QUARTUS ENGINEERING

TESSERACT XL-HD MODULE

USER MANUAL

DOCUMENT NO: Q5179-0001

Revision	Date	Author	Release Notes/Change Description
A	August 24th, 2020	Brendan Hofmann	Initial Release
B	January 10th, 2022	Jesse Melrose	Modifications for LGIT

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1 OVERVIEW

The Tesseract XL-HD Module (referred to as Tesseract here-on) is a precision optical instrument used to present an optical test pattern to camera modules for calibration and testing. The Tesseract contains optical elements and data storage electronics. Images of the Tesseract are below.

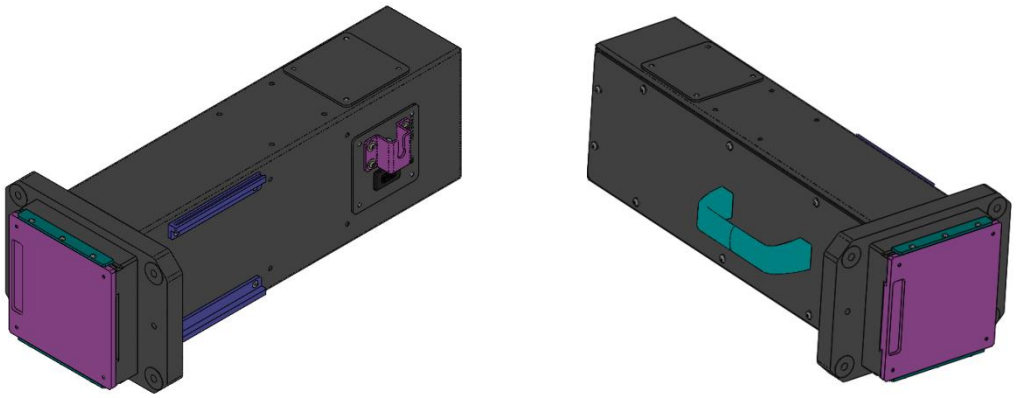


Figure 1-1 Isometric Views of the Tesseract Module

The Laser Enclosure Module (referred to as Laser Module here-on) is an 4-channel laser fiber splitter used to provide a fiber input to the Tesseract unit. The Laser Module contains a laser head and laser controller, thermal management components and control electronics. The Laser Module requires AC electrical power for operation, and is controllable over USB communication port. Images of the Laser Module are below.

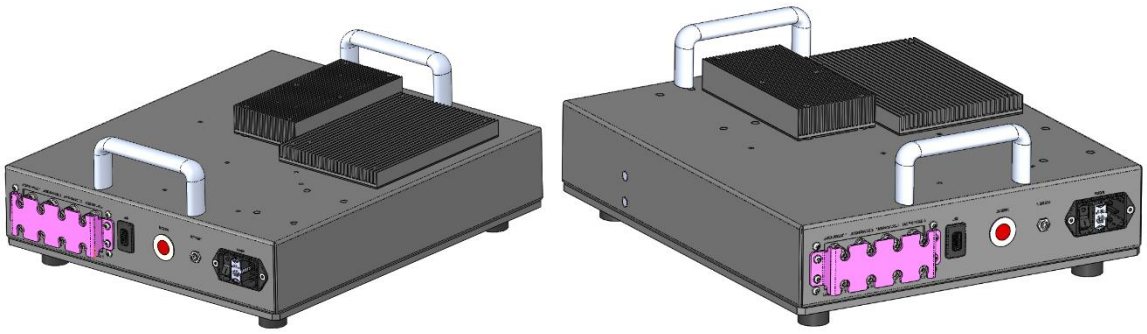


Figure 1-2 Isometric Views of the Laser Module

2 HANDLING NOTES

2.1 TESSERACT STORAGE

When removed from the shipping carton, the Tesseract can be stored ***with the shipping cap on*** prior to installation in a fixture in the three positions shown in Figure 2-1 below.

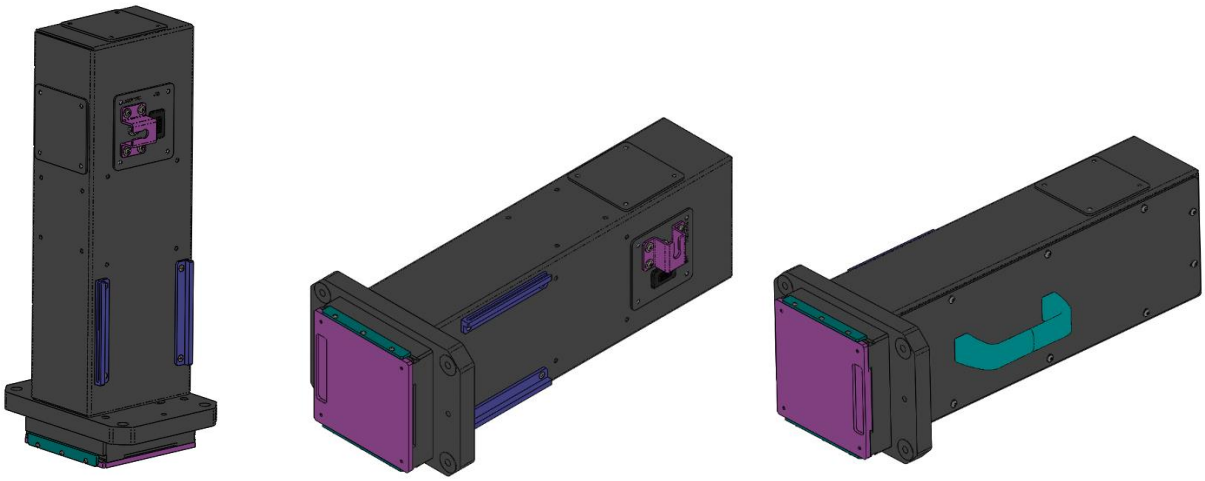


Figure 2-1 Acceptable Storage Postures when Shipping Cap is Installed

2.2 SOP SHIPPING CAP REMOVAL

The shipping cap should only be removed after the Tesseract is installed in a fixture. To remove the shipping cap four M3 captive screws need to be loosened, shown in Figure 2-2 below.

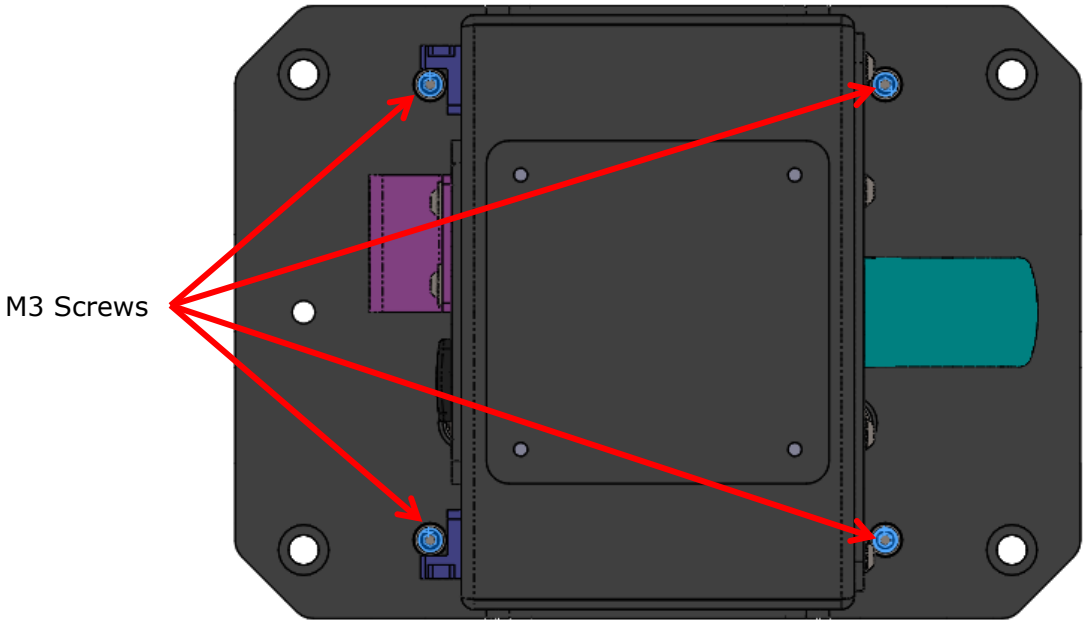


Figure 2-2 Location of M3 Captive Screws for Shipping Cap Fastening (highlighted in blue)

Once the four M3 screws are loosened, the shipping cap can slide off through its machined channels on the side. The direction that the shipping cap can slide is based on which side the handle is on, shown in Figure 2-3 below.

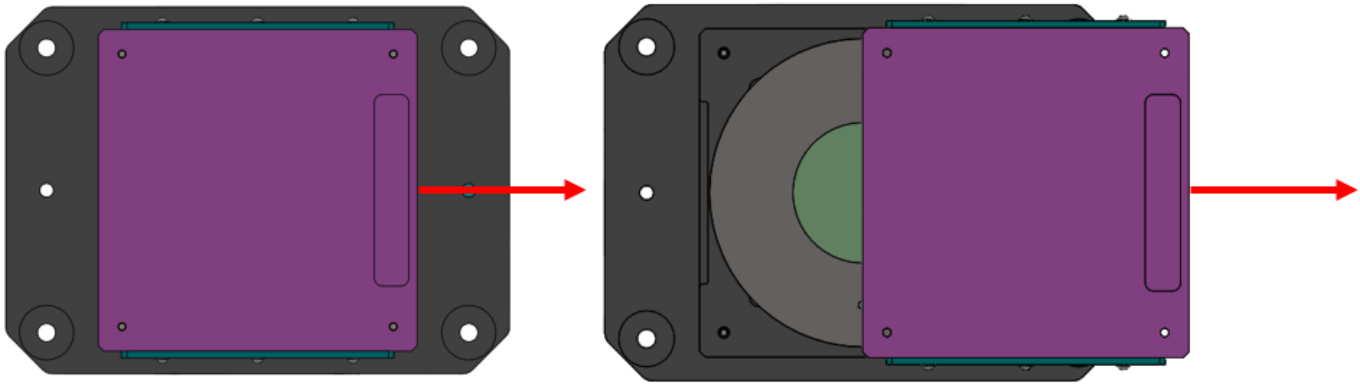


Figure 2-3 Shipping Cap Removal Example

2.3 SHIPPING CAP STORAGE

Once the shipping cap is removed it can be stored on the plastic slides located on the side of the Tesseract in the direction indicated, shown in Figure 2-4 below.

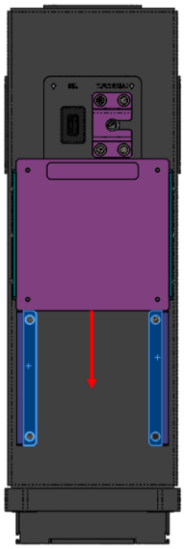


Figure 2-4 Shipping Cap Storage Location and Sliding Direction (highlighted in blue)

2.4 SHIPPING CAP INSTALL

Before removal of the Tesseract from a fixture, the shipping cap must be reinstalled. The shipping cap can be installed on either end that the Tesseract's channels run, shown in Figure 2-5.

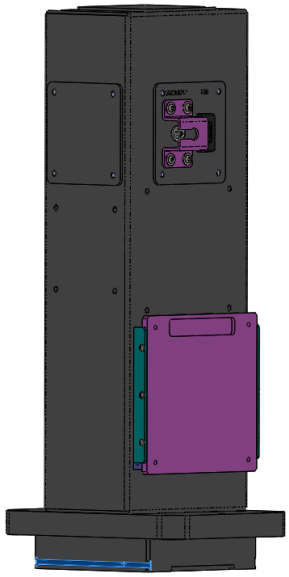


Figure 2-5 Tesseract Slide Channel Location (highlighted in blue)

The shipping cap will hit a hard stop when it is fully installed. Next, the captive screws can then be rethreaded into the shipping cap, which will hit a hard stop when fully tightened.

3 INTERFACES

3.1 MECHANICAL INTERFACES

The Tesseract is to be located with a pin/diamond pin arrangement in the mounting fixture to pick up two precision pin holes in the front mount of the Tesseract shown in Figure 3-1 below. For sizes and tolerances of the holes refer to the ICD in the Appendix.

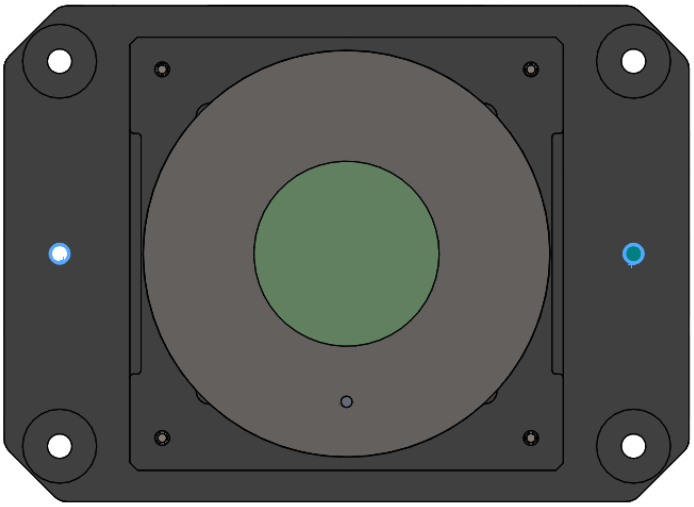


Figure 3-1 Pin holes for location of the Tesseract (highlighted in blue)

The Tesseract should be mounted with the rectangular pattern of counter bored thru holes for M6 fasteners shown in Figure 3-2 below. For locations and tolerances of the mount refer to the ICD in the Appendix.

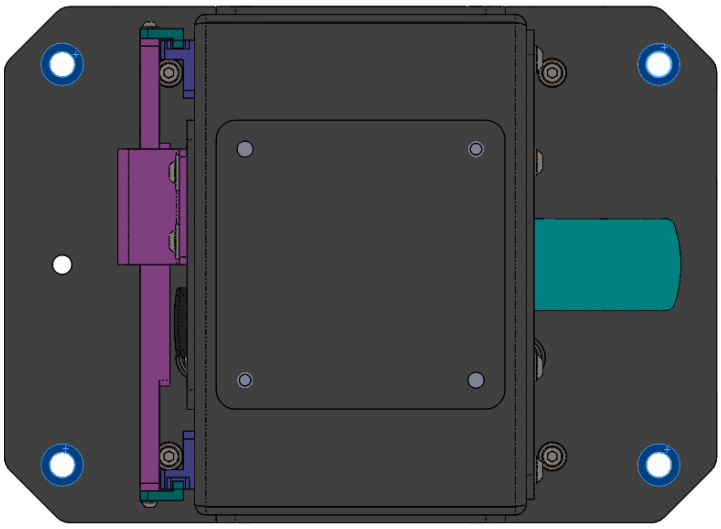


Figure 3-2 M6 thru-hole mounts (highlighted in blue)

The Laser Module should be mounted with the rectangular pattern of threaded isolators for M6 fasteners shown in Figure 3-3 below. For locations and tolerances of the mount refer to the ICD in the Appendix.

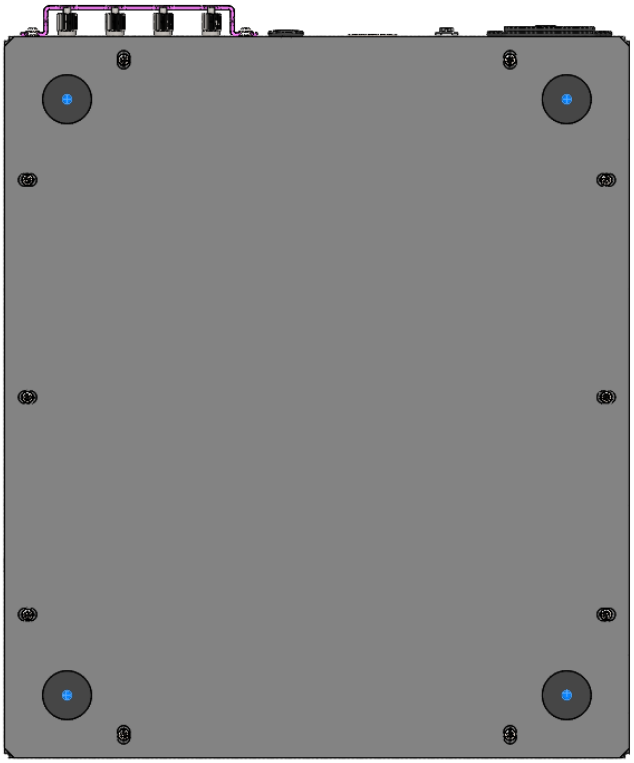


Figure 3-3 M6 threaded mounts (highlighted in blue)

3.2 TESSERACT OPTICAL INTERFACES

The side panel of the Tesseract has an FC/APC fiber optic input port, shown in Figure 3-4 below.

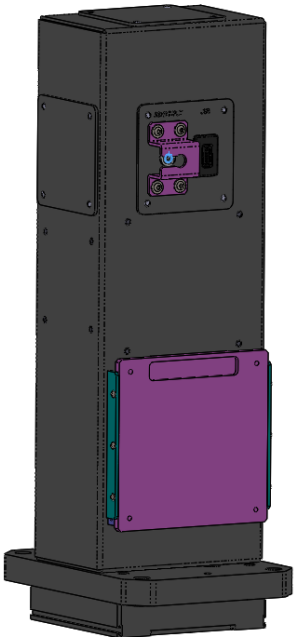


Figure 3-4 FC/APC Fiber Optic Input Port (highlighted in blue)

To attach and detach fibers to the Tesseract's fiber optic input, you must remove the fiber locking panel. After the fiber is installed, you must reattach the fiber locking plate. The fiber locking panel uses 4-tamper resistant M3 screws to hold it in place, shown in Figure 3-5 below. Refer to the ICD in the Appendix for fiber locking plate removal tool.

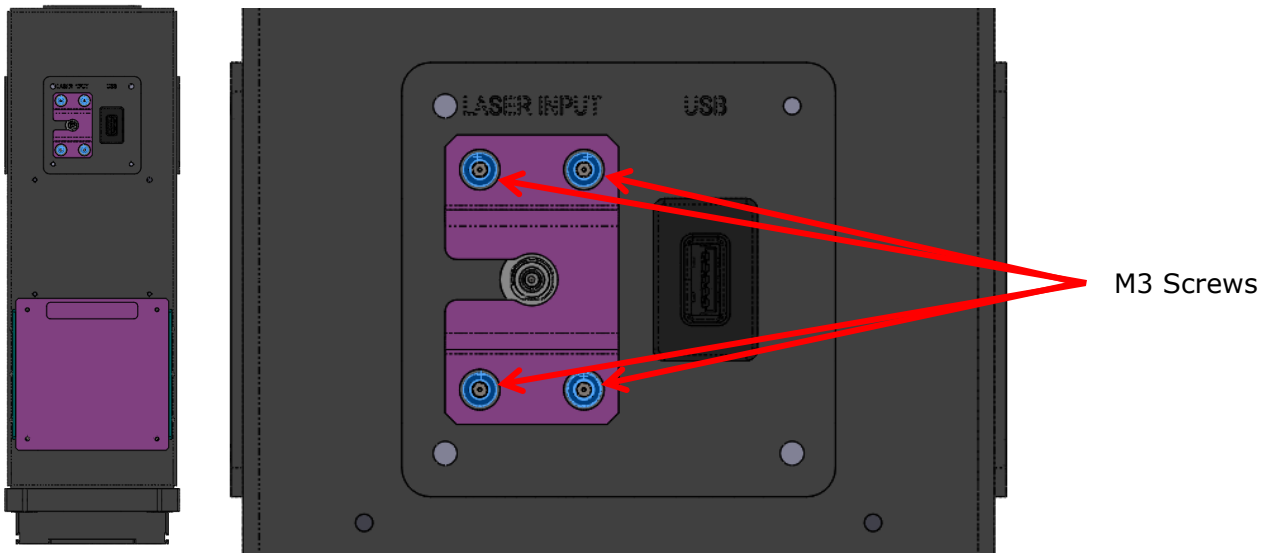


Figure 3-5 Fiber Locking Panel Fastener Locations (highlighted in blue)

The Tesseract contains a diffractive optic that serves as a 73 x 55 beam splitter and presents a spot pattern of collimated beams to device under test (DUT). Note that the default configuration of the Tesseract presents an infinite conjugate image of the spot pattern to the DUT. The spot pattern is rectangular to best fill the detector surface of the DUT and is represented below in Figure 3-6 below.

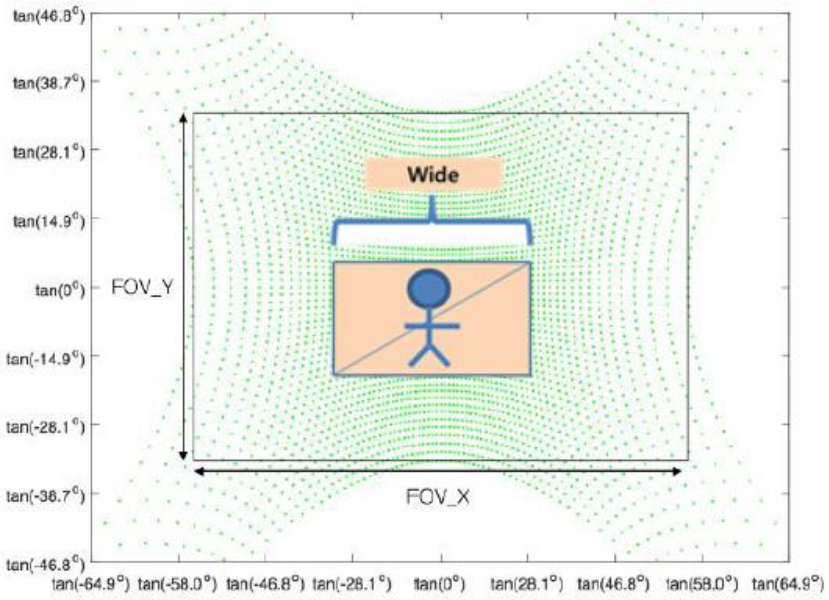


Figure 3-6 Optical Test Pattern of Tesseract

The clocking of the spot pattern with respect to the mechanical interface is shown below in Figure 3-7. There are two possible configurations of the spot pattern, Vx and Vy. The default orientation is Vy. The configuration of a given Tesseract unit is recorded in the enclosed documentation. Note that this configuration is important to appropriately orient the DUT with respect to the Tesseract.

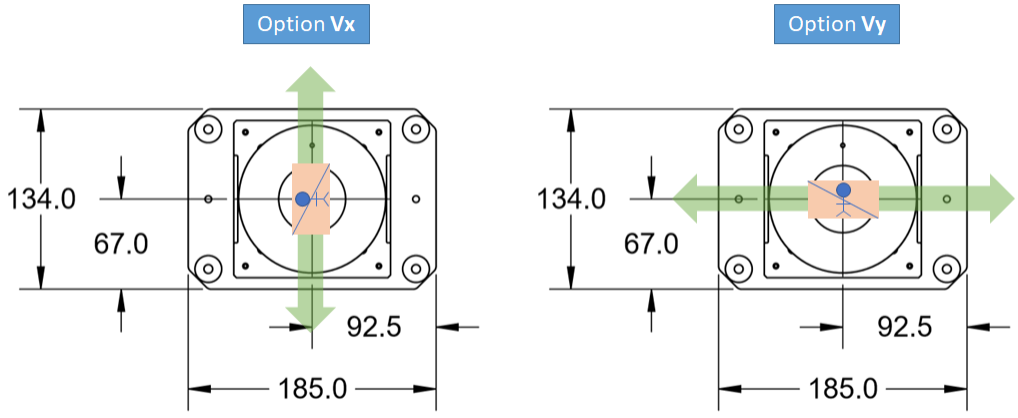


Figure 3-7 Test Pattern (Vy Default)

For the location of the DOE see the ICD in the Appendix (DOE is listed as the "Optic Surface"). It is desirable to avoid vignetting in test images by locating the DUT as close as possible to the Tesseract DOE.

3.3 LASER MODULE OPTICAL INTERFACES

The side of the Laser Module has an interlock port and 4 FC/APC fiber optic outputs, shown in Figure 3-8 below. The interlock port needs to be shorted for the laser to turn on.

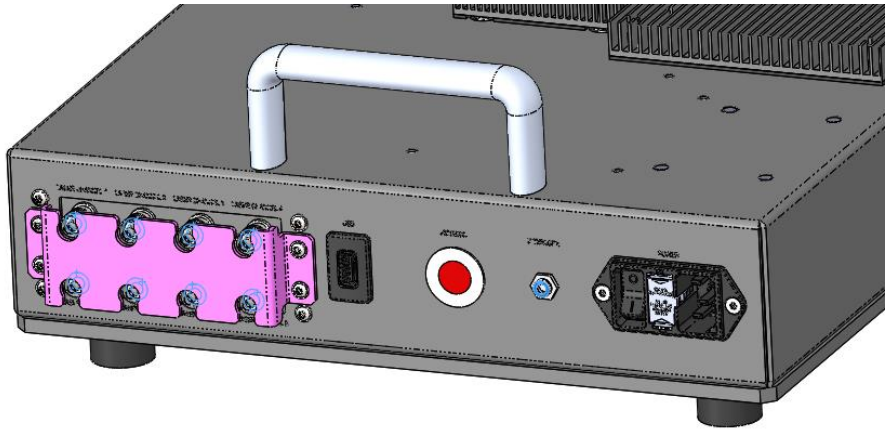


Figure 3–8 Interlock port and Fiber Optic Outputs (highlighted in blue)

To attach and detach fibers to the 4 fiber optic outputs, you must remove the fiber locking panel. After the fibers are installed, you must reattach the fiber locking plate. The fiber locking panel uses 4-tamper resistant M3 screws to hold it in place, shown in Figure 3-9 below. Refer to the ICD in the Appendix for fiber locking plate removal tool.

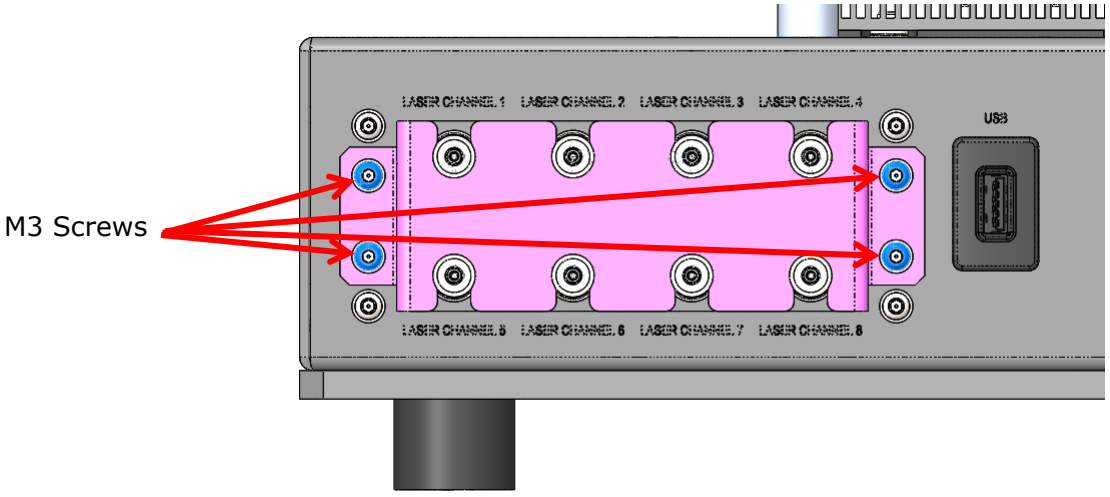


Figure 3–9 Fiber Locking Panel Fastener Locations (highlighted in blue)

3.4 ELECTRICAL INTERFACES

The side panel of the Tesseract has a USB-C connector for calibration data storage shown in Figure 3-10 below.

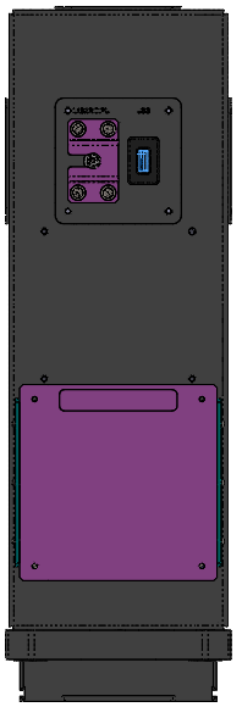


Figure 3-10 Tesseract Electrical Connection (highlighted in blue)

The side panel of the Laser Module has 3 separate connectors for the interlock, signal, and power, shown in Figure 3-11 below.

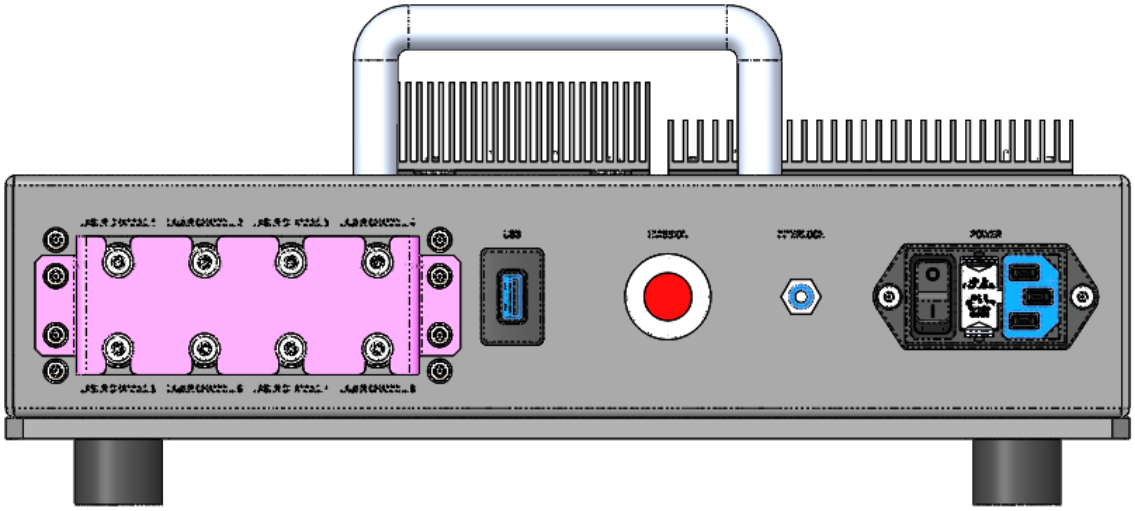


Figure 3-11 Laser Module Electrical Connections (highlighted in blue)

The individual connectors are detailed in Table 3-1 below. All items listed are shipped with the unit.

Table 3-1 Laser Module Electrical Connections

Connector	Description	Destination
3.5mm Jack	Interlock Port	To Be Shorted
USB	Communications	Control PC
IEC Port	Power Supply	Power Outlet

The Laser Module can accept most common AC voltages ranging from 80-264VAC at 47-63Hz. The expected power draw for each Laser Module is 44W maximum.

4 COMMUNICATION

A MacOS graphical user interface (GUI) is available that allows for communication with the Laser Module unit to monitor system status, retrieve system parameters and adjust laser power. The communication is conducted over a USB interface using the USB port on the External face of the unit. Additional information on the MacOS will be provided upon request.

5 SETUP PROCEDURE

The Tesseract is designed to be integrated into customer test fixtures and its sole purpose is to deliver a precision optical test pattern to a device under test (DUT). The DUT socket and frame grabbing interface is the responsibility of the customer, and this procedure assumes that the integrator has built a compatible mechanical interface for the Tesseract. This procedure will represent the steps required to install a single Tesseract.

1. Inspect all components for visible damage prior to beginning the installation.
2. Install the Tesseract into the customer fixture per the mechanical interfaces on the Interface Control Document (ICD) in the Appendix. Note that the customer fixture is anticipated to have

precision ground pin / diamond pin locating features to provide a repeatable and precision interface.

a. The unit should be oriented as shown in
b. Figure 5-1 below. While holding the handle, slowly lower the Tesseract on to the interface mount. Once the front mount of the Tesseract has contacted the interface plate surface, the mounting bolts should be installed.
c. Once the Tesseract is lowered and secured onto the interface plate, the shipping cap can be removed. Take care not to touch or work near the DOE surface, once the Tesseract has been installed, as the outermost optics are easily damaged.

3. Remove the fiber locking panel for the Laser Module and the fiber terminators for the number of desired channels. Attach the desired amount of provided FC/APC armored fibers to the output ports. Install the provided plastic caps onto the fiber terminators and store them with the unit. After all desired ports have fibers installed, reattach the fiber locking panel.

4. Remove the fiber locking panel for the Tesseract and attach the desired FC/APC armored fiber from the Laser Module to the input port. After installing the fiber into the input port, reattach the fiber locking panel.

5. Ensure the interlock port is shorted. The Laser Module is supplied with a shorting plug that can be integrated into the customer fixtures interlock loop (i.e. load door limit switch). The shorting plug is designed to be integrated to a customer switch (no power required, just complete the loop) for an additional level of laser safety.

6. Connect the power cable to the Tesseract and Laser Module panel.

7. Connect the Tesseract and Laser Module to control computer via supplied USB cable.

8. (Optional) Use GUI to track system progress and modify laser power if necessary.

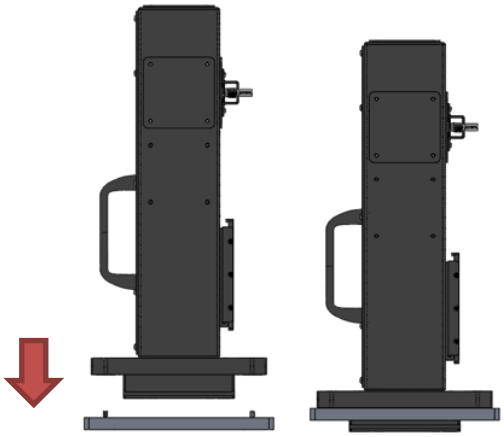


Figure 5-1 Tesseract Installation

9. To turn on the Laser Module, flip the power switch, shown below in Figure 5-2. The switch will turn red if the power is on. Do not rapidly power cycle the unit or switch the interlock at frequencies higher than 1 cycle per second. Wait 5 minutes before conducting any tests to allow the laser to warm up.

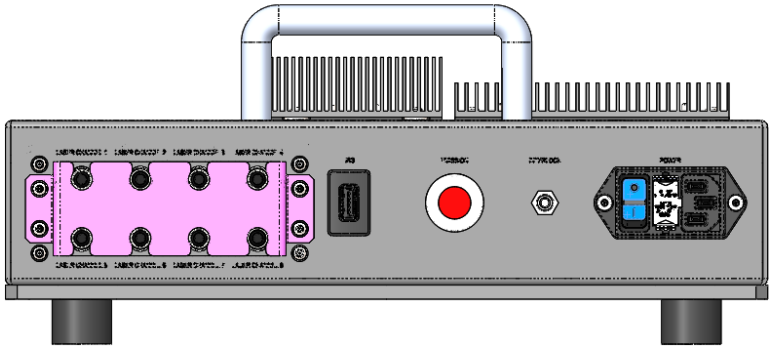


Figure 5-2 Laser Module Power Switch (highlighted in blue)

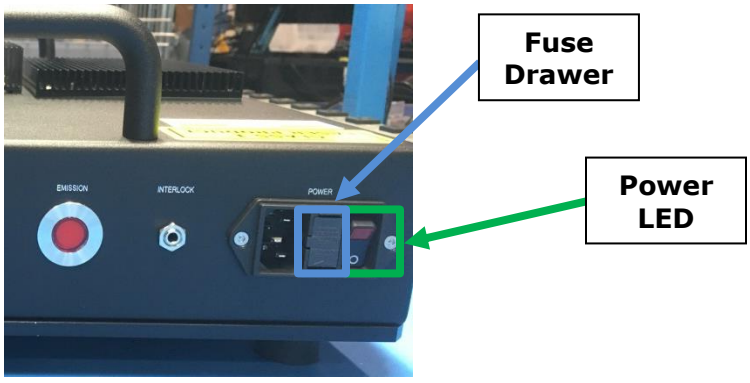
6 APPENDIX

6.1 STANDARD OPERATING PROCEDURE FOR TROUBLESHOOTING LASER POWER ISSUES

In the case where there is no laser light visible from the optical output when the Tesseract has been properly installed in accordance with the setup procedure in section 5, the following procedure should be followed to track down the root cause of the issue.

NOTE: Follow these steps in order only until the laser emission is restored. Once the emission is restored, this procedure is complete. Continuing to follow the steps after emission is restored may result in damage to the Laser Module.

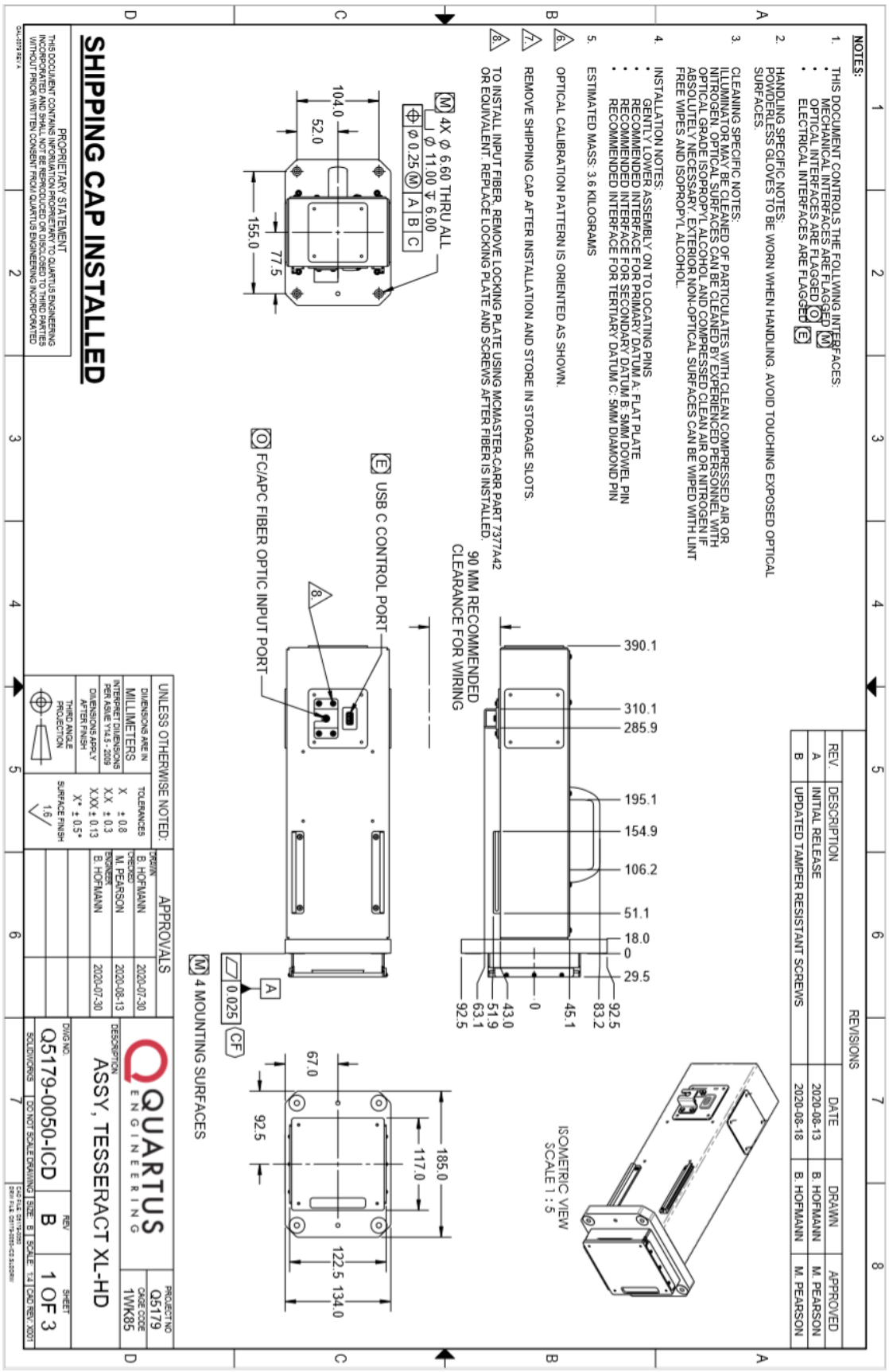
1. Verify that the supplied power cable and interlock plug are installed into the connector bulkhead as instructed in section 5. Ensure that the power switch above the power plug is switched on. This is indicated by a LED light as shown below. If this LED is illuminated and there is no laser emission from the optical output, proceed to step 2.



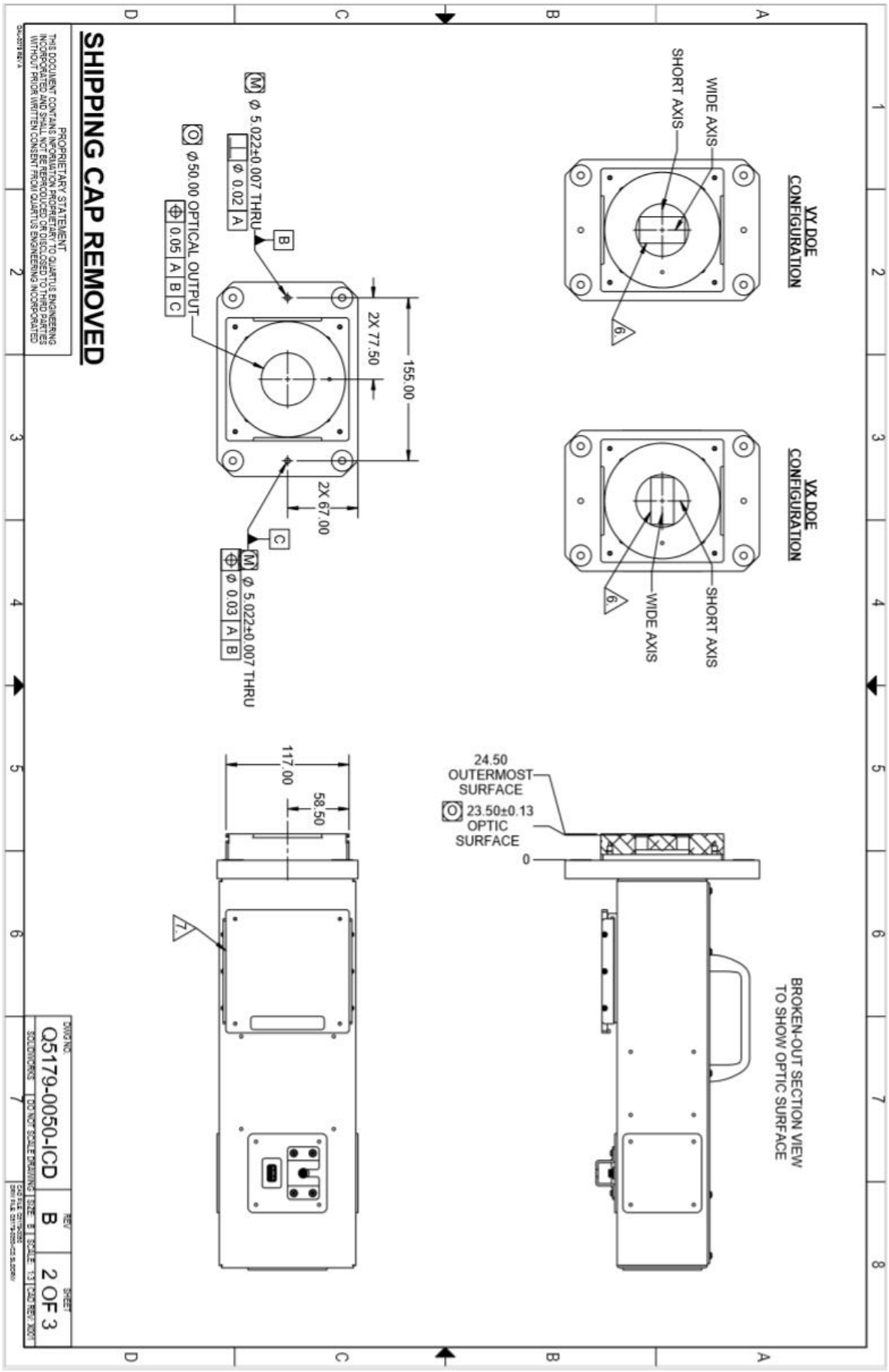
If the LED is not illuminated, the internal fuse of the power switch may have blown. This can be inspected by removing the fuse drawer and visually inspecting the fuse for breaks. If a broken fuse is found, it should be replaced by an equivalent 8A 250VAC 5x20MM fuse.

6.2 INTERFACE CONTROL DOCUMENTS

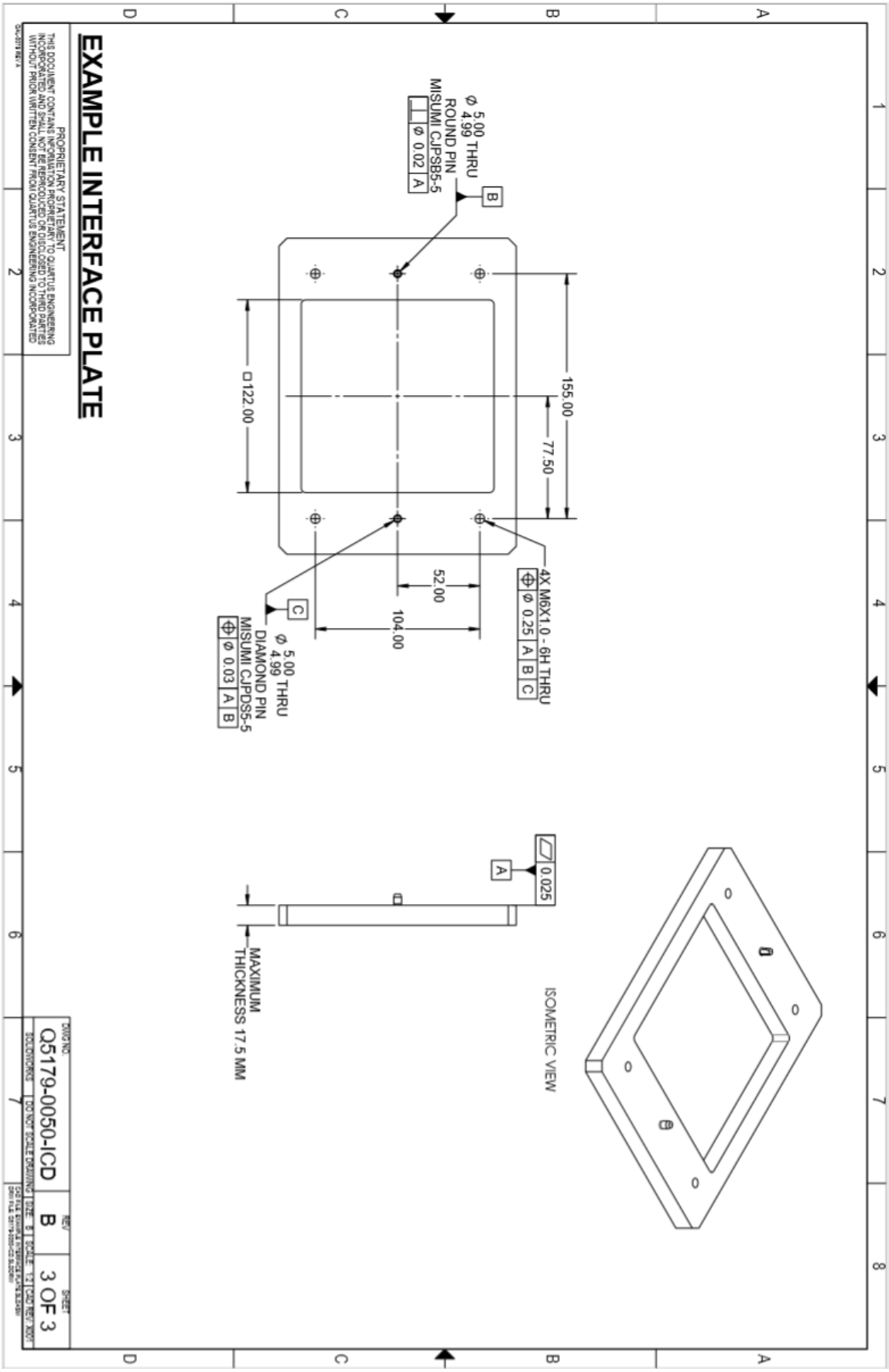
TESSERACT INTERFACE CONTROL DOCUMENT (PAGE 1)



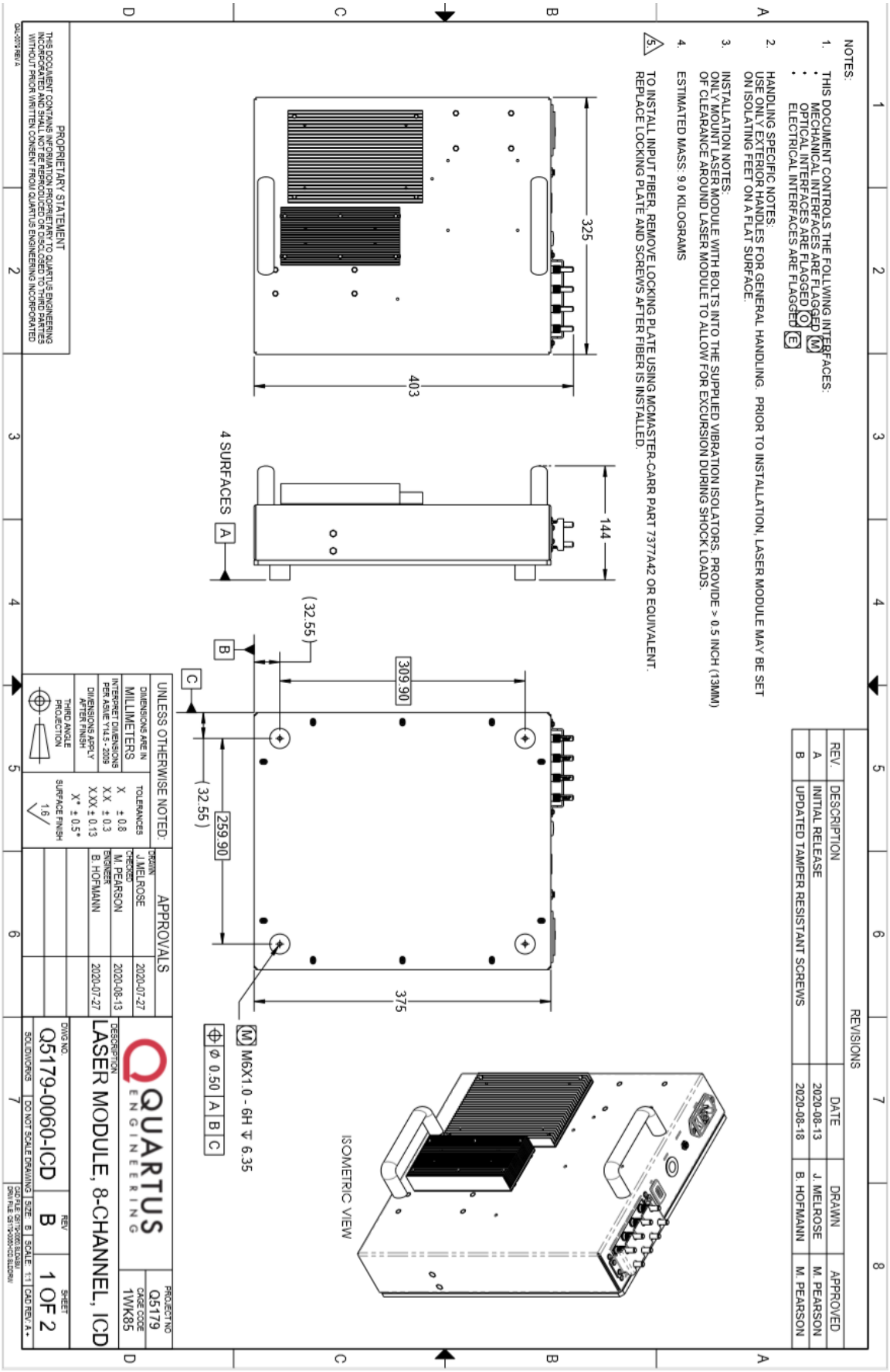
TESSERACT INTERFACE CONTROL DOCUMENT (PAGE 2)



TESSERACT INTERFACE CONTROL DOCUMENT (PAGE 3)



LASER MODULE INTERFACE CONTROL DOCUMENT (PAGE 1)



LASER MODULE INTERFACE CONTROL DOCUMENT (PAGE 2)