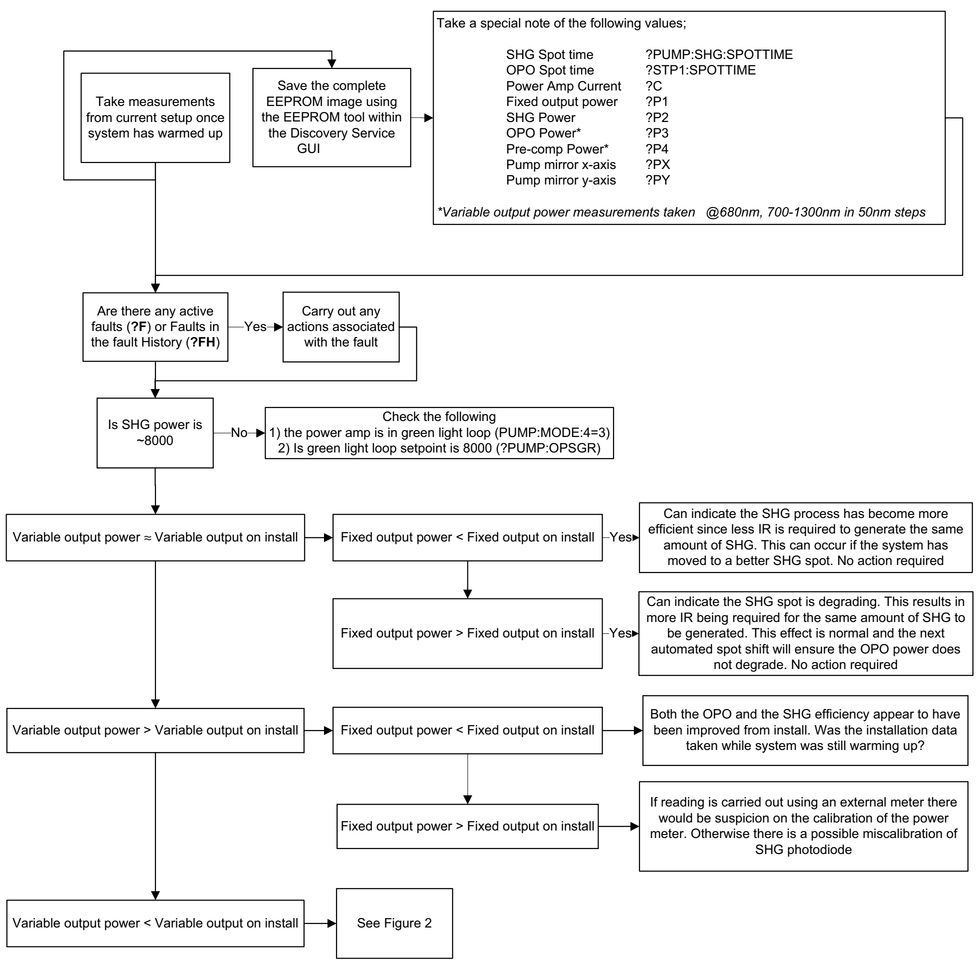

Figure 2.2-1. Initial Data Collection

Reduction in Variable Output Power

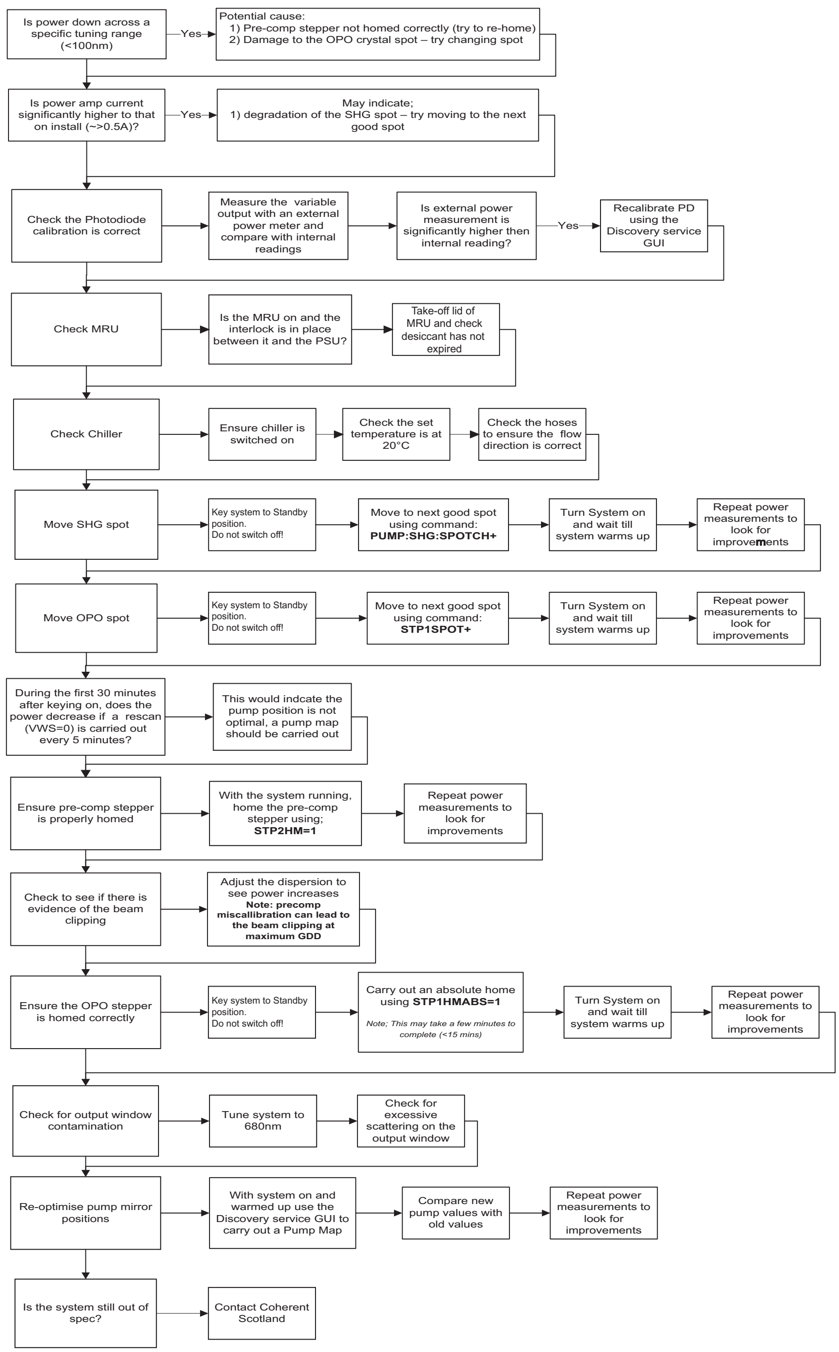

Figure 2.2-2. Reduction in Variable Output Power

Introduction

In the Discovery TPC, the light from the fixed and variable beamlines is modulated via the AOM attenuators. The transmission of light is dependent upon the RF signal amplitude applied to the AOMs via the RF drivers. The RF drivers apply the electrical RF signal in accordance with settings supplied either through their serial connections and the calibration file (internal mode) or through a combination of serial and analogue voltage (External Mode). When using a combination of commands and analogue signal voltages, the maximum achievable output power available through the DC signal voltage modulation is capped by the level selected via serial command. If there is an issue with any part of this, there will be problems obtaining light from one of more of the beamlines.

Preliminary Check

Perform the following steps before diagnosis of the attenuator system.

- Internal power meters P1 and P4 are reading non-zero power levels.
  All internal power meters are placed before the AOM attenuator.
- The AOMs are in internal mode.
- The shutter is open.
- The required port parameters have been observed and implemented in the relevant input configuration (see Table 2.3-1).

Ensure connection established to both attenuators and the RF drivers are properly assigned (to fixed and variable in the GUI).Refer to Table 2.3-1with the required connection protocols for each serial port.

Table 2.3-1. TPC Connections

CONNECTION	SPECIFICATION	DESCRIPTION
Mod- Tunable	• USB type-B • Data bits:8 • Parity bits:0 • Baud: 57600 • Handshake: No	Serial connection to the Tunable AOM driver.
Mod-Fixed		Serial connection to the Fixed (1040 nm) AOM driver.
RF In Tunable	• SMA plug • Input impedance: 50 Ohm • Maximum input power: < 2.5 W • Frequency range: 73-147 MHz • VSWR: < 1.2:1	RF input sent directly to the Tunable AOM.
RF in Fixed		RF input sent directly to the Fixed (1040 nm) AOM.
Analog Tunable	• SMA plug • Input impedance: 10 kOhm • Maximum input: 10 Vdc	0-10 Vdc input to set/modulate Tunable laser power.
Analog Fixed		0-10 Vdc input to set/modulate Fixed laser power.

Unable to Connect

If a connection can not be established to the attenuator, ensure that the Coherent GUI with the associated USB-device-drivers are installed. Having checked the drivers, if neither driver can connect go straight to tracing the 24 V in "24 V Troubleshooting".

- Open the device manager and disconnect and reconnect the driver serial USB cable to the PC while the laser PSU is powered on.
- Ensure that the device is recognized.

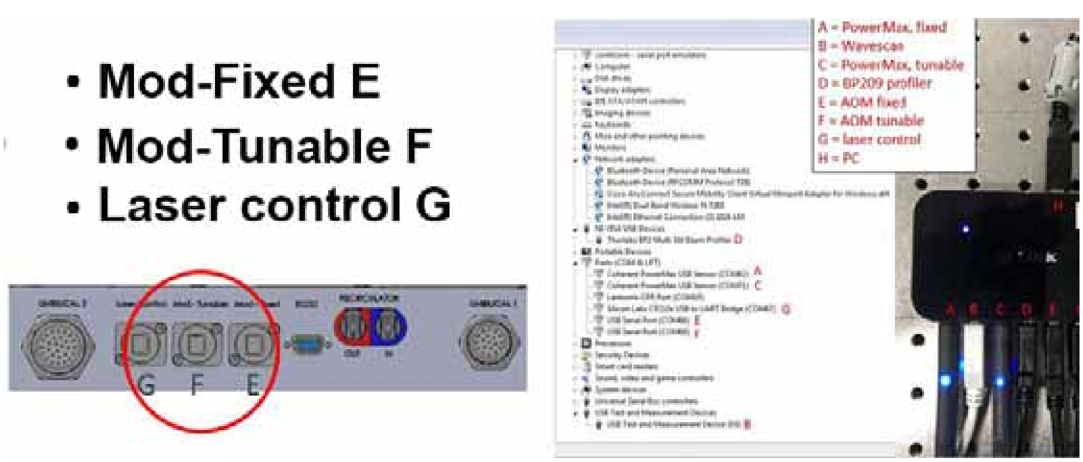

Figure 2.3-1. Device Manager with Driver Connection

Before progressing:

- Try changing to another, known good USB port on the control PC, or excluding a USB hub if one is being used.
- Try using a known good USB cable to confirm that the issue is not external.

If nothing is registered in the device manager, it suggests that the driver is not active. This could be a driver fault, or a wiring problem particularly if one driver can connect and the other cannot. The communications connections should be checked first and then the power second.

1. Power off the laser PSU and remove the outer cover a shown in Figure 5.1-1.
2. Disconnect the "serial input USB" patch from the driver side as indicated in Figure 2.3-2 and connect the PC USB directly to the driver in its place. Power on the PSU.
   If there is no device registered on the device manager, continue to the next step..

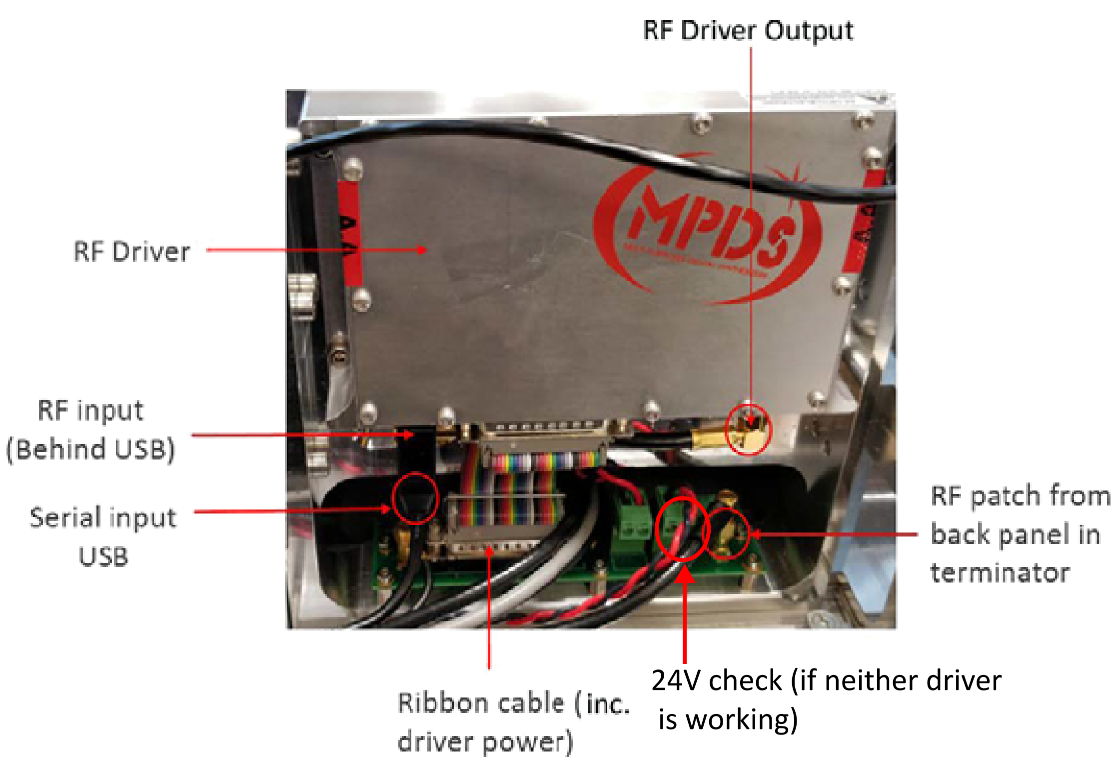

Figure 2.3-2. Driver Components

24 V Troubleshooting

1. Test the 24 V connector on the board of the non-working driver. If neither driver is working, trace 24V connection at driver boards back to the power distribution board.
2. If all 24V are present at the boards, suspect the driver board, ribbon cable or driver.
   a.) Power off, swap ribbon cables, power on and try to connect to driver with computer. See if issue moves to other driver
   b.) Repeat with driver and then driver board to deduce faulty component.
   c.) If fault remains on same side after changing all parts above, suspect 24V connection cable between boards. Replace 24V cable.

No Light Output with the Calibration File

This troubleshooting path assumes the attenuator communication has been established but there is no light available from the attenuator. Connect the **Coherent GUI and use the factory-supplied calibration file.**

Test in internal mode, transmission 100%.

1. No light out of the attenuators - The issue is with the driver or cabling (between the driver and AOM).
2. Light out observed - The issue is from the customer control, external voltage source or the cables carrying the external signal to the driver from the source up to the driver.

No Light Out Troubleshooting

If there is no light from the attenuators using the Coherent GUI, this indicates that there is a problem internal to the attenuator setup. Possible failures include connection issues, board failures or driver failures or the calibration files is not setup properly.

1. Power OFF the system and remove the cover (see Figure 5.1-1).
2. On appropriate driver (tunable or fixed), check that the RF driver output SMA cable is connected securely to RF input. If correction made, power on and re-test (see Figure 2.3-2). If not, continue.
3. Replace the driver (see Figure 2.3-2).

4. If light output still cannot be achieved using the Coherent GUI and internal mode, contact the factory for support.

Light Observed in Internal Mode with GUI but NOT in Customer Control Troubleshooting

Some troubleshooting of the customer set-up is required to differentiate between Coherent module failures, customer supplied equipment failure or connectivity issues. This section assumes that the laser works in internal mode using the Coherent GUI and Coherent calibration file.

Use customer control software in internal mode. **Is there light out of the laser AOMs? Proceed to the troubleshooting below based on the results.**

1. **No but there was light out with Coherent GUI + calibration file.**

   Customer control is not interacting properly with the AOM RF driver.

   Recommendation to the customer:

   - Revert to Coherent GUI until they can troubleshoot software.
   - If the customer uses external mode, check that external mode works using the Coherent GUI. If not, follow the troubleshooting for external mode listed in step 2 below but only use the Coherent GUI.
     In summary, if the frequency calibration is incorrect, there will be no output. If the RF power is set incorrectly, there will be the wrong optical power or no optical power for the setting.
   - Check connection protocol against table (Table 2.3-1) and calibration file values in customer software (RF power and frequency for given transmission powers at given wavelengths). See “AOM Calibration File” on page 5.9-1 for more details.

2. **There is light out in internal mode with customer control software but not in external mode.**

   a.) The issue is with external modulation configuration. Test the set-up in external mode with the customer’s dc supply which can be a 10 V supply or connections. (This troubleshooting path assumes the customer is using and having issues with the external mode).

i. Test dc voltage source on oscilloscope (couple to dc) using the customer SMA cable if possible

ii. Confirm impedance matching between customer voltage supply and laser

iii. If OK, connect dc input directly to RF driver board as circled below in Figure 2.3-3, bypassing the back panel and patch.Continue to step b.

Figure 2.3-3. "dc in" patch from Discovery back panel

b.) No light out but there is 10 V on the cable at the correct impedance in external mode

i. Switch off PSU

ii. Replace ribbon cable

iii. Power on PSU

iv. If there is 10 V present but still no light out, replace the driver

v. If there is no 10 V present, change driver board

If still no light in external after driver replacement, contact Coherent Scotland for support.

Pointing Changes with Wavelength Setting

This indicates that the AOM calibration file needs to be updated (Frequency/y-axis).

Output Power Does Not Correspond to Transmission Settings

The power display is indicative only and expectations of precision should be reasonable. If the precision is not reasonable, this indicates that the corresponding RF Power calibration section might need updating. Try replacing or swapping the fixed and tunable drivers and see if the issue follows the drive or the input configuration. If the issue follows the driver, replace the driver.

In external mode only, this indicates an issue with the customer-supplied external voltage, or their expectation. Optical power output is not linear with DC voltage input. Furthermore, there is interplay between the attenuation setting (serial input) and the D applied, where the serial input RF power determines the maximum voltage achievable with 10 VDC into the analogue input.

If external control is not behaving as expected, isolate system by removing as much 3rd party equipment if possible and check voltage output on scope. Look for additional and unusual customer-supplied apparatus, such as an analogue DC amplifier for the 0-10 V signal, check signal levels correspond to what customer thinks they are and check impedance.

Output Power is Noisy

- Check if noisy in internal mode.
- If there is no noise in internal mode, suspect customer voltage supply or amplifier, RF cable, external pickup.
- If there is noise in internal mode, check internal power meters.
- Confirm noise on Coherent thermopile power meter? If so, continue run troubleshooting.

Discovery Block Diagram

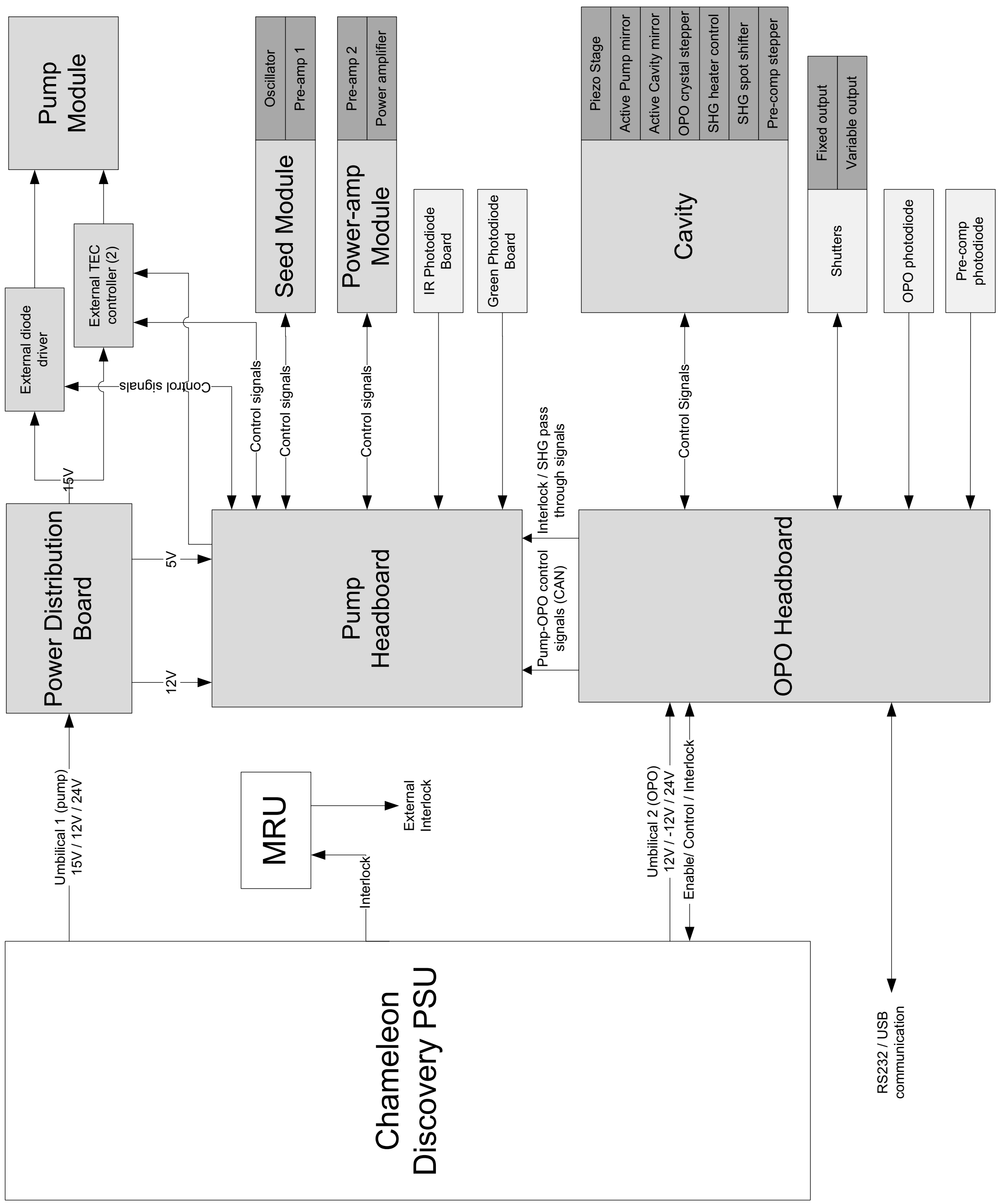

Figure 3.1-1. Block Diagram

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Test Points

The information in Table 3.2-1 and Table 3.2-2 provides additional test points for the OPO and Pump headboards. Figure 3.2-1 and Figure 3.2-2 gives the location of the additional test points for OPO and Pump headboards.

OPO Headboard Test Points

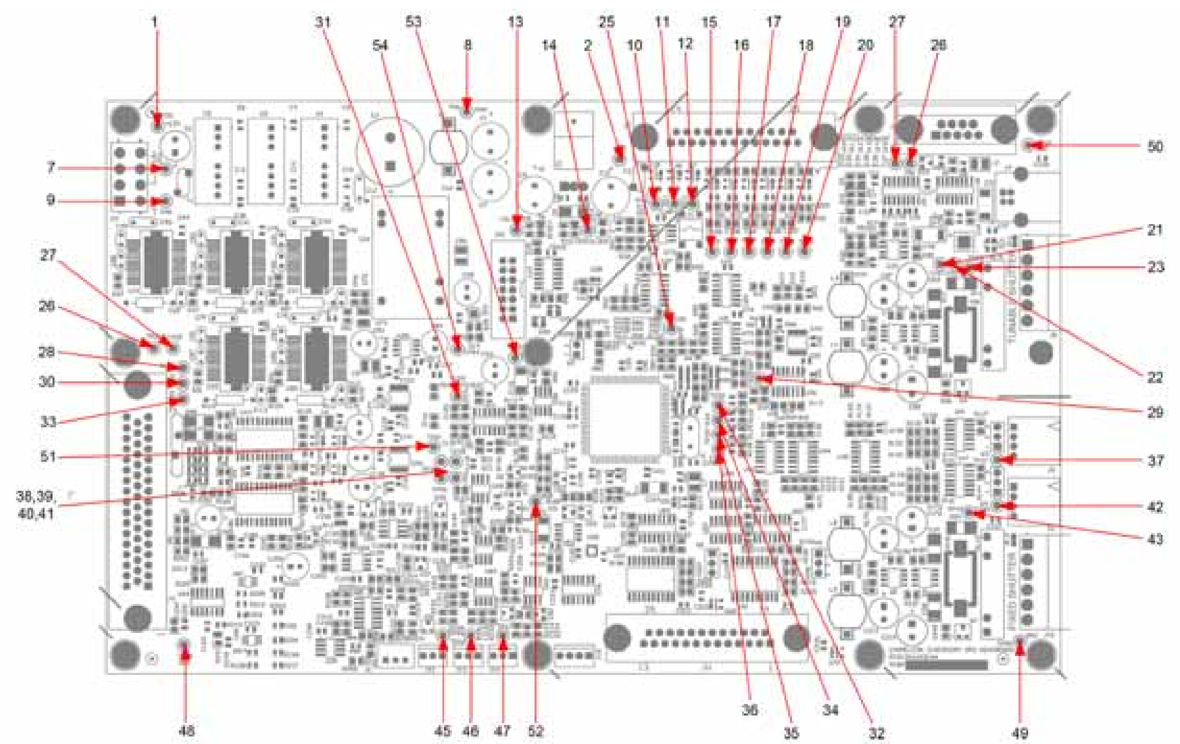

Figure 3.2-1. OPO Headboard - Test Points

Table 3.2-1. OPO Headboard Test Point Description

TEST POINT	DESCRIPTION	TEST POINT	DESCRIPTION	TEST POINT	DESCRIPTION
TP1	+12 V	TP21	USB RS232 TX	TP37	Not used (Emission LED 2)
TP2	+5 V test point (regulator)	TP22	USB RS232 RX	TP38	CX DAC output
TP5	EXT RS232 TX	TP23	Shutter 1 Coil	TP39	CY DAC output
TP6	EXT RS232 RX	TP24	+3.3 V test point (regulator)	TP40	PY DAC output
TP7	-12 V	TP25	UVP Voltage	TP41	Piezo stage DAC output
TP8	GND	TP26	PY high voltage output	TP42	Emission LED Fault
TP9	+24 V	TP27	PX high voltage output	TP43	Shutter 2 Coil
TP10	PSU Shutter 2 LED	TP28	Piezo stage high voltage output	TP45	Pre-comp Photodiode Raw voltage
TP11	PUS Shutter 1 LED	TP29	OVP Voltage monitor	TP46	Not Used
TP12	PSU Fault LED	TP30	CX high voltage output	TP47	OPO Photodiode Raw voltage
TP13	Watchdog Reset	TP31	PX DAC output		
TP14	Interlock	TP32	Strain Gauge output	TP48	GND
TP15	External Interlock	TP33	CY high voltage output	TP49	GND
TP16	PSU Emission LED Fault	TP34	Not Used	TP50	GND
TP17	PSU Supply Fault	TP35	Pre-comp photodiode input into processor	TP51	Pre-comp rear limit
TP18	Shutter 2 Push Button			TP52	BBO home complete

Table 3.2-1. OPO Headboard Test Point Description (Continued)

TEST POINT	DESCRIP-TION	TEST POINT	DESCRIP-TION	TEST POINT	DESCRIP-TION
TP19	Shutter 1 Push Button	TP36	OPO PD input into processor	TP53	TX1
TP20	Key on/ Key off			TP54	RX1

Pump Headboard Test Points

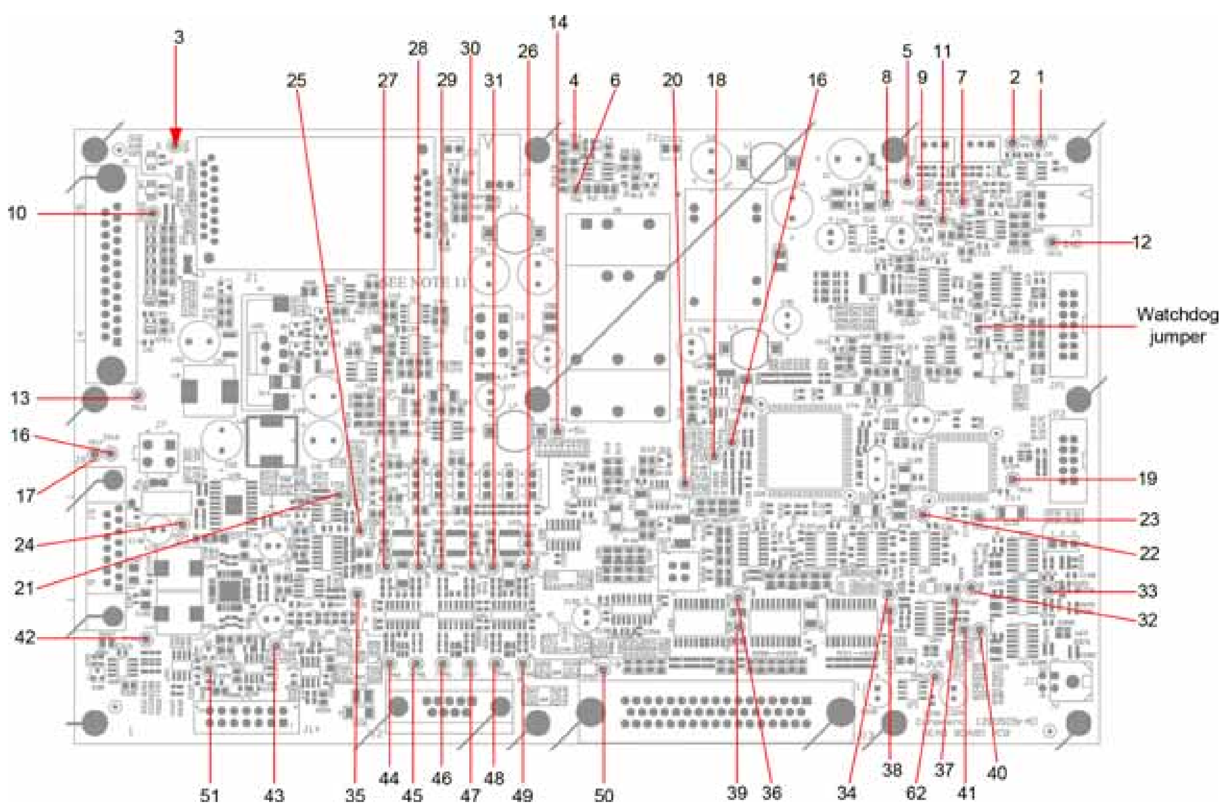

Figure 3.2-2. Pump Headboard - Test Points

Table 3.2-2. Pump Headboard Test Point Description

TEST POINT	DESCRIPTION	NOTES
TP1	Power-amp PD signal to CPU	Power-amp photodiode voltage going into processor (0-2.5)
TP2	Power-amp Under voltage	The lower voltage at which the CPLD will switch off if the PD4 signal (TP11) goes below. This value can be changed by varying VR1
TP3	AGND	Analogue ground
TP4	PD5 Voltage	520nm photodiode voltage to processor (0-2.5V)
TP5	Power-amp over voltage	The upper voltage at which the CPLD will switch off if the PD4 signal (TP11) goes above. This value can be changed by varying VR2
TP6	Green PD raw voltage	520nm photodiode raw voltage (0-3.3V)
TP7	Power-amp PD raw voltage	Not relevant
TP8	+4V ref	+4V
TP9	AGND	Analogue Ground
TP10	HV out B	
TP11	Power-amp PD raw voltage	(0-5 V)
TP12	AGND	Analogue ground
TP13	LBO Drive	(0-24v) vary depending on drive
TP14	+5V (regulator)	+5V
TP15	+3.3V	+3.3V
TP16	Pin 7 pre-amp diode 2 D-type	Spare
TP17	Pin 7 pre-amp diode 2 D-type	Spare
TP18	+3.3V	+3.3V
TP19	Service test pin (I/O=4)	Only required for hardware/software testing
TP20	+3.3V (regulator)	+3.3V
TP21	Diode 3 Measurement	Pre-amp 2 - Vout=1.82V/Amp (2.5 max)
TP22	Service test pin (I/O=44)	Only required for hardware/software testing
TP23	Service test pin (I/O=27)	Only required for hardware/software testing
TP24	Diode 3 Setpoint	Pre-amp 2 drive from PSU (0-3.3V)
TP25	AGND	Analogue Ground

Table 3.2-2. Pump Headboard Test Point Description (Continued)

TEST POINT	DESCRIPTION	NOTES
TP26	TEC 3 Set point	Pre-amp 1 TEC set point
TP27	TEC 6 Setpoint	Power-amp pump diode 2 TEC set point going to wavelength electronics TEC controller 2
TP28	Diode 4 Setpont	Voltage going to wavelength electronics for power-amp diode driver
TP29	Diode 3 Setpoint	Pre-amp 2 drive from PSU (0-3.3V)
TP30	Not used	Spare DAC
TP31	TEC 2 Setpoint	Not used
TP32	Multiplex A0	Selecting one of four inputs
TP33	Thermistor 4 in	Pre-amp 2 thermistor value
TP34	Multiplex A1	Selecting one of four inputs
TP35	TEC 4 setpoint	Pre-amp 2 input
TP36	Spare	Spare
TP37	Therm base meas in	External thermistor not used
TP38	Resistor value for version control	
TP39	Spare	Not used
TP40	Thermistor 5 input	Wavelength electronics Tec Driver input for power-amp diode 1
TP41	Thermistor 6 input	Wavelength electronics Tec Driver input for power-amp diode 2
TP42	PD3 signal to processor	Pre-amp 2 photodiode
TP43	Diode 4 enable	Power-amp enable (3.3V logic) (high = enable)
TP44	TEC 5 Set point	Power-amp pump diode 1 TEC set point going to wavelength electronics TEC controller 1
TP45	LBO Set point	Voltage output to define LBO setpoint
TP46	Diode 2 Setpoint	Pre-amp 1 set point
TP47	TEC 4 Setpoint	Pre-amp 2 TEC set point
TP48	Diode 1 Setpoint	Oscillator pump set point
TP49	TEC 1 Setpoint	Oscillator pump diode TEC set point
TP50	AGND	Analogue ground

Table 3.2-2. Pump Headboard Test Point Description (Continued)

TEST POINT	DESCRIPTION	NOTES
TP51	Power-amp measurement in	Voltage coming back from the PowerAmp - A direct indication of the power-amp current
TP52	+2.5V (regulator)	+2.5V

Introduction

Table 3.3-1, Table 3.3-2 and Table 3.3-3 give the pin descriptions of connectors at the Pump Headboard, OPO Headboard and the Power Distribution board. See “Test Points” on page 3.2-1 information on the test points and “Discovery Block Diagram” on page 3.1-1 for the system diagram.

Figure 3.3-1 provides the connector details for the MRU Interlock connector.

Pump Headboard Pin Description

Table 3.3-1. Pump Headboard Pin Description

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J8 15-way D-type	Pump headboard to Power amp module	1=Pre-amp 2 TEC + 2=Pre-amp 2 TEC + 3=Pre-amp 2 - 4=Pre-amp 2 - 5=Pre-amp 2 PD Input 6=AGND 7=Not used 8=Not used 9=pre-amp 2 diode drive + 10=pre-amp 2 diode drive + 11=pre-amp 2 diode drive - 12=pre-amp 2 diode drive - 13=pre-amp 2 thermistor IN 14=AGND 15=Not used

Table 3.3-1. Pump Headboard Pin Description (Continued)

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J14 14-way Microfit	Pump headboard to Pump board	1=Power amp pump diode 1 TEC Enable out (Blue) 2=Power amp pump diode 1 Thermistor (Red) 3=Power amp pump diode 2 TEC Enable out (Pink) 4=Power amp pump diode 2 Thermistor (Grey) 5=Power amp diode Enable (Blue) 6=Power amp diode Setpoint (Green) 7=Power amp diode feedback (Blue) 8=Power amp pump diode 1 TEC Setpoint (Green) 9=AGND (Orange) 10=Power amp pump diode 2 TEC Setpoint (White) 11=AGND (Yellow) 12=Not used 13=Power amp diode over current protection (Orange) 14=AGND (Red)
TEC 1 6 way Molex	Pump headboard to Power amp pump diode 1 TEC	1=TEC Enable (Blue) 2=AGND (Orange) 3=Themister (Red) 4=Not used 5=Not used 6=Setpoint (Green)
TEC 2 6 way Molex	Pump headboard to Power amp pump diode 2 TEC	1=TEC Enable (Pink) 2=AGND (Yellow) 3=Themister (Grey) 4=Not used 5=Not used 6=Setpoint (White)
Driver 4 way Molex	Pump headboard to Power amp diode driver	1=Not used 2=Not used 3=Not used 4=Diode current meas output (Blue)

Table 3.3-1. Pump Headboard Pin Description (Continued)

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
Driver 6 way Molex	Pump headboard to Power amp diode driver	1=AGND (Red) 2=Not used 3=Power amp diode over current protection (orange) 4=Power amp diode Enable (Blue) 5=Power amp diode Setpoint 6=Not used
J1 3-way latched header	Pump headboard to SHG PD	1=+5V (Blue) 2=AGND (Green) 3=PD signal (Red)
J5 3-way latched header	Pump headboard to IR PD	1=+5V (Blue) 2=AGND (Green) 3=PD signal (Red)

Table 3.3-1. Pump Headboard Pin Description (Continued)

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J4 25-way D-type	Pump headboard to OPO headboard (J11)	1=CANL 2=RS232 Rx 3=AGND 4=Interlock IN - 5=Key switch IN+ 6=AGND 7=LBO stage signal 8=AGND 9=+5V 10=LBO stage signal 11=PGND 12=HV Out A 13=HV Out B 14=CANH 15=RS232 Tx 16=Interlock IN+ 17=AGND 18=Keyswitch IN- 19=LBO stage signal 20=LBO stage signal 21=LBO stage signal 22=LBO stage signal 23=PGND 24=LBO Thermister 25=LBO Drive
J9 3-way Microfit	Pump board (J9) to micro-switches	1=Micro-switch 2 NO 2=Micro-switch 1 NO 3=Micro-switch 2 COM 4=Micro-switch 1 COM

OPO Headboard Pin Description

Table 3.3-2. OPO Headboard Pin Description

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J1 9-way D-type	OPO headboard to Back panel	1=Not used 2=RS232 Tx (Blue) 3=RS232 Rx (Red) 4=Not used 5=AGND (Green) 6=Not used 7=Not used 8=Not used 9=Not used
J14 3-way lock header	OPO headboard (J14) to OPO PD	1=PD signal (Blue) 2=GND (Green) 3=+12V (Red)
J12 3-way lock header	OPO headboard (J12) to pre-comp PD	1=PD signal (Blue) 2=GND (Green) 3=+12V (Red)
J3 8-way Minifit	OPO headboard to bulkhead umbilical connector 2	1=Not used 2=GND (Black) 3=+12V (Blue) 4=GND (Black) 5=+24V (Green) 6=Not used 7=-12V (Brown) 8=Not used

Table 3.3-2. OPO Headboard Pin Description (Continued)

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J2 25-way D-type	OPO headboard to bulkhead umbilical connector 2	D-Type 25-way (OPO J2) 1=GND 2=GND 3=Shutter2 LED- (Black) 4=Shutter1 LED- (Black) 5=PSU Emission LED- (Black) 6=GND 7=Ext Interlock+(Green) 8=PSU Emission LED Fault+ (Yellow) 9=PSU Supply Fault- (Black) 10=Shutter2 Push Button- (Black) 11=GND 12=Shutter1 Push Button+ (Red) 13=Key ON/OFF+ (Brown) 14=Not used 15=Shutter LED+ (White) 16=GND 17=Shutter1 LED+ (Orange) 18=PSU Emission LED+ (Violet) 19=Ext Interlock- (Black) 20=PSU Emission LED Fault-(Black) 21=GND 22=PSU Supply Fault+ (Grey) 23=Shutter2 Push Button+ (Blue) 24=Shutter1 Push Button- (Black) 25=Key ON/OFF+ (Black)

Table 3.3-2. OPO Headboard Pin Description (Continued)

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
Amphenol 28-pin bulkhead connector	OPO headboard to bulkhead umbilical connector 2	A=+12V (Blue) B=GND (Black) C=+24V (Green) D=GND (Black) E=-12V (Brown) F=Not used G=Key ON/OFF+ (Brown) H=Key ON/OFF+ (Black) J=Shutter1 Push Button+ (Red) K=Shutter1 Push Button- (Black) L=Shutter2 Push Button+ (Blue) M=Shutter2 Push Button- (Black) N=PSU Supply Fault+ (Grey) P=Shutter2 Push Button- (Black) R=PSU Emission LED Fault+ (Yellow) S=PSU Emission LED Fault-(Black) T=Ext Interlock+(Green) U=Ext Interlock- (Black) V=PSU Emission LED+ (Violet) W=PSU Emission LED- (Black) X=Shutter1 LED+ (Orange) Y=Shutter1 LED- (Black) Z=Shutter LED+ (White) a=Not used b=Not used c=Not used d=Not used e=Shutter2 LED- (Black)

Power Distribution Headboard Pin Description

Table 3.3-3. Power Distribution Board Pin Descriptions

CONNECTOR	GENERAL DESCRIPTION	PIN DESCRIPTION
J9 Minifit 5 way	Power Distribution Board to Pump Headboard (J6)	1=+12V (Blue) 2=+12V (Blue) 3=+5V (Red) 4=AGND (Black) 5=AGND (Black) 6=AGND (Black)
J8 Minifit 5 way	Power Distribution Board to Pump Headboard (J7)	1=+24V (Green) 2=Not used 3=AGND (Black) 4=Not used
J3 Terminal block 6 way	Power Distribution Board to External diode driver	1=GND (Black) 2=+5V (Blue) 3=Laser Diode anode,+15V (Red) 4=Laser diode cathode (Green) 5=Not used 6=Not used
J1 Terminal block 4 way	Power Distribution Board to TEC 1	1=+15V(Blue) 2=GND (Green) 3=TEC+VE (Black) 4=TEC-VE (Red)
J2 Terminal block 4 way	Power Distribution Board to TEC 2	1=+15V(Blue) 2=GND (Green) 3=TEC+VE (Black) 4=TEC-VE (Red)

MRU Interlock Connector

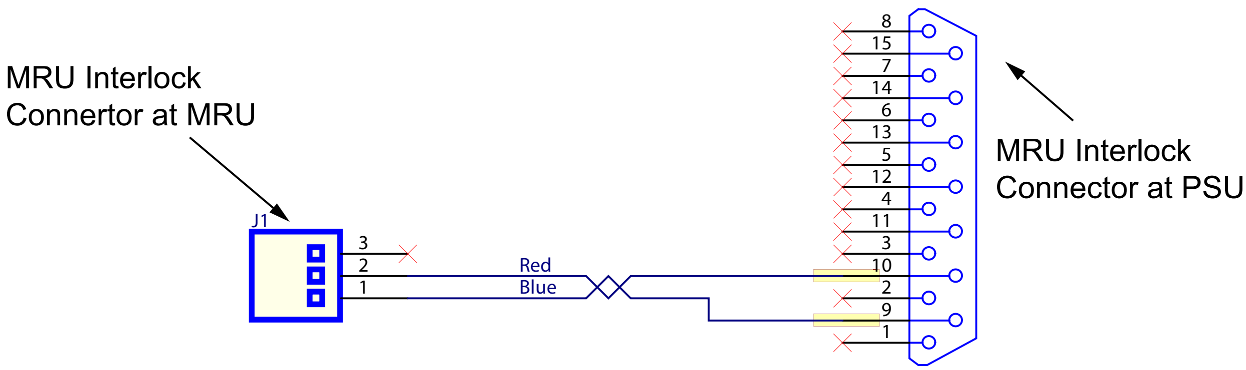

Figure 3.3-1. MRU Interlock Connector

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Service GUI Introduction

The DiscoveryServiceGUI is a Windows application intended for Coherent Field Service. The Service GUI can communicate with the Coherent Discovery laser system and the laser pump module.

The Service GUI primary functions are:

- Communication by a command prompt
- Laser firmware upgrading
- Laser EPROM management
- Automatic Laser calibration (for Discovery OPO connection)

The Service GUI secondary functions are:

- Logging laser and instrument readings
- Scripting
- Graphing

Installation

The DiscoveryServiceGUI is available in a 32Bit or 64Bit version.

Users must verify and execute the following information for software installation.

- Check the Windows OS before selecting which version of the DiscoveryServiceGUI to install.
- Have administrative rights for both installation and execution.
- Double click the **Setup.exe** application to execute the GUI installers and USB drivers.

The Discovery Service GUI can communicate with some third party instruments, but the device drivers and software for the instruments must be installed separately.

After the installation is complete, the following icons will appear on the Windows Desktop and Start Menu.

Figure 4.1-1. Icon Shortcuts

Discovery Service GUI Layout

Figure 4.1-2 is a view of the Service GUI main screen.

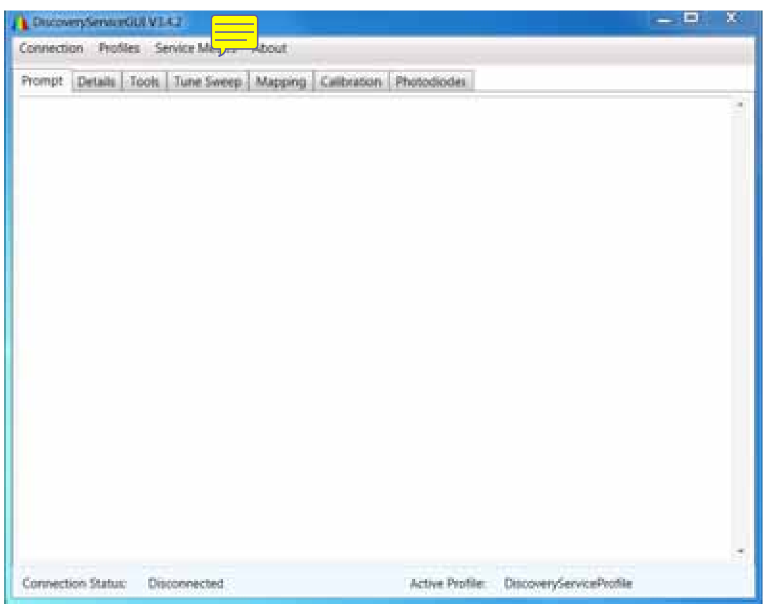

Figure 4.1-2. Service GUI Main Screen

Menu Items

The menu consist of four items: Connections, Profiles, Service Meters and About. The following information gives a description of the Connections, Profiles, and Service Meters.

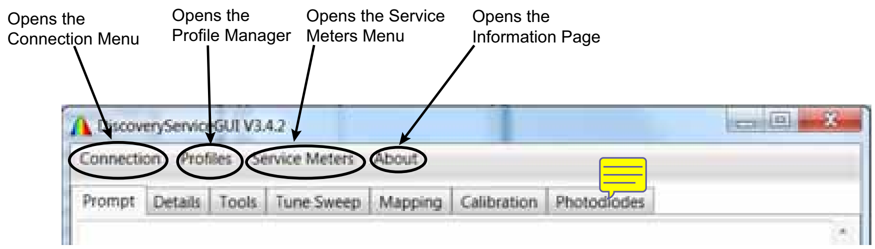

Figure 4.1-3. Menu Items

Connection Menu

The Discovery laser is connected to the Service GUI by RS-232. The default connections parameters for the RS-232 are shown in Figure 4.1-4 of the Connections tab. When the Discovery Service GUI finds a working connection, it will record the connection settings and try to use the same settings for the next start-up.

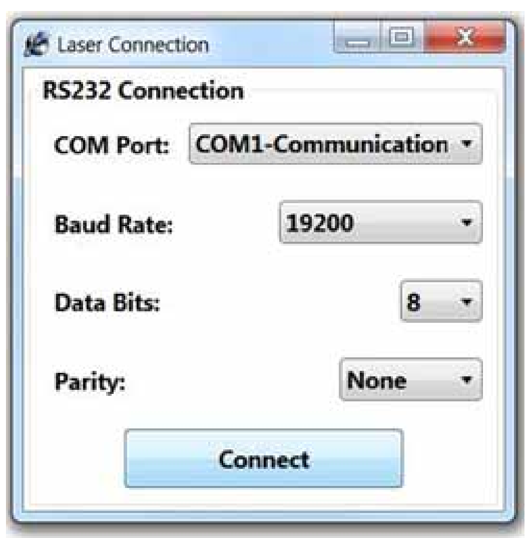

Figure 4.1-4. Connections Menu

Prompt Tab

Laser commands and queries can be added in the Prompt tab. The prompt tab uses the same method as third part console application for example TeraTerm or HyperTerminal.

- When the Service GUI connects to the laser, the command prompt is displayed.
- `CHAMELEON>` is the command prompt for the Discovery OPO.
- Commands are typed at the command prompt and transmitted to the laser when the return key is pressed.
- Previous commands used are retrieved using the up and down arrow keys.
- Text can be highlighted by using the left mouse button click.
- Text can be copied to the system clipboard and pasted into the command prompt area using the right mouse button click.

Logging Parameter

A new logging parameter is created using the right click anywhere in the command prompt area. If the active profile is user defined, this action will open a menu similar to Figure 4.1-5.

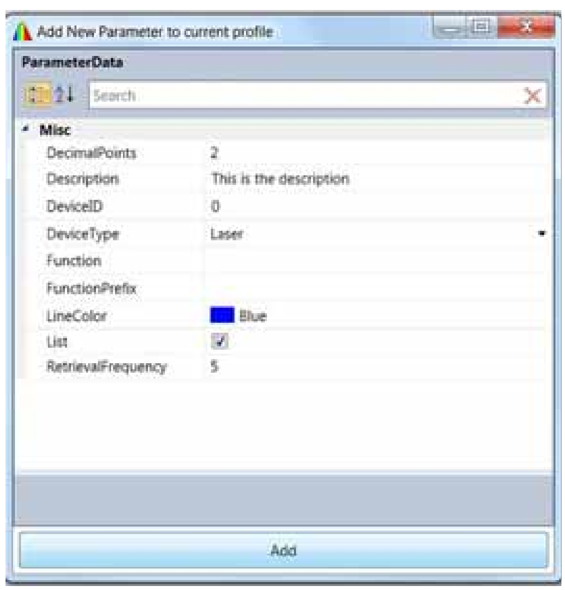

Figure 4.1-5. Logging Parameters Menu

The contents of the system clipboard will automatically fill the Function field. Other fields can be modified in the open menu. This ability lets the user highlight query text from the command prompt area and quickly add the information to the active profile without opening the Profile Manager.

When **Add** is pressed, the logging parameter is added to the active profile. The operation can be canceled by closing the menu without pressing **Add**.

Details Tab

The Details tab displays a list of the parameters in the active Profile. Each entry has the fields shown in Figure 4.1-6.

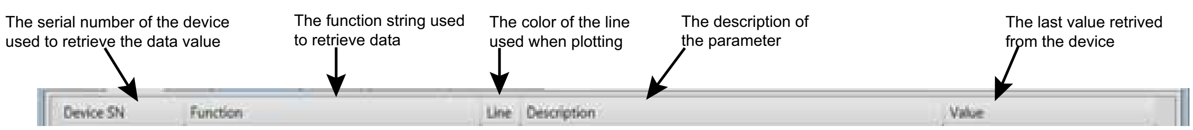

Figure 4.1-6. Details Tab

Items in the Details table can be plotted on a graph. The graph plot is achieved in two ways:

1. By double clicking the item.

2. By using the Ctrl and Shift keys in conjunction with a left mouse button click to select multiple items. Then right click any of the selected items and choose **Send To Graph**.

Graphing

When an item is selected for graphing, a menu similar to Figure 4.1-7 will appear.

Figure 4.1-7. Graphing Menu

Service Tools (OPO connections only)

The Service Tools are the functions under the three tabs, shown in Figure 4.1-8, of the Service GUI main screen. These tools give the user the ability to perform service functions on the laser.

Figure 4.1-8. Service Menus

Service Meters Menu

Before using the service tools, the Service GUI must be configured with the external meters through the Service Meter menu.

Open the Service Meters menu shown in Figure 4.1-9

The user can select which external meters are used for the three service tools. The external meters must be configured before the relevant Service Tool is used.

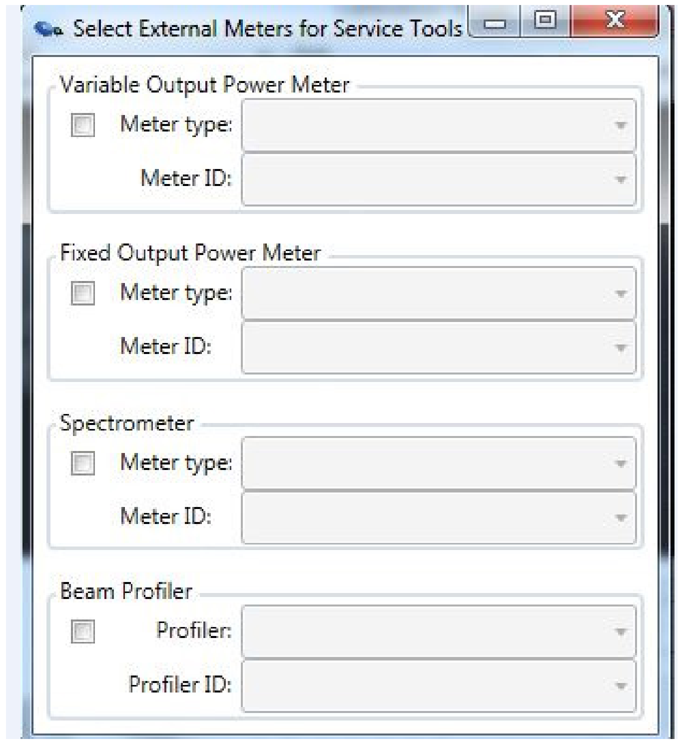

Figure 4.1-9. Service Meters Menu

Some tools do not require all the meters to be enabled. Table 4.1-1 describes which meters are used. See “Connect Measurement Devices within Service GUI” on page 1.2-19 for more information on the external meter requirements for installation.

Table 4.1-1. Required Meters

	OPO POWER METER	IR POWER METER	SPECTROMETER	BEAM PROFILER
TUNE SWEEP	X	Optional	X	
MAPPING	X			
CALIBRATION	X		X	
AOM CALIBRATION	X		X	X

Tune Sweep Menu

The Tune Sweep menu has two main functions, **Data Run Function** and **Sweep and Record Function**.

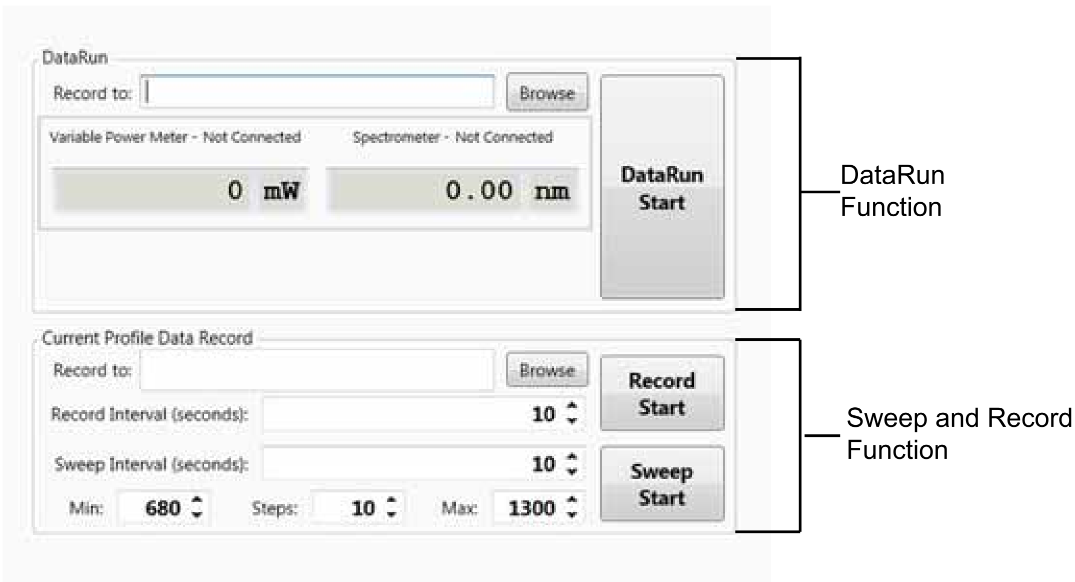

Figure 4.1-10. Tune Sweep Menu

NOTICE
Do not send commands via the Command Prompt while any of the Tune Sweep functions are in progress. This can affect the collected data results .

Data Run Function

The purpose of the Data Run function is to generate a CSV file containing laser and external meter readings during a controlled wavelength sweep.

- The location and name of the CSV file must be specified in the Record To field.
- The status of the external meter and spectrometer connections are displayed. Readings will not update until the Data Run process starts.
- When the Data Run function starts, any sweep and record functions will immediately stop.

- When the Data Run function starts, the GUI will try to connect to the meters enabled in the Service Meters menu.
- During the Data Run operation, the GUI will stop any logging actions. The logging will resume when the Data Run operation is complete or is stopped manually.
- The Data Run can be manually stopped by clicking the **DataRun Stop** button.

Sweep and Record Function

The sweep and record features are two independent functions that can be started and stopped independently. When the sweep or record function start, the GUI will display the readings from the meters enabled in the Service Meters menu. The values will not be recorded unless the meters appear in the active profile.

The sweep function uses the Sweep Interval, Min, Max and Steps fields to change the Discovery wavelength.

- When **Sweep Start** is pressed the wavelength sweep starts at the set Min value and increases toward the Max value.
- The wavelength is moved in set Steps increments.
- The Sweep Interval value sets the time period between each increment.
- When the set Max value is reached, the operation reverses and the wavelength decreases.
- The cycle repeats until the sweep is manually stopped by clicking the **Sweep Stop** button.

The record function uses the parameters specified in the active Logging Profile to record the data to a CSV file.

- The record function records a CSV file to the location and name specified in the Record To field.
- The record function will collect and record the data at the frequency set in the Record Interval field.

NOTICE
The Retrieval Frequency set value in each logged parameter is overridden during the record function. The data is collected and recorded at the set frequency in the Record Interval field.

- The record function can be manually stopped by clicking the **Record Stop** button.

Mapping Menu

The mapping menu allows the user plot a map of the internal and external power readings for each pump piezo position. See “Pump Map Routine” on page 1.2-20 for more information on the mapping menu.

Calibration Menu

The Calibration menu uses the external spectrometer to collect wavelength readings for widely spaced BBO stepper positions. The information is then used to calculate an accurate set of stepper positions that are saved to the laser memory. See “Service GUI” on page 1.2-14, “Wavelength Calibration” on page 5.2-1 and “Photodiode Calibration” on page 5.3-1 for more information on the calibration information.

Profile Manager

When the GUI connects to a laser, it will immediately start to record readings from the laser in a process called Logging. The logging cycle is set to 1 second. The GUI uses a Logging Profile to determine the behavior of the Logging process.

The Logging Profile allows the users to change how the GUI logs the data by importing a file. The file must have the settings necessary to inform the GUI what parameters to log, where to get the data, how frequently to get the data, how frequently to log the data and where to log the data.

The Logging Profile is used to store general GUI information for example the last known working communication link and the location of firmware upgrade files.

Logging Profiles are used to:

1. Define the configuration of user options in the GUI.

2. Define the paths for storage of files.
3. Define the logging behavior of the GUI.

Profile Format

The Profile file is written in a language called XML (Extensible Mark-up Language). This language is readable by both humans and computer applications. The language structure allows users to edit the XML file using a utility such as NotePad. If the syntax is correct, the GUI application can use the resulting Profile.

The profiles are located in the following folders:

WINDOWSXP	C:\Documents and Settings\All Users\Applications Data\Coherent\GlasgowGUI
WINDOWS7	C:\ProgramData\Coherent\GlasgowGUI
WINDOWS8	C:\ProgramData\Coherent\GlasgowGUI

Default Profiles

Before the user creates a profile, the GUI must start with a default profile. The one default profile supplied with the application is shown in Figure 4.1-11.

Figure 4.1-11. Default Profile

When the GUI starts it will import this profile. The default profile becomes the Active Profile. The GUI will use the file content to connect to a Discovery laser and start the data logging system.

Profile Manager Layout

A menu tool called Profile Manager is available for easy management of the profile system.

When the GUI is started, a menu item appears called Profiles.

Click the **Profiles** tab to open the Profile Manager menu. See Figure 4.1-12.

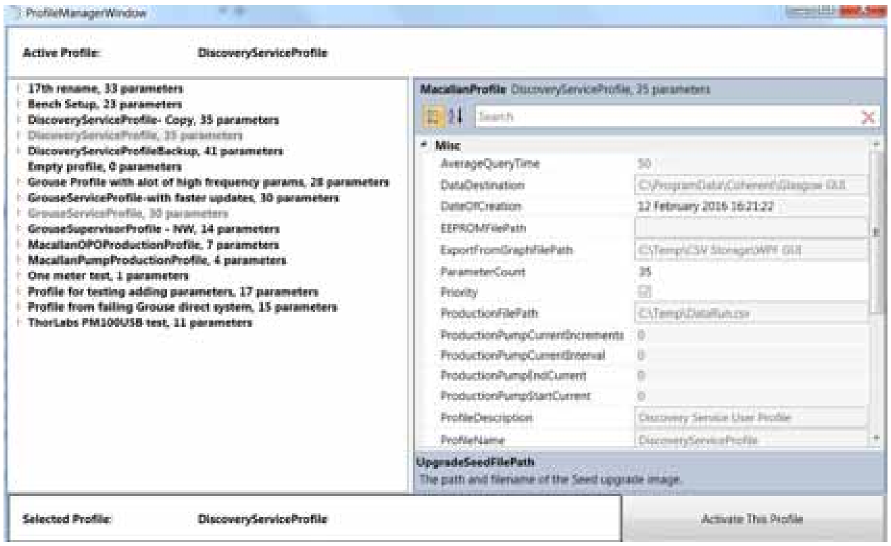

Figure 4.1-12. Profile Manager Menu

There are 4 regions in the Profile Manager.

- **Active Profile** - Shows the Profile that is currently active
- **Left Panel** - Shows an overview of the Discovery Profiles found on the host PC. By clicking the symbol, the profile logging parameters are displayed in a hierarchical structure. Clicking on a node in the Left Panel will populate the Right Panel.
- **Right Panel** - Shows the details of the Profile or Parameter node selected in the Left Panel.
- **Selected Profile** - Shows the Profile currently being edited in the Profile Manager.
- **Activate This Profile** - Click the **Active This Profile** to apply the selected profile. The applied profile becomes the Active Profile. This action will close the Profile Manager. Closing the Profile Manager without activating a profile will not affect the currently Active Profile.

Left Panel

This panel shows the list of available Profiles on the host PC.

Default Profiles are grayed out. They can only be viewed, not edited.

Adding, Copying and Deleting user profiles using right click

- Right click on the Profile nodes in the Left Panel to add, delete, copy or paste the profiles.
- Right click the whitespace in the Left Panel to add new Profiles.
- A single Profile is selected with the left click. Multiple Profile selection is not possible.

Right Panel

The right panel displays the content and allows the editing of the node selected on the Left Panel.

When a user Profile is selected, the fields can be edited. A description of each field is displayed at the base of the panel.

The details of the Profile fields are found in Table 4.1-2.

Table 4.1-2. Profile Field

FIELD	PURPOSE
AverageQueryTime	The average time in milliseconds for the laser system to respond to parameter queries
DataDestination	The path to be used to store the GlaLogData.h5 file
DataDestination	The Date and Time the Profile was originally created
Parameters	A collection of parameter objects contained within the Profile
ProductionFilePath	The path to be used to store the production data file
ProfileDescription	A description of the Profile
ProfileName	The Profile name This is used by the GUI to identify this Profile. The GUI expects the *ProfileName* to match the name of the XML file (without the filename extension)
SearchForPort	Not Used
StorageDisabled	If 'true' no data is recorded to the file specified at the *DataDestination*
StorageFormat	Only 'HDF5' is available

Table 4.1-2. Profile Field (Continued)

FIELD	PURPOSE
StorageOverwrite	Defines the behavior of the GUI if the *StorageSizeLimit* is reached If 'True' the existing file (as defined in the *DataDestination*) will be deleted and a new file of the same name and path will be created If 'False' the GUI will rename the existing file with a timestamp and will create a new file with the name specified in the *DataDestination*
StorageSizeLimit	Defines the size limit of the storage destination file in MegaBytes If the size limit is reached, the GUI will behave as defined in the *StorageOverwrite* field
UpgradeBootLoaderFilePath	The last path used to locate the laser system bootloader file
UpgradeFilePath	The last path used to locate the laser system application file
UpgradeSeedBootLoaderFilePath	The last path used to locate the laser seed bootloader file
UpgradeSeedFilePath	The last path used to locate the laser seed application file

When the ProfileName field is changed, the name of Profile will change in the Left Panel. Also, the name of the related XML file will change in the file system.

When a parameter node is selected in the Left Panel, the Right Panel displays the fields related to the parameter.

When the parameter is part of a user Profile, the parameter fields can be edited.

The details of the parameter fields are found in Table 4.1-3.

Table 4.1-3. Parameter Fields

FIELD	PURPOSE
DecimalPoints	Defines the name of the parameter
Description	Describes the purpose of the parameter to be displayed in the Details panel
DeviceID	A reference to an instance of the DeviceType
Function	A string that will be passed to the device instance in order to select the correct function for the parameter This field will be used by the GUI to identify this parameter
FunctionPrefix	A string that will be prefixed immediately before the Function string

Table 4.1-3. Parameter Fields (Continued)

FIELD	PURPOSE
LineColor	The color of the line used in any graphs
List	When set to “true” the parameter will appear in the Details panel
RetrievalFrequency	Defines the number of iterations of the logging loop to wait between the retrieval of data from the DeviceID

Managing Logging Parameters

Each Profile has a set of parameters that determine the logging behavior.

By clicking next to the Profile, the parameter nodes can be viewed. See Figure 4.1-13 for a view of the Profile Manager with the parameters opened.

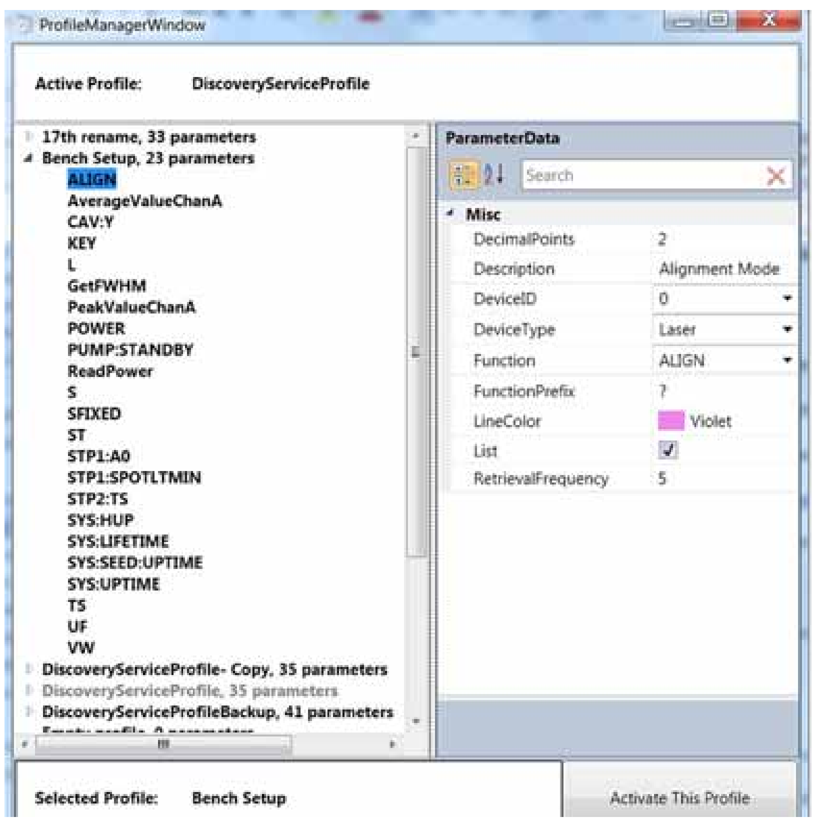

Figure 4.1-13. Profile Manager Menu

Adding, Copying and Deleting user parameters using right click

- New parameters are added to a Profile by right clicking the Profile node.
- Parameters can be selected by a single left mouse button click.
- Select multiple parameters by using the Shift and Ctrl keys in conjunction with the left mouse button click.
- Right click to copy and delete the selected parameters.
- Right click on the selected parameters to paste in the Profile nodes.

Introduction

The following information provides the Chameleon Discovery service commands and queries. It is assumed that the engineer has read the Software section of the Chameleon Discovery Operator's Manual.

To place the system into service mode, enter the command: `ACCESS=CLG5182`.

General

Table [illegible]-1. General Command and Query

COMMAND / QUERY	DESCRIPTION
E=n ECHO=n ?E ?ECHO	A change in echo mode takes effect with the first command sent after the echo command. n=0 turns echo OFF. Characters transmitted to the laser are not echoed to the host. n=1 turns echo ON. Characters transmitted to the laser are echoed to the host. Returns the terminal echo state.
PROMPT=n ?PROMPT	Turns "CHAMELEON>" prompt on/off 0=off, 1=ON, 2=Prompt is MacOPO, 3=Prompt is Chameleon Returns the prompt setting
ACCESS= ?ACCESS	The command to enter or exit service mode (access=0 returns to user mode). Returns the access level.
CV=xxx ?CV	A command to set the Chameleon Version number Returns Chameleon Version 0=Ultra, 1=Vision, 2=Vision-S, 3=Discovery
SN=*nnnn* ?SN	Sets the unit serial number [1000;9999] Returns the unit serial number [1000;9999]
SYS:CR=n ?SYS:CR	Set terminal carriage return. Query carriage return setting. 1=On (default), 0=Off
EOT=*n* ?EOT	Enable / disable end of text character 1=Enable, 0=Disable (default) Query state of end of text character

Table 4.2-1. General Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
NOISEFLOOR= ?NOISEFLOOR	Sets Threshold value that defines the system is lasing Query Threshold value that defines the system is lasing
BOOT=1	A command to let the watchdog reboot the OPO system
PUMP:MOD1SN ?PUMP:MOD1SN	Set the serial number of the seed module Query the serial number of the seed module
HB= ?HB	Sets the state of the heartbeat Query the state of the heartbeat
HBR= ?HBR	Sets the heartbeat rate Query the heartbeat rate

Timer

Table 4.2-2. Timer Command and Query

COMMAND / QUERY	DESCRIPTION
?UPTIME	Returns time since last boot (seconds)
?HH	Returns head hours
?HUP	Returns the number of hours that the head software has been running for

System Operation

Table 4.2-3. System Operation Command and Query

COMMAND / QUERY	DESCRIPTION
L=*n* Laser=n ?L PRINT Laser	Sets the soft key state n=0 is off, n=1 is on Returns status of laser 0=off (Standby), 1=On, 2=Off due to a fault (check faults or fault history)
?K PRINT KEYSWITCH	Returns status of keyswitch 0=Off, 1=On

System

Table 4.2-4. System Query

COMMAND / QUERY	DESCRIPTION
?F PRINT FAULTS	Returns a list of number codes of all active faults
?FT	Return the active fault with text description
?FH PRINT FAULT HISTORY	Returns a list of number codes of all faults that have occurred since the last laser on command.
?FHT	Return the historic fault with text description
?F:*n*	Returns description of system fault number '*n*'
?TS PRINT TUNING STATUS	Returns the tuning status 1=tuning, 0=competed tune (both stepper and stage locked)
?SV PRINT SOFTWARE	Returns the version number of the power supply software
?ST	Returns the current operating status string, such as "Tuning" or "OK"
?REV	A query for the board revisions
?PUMP:CPLDVER	A query for the CPLD Version (If =0, CPLD version is less than 2.43)
?TSTIME	Query the time period (in minutes) since the last OPO re-scan (RB5 onwards)
?PIDVARS	Query PID variables
?IMAGE	Query the EPROM contents
TMAX=nnn TUNING LIMIT MAX=nnn ?TMAX PRINT TUNING LIMIT MAX	Sets Maximum tuning limit (within the calibrated tuning range) Returns value of maximum available wavelength in nm
TMIN=nnn TUNING LIMIT MIN=nnn ?TMIN PRINT TUNING LIMIT MAX	Sets Minimum tuning limit (within the calibrated tuning range) Returns value of minimum available wavelength in nm

Photodiode

Table 4.2-5. Photodiode Command and Query

COMMAND / QUERY	DESCRIPTION
?APDP4	Query the Pre-comp photodiode raw voltage into CPU (TP35) Voltage range [0-2.5]
P4CAL=xxxx	Set prepower scaling factor for wavelength xxxx=Measured power in mW
?APDP3	Query the OPO photodiode raw voltage into CPU (TP36) Voltage range [0-2.5]
?PUMP:APD:1	Query the oscillator photodiode raw voltage
?PUMP:APD:2	Query the pre-amp 1 photodiode raw voltage
?PUMP:APD:3	Query the pre-amp 2 photodiode raw voltage
?PUMP:APD:4	Query the IR photodiode raw voltage
?PUMP:APD:5	Query the green photodiode raw voltage
?P1	Query the IR output power (mW)
?P2	Query the green output power (mW)
?P3	Query the OPO output power (mW)
?P4	Query the pre-comp output power (mW)

Alignment Mode

Table 4.2-6. Alignment Mode Command and Query

COMMAND / QUERY	DESCRIPTION
ALIGN=n ?ALIGN	Access to the variable output alignment mode Returns the status of the variable output alignment mode 1=Enabled, 0=Disabled
ALIGNP=xxxx ?ALIGNP	Set the variable output alignment power in mW Returns the laser power available in mW with variable output alignment mode enabled

Table 4.2-6. Alignment Mode Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
ALIGNW=xxxx ?ALIGNW	Set the wavelength in nm of the variable output alignment mode Returns the variable output alignment mode laser wavelength in nm
ALIGNFIXED=1 ?ALIGNFIXED	Access to the fixed alignment mode Returns status of the fixed alignment mode
ALIGNFIXEDP=xxxx ?ALIGNFIXEDP	Set the power in mw of the fixed output alignment mode Query the power in mw of the fixed output alignment mode

Shutter

Table 4.2-7. Shutter Command and Query

COMMAND / QUERY	DESCRIPTION
SVAR=*n* S=n SHUTTER=n ?SVAR ?S PRINT SHUTTER	Changes state of the tunable output external shutter Returns the state of the tunable output external shutter 0=Closed, 1=Open
SFIXED=*n* ?SFIXED	Changes state of the fixed output external shutter Returns the state of the fixed output external shutter 0=Closed, 1=Open

Active Mirrors

Table 4.2-8. Active Mirrors Command and Query

COMMAND / QUERY	DESCRIPTION
CX= PZTXC ?CX ?PZTXC	Sets / Returns cavity x value Range [0;65535]
CY PZTYC ?CY ?PZTXC	Shows x results for both x & y Sets / Returns cavity x value Range [0;65535]
PX= PZTXP PX ?PZTXP	Sets / Returns pump x value
PY= PZTYP ?PY ?PZTXP	Shows x results for both x & y Sets / Returns pump x value

Tuning Stepper

Table 4.2-9. Tuning Stepper Command and Query

COMMAND / QUERY	DESCRIPTION
STP1HM=1 HOME STEPPER=1 HM=1	Carries out a rotational home [0;1]
STP1HMABS=1 ?STP1HMABS	Carries out a translational home [0;1]
?STP1TS	Returns the Stepper 1 tuning status 1=moving, 0=not moving

Table 4.2-9. Tuning Stepper Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
STP1POS=nnn STEPPER POSITION=nnn STPRPOS= ?STP1POS ?STPRPOS	Move the tuning motor to the specified absolute position count Display Tuning stepper position
?STP1POSABS	Queries the absolute position (in steps) with respect to the absolute home position
STP1POSW:xxxx=nnnn ?STP1POSW:xxxx	A command define the BBO position (nnnn) at a given wavelength (xxxx) Query the BBO position at a given wavelength (xxxx)
STP1SPOTTIME:x=yyyy.y ?STP1SPOTTIME:x	Sets the amount of time (in hours) that BBO spot x has been used Returns the amount of time (in hours) that BBO spot x has been used
STP1SPOTGOOD:x=n ?STP1SPOTGOOD:x	Sets whether BBO spot *x* is a good or bad Returns whether BBO spot *x* is a good or bad 1=Good, 0=Bad
STP1SPOT+	Move the BBO spot to the next good spot
STP1SPOT-	Move the BBO spot to the previous good spot
STP1SPOT=xx ?STP1SPOT	Move to BBO spot x Query current BBO spot number
STP1SPOTLTMIN ?STP1SPOTLTMIN	Sets / Returns the time (in hours) when the BBO spot will shift once the shutters are closed
STP1SPOTLTMAX ?STP1SPOTLTMAX	Sets / Returns the time (in hours) when the BBO spot will be forced to shift (CURRENTLY NOT ACTIVE)
STP1DEL_LUT	Resets the BBO look up table to default
STP1SAVE_LUT	Forces the BBO look up table that is held in memory to by saved to the EEPROM
STP1OFFSET ?STP1OFFSET	Sets / Returns the number of steps that the BBO Stepper will deviate from the value in the look up table
?STP1SPOTLIST	GUI query for the BBO Spot table
?STP1SPOTVIEW	Viewable version of BBO Spot table
?STP1POSLIST	View BBO position look up table

Piezo Stage

Table 4.2-10. Piezo Stage Command and Query

COMMAND / QUERY	DESCRIPTION
?STAGEW=	Returns the cavity position for a specific wavelength
STAGEPOS= ?STAGEPOS	Sets / Returns the exact position of the cavity stage
STAGEDAC= PZTZC= ?STAGEDAC ?PZTZC	Sets / Returns DAC reference for piezo stage driver
STAGEP= ?STAGEP	Sets / Returns proportional gain for strain gauge PID Range [-500.0;500.0]
STAGEI= ?STAGEI	Sets / Returns integral gain for strain gauge PID Range [-500.0;500.0]
STAGED= ?STAGED	Sets / Returns differential gain for strain gauge PID Range [-500.0;500.0]
STAGET= ?STAGET	Sets / Returns differential gain for strain gauge PID Range [1.0;10000.0]
STAGESTEPMAX= ?STAGESTEPMAX	Sets / Returns maximum corrective step for the strain gauge PID
?STAGEOFFSET	Query the offset between prediced and actual stage position Range [0;65535]
STAGECALREF= ?STAGECALREF	Sets / Returns strain gauge offset reference Range [0;65535]
STAGESGGAIN ?STAGESGGAIN	Sets / Returns strain gauge Gain reference
STAGESGCAL	Command to automatically calibrate the strain gauge
STAGECAL	Sets the stage position into the cavity look up table for the current wavelength

OPO

Table 4.2-11. OPO Command and Query

COMMAND / QUERY	DESCRIPTION
WV=nnn WAVELENGTH=nnn VW=nnn ?WV PRINT WAVELENGTH ?VW	Sets / Returns the wavelength to the specific value in nanometers.
WVS=nnn WAVELENGTH STEP=nnn ?VWS=nnn	Sets the wavelength by the specified amount in nanometers
MAXPC	Maximize power using coarse scan
MAXPF	Maximize power using fine scan
?MAXP	Returns max power observed during the last scan
MAXPCSTEP ?MAXPCSTEP	Sets / Returns coarse step size Range [1;2000]
MAXPFSTEP ?MAXPFSTEP	Sets / Returns fine step size Range [1;2000]
MAXPCRANGE ?MAXPCRANGE	Sets / Returns coarse scan range Range [1000;16000]
MAXPFRANGE ?MAXPFRANGE	Sets / Returns fine scan range Range [500;8000]
PLOCK=n ?PLOCK	Sets / Returns power lock to setpoint 1=Enabled, 0=Disabled
PLOCKP= ?PLOCKP	Sets / Returns proportional gain for photodiode PID Range [-500.0;500.0]
PLOCKI= ?PLOCKI	Sets / Returns integral gain for photodiode PID Range [-500.0;500.0]
PLOCKD= ?PLOCKD	Sets / Returns differential gain for photodiode PID Range [-500.0;500.0]
PLOCKT= ?PLOCKT	Sets / Returns differential gain for photodiode PID Range [1.0;10000.0]

Table 4.2-11. OPO Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
PLOCKSTEPMAX= ?PLOCKSTEPMAX	Sets / Returns maximum corrective step for the photodiode PID
PLOCKFDL ?PLOCKFDL	Sets / Returns the Power Lock Fail Detection Limit (number of consequative times the system can drive while power goes down) Range [1;65535]
PLOCKR ?PLOCKR	Sets / Returns lock range for the Tuning PID before a rescan occurs
PLOCKWARMUP=xxx ?PLOCKWARMUP	Sets / Returns the number of warm up minutes, with 0 meaning that it will not attempt to retune

Pre-comp Stepper

Table 4.2-12. Pre-comp Stepper Command and Query

COMMAND / QUERY	DESCRIPTION
STP2=x COMP=x ?STP2 ?COMP	Sets / Returns the state of the pre-comp stepper 0=Disable, 1=enable
STP2HM=1 HMCOMP=1 ?STP2HM ?HMCOMP	Sets / Returns the pre-comp stepper to home Returns 0 if not homed, 1 if homed
?STP2TS	Returns the pre-comp stepper tuning status 1=moving, 0=not moving
STP2POS= COMPPOS= ?STP2POS ?COMPPOS	Sets / Returns the pre-comp stepper position
STP2POSW= ?STP2POSW=	Sets / Returns the pre-comp stepper for a given wavelength Range [650.0;1350.0]

Table 4.2-12. Pre-comp Stepper Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
STP2SPEED STP2TSMIN= ?STP2SPEED ?STP2TSMIN	Sets / Returns the constant / minimum speed of the pre-comp stepper
STP2TSMAX= ?STP2TSMAX	Sets / Returns the maximum speed of the pre-comp stepper

Pre-comp Calibration

Table 4.2-13. Pre-comp Calibration Command and Query

COMMAND / QUERY	DESCRIPTION
COMPWCAL:yy=zzzz ?COMPWCAL:yy	Sets / Returns wavelength for calibration curve point:yy=zzzzz
COMPGCALH:yy=zzzz ?COMPGCALH:y	Sets / Returns GDD max for calibration curve point:yy=zzzzz
COMPGCALL:yy=zzzz ?COMPGCALL:y	Sets / Returns GDD min for calibration curve point:yy=zzzzz
COMPSCALH:y=yy ?COMPSCALH:y	Sets / Returns stepper max value for calibration curve point:y=zzzzz
COMPSCALL:yy=zzzz ?COMPSCALL:y	Sets / Returns stepper min value for calibration curve point:y=zzzzz
?GDDVIEWCAL	Returns a table of all the pre-comp calibration data
RESETPRE	Reset the precomp data

Pre-comp User Curves

Table 4.2-14. Pre-comp User Curves Command and Query

COMMAND / QUERY	DESCRIPTION
GDDCURVE=xx ?GDDCURVE	Sets / Returns the GDD calibration curve. This switches the system into auto GDD. Curve 0 is reserved for zero dispersion curve. Range [0;32] xx=Curve number
GDDCURVEN=xxxxxx ?GDDCURVEN	Sets/ Returns the GDD curve by name xxxxxx
GDD=xxxxx ?GDD	Sets / Returns the GDD value. This switches the system into manual GDD. xxxxx=GDD in fs^2 Returns yyyyy where yyyyy is the GDD in fs^2 or yyyyy X, where the character X denotes that the value has been extrapolated from limited calibration data
SETCURVEN:x=yyyyy ?CURVEN:x	Sets / Returns the name of the calibration curve. Note: All curve names are automatically converted to upper case.
SETCURVEPT:ww=x:yyyy:zzzzz ?CURVEPT:ww=x ?CURVE:ww=x	Sets the curve ww point x where zzzzz fs^2 at yyyy nm Returns:zzzzz yyyy where zzzzz is GDD, yyyy is wavelength
?CURVEPTGDD:x	Query GDD of current curve at point x
?CURVEPTW:	Query wavelength of current curve at point x
?CURVE:ww	Returns the calibration values of curve ww Returns calibration values for curve ww, returns array of calibration points: x1 yyy1 zzzzz1, x2 yyyy2 zzzzz2. x3 yyyy3 zzzzz3
?GDDMAX	Returns the maximum GDD value available at the current wavelength
?GDDMIN	Returns the minimum GDD value available at the current wavelength
?GDDMAX:xxxx	Returns the maximum GDD value available at wavelengths xxxxnm
?GDDMIN:xxxx	Returns the minimum GDD value available at wavelengths xxxxnm
DELCURVE=xx	Deleted curve number xx
DELCURVEPT=x	A command to delete the last point in a curve

Table 4.2-14. Pre-comp User Curves Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
?GDDLIST	Returns a list of all GDD curves
GDD:RESETCURVES	Resets all User GDD curves back to default (zero GDD remains)

Cavity Look-up Table

Table 4.2-15. Cavity Look-up Table Command and Query

COMMAND / QUERY	DESCRIPTION
CAVSET=	Set cal: wavelength, stage, BBO, power, 3 x scale, ADC
?LUT_ALL	Returns entire Lookup table
?CAVLUTVIEW	Returns Cavity look up table in a readable format
CAVDEL_LUT	
LUTDELW=	Delete entry for the specified wavelength
CAVP3PWR:x=y ?CAVP3PWR:x	Records / Returns P3 power of Y against wavelength X
CAVP3ADC:x=y ?CAVP3ADC:x	Records / Returns P3 ADC of Y against wavelength X
CAVP4PWR:x=y ?CAVP4PWR:x	Records / Returns P4 power of Y against wavelength X
CAVP4ADC:x=y ?CAVP4ADC:x	Records / Returns P4 ADC of Y against wavelength X
CAVSTAGEPOS:x=y ?CAVSTAGEPOS:x	Records / Returns strain gauge position of Y against wavelength X
?CAVWV:x	View row from the cavity look up table for a given wavelength x
?CAVID:x	View row from the cavity look up table for a given row x

EPPROM

Table 4.2-16. EEPROM Command and Query

COMMAND / QUERY	DESCRIPTION
EPROMRESETPRE	Reset Pre-comp EEPROM values to factory default
?PUMP:EPROM	Query pump EEPROM values

SHG Spot Shifting

Table 4.2-17. SHG Spot Shifting Command and Query

COMMAND / QUERY	DESCRIPTION
PUMP:SHG:SPOT-TIME:x=yyyy.y ?PUMP:SHG:SPOTTIME:x	Sets / Returns the amount of time (in hours) that SHG crystal spot x has been used
?PUMP:SHG:SPOTTIME	Returns the amount of time (in hours) that the current SHG spot has been used
PUMP:SHG:SPOTGOOD:x=n ?PUMP:SHG:SPOTGOOD:x	Sets / Returns whether SHG spot *x* is a good or bad 1 = Good 0 = Bad
PUMP:SHG:SPOTIDX=xx ?PUMP:SHG:SPOTIDX	Moves / Returns to SHG spot x
PUMP:SHG:SPOTCH+	Move the SHG spot to the next good spot
PUMP:SHG:SPOTCH-	Move the SHG spot to the previous good spot
PUMP:SHG:SPOTLT ?PUMP:SHG:SPOTLT	Sets / Returns the time (in hours) that the SHG spot should be shifted
PUMP:SHG:SPOTSHIFT ?PUMP:SHG:SPOTSHIFT	Sets / Returns the distance (in microns) between each spot shift position
PUMP:SHG:SPOTPOS1 ?PUMP:SHG:SPOTPOS1	Sets / Returns the absolute position (in microns) from home for SHG spot 1
?PUMP:SHG:SPOTPOS:x	Returns the absolute position of SHG spot *x*
PUMP:PSCALB	Initial calibration of stepper (used for initial setup)
PUMP:PSRESB	Moves stepper to '0' position

Table 4.2-17. SHG Spot Shifting Command and Query (Continued)

COMMAND / QUERY	DESCRIPTION
PUMP:PSPOSN= ?PUMP:PSPOSN	Moves / Returns to absolute stepper position (closed loop)
PUMP:PSSTEP=	Move specified number of steps (open loop)
PUMP:PSMOVE=	Move to relative position (closed loop)
PUMP:SHG:GRCALV ?PUMP:SHG:GRCALV	Sets / Returns the voltage level required of Green PD during spot calibration
?PUMP:SHG:SPOTLIST	Returns the SHG Spot table

Light-loop

Table 4.2-18. Light-loop Command and Query

COMMAND / QUERY	DESCRIPTION
PUMP:MODE:n=x ?PUMP:MODE:n	Sets / Returns mode of operation in current mode (x= 1) or light loop (x=2) for the oscillator (n=1), pre-amp 1 (n=2), pre-amp 2 (n=3).
PUMP: MODE:4=n	Puts pump into current mode (n=1), IR light loop (n=2) or green light loop (n=3)
?PUMP:MODE:4	Returns the light-loop state (1=current mode, 2=IR light loop, 3=green light loop)
PUMP:OPSGR=xxxx ?PUMP:OPSGR	Sets / Returns the green light-loop set power
PUMP:OPSIR=xxxx ?PUMP:OPSIR	Sets / Returns the IR light-loop set power
PUMP:IDL:n=	Current loop set point for stage <n>; n=1 (oscillator), 2 (pre-amp 1), 3 (pre-amp 2), 4 (power amp).
PUMP:IDLMAX:n= ?PUMP:IDLMAX:n	Maximum current for stage <n>; n=1 (oscillator), 2 (pre-amp 1), 3 (pre-amp 2)
PUMP:LLSP:n= ?PUMP:LLSP:n	Light-loop set point for stage <n>; n=1 (oscillator), 2 (pre-amp1), 3 (pre-amp2), 4 (power-amp)

Pump Photodiodes

Table 4.2-19. Pump Photodiodes Commands and Query

COMMAND / QUERY	DESCRIPTION
?P1 ?PFIXED ?PUMP:OPIR	Query the power from the fixed output (in mW)
?P2 ?P ?PUMP:OPGR	Query the Green power (in mW)
PUMP:OPLIR=xxxx	Calibrate Photodiode 1 (IR) (where xxxx is the current power in mW)
PUMP:OPLGR=xxxx	Calibrate Photodiode 2 (Green) (where xxx is the current power in mW)
PUMP:OPCIR=XXXX ?PUMP:OPCIR	Sets/ Returns the IR PD conversion factor (mW per Volt)
PUMP:OPCGR=XXXX ?PUMP:OPCGR	Sets/ Returns the Green PD conversion factor (mW per Volt)
PUMP:PDIROFFSET=X.XXX ?PUMP:PDIROFFSET	Sets / Returns the IR PD Offset
PUMP:PDGROFFSET=X.XXX ?PUMP:PDGROFFSET	Sets / Returns the Green PD Offset
?PUMP:PDOFFSET:4	Query the Raw IR PD voltage with the offset voltage applied
?PUMP:PDOFFSET:4	Query the Raw green PD voltage with the offset voltage applied
PUMP:PDMIN:n= ?PUMP:PDMIN:n	Minimum photodiode voltage to be exceeded before stage <n> gets turned on; n=2 (pre-amp 1), n=3 (pre-amp 2), n=4 (power-amp)

LBO Oven

Table 4.2-20. LBO Oven Commands and Query

COMMAND / QUERY	DESCRIPTION
?PUMP:ADLBO	Query Drive rate for LBO oven
?PUMP:ATLBO	Query LBO temperature
PUMP:TLBO ?PUMP:TLBO	Sets / Returns temperature set point for LBO
PUMP:TDL:n ?PUMP:TDL:n	Temperature set point for TEC <n>; n=1 (oscillator), 2 (pre-amp 1), 3 (pre-amp 2), 4 (power-amp, diode 1), 5 (power-amp, diode 2)
PUMP:TLMAX ?PUMP:TLMAX	Maximum temperature for LBO

Oscillator PD

Table 4.2-21. Oscillator PD Command and Query

COMMAND / QUERY	DESCRIPTION
PUMP:PD1OVP= ?PUMP:PD1OVP	Sets / Returns OVP Digipot value to / from EEPROM
?PUMP:PD1OVADC	Reads the actual OVP voltage from ADC
PUMP:PD1UVP= ?PUMP:PD1UVP	Sets / Returns UVP digipot value to / from EEPROM
?PUMP:PD1UVADC	Reads the actual UVP voltage from ADC
PUMP:PD1VOS= ?PUMP:PD1VOS	Sets / Returns offset to / from EEPROM
?PUMP:PD1VADC	Reads voltage from ADC

Pump Monitoring

Table 4.2-22. Pump Monitoring Query

QUERY	DESCRIPTION
?PUMP:AIDL:n	Actual drive current for stage <n>; n=1 (oscillator), 2 (pre-amp 1), 3(pre-amp 2), 4 (power amp)
?C	Alternative way to query the actual power-amp drive current
?PUMP:APD:n	Actual voltage detected on photodiode <n>; n=1 (oscillator), 2 (pre-amp1), 3 (pre-amp2), 4 (power-amp), 5 (SHG)
?PUMP:AITEC:n	Actual drive rate for TEC <n>; n=1 (oscillator), 2 (pre-amp 1), 3 (pre-amp 2), 4 (power-amp, diode 1), 5 (power-amp, diode 2)
?PUMP:ATDL:n	Actual temperature of thermistor <n>; n=1 (oscillator), 2 (pre-amp 1), 3 (pre-amp 2), 4 (power-amp, diode 1), 5 (power-amp, diode 2)
?PUMP:ADLBO	Actual drive rate for LBO oven
?PUMP:ATLBO	Actual LBO temperature
?PUMP:STATE	Laser state, returned as string
?PUMP:TECLK:n	Query lock state of TEC <n>, 0=unlocked, 1-locked; n=1 (oscillator), 2 (pre-amp11), 3 (pre-amp 2), 4 (power-amp, diode 1), 5 (power-amp, diode 2) ; used by GUI

Pump Seed PID SHG Feedback Control Parameters

Table 4.2-23. SHG Feedback Control Parameter Command and Query

COMMAND / QUERY	DESCRIPTION
PUMP:LBOTP= ?PUMP:LBOTP	Overall gain for temperature control of LBO
PUMP:LBOTI= ?PUMP:LBOTI	Integral time for temperature control of LBO
PUMP:LBOTD= ?PUMP:LBOTD	Derivative time for temperature control of LBO

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Discovery Software Table

Follow the guide in the table shown below for matching the versions.

Table 4.3-1. Software Compatibility Table

BASELINE VERSION	PUMP BOARD SOFTWARE VERSION	OPO BOARD SOFTWARE VERSION
2.0	2.07 (bootloader 2.20)	2.16 (bootloader 2.02)
3.0	3.09 (bootloader 3.02)	3.14 (bootloader 3.02)
4.0	4.24 (bootloader 3.02)	4.27 (bootloader 3.02)
4.5	4.32 (bootloader 3.02)	4.27 (bootloader 3.02)
5.0	5.21 (bootloader 3.02)	5.28 (bootloader 3.02)

Software Upgrade Procedure

NOTICE
Factory Support must be consulted prior to performing the upgrade procedure.

1. Verify the laser is stable, in specification and without any other initial problems.
2. Record the standard troubleshooting data-points and performance measurements to use for later reference if required.
3. Check the USB/serial interface port for later reference before switching off User GUI.

4. Confirm remote PC operating system version: 32bit or 64bit.
5. Transfer the latest revision Service GUI and the firmware files to the PC in use. Make note of where the files are saved.
   - Grouse
   - MacOPO
6. Open the Service GUI
7. Open EPROM Tool and save a copy of the data.
8. Put laser in RS-232 Standby, `L=0`.
9. Query `?st` to confirm ramp to standby is complete before continuing.
10. Open the Tools menu.
11. Open Upgrade Firmware tab:
    - Uncheck the OPO enable upgrade check-box
    - Check the pump upgrade check-box to run the pump firmware upgrade first
12. Browse to the previously transferred stored Grouse software location. Refer to step 5.
13. Click the upgrade tab to start the upgrade. The upgrade takes approximately 15 mins.
14. Close upgrade tab.
15. Open the upgrade tab to run the OPO upgrade:
    - Uncheck the pump upgrade enable check-box
    - Check the OPO upgrade enable check-box
16. Browse to the previously transferred stored MacOPO software location. Refer to step 5.
17. Click the upgrade tab to start the upgrade. The upgrade takes approximately 5 mins.
18. Close upgrade firmware tab.
19. Send `?sv` to confirm the upgrade was successful showing new firmware versions.
20. Send `?stp1offset` command to verify that there is currently no active wavelength calibration offset (=0).

21. Send `stp1:offset=320` to add 10 nm offset to the calibration table.
    - The firmware upgrade offsets the WL Cal by 10 nm
22. Send `stp2:park=1000` to prepare for future use of precomp park location.
23. Send `stp2parkon=0`.
24. Send `stp1spotmax=38` to define tuning stepper end-location.
25. Send `boot=1` to remotely power-cycle the OPO, could take several minutes (?st)
26. Confirm that there are no active faults or in the fault history:
    - `?f`
    - `?fh`
    - it's normal to observe a key-on fault at this point
27. Confirm the commands sent in steps 20, 21, 22, 23 are stored after the boot cycle.
28. After the boot cycle completes send:
    - `L=0`
    - `L=1`
    - The commands are the remote key-cycle to clear the key-on fault and ramp the laser remotely.
29. Confirm specifications and performance.
30. Save final EEPROM data.

Baseline 4 and Customer GUI Fault

Baseline 4 and the customer GUI revisions < 1.5.5 have an issue with the laser ramping to Standby intermittently. The problem is caused by the polling frequency from the GUI to the laser. GUI revision ≥ 1.5.5 slows down the traffic but does not eliminate the problem completely, however it can be a useful tool for troubleshooting the issue. The ultimate fix is to upgrade to baseline 5.

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Discovery Cover Removal

To remove the outer-head cover on the Discovery, first loosen and remove all of the bottom screws. Then remove the top screws as the last step.

To replace the cover, first attach all of the top screws. Then attach all of the bottom screws. This will prevent unnecessary screw tension on the laser head cover.

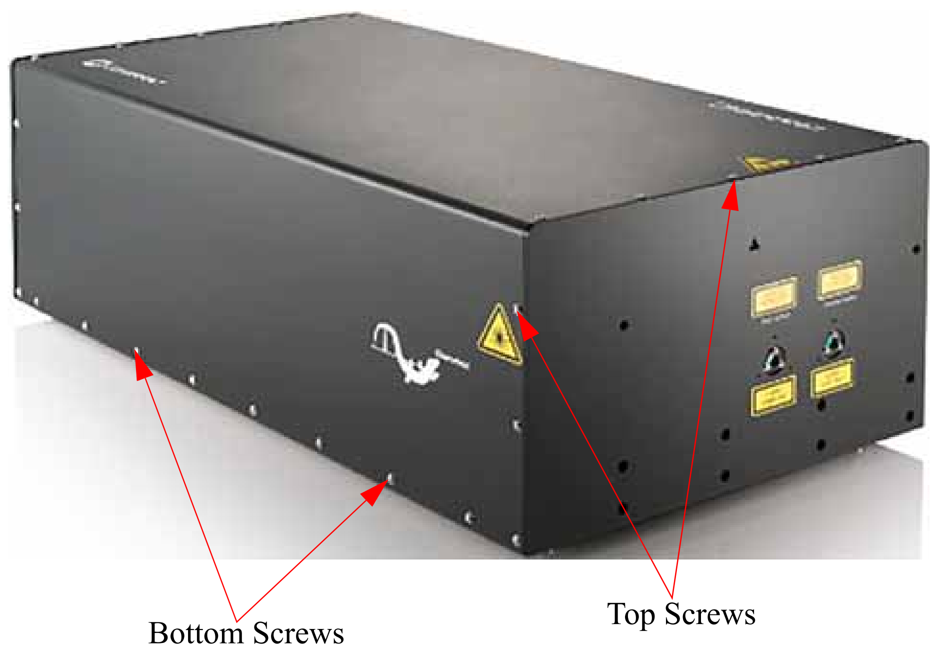

Figure 5.1-1. Discovery Laser Head - Screw Location

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Wavelength Calibration

If the wavelength accuracy differs > ± 5 nm, a wavelength calibration must be performed. Four different calibrations are available based on how much the wavelength differs.

If the partial range > 15 nm is unsuccessful or the EPPROM Look-up table has been corrupted proceed to the procedure “Full Range” on page 5.2-3.

The WaveScan must be connected to the APE software and Service GUI for the calibration procedures. See “APE WaveScan” on page 1.2-16 and “Connect Measurement Devices within Service GUI” on page 1.2-19 for details on connecting the WaveScan.

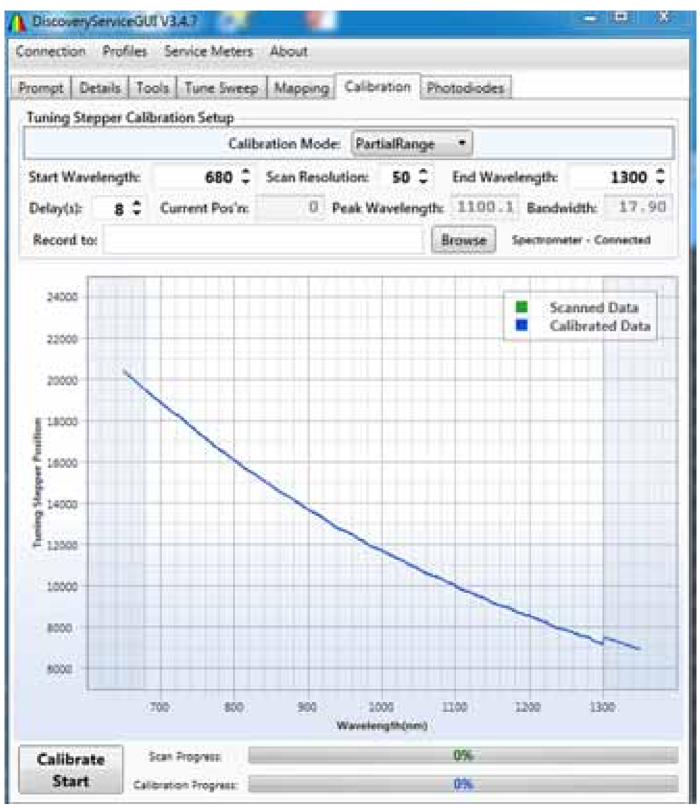


Figure 5.2-1. Partial Range Calibration Mode

Single-point Calibration

1. Open the **Prompt** tab.
2. Identify the wavelength points that need calibration from data run file.
3. Use command `?stp1pos` to find position.
4. Use `Plock=0` to switch off power lock.
5. Look at the WaveScan while sending command `stp1pos=xxxx` (where xxxx=stepper position) to change wavelength by stepper counts.
6. Make adjustments from 50 to 200 steps at a time until desired wavelength is found.
7. Send command `Plock=1`.
8. Check the wavelength on the WaveScan to verify the wavelength specification.
9. Repeat steps 3 to 5 if the position needs to be readjusted.
10. Once stepper position is found use command `stp1posw:wavelength=stepper value` to calibrate the spot.
11. Once the all of positions have been calibrated, send command `stp1save_lut` to save the data to the look-up table.

Partial Range "user entry" < 15 nm Discrepancy

1. Open the **Calibration** tab.
2. Switch the Calibration Mode tab to PartialRange. See Figure 5.2-1.
3. Allow 30 s for the laser to collect the current calibration data and create the Tuning Stepper / Wavelength graph.
4. Enter the desired Start Wavelength and End Wavelength points.
5. Browse to a desktop location to store the file.
6. Click on the Calibrate Start button to begin the procedure.

Partial Range "680 to 1300" > 15 nm Discrepancy

1. Open the **Calibration** tab.
2. Switch the Calibration Mode tab to PartialRange. See Figure 5.2-1.
3. Allow 30 s for the laser to collect the current calibration data and create the Tuning Stepper / Wavelength graph.
4. Enter the desired Start Wavelength as 680 and End Wavelength as 1300.
5. Browse to a desktop location to store the file.
6. Click on the Calibrate Start button to begin the procedure.

Full Range

1. Open the **Prompt** tab.
2. Send `tmin=650` and `tmax=1350` to widen the tuning range.
3. Tune to 655 nm.
4. Send command `?stp1pos` to find the actual stepper position. Record this value.
5. Use the command `plock=0` to switch off power lock.
6. Send the command `stp1pos=xxxx` in 50-100 steps up or down to identify the exact stepper location on the Wavescan for 655 nm ± 1 nm. Send the `plock=1` command after each change to switch power lock on.
7. Make a note of the stepper value for 655 nm ± 1 nm
8. Go to Calibration tab and switch the calibration mode to Full-Range.
9. Store the actual stepper value for 655 nm into the Start Position (@655 nm) box to the nearest 50 steps.
10. Go back to the prompt tab and tune to 1340 nm.
11. Repeat steps 4 to 7 exactly to find the stepper position for 1340 nm ± 1 nm.
12. Enter the 1340 nm position in the End Position (@1340 nm) box.
13. Tune the laser to 655 nm and set the stepper position `stp1pos=X` to the correct stepper position for 655 nm ± 1 nm. The wavelength calibration must start at 655 nm.

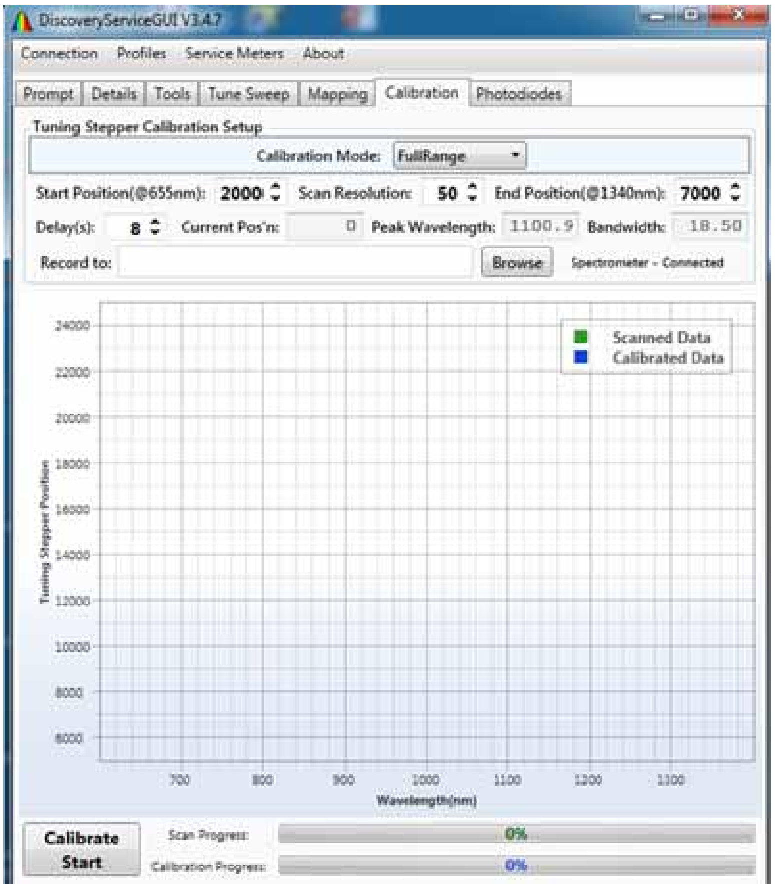


Figure 5.2-2. Full Range Calibration Mode

14. Browse to a desktop location and store the file.

15. Click the Calibrate Start button to begin the procedure.

16. The procedure will take approximately 2 hours. The stepper position is checked and adjusted for accuracy from 655 nm to 1340 nm in 1 nm increments.

17. The Scan Progress bar will display progress in motion. The Calibration Progress bar will update the EEPROM with the new stepper calibration positions at the end as shown in the graph created.

18. At the end of the procedure the tuning min & max should automatically return 680 nm / 1300 nm. Send the commands `?tmin` and `?tmax` to confirm the tuning range.

19. Run the DATA RUN program to confirm calibration accuracy across the full tuning range.

Photodiode Calibration

Two photodiode calibration modes are available:

- The fixed 1040 nm line calibration
- The tunable wavelength range calibration

If a photodiode calibration is required to match the power meter value in the fixed or tunable range, follow the procedures described below.

Fixed Calibration

Follow the steps below to calibrate the fixed 1040 nm line.

1. Make sure the system has been keyed on for at least 10 minutes.
2. Place a power meter in front of the fixed output port.
3. In the **Prompt** tab, open fixed shutter, `Sfixed=1`
4. Take power reading from the power meter.
5. In the **Prompt** tab, send the command: `P1cal=xxxx`, where xxxx equals external power measurement in milliwatts.
6. The Fixed photodiode should now be calibrated with `?P1` matching the power meter.

Tunable Calibration

Follow the instructions below to calibrate the photodiode for the tunable wavelength range.

The PowerMaxUSB must be connected to the Service GUI for the tunable calibration procedure. See “PowerMaxUSB” on page 1.2-18 and “Connect Measurement Devices within Service GUI” on page 1.2-19 for the connection procedure.

---

1. Make sure the system has been keyed on for at least 10 minutes.
2. Place the PowerMaxUSB in front of the tunable output port.
3. Verify the PowerMaxUSB is connected to the service GUI under the **Service Meters** tab.
4. Open the **Photodiodes** tab.
5. Enter the necessary wavelength range in the Min / Max boxes.
6. Click the **Calibrate Start** button to begin the procedure.

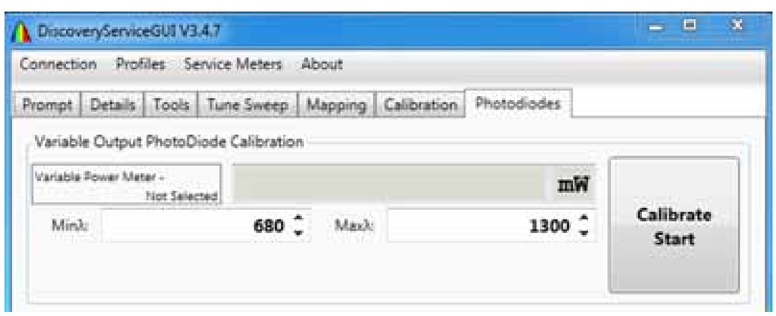
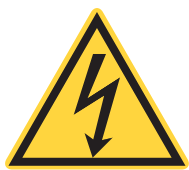


Figure 5.3-1. Tunable Photodiode Calibration

Photodiode Replacement

Prior to exchanging out any of the photodiode PCBAs, verify PD cabling has continuity and is connected properly.

CAUTION!
Electronic components can be damaged by electrostatic discharge. Make sure properly grounded wrist straps are worn when handling printed circuit board assemblies. Use ESD packaging as necessary.



WARNING!
Make sure mains power is in the OFF position before you use an ESD wrist strap. Grounding yourself with power applied can cause an electric shock.

SHG PD (P2)

1. Start the laser system with the key in standby mode.
2. From the **Prompt** tab, place the system into current mode `pump:mode:4=1`.
3. Key-on the laser system.
4. Wait for system to ramp-up, then confirm specified OPO performance.
5. If the OPO specifications are not reached:
    a.) Identify the existing drive current, `?pump:idl:4`
    b.) Increase the drive current in small increments until the system meets the OPO specifications, `pump:idl:4=xxx` where xxx is the queried value plus < 0.5
    - Set the current: typical range between 7 to 8 A
    - Tune the laser across the tuning range and verify that the system is in specification
    - If the power is too low, the current should be increased in small increments until all wavelengths are in specification

c.) Once the system meets OPO specifications and the power amp current is determined, it is assumed that the Green is producing 8 W.

6. Key to standby mode. Let the system ramp down, then power OFF.

7. Disconnect and remove back panel. Remove the following connections:
   - J1
   - J2
   - J3
   - USB
   - MRU hoses
   - Chiller hoses
   - BNC

8. Remove the PCB from the mount. **<u>Only remove the PCB, not the mount.</u>**

Figure 5.3-2. SHG Photodiode

9. Install the new PD 2 PCB.

10. Install back panel and reconnect electrical, MRU and chiller lines.

11. Start and key ON the laser system.

12. Check the PD2 value, `?p2`.
13. Calibrate PD using the command `pump:oplgr=8000`.
14. Key OFF the laser system.
15. Return system to green light-loop mode `pump:mode:4=3`.
16. Key ON the system.
    - The system should ramp up to 8 W. Send the command `?p2` to confirm specified performance. `?p2` should return 8000.

Fixed Output PD (P1)

1. Start the laser system with the key in standby mode.
2. Send `?alignfixedp` to identify the fixed output alignment power level.
3. Power OFF the laser system.
4. Remove the laser head front panel.
5. Remove and replace Fixed Output PD board.

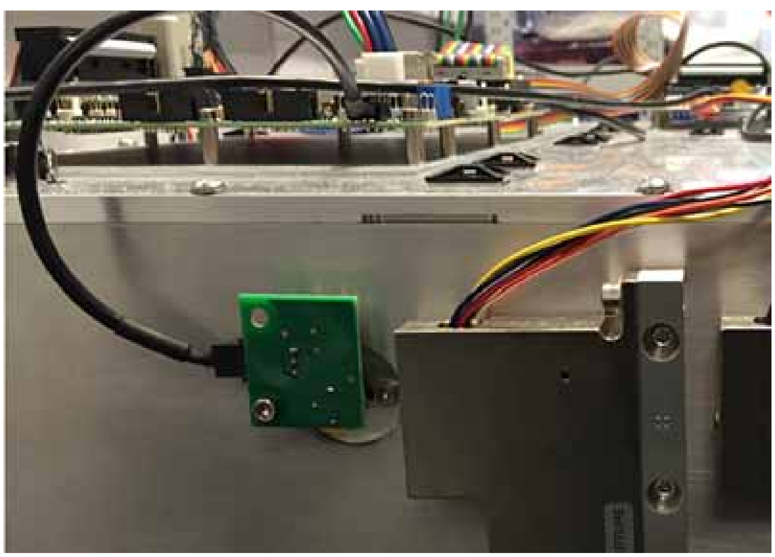


Figure 5.3-3. Fixed Output PD (P1)

6. Start the laser system.

7. Measure TP11 on the pump board and maximize the voltage on TP11 by using the slop of the screws to translate the board. See “Pump Headboard Test Points” on page 3.2-3 for location and information on TP11.
8. Measure the IR output power using external power meter.
9. Use the command `P1cal=xxxx` to calibrate the PD in mW with the laser in service mode.
10. Send `?p1` to confirm PD matches external value.
11. Enter the command `alignfixedp=xxxx` where xxxx = value measured in step 2 in mW.
12. Enter fixed alignment mode by command `alignfixed=1` or through the customer GUI. Make sure the measured power equals the value in step 2.
13. Increase or decrease fixed-alignment power using `alignfixedp=xxxx` to match power meter.

Dual Color PD (P3)

If P3 PD is defective, the OPO will not run. The laser will not have any output as the value generated from this PD forms part of the feedback loop to calibrate the OPO light-loop. If there is no lasing, this PD should be replaced as a last step for field recovery.

1. Power OFF the laser system.
2. Remove the PCB from the mount. **Only remove the PCB, not the mount.**

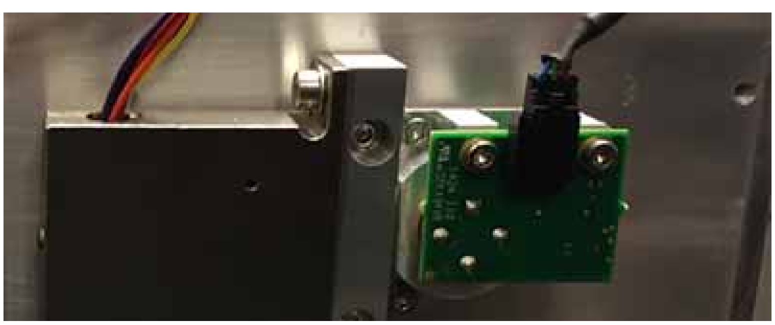


Figure 5.3-4. Dual Color PD (P3)

Dual Color PD (P4)

1. Access PD P4 through the side panel.

2. Remove and replace PD P4.

NOTICE
When accessing the photodiode and cable, try not to bend or stress the armored fiber coming from the power-amplifier module. If possible avoid touching this at all.

Figure 5.3-5. Dual Color PD (P4)

3. Run tunable calibration procedure. See “Tunable Calibration” on page 5.3-2.

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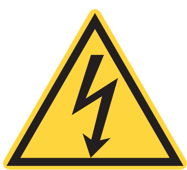
Introduction

Use the following procedures to replace the Discovery pump board (page 5.4-1), OPO board (page 5.4-6)or power distribution board (page 5.4-9).

CAUTION!
Electronic components can be damaged by electrostatic discharge. Make sure properly grounded wrist straps are worn when handling printed circuit board assemblies. Use ESD packaging as necessary.



WARNING!
Make sure mains power is in the OFF position before you use an ESD wrist strap. Grounding yourself with power applied can cause an electric shock.

Pump Board Replacement

1. Place the laser into Standby.

Figure 5.4-1. Pump Board

1. Open the Discovery Service GUI. Verify the GUI is in service mode, `?access`.
2. Record the software version `?sv`.
3. Save EEPROM information. See "EEPROM Tool" on page 1.2-15.
4. Record the SHG spot position `?pump:shg:spotidx`.
5. Measure the UVP (TP2) & OVP (TP5) voltages to ground. See "Pump Headboard Test Points" on page 3.2-3 for location and information on TP2 and TP5.

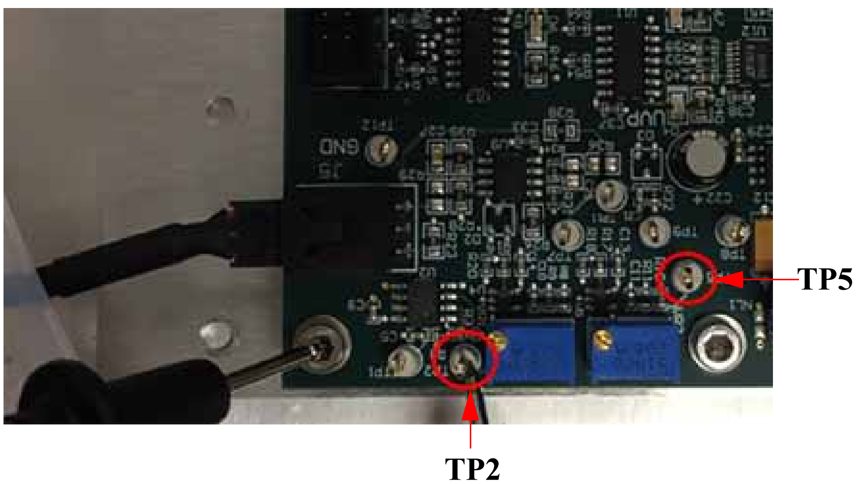


Figure 5.4-2. TP2 and TP5

6. Power OFF the laser system.
7. Remove the connectors and the original pump board.
   a.) J3 = SHG Photodiode connector P2
   b.) J4 = 25-way D-type ribbon cable connecting to the OPO board
   c.) J5 = IR photodiode connector P1
   d.) J6 = white Molex connector to the power distribution board PDB
   e.) J7 = white Molex connector to the PDB
   f.) J8 = 15-way D-type connector to the poweramp
   g.) J9 = black Molex interconnect cable

Figure 5.4-3. Pump Board with Connectors Removed

h.) J13 = 50-way D-type connector to seed

i.) J14 = black Molex connector to wavelength TEC & diode electronic drivers

8. Remove SHG piezo stage daughter board.

NOTICE
The daughter board is tightly seated to the pump board. Use caution when removing the board.

9. Remove the 11 M2.5 screws that hold the PCB in place.
10. Install the new pump board.
11. Replace the 11 M2.5 screws.
12. Install SHG piezo stage daughter board on the new/replacement pump board. Make sure both ends are carefully and fully inserted into the home position (listen for an audible click).
13. Only connect J6, J7 and a standard R-S232 serial cable. Connect the RS-232 cable from the board to the service engineer's laptop. See Figure 5.4-4.
14. Start the laser system with the key in standby mode.

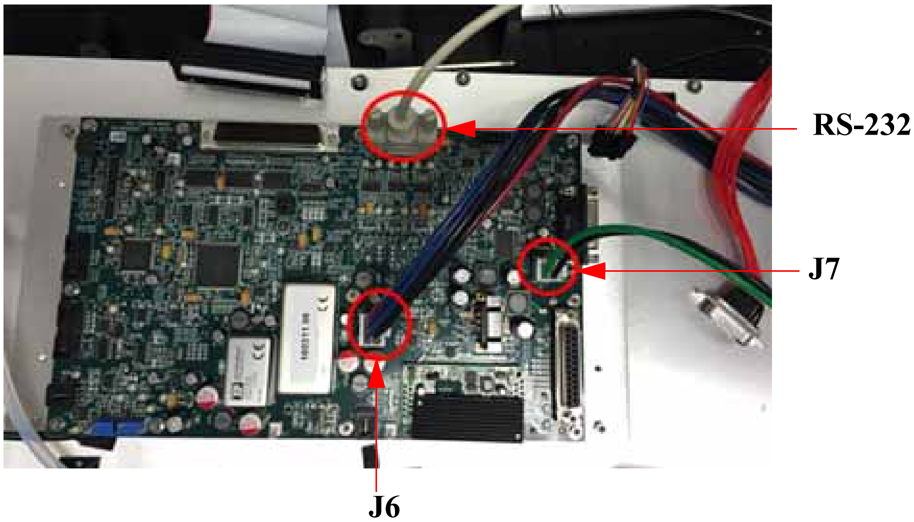


Figure 5.4-4. J6, J7 and RS-232

15. Refer to the data collected in step 5. Reset the UVP & OVP voltages using a potentiometer trim-tool. Adjust VR1 for UVP (measure the voltage on TP2), adjust VR2 (check TP5). See Figure 5.4-5.

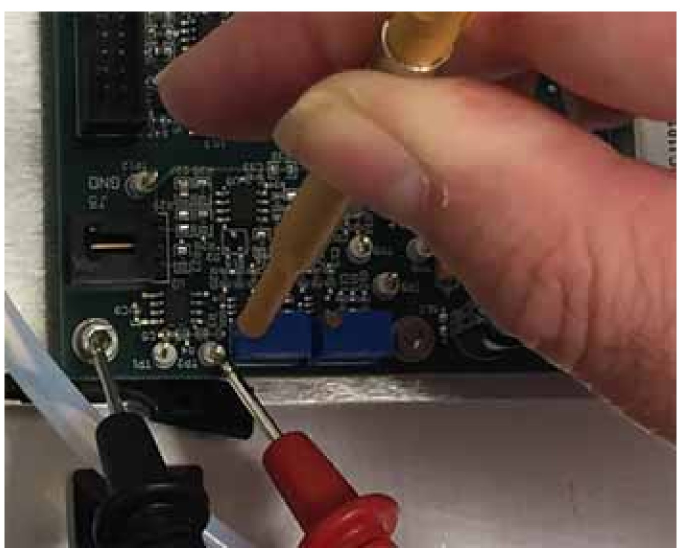


Figure 5.4-5. Pump PCB Potentiometer Adjustment

16. Open Discovery Service GUI prompt window. The prompt should display `GROUSE>`. This is the pump laser system.
17. Upload the same version of base code software as the original PCB unless a software upgrade is planned for both the pump board and OPO board immediately following this procedure. See “Discovery Software Table” on page 4.3-1.

NOTICE
When the software version `?SV` is queried over the pump board, 2 numbers are given eg. 4.32, 3.02. The first number relates to the pump board software version and the second number relates to the pump board bootloader version.

---

18. Power OFF and connect the remaining connectors, remove RS-232 cable.
19. Power ON the laser system.
    - Listen for a high-frequency noise. This is the SHG stage.
    - If the high-frequency noise is not heard, proceed to step 23.
20. Load the EEPROM data.
21. Refer to step 4 for the recorded data. Send the query `?pump:shg:spotidx` to verify the SHG spot is at the same position prior to exchanging out the board.
22. If the spot position is not correct, send command `pump:shg:spotidx = x` (where x is the needed spot position).
23. Verify the board has been properly programmed and initialized. Enter the following queries:

    a.) `?pump:MF:1`
    - The query should return a suffix of 1 (?pump:MF:1 1)
    - This allows the headboard to control the seed module

    b.) `?pump:MF:3`
    - The query should return a suffix of 1 (?pump:MF:3 1)

- This allows the headboard to control the power amp and pump modules

c.) `?pump:MF:4`

- The query should return a suffix of 1 (?pump:MF:4 1)
- This allows the headboard to control the LBO

d.) `?pump:SMF:2`

- The query should return a suffix of 1 (?pump:SMF:2 1)
- This enables the SHG stepper motor

If any of the queries do not return the correct information, the settings will need to be changed by entering the command.

- `pump:MF:x=1`, where x is the number of the module that needs to be updated
- `pump:SMF:2=1` for the SHG stepper command

If the settings are updated, the power must be cycled to set the parameters.

24. Verify all the modules are switched on and the power amp is in light-loop.
    - `pump:on=4`
    - `pump:mode:4=3`
25. Key ON and check the specified performance of the laser system before the outer-head cover is replaced. Refer to "Discovery Cover Removal" on page 5.1-1.

OPO Board Replacement

1. Place the laser in Standby
2. Open the Discovery Service GUI. Verify the GUI is in service mode, `?access`.
3. Record the software version `?sv`.
4. Save EEPROM information. See "EEPROM Tool" on page 1.2-15.
5. Record the BBO spot position `?stp1spot`.
6. Power OFF the laser system.

7. Remove the connectors.

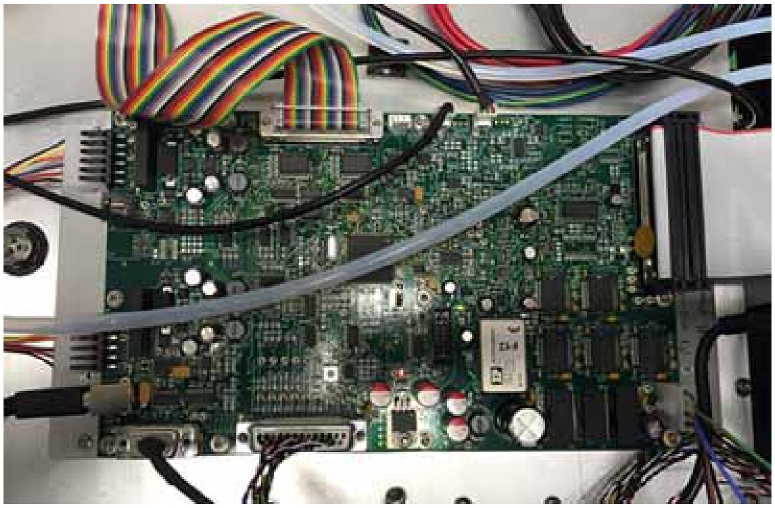


Figure 5.4-6. OPO Board

a.) J1 = RS-232 connector

b.) J2 = Umbilical 2 D-type connector

c.) J3 = Umbilical 2 Molex connector

d.) J4 = USB connector

e.) J5 = Tunable shutter molex connector

f.) J6 = 50-way D-type ribbon-cable to bulkhead

g.) J8 = Emission LED

h.) J10 = Fixed shutter Molex connector

i.) J11 = 25-way D-type ribbon cable to pump board

j.) J12 = Precomp photodiode connector P4

k.) J14 = OPO photodiode connector P3

8. Remove the 11 M2.5 screws and the OPO board.

9. Install the new OPO board, screws and connections shown in step 5.

10. Power ON the laser system with the key in standby mode.

The laser will make a high-frequency noise, this is normal behavior. During warm-up the power supply Fault LED will flash.

---

11. Open Discovery Service GUI. Verify the GUI is in service mode. Choose the needed COM Port.
12. Confirm the correct software is loaded. See “Discovery Software Table” on page 4.3-1 for software compatibility.
13. If the software version is not correct, upload the needed software unless a software upgrade is planned for both the pump board and OPO board immediately following this procedure.
14. Upload the EEPROM data.
    a.) Open file
    b.) Select all
    c.) Save to the laser
15. Run the absolute home procedure for BBO stepper `stp1hmabs=1`. This will take from 10 seconds to 15 minutes to run depending on stepper position related to spot position.

NOTICE
The absolute home procedure can only be run in standby mode, query the status to confirm `?st`.

---

16. Send `?st` through the GUI prompt window. The system will respond with “Please Wait” if the stepper is moving. Once the procedure is complete the system will respond with “Standby”.
17. Check BBO spot position `?stp1spot`. Refer to step 5 for the recorded data. Set the BBO to the correct position `stp1spot=x`.
18. Key ON and check the specified performance of the laser system before the outer-head cover is replaced. Refer to “Discovery Cover Removal” on page 5.1-1.

Power Distribution Board Replacement

Prior to replacing the power distribution board, check the 5 fuses on board for continuity.

The board replacement is a straight swap that requires no configuration. Make sure all of the connections are reconnected correctly. Do not confuse J1 and J2.

Figure 5.4-7. Power Distribution Board (PDB)

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Introduction

Use the following procedures to replace the Discovery diode and TEC drivers.

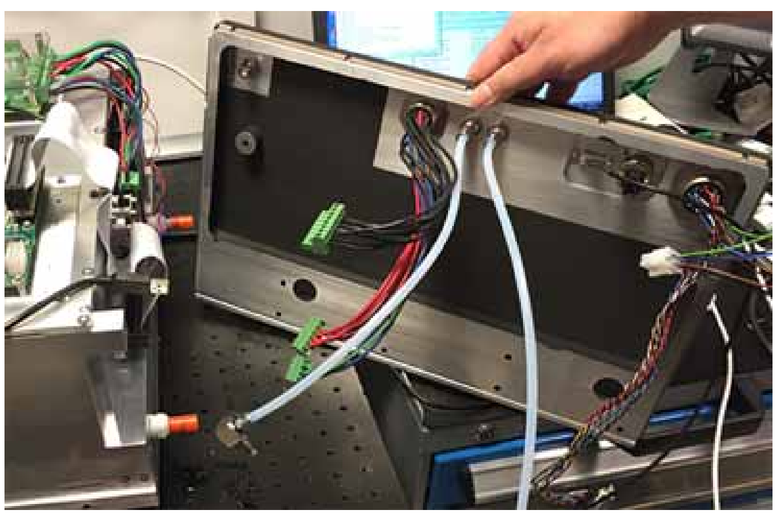
CAUTION!
Electronic components can be damaged by electrostatic discharge. Make sure properly grounded wrist straps are worn when handling printed circuit board assemblies. Use ESD packaging as necessary.

WARNING!
Make sure mains power is in the OFF position before you use an ESD wrist strap. Grounding yourself with power applied can cause an electric shock.

Diode Driver Replacement

1. Power OFF the power supply.
2. Power OFF the chiller.
3. Power OFF the MRU.
4. Disconnect umbilicals, chiller hoses and MRU hoses from laser head rear panel.
5. Remove the back panel (10 M4 bolts).
6. Disconnect internal connectors and MRU hoses to completely disconnect the back panel from the laser head. See Figure 5.5-1.

Back Panel



Connections

Figure 5.5-1. Back Panel

7. Disconnect the black, blue, red & green cables from the diode driver. See Figure 5.5-1.
8. Disconnect J2 D-Sub and J3 white Molex connector.
9. Remove the diode driver.

Figure 5.5-2. Diode Driver

10. Clean thermal paste from the back of the diode driver block.
11. Apply a small amount of heat sink compound (0.1 mm thick) and spread evenly along the new diode driver block.
12. Install the new diode driver.
13. Replace the connectors and back panel.

NOTICE
When replacing the back panel, verify the cabling is not pinched between the housing and back panel.

TEC Driver (Temperature Controller) Replacement

The temperature controller TEC Drivers are not present on current and future Discovery builds.

---

1. Power OFF the power supply.
2. Power OFF the chiller.
3. Power OFF the MRU.
4. Disconnect umbilicals, chiller hoses and MRU hoses from laser head rear panel.
5. Remove the back panel (10 M4 bolts).
6. Disconnect internal connectors and MRU hoses to completely disconnect the back panel from the laser head. See Figure 5.5-1.
7. Disconnect:
   a.) J1 = Diode 1 poweramp TEC
   b.) J2 = Diode 2 poweramp TEC

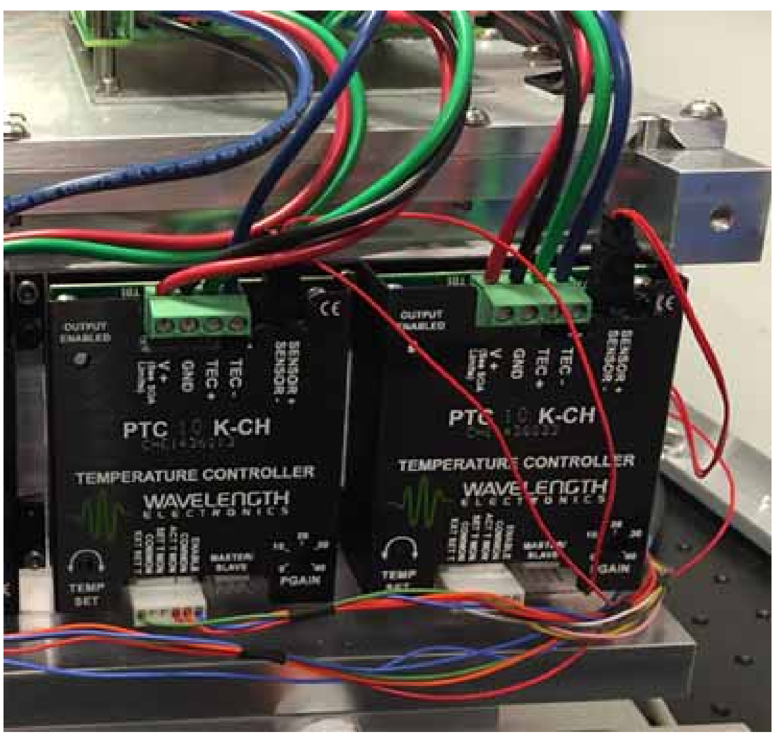


Figure 5.5-3. TEC Drivers

8. Install the new TEC driver.
9. Replace the connectors and back panel.

Shutter Assemblies Replacement

1. Power OFF the laser system.
2. Remove the front panel.
   (Current systems have 10 x M4 Allen bolts)
   (Earlier systems had 8 x M5 Allen bolts and 2 x M4 Allen bolts)
3. Replace the required shutter. (3 x M3 Allen bolts)
   Both shutter assemblies are interchangeable. The connectors are in sequence left to right.

Figure 5.6-1. Shutter Assemblies

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Introduction

The AOM attenuators are controlled and driven by RF drivers (one per beamline). The drivers provide RF electrical power at the required frequency and magnitude to the attenuators. In response to the RF power applied to them, the AOMs diffract light from their beamline to the laser output. If there is a problem with the attenuator, it might not be possible to enable output since the AOM must be active for this to happen. For reference throughout this section, the RF driver and its connections are shown below in Table 5.7-1.

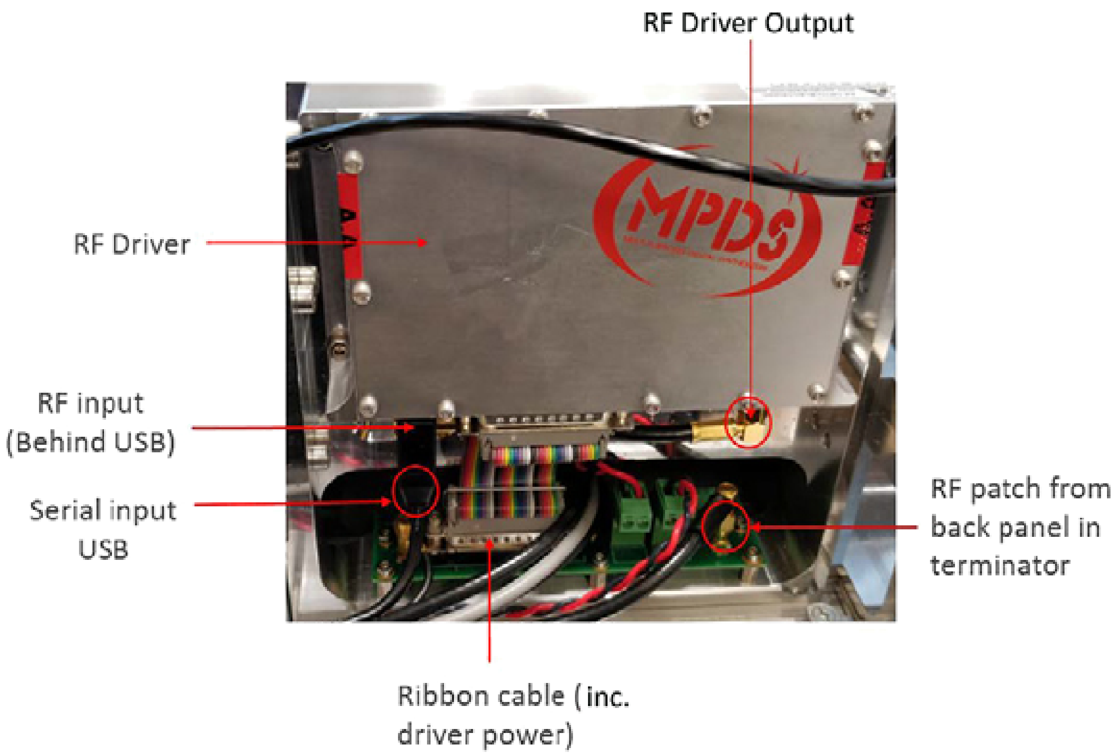

Figure 5.7-1. RF Drive Component Location

Driver Replacement Procedure

1. Power OFF the laser system.
2. Remove cover per the instructions in “Discovery Cover Removal” on page 5.1-1.

Tunable driver is on the right, fixed on the left if standing behind the laser head.

---

3. Carefully disconnect ribbon cable, avoiding pulling on wires, then remove serial and SMA connectors as shown in Figure 5.7-1.

Care should be used when disconnecting SMA cables.
A flat screwdriver can be used to help create a gap between the socket and the connector. Avoid pulling on cable.

---

4. Remove the 4 mounting screws on driver and replace module.
5. Remake connections shown Figure 5.7-1.

Test New Driver

1. Power the system ON at the PSU.
2. Connect to driver with the service GUI.
   Use the old calibration file to get light out of the laser.
3. Test the output with an external power meter.
   If the repair was successful, a new, optimized calibration file should be produced.
4. Replace the cover.

Introduction

Direct RF means that the customer is supplying the AOM RF drive directly to the AOM, bypassing the on-board drivers. The RF power is patched directly from the laser head back panel SMA socket to the corresponding AOM input SMA. Therefore, the Coherent driver must be disconnected and disabled and the RF patch must be established in its place.

Configuring the Direct RF

1. Power OFF the system.
2. Remove cover per the instructions in “Discovery Cover Removal” on page 5.1-1.

Note that the fixed driver is on the left side and the tunable on the right side if you are standing behind the laser head

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3. Follow the directions as indicated in Figure 5.8-1.

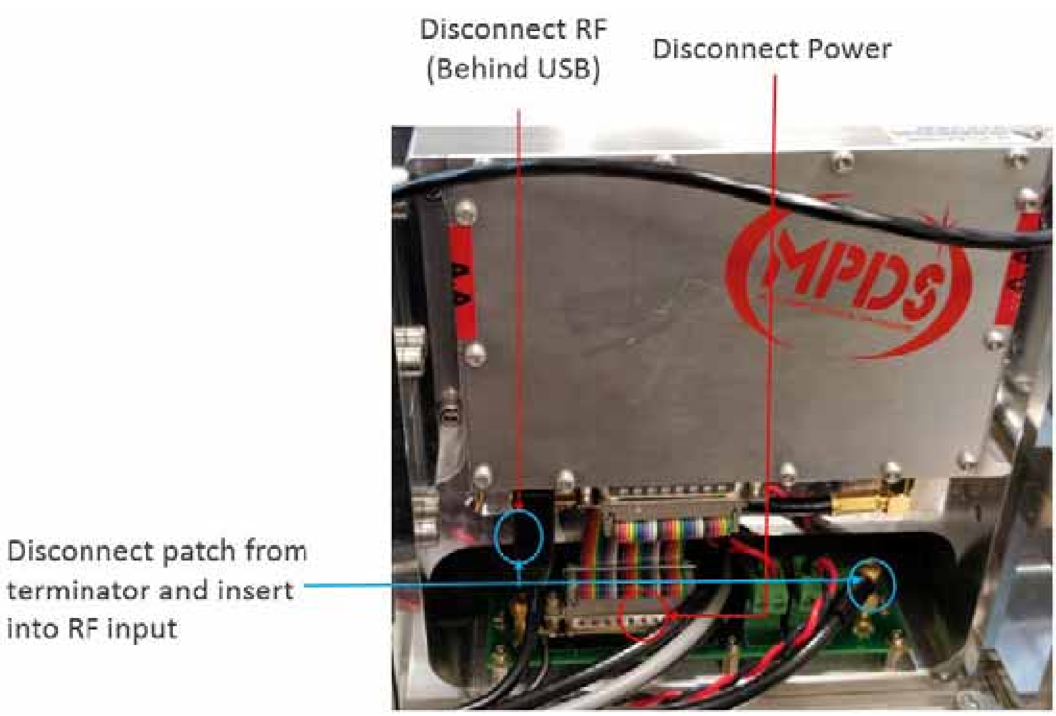


Figure 5.8-1. Direct RF Driver Configuration

a.) Disconnect the ribbon cable from the driver and tape/cover end.

b.) Disconnect the RF output from the bulkhead, situated behind the USB serial input cable going to the driver.

c.) Disconnect the SMA patch cable currently in the terminator and insert this into the bulkhead, where you've just disconnected the RF from the Coherent driver.

d.) Terminate the RF cable from the Coherent driver into the terminator, where you have just disconnected the patch.

e.) Repeat if necessary for a second driver.

f.) Replace the cover.

Only the “RF in” SMA sockets are now functional in terms of attenuation inputs on the back panel. The customer should check that their RF matches the socket protocols stated in Table 2.3-1 on page 2.3-2.

Introduction

The calibration file contains the required output power and frequency data for the AOM driver to send to the AOM to produce user-set transmission level. These settings are wavelength dependent on the tunable output beam path. Therefore the wavelength settings' calibration should be confirmed before starting the attenuator configuration file update. This is because the AOM calibration procedure requires that the WaveScan is connected and plots the wavelength dependent aspect against wavelength as measured on the WaveScan and not the wavelength setting on the laser. Therefore completing both procedures ensures matching between them and therefore optimized settings.

Creating Calibration File

1. Set up the WaveScan and BP209IR profiler for a TPC system.

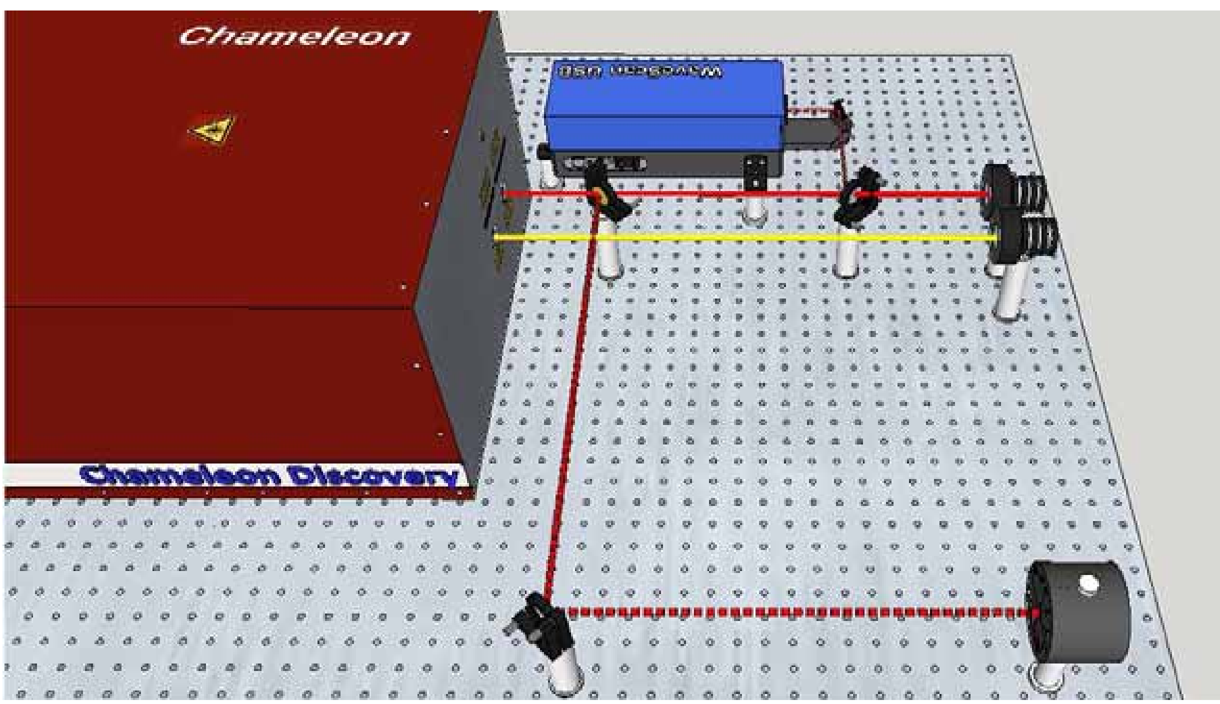


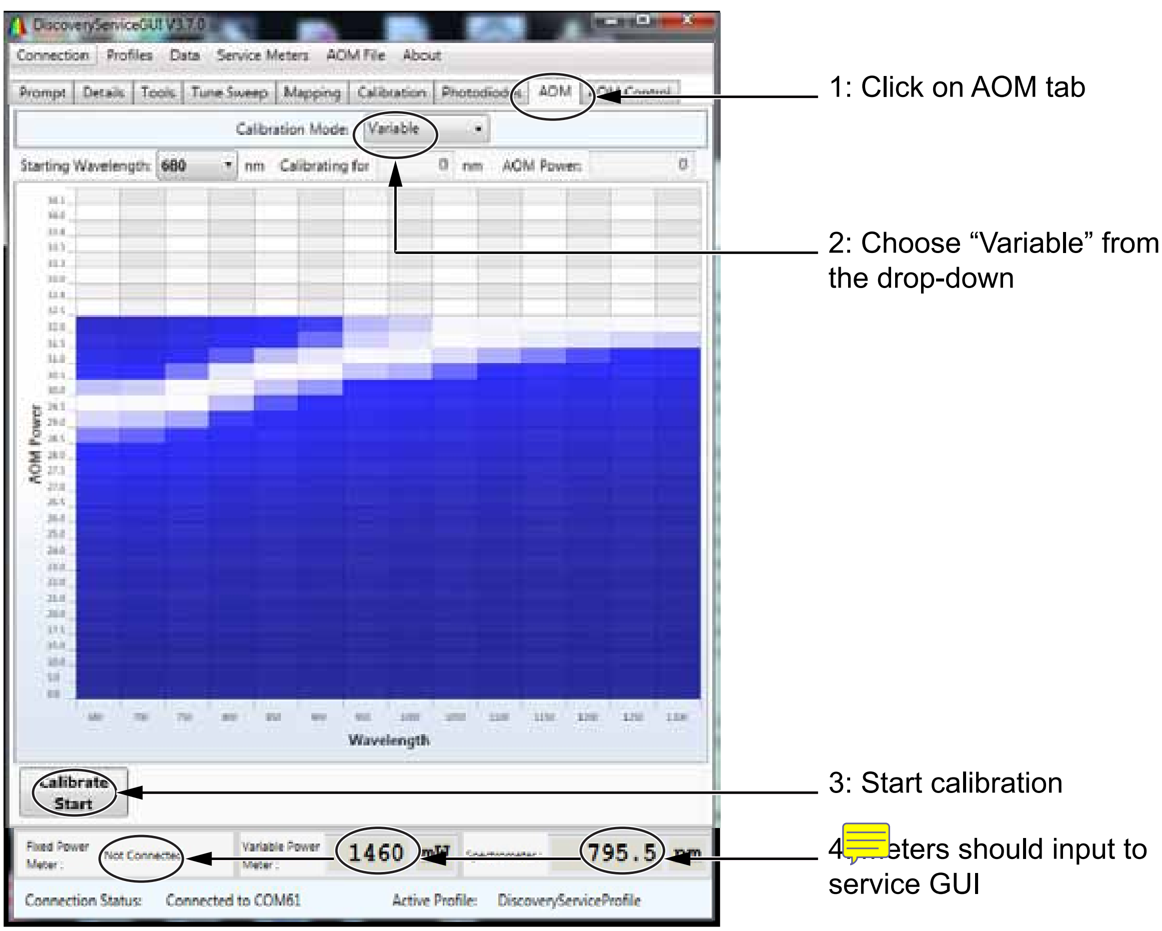
Figure 5.9-1. TPC Calibration Set-up

The Chameleon Discovery TPC's calibrations can all be performed using the set-up shown in Figure 5.9-1.

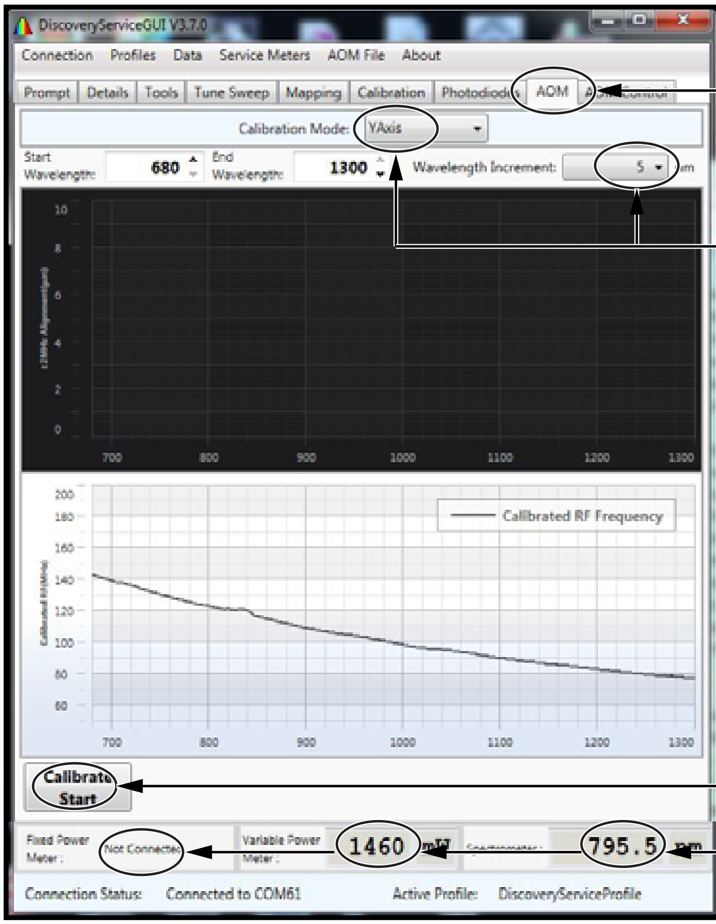
- Beams are aligned into 2 power meters (or 1 at a time).
- First pickoff from main beam (variable) to BP209IR profiler.
- 2nd pickoff from main beam (variable) to WaveScan.
- USBs from instruments connected to DC supplied USB hub.
- The laser is allowed to warm up for > 30 mins.

2. Perform a variable wavelength- AOM/RF power calibration.

   a.) Using the thermopile power meter connected as "variable" and the WaveScan, update the variable calibration profile using the service GUI.



b.) In addition to the RF power setting required to achieve a given transmission level at each wavelength, the RF frequency needs to be varied over the tuning range to counteract the wavelength-dependent pointing shift through the AOM crystal.



1: Click on AOM tab

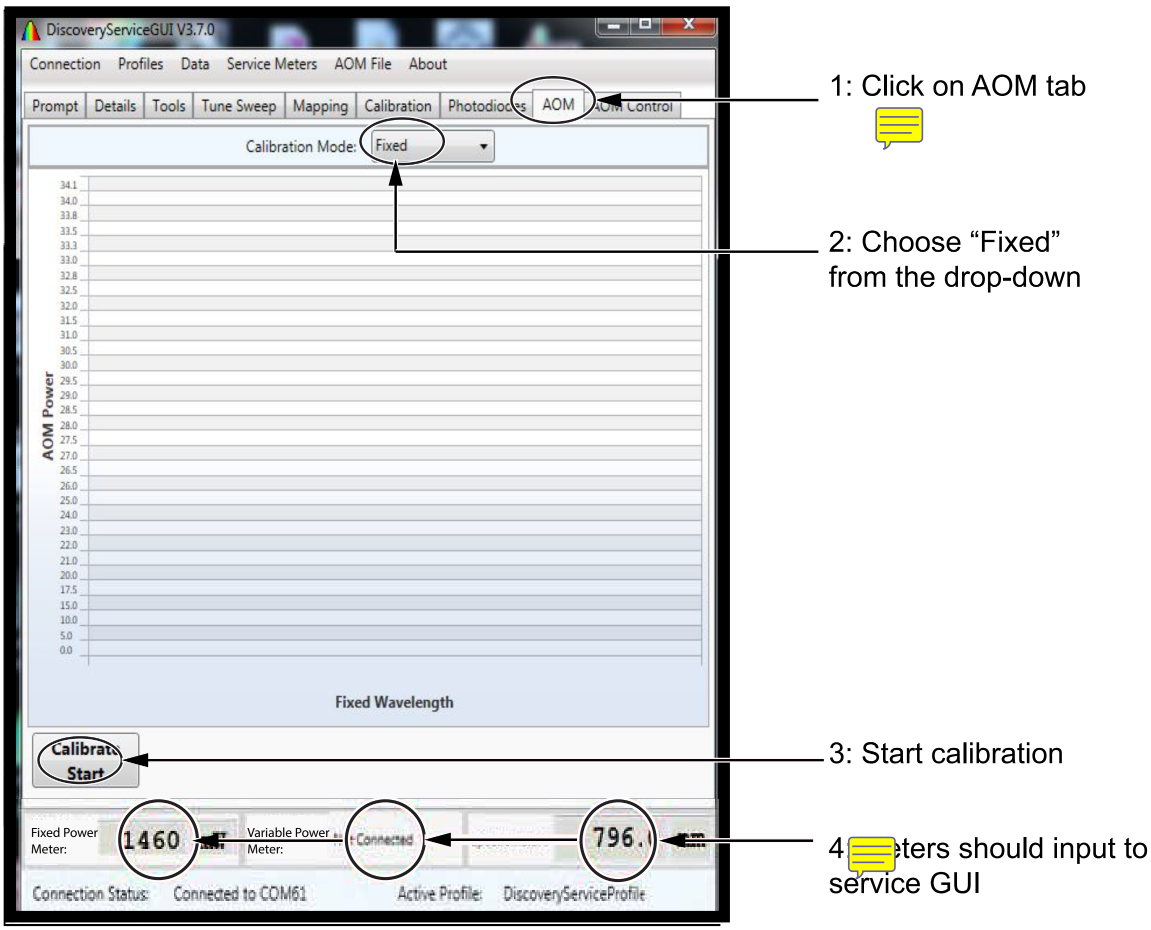
2: Choose "Y-Axis" from the drop-down, 5nm increments

3: Start calibration

4: Wavelength and pointing (vi P209 read during the calibration) c.) The calibration values for fixed wavelength beam path AOM power should then be established.

If there is only one power meter, disconnect it in “Service Meters” and reconnect it as “Fixed Power Meter”.

Physically move the power meter to the fixed output



d.) The new calibrations values are updated to the file.

If the calibration values have been updated in order to counteract an issue, such as those stated above, the system should be retested.
If there has been a significant change in the calibration file in order to re-establish performance, please inform Coherent Scotland, providing as much detail as possible.

FRU Part List

Table 6.1-1. FRU Part List

DESCRIPTION	PART NUMBER
FRU, HOSE ASSY, AIR RECIRCULATOR, CHAMELEON (RoHS)	1040787
Chiller, HECR008-A5-X9	1309119
FRU, HOSE ASSY, WATER SYSTEM, CHAMELEON ULTRA (RoHS)	1094710
AIR RECIRCULATOR, MRU X1, (RoHS)	1309014
FRU, SHUTTER ASSEMBLY	1270133
FRU, COOLFLOW CORROSION INHIBITOR	1234080
FRU, Cable Assy, "Umbilical 2", Chameleon Discovery	1310901
FRU, PCBA, Tested, Dual Color Photo Diode Chameleon Discovery	1310898
FRU, Diode Driver, Wavelength PLD12.5K-CH-PV088,	1309268
FRU, Temperature Controller, Wavelength PTC10K -CH-PV088	1310278
FRU, Chameleon Discovery, Fixed Output Photodiode	1310822
FRU, Cable Assy, "Umbilical 1", Chameleon Discovery	1310900
FRU, Chameleon Discovery, Tested Pump board	1309265
FRU, Chameleon Discovery, Tested OPO board	1309266
FRU, SHG PHOTODIODE BOARD, TESTED, CHAMELEON DISCOVERY	1310894
ASSY, PSU, TESTED AND BOXED, CHAMELEON DISCOVERY	1278525
Cable Assembly, Fiber Headboard to SHG PD, Chameleon Discovery	1317685
Cable Assembly, Fiber Headboard to IR PD, Chameleon Discovery	1317686
Cable Assembly, OPO Headboard to OPO PD, Chameleon Discovery	1317687
Cable Assembly, OPO Headboard to PRE COMP, Chameleon Discovery	1317690
Accessory Kit	1283441

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