Apogee® Elite™
Apogee® 5500
Acclaim 7000™

SERVICE MANUAL

MODULAR

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Apogee® Elite™
Apogee® 5500
Acclaim 7000™

SERVICE MANUAL

(MODULAR) 850-1261-100, Rev. 1

CYNOSURE®
5 Carlisle Road, Westford, MA 01886 USA
Phone: 1-978-256-4200 www.cynosurelaser.com

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Apogee® Elite™
Apogee® 5500
Acclaim 7000™

OPERATOR MANUAL

(Modular) 850-1061-000, Rev. 2

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Glossary of Symbols and Abbreviations

The following international symbols and abbreviations may be used on the Apogee Elite/Apogee 5500/Acclaim 7000 lasers and/or in this manual.

Symbols

	Declaration of Conformity to Medical Device Directive 93/42/EEC CE Mark to Directive 93/465/EEC		Off—power disconnection from mains
	Type B applied part per EN60601-1: 1990		On—power connection to mains
	Attention, consult accompanying documents		Start—initializes connection to mains
	Laser Hazard Warning		Laser Ready Mode
	Dangerous Voltage		Laser Standby Mode
	Non-ionizing Radiation		Foot Switch
	Remote Interlock Connector per EN60601-2-22: 1996		
	Optical Fiber Applicator per EN60601-2-22: 1996	**Other Symbols**	
	Emergency Laser Stop per EN60601-2-22: 1996		Hand Switch

Abbreviations

°C	Degrees Celsius	V	Volts
A	Amperes	DVM	Digital Voltmeter
mA	Milliamp	Hz	Hertz
µA	Microamp	J	Joule
AC	Alternating Current	J/cm²	Joule per square centimeter
cm	Centimeter	kW	Kilowatt
mm	Millimeter	ms	Millisecond
nm	Nanometer	Ω	Ohms
CW	Continuous Wave	mΩ	Milliohms

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About the Lasers

The lasers covered in the operator manual are three solid state lasers used for dermatological applications. They include the Apogee 5500, a high power Alexandrite laser operating at 755 nm; the Acclaim 7000, a Nd: YAG operating at 1064 nm; and the Apogee Elite. The Apogee Elite is a two-in-one laser system that combines the advantages of both the Apogee 5500 and the Acclaim 7000 systems into one versatile laser.

The lasers are used primarily for hair removal and for the treatment of facial and leg telangiectasia, but can also be used for the treatment of pigmented lesions and treatment of sun-damaged skin.

The lasers are designed to effectively couple the laser energy directly to the target while leaving the surrounding tissue unharmed. This principle is known as Selective Photothermolysis (SPT). By careful selection of the wavelength, pulse width, spot size, energy and cooling method, the effectiveness of the laser on the target is maximized, while any heating to the surrounding tissue is minimized. Thermokinetic Selectivity is a corollary of SPT. It uses a laser pulse width that is much longer than the thermal relaxation time of small surrounding structures, yet less than the thermal relaxation time of the large target. This allows the small surrounding structures to remain cool while the larger target heats up to the destruction point.

About the Manual

The *Apogee Elite/Apogee 5500/Acclaim 7000 Operator Manual* provides the following information about the laser:

- Equipment Safety
- Site Preparation
- Laser Operation
- Maintenance
- Customer Support
- Storage and Transport

Although the manual provides useful information on the use and maintenance of the laser, it is not intended to be a complete guide. Cynosure suggests that all health care professionals who plan to use the laser seek further training in its proper use. The custodian of the laser shall take steps to prevent its unauthorized use.

All photography and illustration used in the manual is of the Apogee Elite laser, as all three systems look similar. Unique specifications, performance or product labeling among the lasers is clearly differentiated within the manual.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

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Potential Hazards

As with any equipment, there are potential hazards. Before using the laser, operators should be aware of the following types of hazards: optical, electrical and combustible. This section of the manual describes these potential hazards and suggests precautions. This section also describes safety features designed to minimize potential hazards.

Optical Hazard

The laser emits an intense energy beam of invisible laser light radiation that can cause serious eye damage with direct or even indirect optical contact.

WARNING: Always wear the protective eyewear supplied with the laser system. Failure to wear the appropriate protective eyewear can result in serious eye injury.

Please follow these precautions to avoid optical damage to laser operators, assisting personnel and patients.

- All persons in the room during treatment must wear the protective eyewear recommended by Cynosure. See "System Specifications" starting on page 28.
- Never look directly into the handpiece, fiber or fiber opening, even while wearing protective eyewear.
- Mark treatment rooms with the Laser Warning Signs to avoid unnecessary personnel entering during treatment.
- Limit entry to the treatment room only to personnel who are assisting in treatment and are trained in the use of the equipment.
- Cover windows and other openings in the treatment room to avoid the inadvertent escape of laser light.
- Direct the activated laser only at the intended area of treatment.
- Place one person in charge of the laser system's controls during the treatment.
- Cover reflective objects, such as jewelry or mirrors, which could deflect the laser beam to an area other than the intended treatment area.
- Put the laser into Standby Mode when the laser is not in use. When in Standby Mode, the laser beam cannot be inadvertently activated.
- Ensure that all appropriate staff members are trained to shut off the laser in the case of an emergency.
- Keep the laser start-up key in a safe place outside of the treatment room when the laser is not in use.

Electrical Hazard

The laser system uses potentially lethal electrical components. Do not open the protective panels unless you are trained and authorized to do so.

Hot Water Hazard

The laser uses a hot water system to maintain the laser medium at the proper operating temperature. The water is very hot and could cause scalding. Do not perform any maintenance on the water system while hot. Always let the system cool down before changing the deionizing filter or adding deionized or distilled water.

Laser-Induced Fire Hazard

When the laser beam contacts an exterior surface, that surface can absorb the laser energy. This raises the surface temperature, whether the surface is skin, hair, clothes or any flammable substance. Operators should take the following precautions to prevent a laser-induced fire:

- Use non-flammable substances for uses such as anesthesia, skin preparation, and cleaning or disinfecting instruments.
- Be especially careful with the use of oxygen. Oxygen accelerates both the severity and the extent of a fire.
- Keep a minimum of combustible materials (e.g., alcohol) in the treatment room. If treatment requires the use of gauze, first soak it in water.
- Always keep a small fire extinguisher and water in the treatment room.

Electromagnetic Compatibility Hazards

The Apogee Elite/Apogee 5500/Acclaim 7000 lasers have special precautions regarding electromagnetic compatibility hazards (EMC), and need to be installed and operated according to the EMC information provided in Appendix C, starting on page 55 of this manual.

CAUTION: Portable and mobile radio frequency (RF) communication equipment can affect the Apogee Elite/Apogee 5500/Acclaim 7000 lasers.

CAUTION: The Apogee Elite/Apogee 5500/Acclaim 7000 lasers should not be used adjacent to, or stacked with, other equipment. If the laser must be used adjacent to, or stacked with other equipment, then observe the laser in its configuration to verify that operation is normal.

Laser Safety Features

The laser offers several safety features to prevent its misuse or unintentional activation. All personnel who operate the laser or assist in the operation should be familiar with these safety features.

Key Switch

The Key Switch controls the electrical activation of the laser system. Only those authorized personnel who have access to the key can start the laser system. Keep the laser start key in a secure location to prevent use by unauthorized personnel.

Emergency Laser Stop

The Emergency Laser Stop is a dedicated override switch for immediate shut down of the laser system.

Standby Mode

Standby Mode is designed to prevent unintentional or accidental activation of the laser. The system enters Standby Mode when the operator presses the Standby Key (○).

When the laser is in Standby Mode, the system is on but the operator cannot activate the laser beam without first pressing the Ready Key (⊙).

Delayed Ready Mode

From Standby Mode, press the Ready Key (⊙) to activate the laser. As required by the Center for Devices and Radiological Health of the U.S. Food and Drug Administration and International Standards (IEC601-2-22 and 825-1), there is a 3-second delay from the time the Ready Key (⊙) is pressed until the laser can be activated. This delay, during which the Ready Light blinks, provides time for personnel to prepare before the beginning of treatment.

Automatic Shutdown Feature

When certain faults occur, the laser automatically shuts down and a fault code, message and corrective action is displayed. For a complete list of faults and failure analysis information, see "Troubleshooting," starting on page 43.

Remote Interlock

Cynosure provides a remote interlock that can connect to the doors of the laser room. When the remote interlock is active, the laser automatically shuts down if anyone enters the treatment room.

Audible Tone

Laser emission is indicated by a pulsed tone for the period of the emission.

Laser Warning Signs

Cynosure supplies laser a warning sign with each laser system. We recommend the posting of these sign at all entrances to rooms with an operating laser. Please check the policy of your hospital or clinic.

Locking Casters

The front casters of the laser may be locked into place. On the top of the front casters is a locking lever. To lock the casters, press down on the front of the lever. To release the casters, lift the lever into the original horizontal position.

Device Labels

The Apogee Elite/Apogee 5500/Acclaim 7000 lasers come with a series of required safety labels. Be sure that all personnel are familiar with these labels and their meanings.

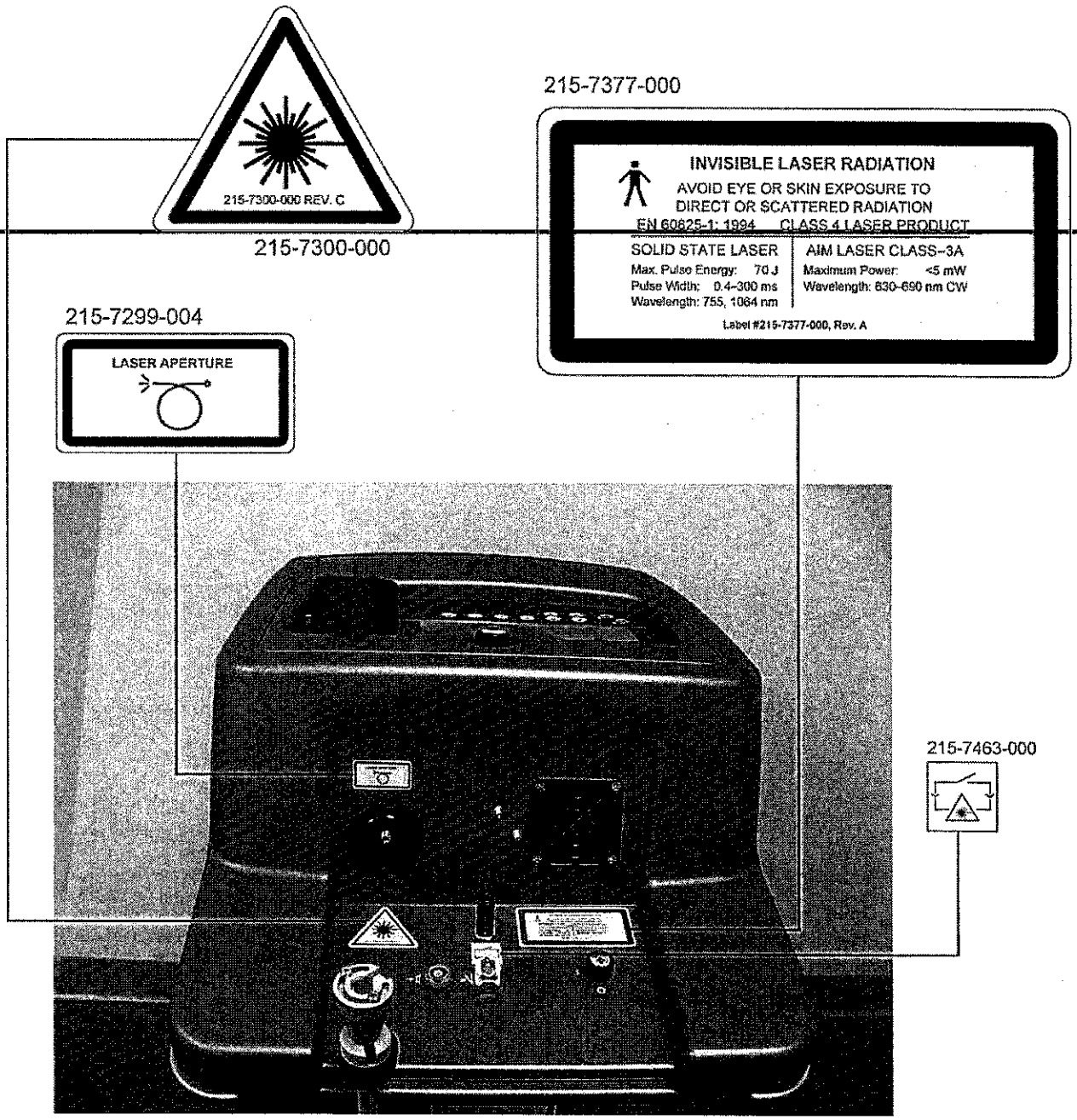

Figure 1A–Device Labels, Upper Rear, Apogee Elite

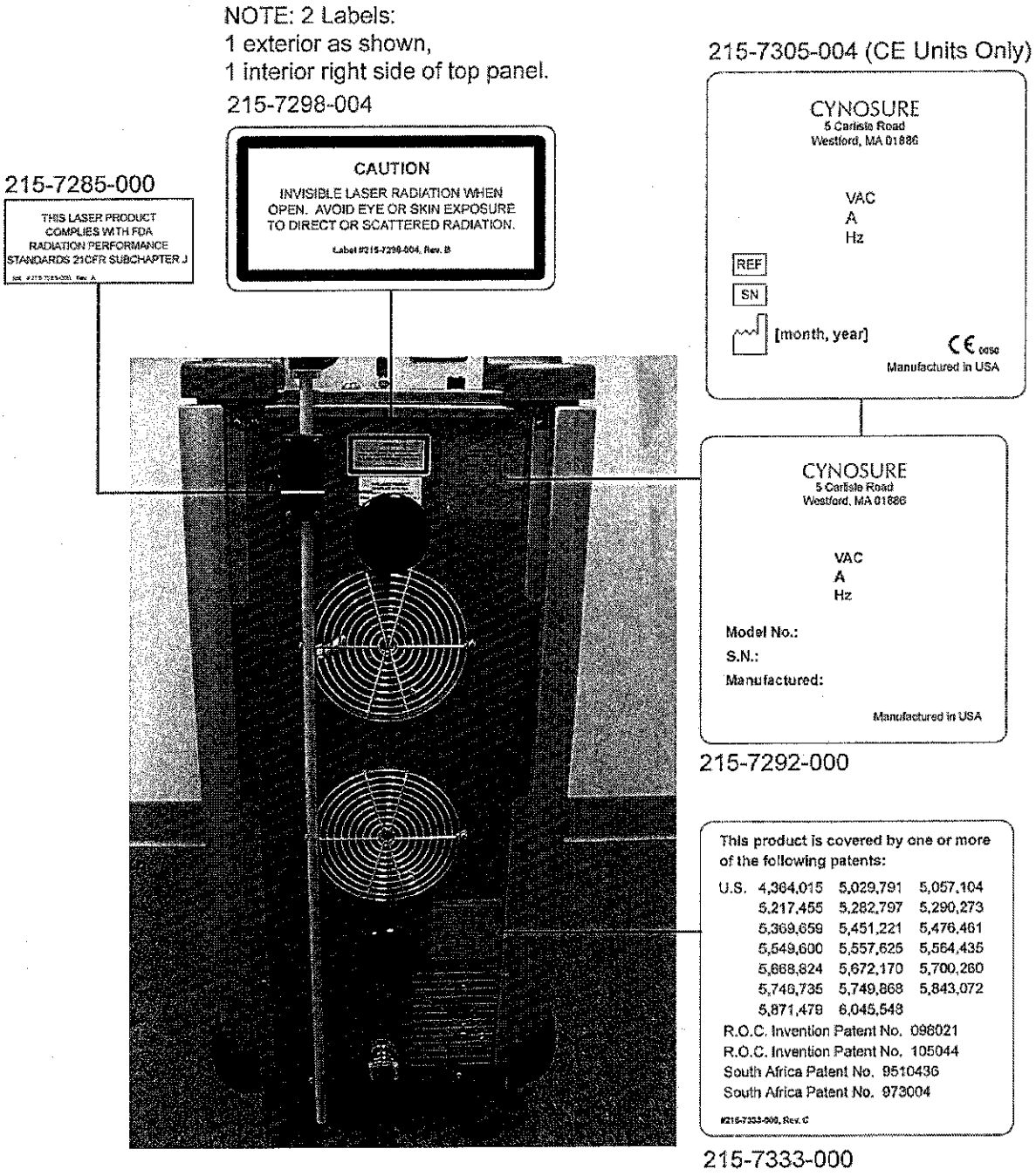

Figure 1B–Device Labels, Lower Rear, Apogee Elite

Section 3 SITE PREPARATION

When preparing the laser site, operators should consider the spatial, electrical, environmental, transportation and storage requirements of the laser unit.

Spatial Requirements

The unit has the following dimensions:

- Height: 41"
- Width: 15"
- Depth: 25"
- Weight: 180 lbs.

Electrical Requirements

Please consider the following electrical requirements before installing the laser unit:

- The AC line power requirements for the laser are:
  200-240 VAC, Single Phase
  30 Amps
  50-60 Hz
- The plug is NEMA L6-30.
- Power receptacles must be within 15 feet of the laser site.
- The power receptacle must be grounded.
- The laser unit should not share a power line with other heavy power-load equipment such as air conditioners or elevators. Ideally, the laser unit should be on a separate power line with a separate circuit breaker.

Environmental Requirements

Follow these environmental requirements to properly maintain the laser system.

CAUTION: Warm air may adversely affect the performance of the cooling unit.

- Most of the heat dissipated by the laser exits to the rear. If the laser is used in conjunction with air-cooling, place the cooling unit away from the rear of the laser. Make sure that any warm air that may deflect from the laser is kept away from the cooling unit as well.
- Keep the air free of corrosive substances, such as salts and acids. These pollutants may damage electrical wiring and optical surfaces.
- Keep dust and hair particles to a minimum. Shave patient's skin in a separate room. Dust and hair particles can cause permanent damage to optical components.
- Keep humidity in the laser room at 20% to 80%, non-condensing.
- Keep the laser room temperature from 50° to 80° F (10° to 27°C).
- Do not place laser unit near heating vents or other sources of temperature variation.

Storage and Transport Requirements

To maintain the laser system properly during storage and transport, follow these requirements.

- To avoid damage to the laser due to freezing coolant, store or transport laser only after the coolant system has been completely drained. See, "Draining the Laser," on page 42 for further information.
- Keep the ambient temperature between 40° and 110° F (4° to 43° C).
- Keep the laser system in a location where the humidity is between 10% and 90%, non-condensing.
- Minimize shock and vibration.
- Do not drop.
- Store the laser system where the air is free of corrosive substances, such as salts or acids.
- Store the laser system where there is a minimum of dust particles.
- Lift only with suitable and appropriate equipment.

This section of the manual gives a general description of the laser and includes specifications of each system.

Main Components

Refer to **Figures 2A, 2B, 2C and 2D** to identify the main components of the laser system.

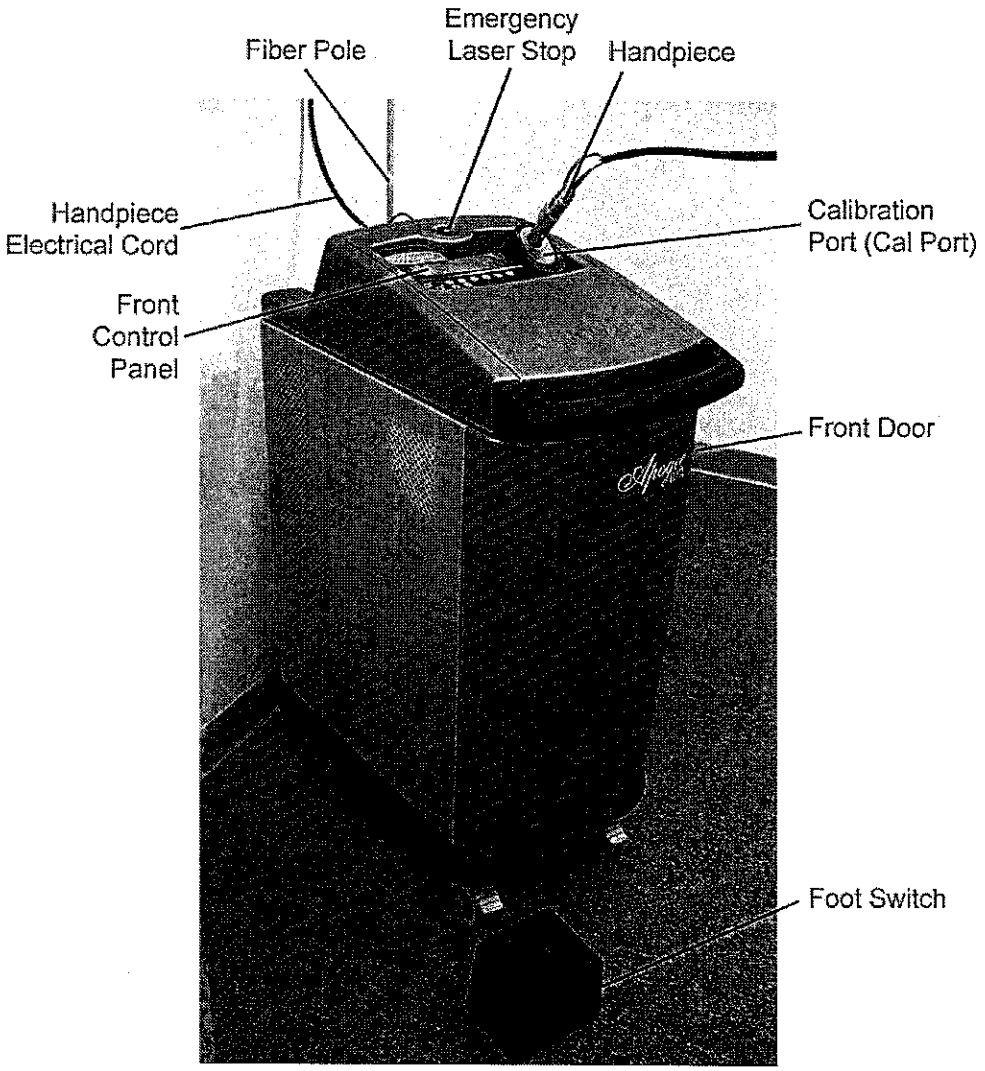

Figure 2A–Main Components, Front View

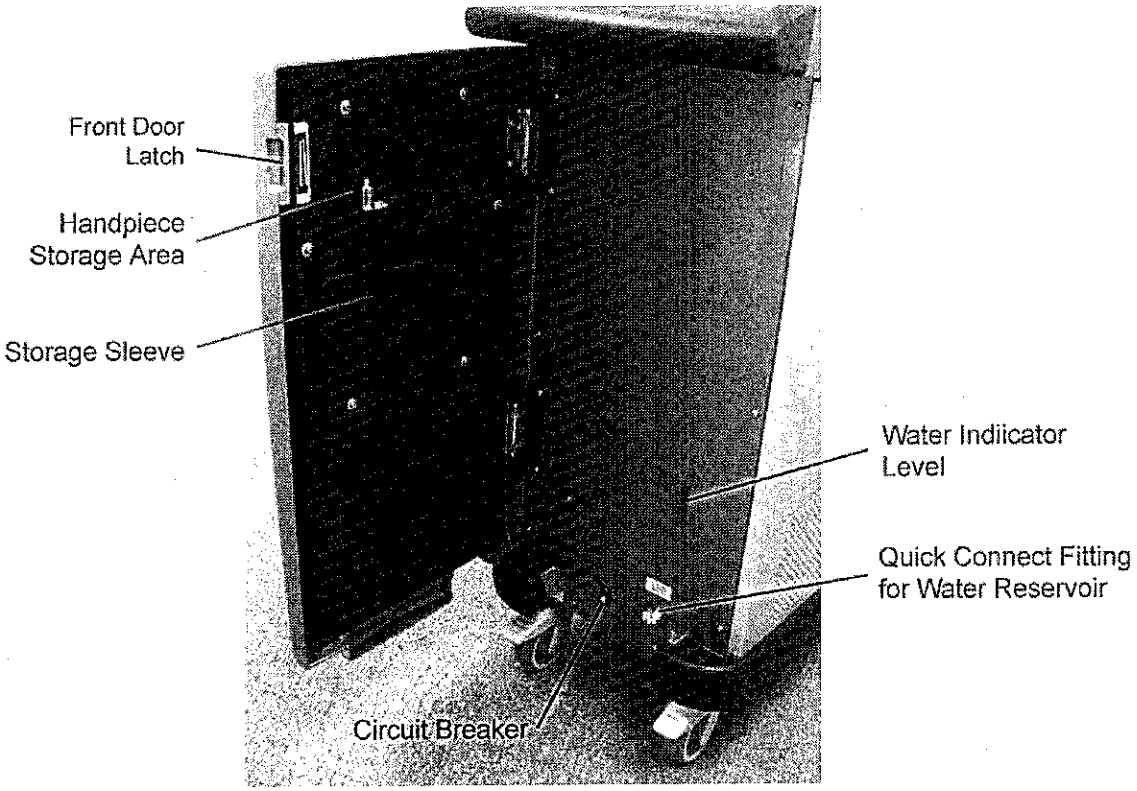

Figure 2B–Main Components, Inside Front Door

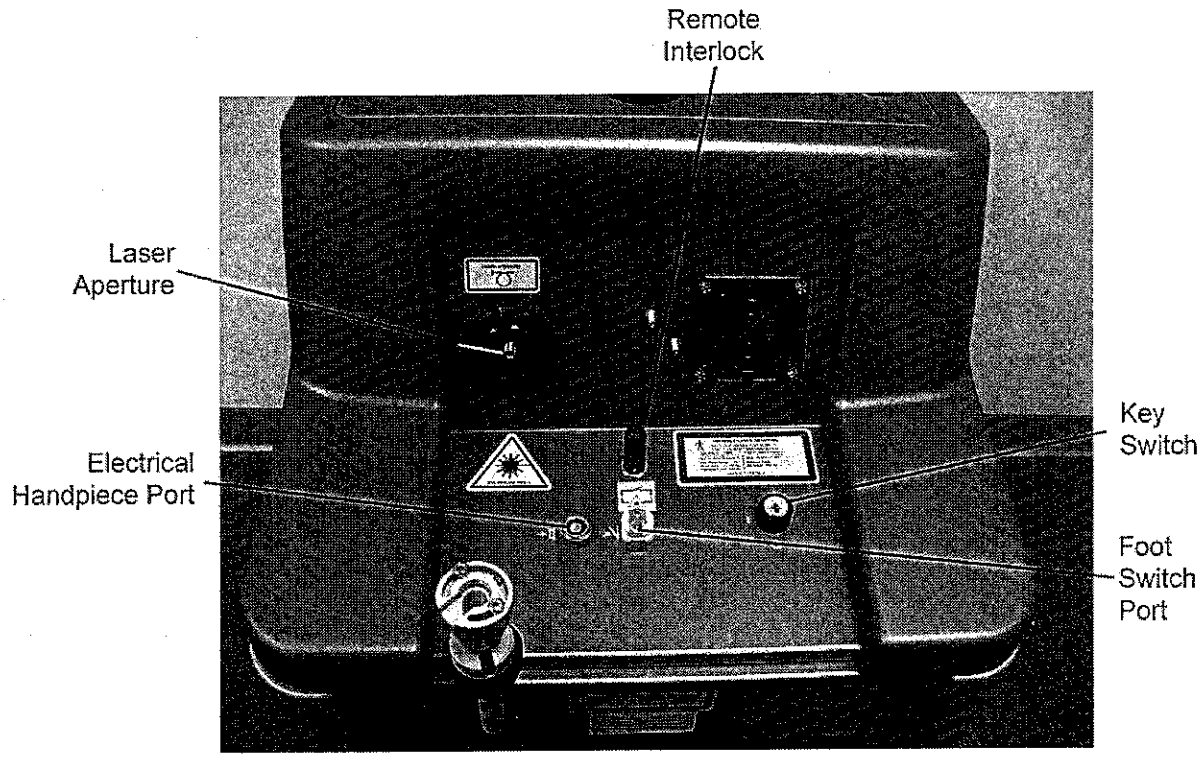

Figure 2C–Main Components, Rear View, Top

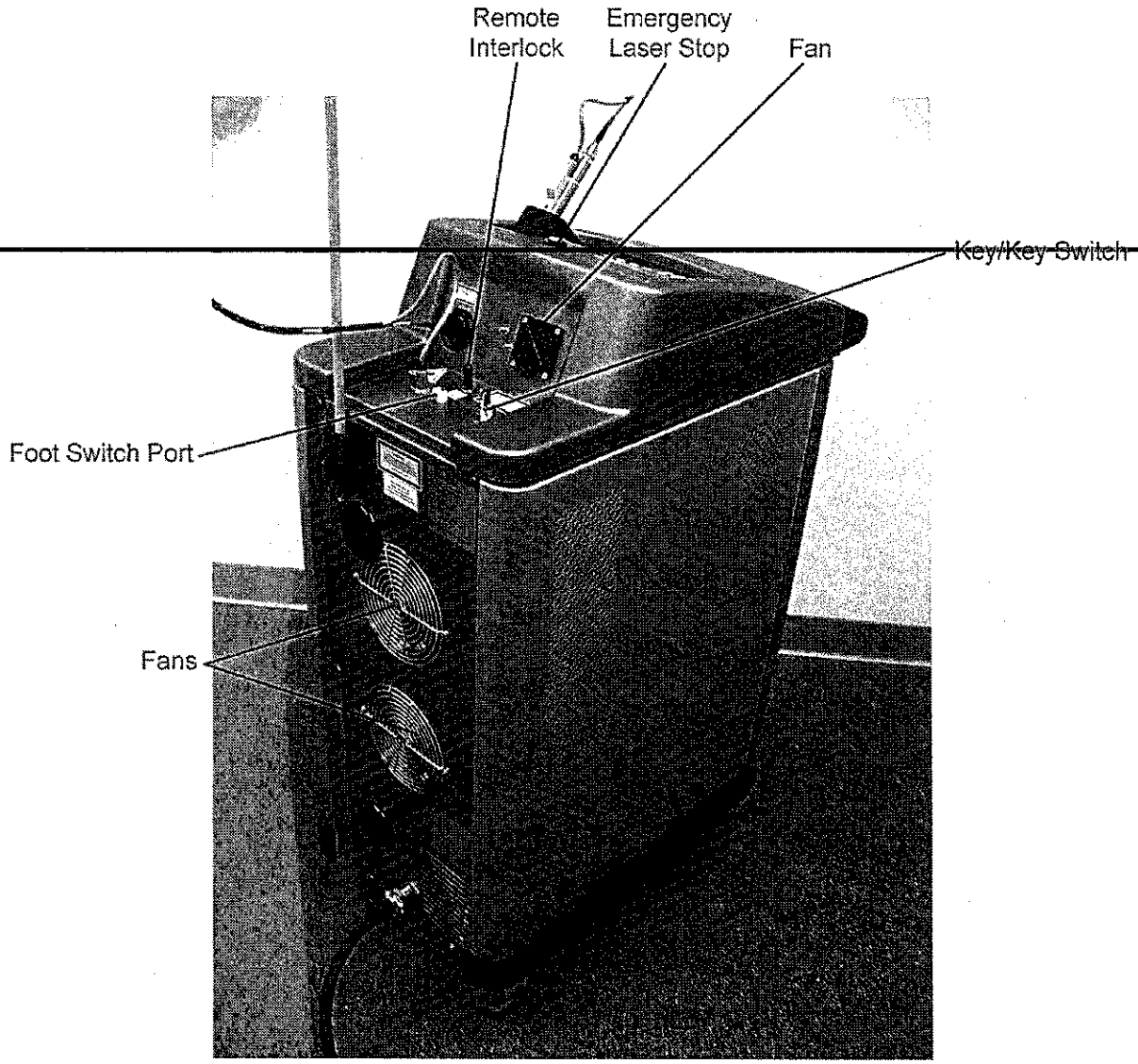

Figure 2D–Main Components, Rear View, Left

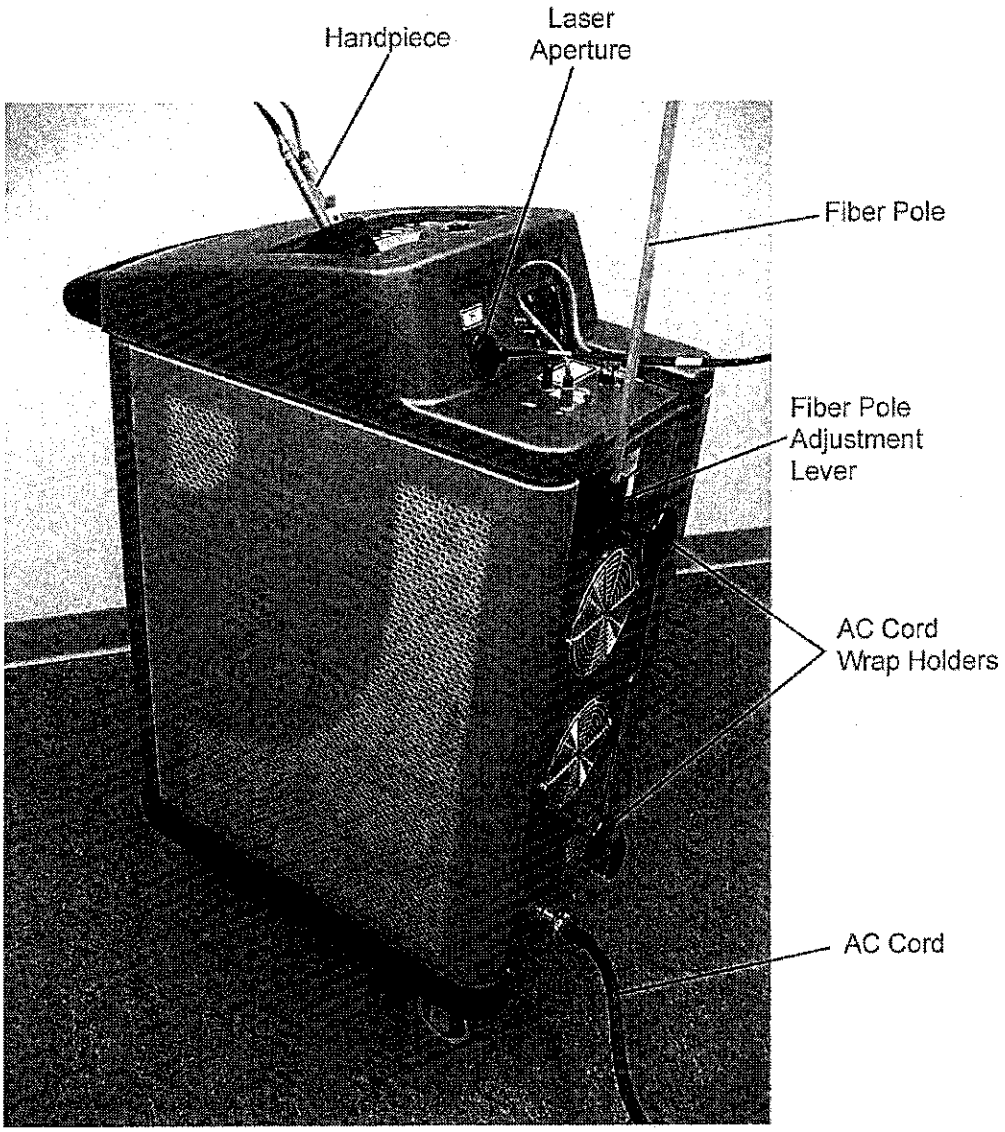

Figure 2E–Main Components, Rear View, Right

Key Switch

The key switch and key, turn the system on and off. There are two positions on the switch: ON (|), and OFF (○). To turn on the laser, insert the key and turn the key switch to the on position. To turn off the laser, turn the key switch to the off position. Always remove the key after use to prevent access by unauthorized users.

Handpieces and Optical Fiber

The delivery system of the laser consists of a fused silica optical fiber that attaches to a handpiece. The optical fiber is 1.5 mm in diameter and 3 meters long. From the laser head, a lens couples the treatment and aiming source into the optical fiber. The optical fiber delivers the laser beam to the handpiece and, thence, to the treatment area.

If the aiming beam is not present at the distal end of the delivery system, its intensity is reduced, or it looks diffused, this indicates a possible problem with the delivery system. Refer to "Troubleshooting," starting on page 43 for more information.

WARNING: There is a potential hazard when inserting, steeply bending, or inadequately tightening the fiber optics. Always follow the recommendations in this manual to avoid damaging the fiber, delivery system and/or potentially causing harm to the patient or operator.

Changing Handpieces

To change handpieces, remove the optical fiber connector to disconnect the fiber from the handpiece, see **Figure 3**. Then disconnect the handpiece electrical cable by pulling it from the handpiece. Connect the new handpiece, and then reconnect the handpiece electrical cable. The laser must be calibrated before initiating treatment with a new handpiece.

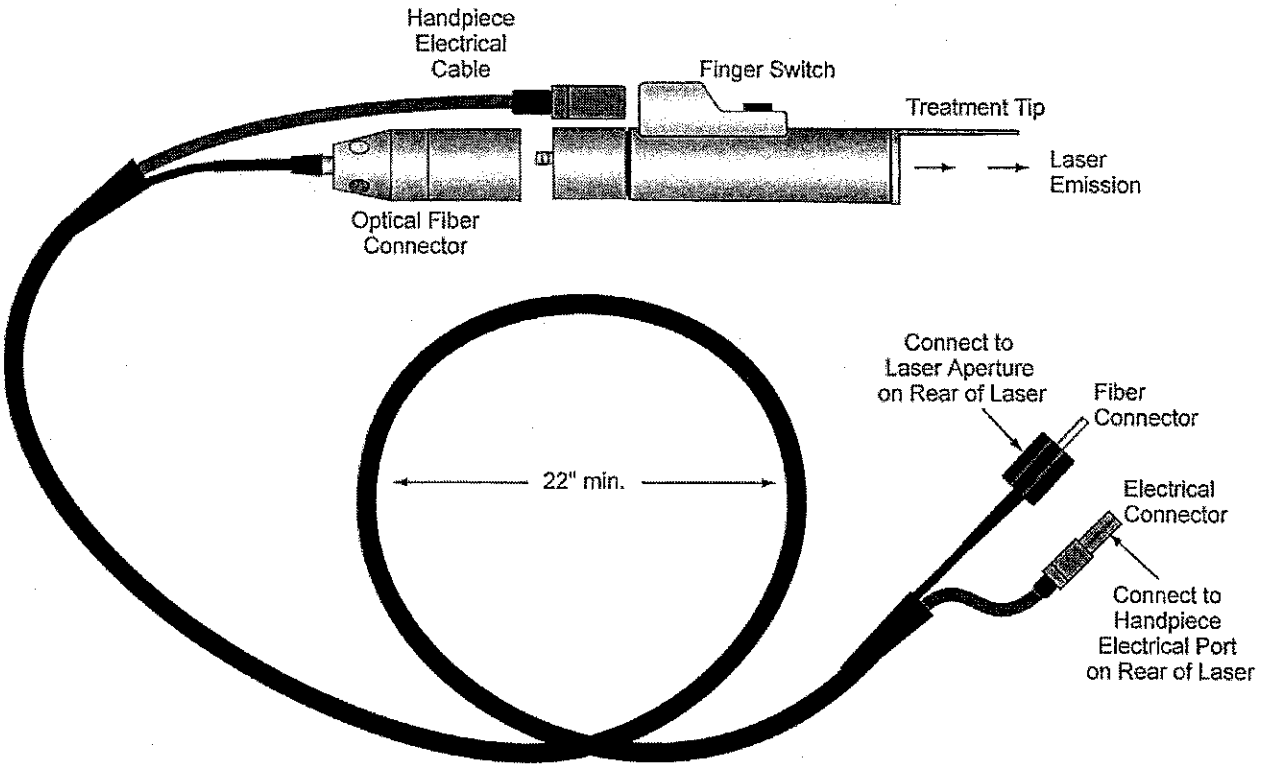

Figure 3–Handpiece

Trigger Switches

When the laser system is in the Ready Mode and the three-second delay has passed, the operator can activate the laser beam by pressing either one of the following switches:

- The Finger Switch, an electrical switch located on the handpiece, as shown in **Figure 3.**
- The Foot Switch, a pneumatic switch that reduces the chance of electrical hazard in a wet environment. To connect the foot switch, insert the foot switch into the footswitch port on the rear of the laser. See **Figure 2C**.

Front Control Panel

The Front Control Panel, see **Figure 4**, contains the controls and displays for operating and monitoring the laser. It is essential that operators understand and use these controls properly.

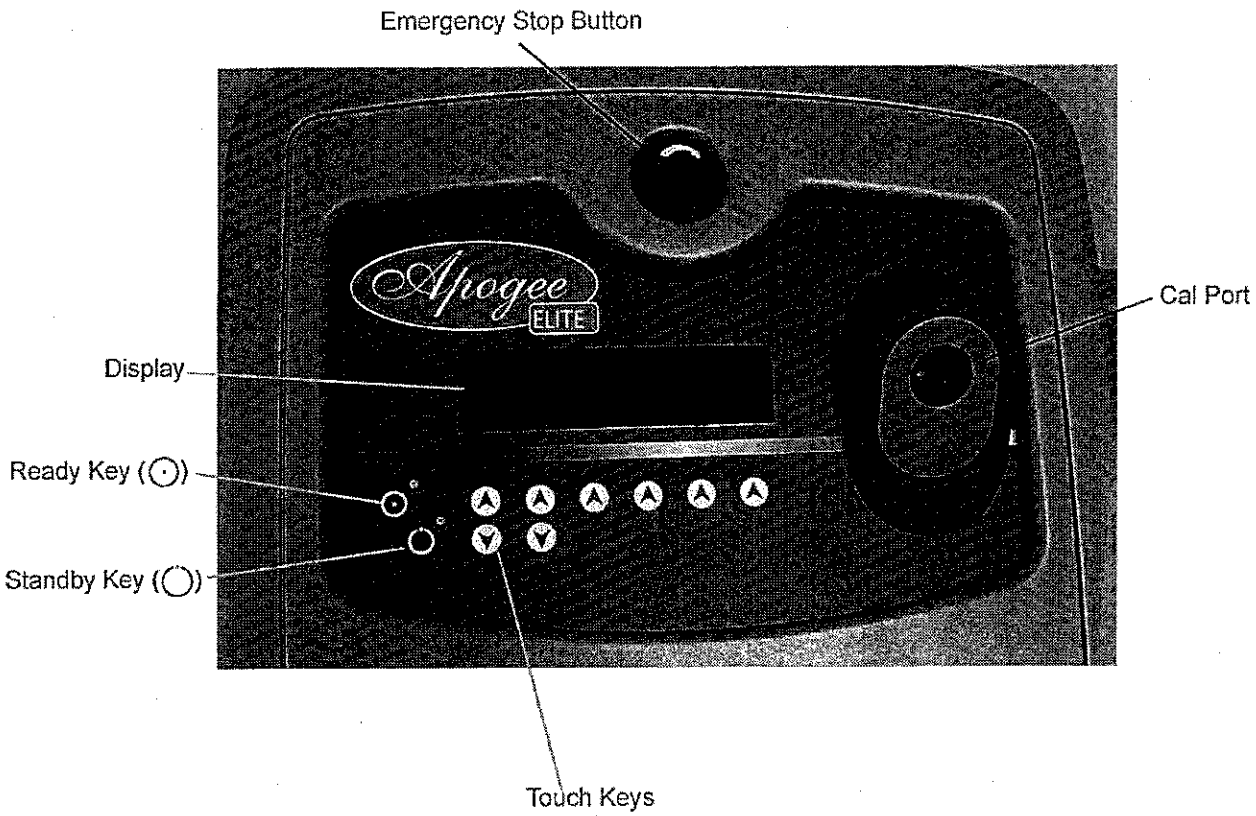

Figure 4–Front Control Panel

Emergency Laser Stop

The Emergency Laser Stop shuts down the system immediately. Press the laser stop only under emergency circumstances. To routinely turn off the laser, use the key switch, see page 20.

When the laser stop is activated, the display remains functional displaying, "Release Laser Stop." To release the laser stop turn the button clockwise, see **Figure 4**.

Cal Port

The Cal Port is where the handpiece (distal end) is placed during calibration. As the handpiece fires laser light into the cal port, a sensor measures the energy of the beam by knowing which handpiece is inserted. The fluence (energy per unit area, J/cm^2) is calculated and shown on the display.

The window in the cal port must be kept clean to ensure proper calibration. Clean the window with a tissue or soft cloth weekly or whenever debris or smudges are present.

WARNING: Failure to keep the cal port window clean may result in incorrect fluence leading to patient injury.

Standby Key

The Standby Key (○) places the system in Standby Mode. When the laser is in Standby Mode an LED next to the key is lit. When the system is in Standby Mode, the laser cannot produce light. See, "Standby Mode," on page 11 for more information.

Ready Key

The Ready Key (⊙) places the system in Ready Mode from Standby Mode only. When the system is in Ready Mode, the LED beside the Ready Key is continuously on and the laser is operational. Activate the laser beam with the foot switch or finger switch (after the 3-second safety delay). When the Ready Light is blinking, it indicates that the laser is not yet ready because of either the 3-second delay, or the internal calibration scheme.

Display

The Display is a LCD screen that displays treatment parameters and other controls.

Touch Keys

The Touch Keys or Up Arrow (⮝) and Down Arrow (⮟) keys allow treatment parameters and controls to be selected or changed.

Main Display Screen

The section details the Main Display Screen functions. Refer to **Figure 5**.

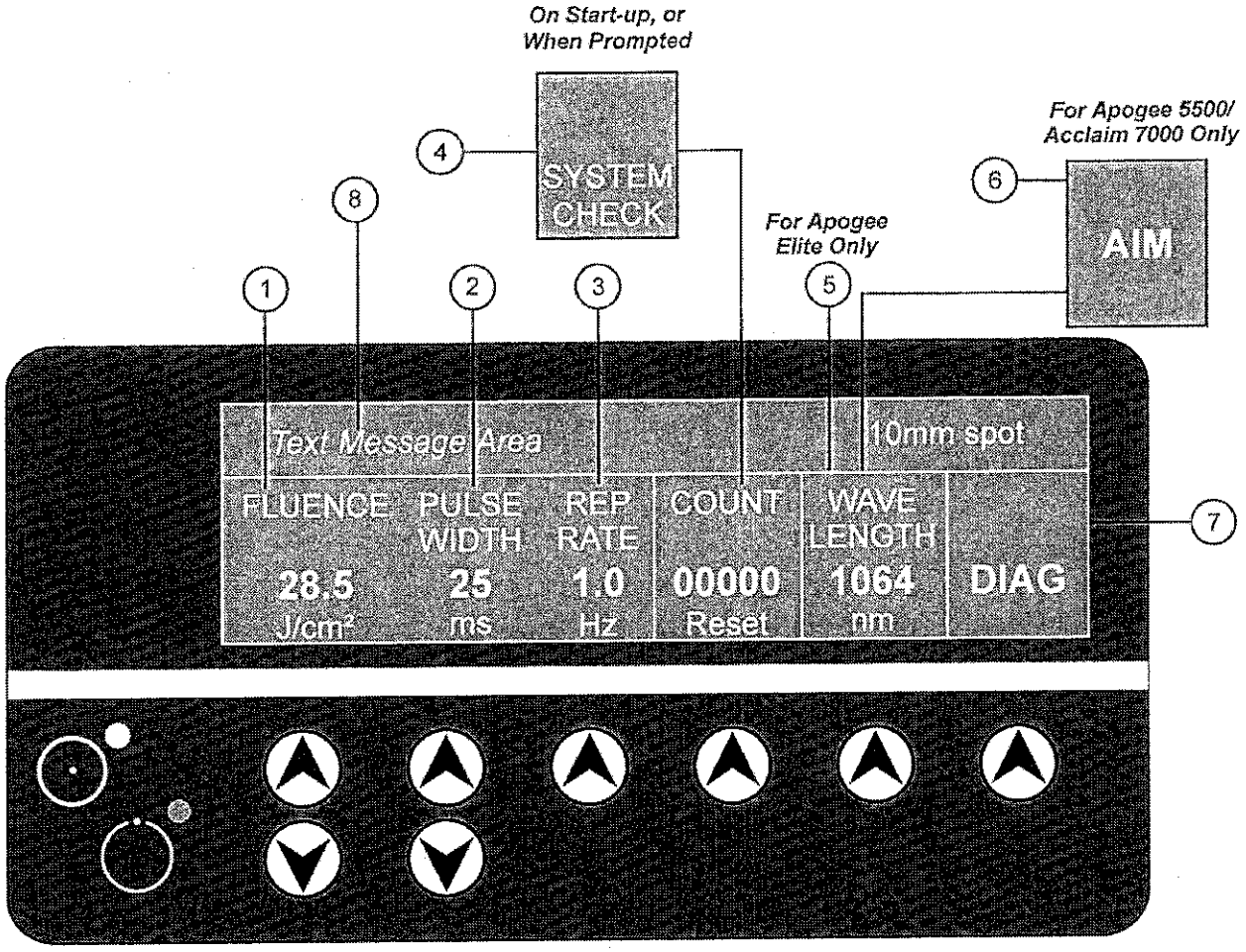

Figure 5–Main Display Screen, Apogee Elite

1–Fluence

The Fluence Display shows the selected fluence from the handpiece. The units are expressed in joules per square centimeter (J/cm^2). Press the (⮝) key to increase the fluence, or press the (⮟) key to decrease the fluence. After the correct fluence is achieved and the system is calibrated, the handpiece can be removed from the cal port.

2–Pulse Width

Pulse Width indicates the period for one laser shot. The pulse width can be set from 0.4 ms up to 300 ms depending on the operating parameters. See, "System Specifications," starting on page 28 for further information. To increase the pulse width, press the (⮝) key. To decrease the pulse width, press the (⮟) key.

3–Rep Rate

Repetition Rate (Rep. Rate) indicates the selected frequency of laser shots. Depending on the laser and spot size, rep rate can be adjusted from 'single' (one shot at a time) to '3 Hz' (three shots per second). See, "System Specifications," starting on page 29 for further information.

Press the (⮝) key directly below the display to toggle through the available rep. rates.

4–Count/System Check

The area of the control panel toggles between two functions: system check and count.

System Check runs a verification of the performance of the laser. This function is necessary at start-up and when required by the system. A text message prompts the operator to initiate a system check. Press the (⮝) key directly below the display to run a system check.

Count displays a count of the treatment pulses as they occur (since the last reset). To reset the count to zero, press the (⮝) key directly below the display.

5–Wavelength

The wavelength display is used to indicate which Apogee Elite laser is in use: 1064-nm YAG laser or 755-nm Alexandrite laser. Press the (⮝) key directly below the display to toggle between laser wavelength selections. Depending on the wavelength selected, the display message will then read:

"Alex 755 Selected, Press any Key," or

"YAG 1064 Selected, Press any Key"

Press any other (⮝) or (⮟) key to confirm your wavelength selection.

NOTE: The wavelength option is for the Apogee Elite only.

6–Aim

Press the (⮝) key directly below the aim display to toggle the Aim Beam off and on.

NOTE: This option is only for Apogee 5500 and Acclaim 7000 lasers only.

7–Diag

The Diag or Diagnostic display provides access to a diagnostic screen. This function is available in Standby mode only. Press the (⮝) key directly below the display to initiate. See "Diagnostic Display Screen," on page 26 for more information on this screen.

8–Text Message Area

The text message area is where helpful information is provided for the user, such as instructions or error messages. The spot size of the handpiece that is connected is also provided.

Diagnostic Display Screen

The diagnostic screen, see **Figure 6**, displays helpful diagnostic information about the status of the laser. Each field on the screen is defined below. To return to the Main Display Screen, Press the (⮝) key directly below "return" on the screen.

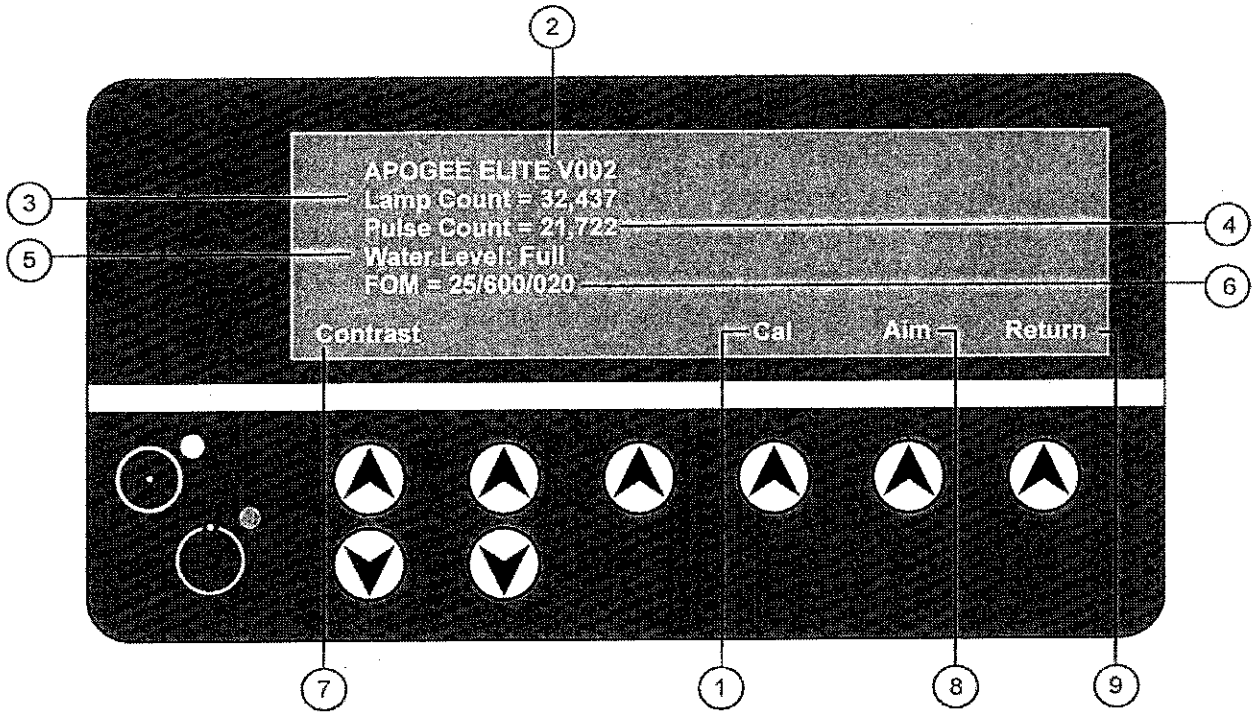

Figure 6–Diagnostic Display Screen

1–Cal

The Cal (calibration) display allows the laser to be calibrated when in Ready mode. Press the (⮝) key directly below 'Cal' to initiate a calibration sequence. Calibration is required only when prompted by the laser display, and takes approximately two minutes to complete. The calibration process checks resonator energy, minimum and maximum fluence and fiber transmission and displays the wavelength.

2–Laser Type/Software Version

The type of laser is displayed, and the version number of the software installed on the unit.

3–Lamp Count

The total number of flashlamp pulses since the last flashlamp change is displayed.

4–Pulse Count

The total number of laser pulses is displayed.

5–Water Level

Water Level supplies information about the coolant level status. If "Full" or "OK" is displayed, then no maintenance is required. If "Add Water" is displayed, then water is required. For more information, see "Adding Water to the Reservoir," on page 42.

6–FOM

This field generates a number used for diagnostic purposes only. It is an indication of the laser's condition at the last selected fluence, voltage and pulse width.

7–Contrast

Contrast allows the screen contrast to be adjusted. Press the (⮝) key or the (⮟) key directly below the contrast display to increase or decrease the contrast.

8–Aim

There are two aim beams, both representing the exact target area within the treatment beam. In Ready Mode, the aim source is red. In all other modes, the aim source is amber. The Aim key allows only the intensity of the red aim beam to be adjusted. Press the (⮝) key directly below "aim" to adjust the beam intensity.

9–Return

Press the (⮝) directly below "return" to exit the diagnostic display and return to the main display.

System Specifications

General Specifications

Specification	Apogee 5500	Acclaim 7000	Apogee Elite
Type (Flashlamp-excited solid state):	Alexandrite laser	Nd:YAG laser	Alexandrite laser, and Nd:YAG laser
Wavelength:	755 nm	1064 nm	755 nm 1064 nm
Method of Optical Output:	Fused silica optical fiber		
Cooling Method:	Water, internally circulated with heat exchanger to air		
Protective Safety Eyewear (min):	> 5.9 O.D. at 755 nm	> 5.8 O.D. at 1064 nm	> 5.9 O.D. at 755 nm > 5.8 O.D. at 1064 nm
Nominal Ocular Hazard Distance (NOHD):	100 meters		
Electrical Power:	200-240 VAC		
	4.5 kVA		
	50/60 Hz		
	Single phase		
Electrical Service Requirement:	30 Amp dedicated outlet		
Aiming Beam Source:	LED/Diode Laser		
Wavelength:	550 nm (amber)/ 633 nm (red)		
Max. Delivered Output Power:	< 5.0 mW		

Handpiece Characteristics

Handpiece Type	*Color*	*Spot Size:*	*Beam Divergence:*
3-mm	Green	3 mm ± 0.5 mm	1/2 angle, 1.9°
5-mm	Black	5 mm ± 0.5 mm	1/2 angle, 2.2°
7-mm	Clear	7 mm ± 0.5 mm	1/2 angle, 2.1°
10-mm	Gold	10 mm ± 0.5 mm	1/2 angle, 2.1°
12-mm	Violet	12 mm ± 1.0 mm	1/2 angle, 2.6°
15-mm	Red	15 mm ± 2.0 mm	1/2 angle, 2.2°

Apogee 5500 Fluence Specifications

Pulse Characteristics (Operator Controlled)				
Handpiece Type	*Rep. Rate*	*Min. Fluence*	*Max. Fluence*	*Pulse Width (ms)*
5.0 mm	1.0 Hz	15 J/cm²	25 J/cm²	0.5
	1.5 Hz	15 J/cm²	25 J/cm²	0.5
	2.0 Hz	15 J/cm²	25 J/cm²	0.5
	3.0 Hz	15 J/cm²	25 J/cm²	0.5
	1.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
10.0 mm	1.0 Hz	7 J/cm²	50 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	40 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
12.0 mm	1.0 Hz	7 J/cm²	35 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	30 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
15.0 mm	1.0 Hz	7 J/cm²	25 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	20 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300

Apogee Elite (Alexandrite Laser) Fluence Specifications

Pulse Characteristics (Operator Controlled)				
Handpiece Type	*Rep. Rate*	*Min. Fluence*	*Max. Fluence*	*Pulse Width (ms)*
3.0 mm	1.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
5.0 mm	1.0 Hz	15 J/cm²	25 J/cm²	0.5
	1.5 Hz	15 J/cm²	25 J/cm²	0.5
	2.0 Hz	15 J/cm²	25 J/cm²	0.5
	3.0 Hz	15 J/cm²	25 J/cm²	0.5
	1.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	15 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
7.0 mm	1.0 Hz	10 J/cm²	100 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	10 J/cm²	85 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	10 J/cm²	70 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
10.0 mm	1.0 Hz	7 J/cm²	50 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	40 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
12.0 mm	1.0 Hz	7 J/cm²	35 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	30 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
15.0 mm	1.0 Hz	7 J/cm²	25 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	7 J/cm²	20 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300

Apogee Elite (Nd: YAG Laser)/Acclaim 7000 Fluence Specifications

Pulse Characteristics (Operator Controlled)				
Handpiece Type	*Rep. Rate*	*Min. Fluence*	*Max. Fluence*	*Pulse Width (ms)*
3.0 mm	1.0 Hz	50 J/cm²	300 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	50 J/cm²	300 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	50 J/cm²	300 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
5.0 mm	1.0 Hz	10 J/cm²	25 J/cm²	0.4
	1.5 Hz	10 J/cm²	25 J/cm²	0.4
	2.0 Hz	10 J/cm²	25 J/cm²	0.4
	5.0 Hz	10 J/cm²	25 J/cm²	0.4
	1.0 Hz	15 J/cm²	240 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	240 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	15 J/cm²	150 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
7.0 mm	1.0 Hz	10 J/cm²	17 J/cm²	0.4
	1.5 Hz	10 J/cm²	17 J/cm²	0.4
	2.0 Hz	10 J/cm²	17 J/cm²	0.4
	5.0 Hz	10 J/cm²	17 J/cm²	0.4
	1.0 Hz	15 J/cm²	160 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	120 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	2.0 Hz	15 J/cm²	75 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
10.0 mm	1.0 Hz	15 J/cm²	80 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	60 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
12.0 mm	1.0 Hz	15 J/cm²	50 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	40 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
15.0 mm	1.0 Hz	15 J/cm²	35 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300
	1.5 Hz	15 J/cm²	25 J/cm²	5, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300

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Section 5 LASER OPERATION

This section of the manual explains the basic operation of the laser including instructions on starting and shutting down the laser, running a system check, laser calibration, setting treatment parameters and using the laser.

Laser Start-Up

WARNING: Always wear the protective eyewear supplied with the laser system. Failure to wear the appropriate protective eyewear can result in serious eye injury.

WARNING: Failure to keep the cal port window clean may result in incorrect energy leading to patient injury.

1. To start the laser, insert the key into the key switch and turn it to ON (|).

   NOTE: There is a warm-up of approximately five minutes for the Apogee 5500 and the Apogee Elite Alexandrite lasers. The Acclaim 7000 and the Apogee Elite Nd: YAG lasers do not require any time to warm up.
2. The front panel display comes on and the laser system runs a self-test (interlock test).
3. If the self-test is successful (all interlock conditions are met), follow the prompts in the test message area to run a system check. See page 34 for more information.

   Otherwise, if a faults occurs refer to, "Troubleshooting," starting on page 43 for information on correcting the problem.

Laser Shutdown

1. To shut down the laser, press the Standby Key (○), to place the laser in Standby Mode.
2. Turn the key switch to OFF (○).

   IMPORTANT: At any time, press the emergency laser stop to immediately shut down the laser
3. Remove the key, and then safeguard it to prevent access by unauthorized users.

System Check

After the laser is warmed up and all interlock conditions are met, the display will prompt the user to run a "system check." The system check verifies the performance of the laser.

1. Make sure that the handpiece is in the cal port.
2. As prompted by the laser, press the Ready Key (⊙). The Ready LED will begin blinking.
3. As prompted by the laser, press the (⮝) key directly below "System Check" and the laser will begin firing. **NOTE:** No laser radiation will escape the delivery system—it is only verifying the laser performance. The laser firing sequence lasts a few seconds. Once the system check is complete, the Ready LED will stop blinking and remain lit.
4. If the system check verifies the laser is working properly, treatment parameters can be set, otherwise the laser must be calibrated, see "Laser Calibration," on page 35."

Setting Treatment Parameters

1. Select desired wavelength, fluence, and pulse width/pulse rate combination. The overall adjustment range is determined by the handpiece and pulse rate selected, see "System Specifications," starting on page 28.
2. Press the Standby Key (○). The laser is now ready to be used for treatment.
3. If treatment parameters need to changed later, return to the main display and make any necessary adjustments. The system will return to operation: 1) after five seconds without a change or, 2) by pressing the Ready Key (⊙).

   NOTE: The system initiates a test firing sequence prior to returning to Ready Mode.

Laser Operation

1. Press the Ready Key (⊙) to place the laser in Ready Mode. **NOTE:** In Ready Mode, no laser light is generated until the finger switch or foot switch is depressed.
2. Remove the handpiece from the cal port. Move the handpiece to the treatment site, placing the handpiece tip to the treatment area.
3. Press either the finger switch or the foot switch to deliver desired laser pulses. After each laser pulse, the counter increments displaying treatment pulses.

   WARNING: If the foot switch or handpiece switch malfunctions and remains on unintentionally while the laser is firing, quickly aim the handpiece at a wet sponge to absorb the laser energy. Press the Emergency Laser Stop immediately.
4. To check energy during treatment, remove the treatment tip, and then place the handpiece into the cal port. Press the foot switch to verify fluence. In accordance with federal regulations, energy is maintained within a narrow range.

Laser Calibration

IMPORTANT: Initiate a calibration only when prompted by a message on the display.

The window in the cal port must be kept clean to ensure proper calibration. Clean the window with a tissue or soft cloth weekly or whenever debris or smudges are present.

1. Press the (⮝) key directly below "Diag" to enter the diagnostic display.
2. Press the (⮝) key directly below 'Cal' to initiate a calibration. The calibration will consist of a sequence of laser firing that will last for several minutes.
3. During this calibration sequence, laser performance will be confirmed and recorded into the system memory.

Energy Regulation During Treatment

If during treatment, the laser power source increases or decreases by more than 20% of the calibrated energy output, an energy "Out of Range" fault occurs, and is displayed on the Main Display Screen. This fault causes the laser to exit Ready Mode and the Ready LED to turn off. To activate the laser again and begin treatment, follow the steps below.

1. Press the Standby Key (○), and then press the Ready Key (⊙) to return to Ready Mode. The Ready LED turns on and the Standby LED turns off.
2. Place the handpiece into the cal port, and then fire the laser until "Fluence Verified," appears on the display. If required, an automatic recalibration will occur.
3. The laser will return to the selected energy output level, and then treatment can continue.

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The section covers training requirements, indications, contraindications, possible adverse effects, patient selection and treatment recommendations.

Laser Operator Training Requirements

This manual is not intended to be a complete guide to laser use. Cynosure recommends that all qualified personnel who operate the laser system first seek training that includes, but is not limited to, the following aspects of laser operation:

- Basic Laser Physics
- Laser Safety
- Soft Tissue Interaction
- Laser Operating Procedures
- Laser Set-up Procedures
- Potential Hazards
- Hands-on Experience

Indications, Contraindications and Adverse Effects

Indications

The Apogee Elite, Apogee 5500 and Acclaim 7000 lasers are indicated for hair removal, leg and facial veins, vascular lesions, pigmented lesions, non-ablative skin treatment and wrinkle reduction.

Contraindications

Therapy using the Apogee Elite, Apogee 5500 and Acclaim 7000 lasers is contraindicated for those patients who:

- are hypersensitive to light in the near infrared wavelength region,
- take medication which is known to increase sensitivity to sunlight,
- take anticoagulants,
- have seizure disorders triggered by light,
- are pregnant

Avoid treating sun-damaged skin with the 755-nm wavelength (Alexandrite laser of the Apogee Elite/Apogee 5500 systems).

Adverse Effects

Adverse effects such as blistering, hypopigmentation or hyperpigmentation may result from the use of excessive energy levels.

WARNING: Subcutaneous injection of lidocaine or other local anesthetic prior to laser treatment with the laser may increase the incidence of adverse effects, such as burns, erythema and blistering.

WARNING: To reduce the incidence of adverse effects, such as burns, erythema and blistering, do not treat sun-exposed areas of skin with the 755-nm wavelength (Alexandrite laser of the Apogee Elite/Apogee 5500 systems).

Pretreatment Recommendations

At the time of the initial visit, the physician should determine the suitability of the laser treatment, inform patients about the treatment, and take photographs of the target site.

Determine Suitability

In determining suitability, physicians should consider the following factors for each individual case:

- Patient's age,
- Patient's skin type,
- Family history of the patient,
- Current medications,
- Reason patient is seeking treatment,
- Patient's expectations,

Inform Patient About the Treatment

After determining suitability, the physician should inform the patient of the following:

- The expected outcome of the treatment versus other possible outcomes.
- The probable number of treatments needed to achieve the desired outcome.
- Possible side effects resulting from laser treatment.
- The gradual disappearance of hair.

Photographs

It is helpful to have photographs of the pretreatment area to assess precisely the success and progression of the treatment.

Treatment Recommendations

The operator should be able to determine the appropriate energy level of the laser, number of treatment sessions, size of treatment area at each session, and when no further treatment is warranted. At the time of treatment, the laser operator should also take precautions to prevent fire, see "Laser-Induced Fire Hazard," page 10.

Minimizing Adverse Effects

Adverse effects such as erythema, blistering, burns and scarring may be reduced by air cooling or coolant gel. Prior to treatment, remove all make up, lotions or creams from the area to be treated. Apply cooled, clear gel to freshly prepared clean areas.

Setting Energy Level

Depending on the patient's skin color, different energy levels are needed. Generating test spots prior to treatment is recommended.

Number and Length of Treatment Sessions

The number and length of treatment sessions depends on the size of the treatment area, the success rate of the treatment, and the patient's tolerance of the treatment.

Determining End of Treatment

The physician should determine the end of treatment by the complete success of treatment, non-compliance on the part of the patient, or adverse effects of the treatment.

Posttreatment Recommendations

After each treatment session, physicians should advise their patients on the proper care of the treated area.

- Wash the treatment area gently with soap and water. Do not soak.
- Do not shave the treated area if crusting is evident.
- Avoid contact sports or any other activity that could cause bruising of the treated area.

This section of the manual discusses maintenance practices, such as cleaning and disinfecting equipment. The section also provides a troubleshooting chart with indicator codes and a list of laser accessories.

Installing the Optical Fiber

Refer to **Figure 3** for an illustration of the fiber assembly and handpiece.

1. Inspect the fiber ends to verify that they are clean and free of all dust.
2. Screw the fiber connector into the laser aperture on the rear of the laser. See **Figure 2C** for laser aperture location.
3. Firmly seat the electrical connector into the electrical handpiece port on the rear of the laser. See **Figure 2C** for the location of electrical handpiece port.
4. Attach the optical fiber connector to the handpiece.
5. Connect the handpiece electrical cable to the handpiece.
6. Open the latch on the fiber pole holder. Place the place the fiber/electrical cable inside, and then close the latch. If the fiber pole needs to be raised of lowered, use the fiber pole adjustment level on the rear of the laser.
7. Verify that all connections are tight.
8. Place the handpiece into the handpiece holder.

Cleaning and Disinfecting Equipment

Cynosure suggests that operators periodically clean and disinfect the exterior of the laser system and the optical fiber. Always turn off the system before cleaning. The handpiece and tip should be cleaned and disinfected after each treatment session in the following manner:

1. Clean the exterior of the laser system with a mild soap and water.
2. When necessary, disinfect the exterior parts of the equipment with a hospital-grade disinfectant.
3. Use a soft cloth for both cleaning and disinfecting.
4. Be careful not to contaminate the optics with soap or disinfectant.
5. Disinfect the handpiece by wiping the exterior surfaces, especially the tip, with hospital-grade disinfectant. Be careful not to allow the disinfectant to have contact with the internal optics or seep into the finger switch.
6. Disinfect the fiber by soaking in 70% (minimum) isopropyl alcohol. Cap the end connectors, and keep them out of the alcohol as much as possible.

Adding Water to the Reservoir

During normal operation, fill the reservoir when "ADD WATER" is indicated on the laser's Front Panel Display. Water level status can be checked at any time by accessing the Diagnostic Display Screen from Standby Mode. **NOTE:** The "ADD WATER" fault will not occur in Ready Mode.

WARNING: The water is very hot and could cause scalding. Do not perform any maintenance on the water system while it remains hot. Always let the system cool down before adding deionized or distilled water.

1. After a cool down period, turn the laser ON (|) and place in the Standby mode. Press the (⏏) key directly below the Diag Display to access the Diagnostic Display Screen.
2. Connect the filler tube and funnel assembly to the quick connect fitting located inside the front door, see **Figure 2B.**
3. Fill the reservoir with distilled or de-ionized water until the water level reads "FULL."

   CAUTION: Use distilled or de-ionized water only when filling the reservoir; tap water can damage the system.
4. Remove the filler tube and funnel assembly.
5. To resume laser operation, press the (⏏) key directly below "RETURN" on the display.

Draining the Laser

Before the laser is transported or stored, the coolant system must be completely drained to prevent any possible damage to the laser resonator or the coolant system. Drain the laser as follows.

1. Place a suitable drain pan underneath the laser.
2. Connect the Filler Tube and Funnel Assembly to the quick connect fitting located on the heat exchanger under the laser chassis.
3. Allow the laser to completely drain.
4. Add a 16 oz bottle of 70% isopropyl alcohol to the reservoir.
5. Turn on the laser to allow the water pump to circulate the alcohol throughout the system.
6. After one minute of operation, turn off the laser. Drain the laser completely.

Troubleshooting

Faults

The user may encounter faults while operating the laser system. When a fault occurs a fault code appears on the display followed by a brief text message. There are two types of faults: 1) errors, or 2) warnings.

Errors faults are critical and will cause the laser to stop operating. These faults codes begin with the prefix 'E' meaning error. Some of these errors require that you contact the Cynosure Service Department.

Warnings are faults that indicate an improper laser state or operator error. These fault codes begin with the prefix 'W' meaning warning. For example, an attempt to fire the laser without a fiber present causes a warning fault to occur. The operator can usually correct these faults.

All faults codes and messages are listed in the following table, along with the probable cause and corrective action if applicable.

Fault Code Table

Fault Code and Text Message	Probable Cause/Corrective Action
E01: Water Flow Fault Cycle Power	Broken pump or blown fuse—needs service.
E02: Open Shutter Fault	Safety shutter stuck open—do not use laser until serviced.
E03: Closed Shutter Fault	Safety shutter stuck closed—do not use laser until serviced.
E04: Fuse Open Call Service	Cap bank fuse blown or shorted dump circuit—needs service.
E05: Check Sum Error Call Service	Computer memory error—needs service.
E06: IGBT Module Short	IGBT shorted—needs service.
E07: IGBT Module Fault	IGBT overload sensed—restart laser to continue.
E08: Heater Fault Call Service	Open thermostat, heater, or blown heater fuse—needs service.
E09: Coolant Sensor Fault Call Service	Open thermistor or unplugged—needs service.
E10: No High voltage	Cap bank or HVPS wire shorted—needs service.
E11: Open Shutter Fault YAG	YAG shutter stuck open—do not use laser until serviced.
E12: Closed Shutter Fault YAG	YAG shutter stuck closed—do not use laser until serviced.
E13: No Simmer	Broken lamp or blown fuse—needs service.
E14: HVPS Fault	HVPS overtemp or disconnected—restart laser.
E15: Dump Fault; Call Service	Fuse fault at power up—needs service.
E16: Dump Fault; Call Service	Dump always on—needs service.
E17: Dump Fault; Call Service	Dump not working—needs service.
E18: Flow Error; Call Service	Flow switch not responding—needs service.
E21: Alex Meter Error Call Service	Wrong res port or cal port calibration—needs service.

Fault Code Table (Cont.)

Fault Code and Text Message	Probable Cause/Corrective Action
E22: Alex Cal Failed Call Service	Resonator energy too low, or YAG fired—needs service.
E23: Low Trans. Replace Fiber/Handpiece	Damaged fiber, handpiece or focus lens—needs replacement.
E24: YAG Meter Error Call Service	Wrong res port or cal port calibration—needs service.
E25: YAG Cal Failed Call Service	Resonator energy too low, or Alex fired—needs service.
E26: No Energy check Fiber/Handpiece	Broken fiber or unusable focus lens—needs replacement.
W50: Interlock Open Check Interlock	Install remote interlock connector or if using interlock, close room door.
W51: No Fiber Connect Fiber	Install delivery fiber and handpiece.
W53: Low Water Add Water	Add water to reservoir
W54: HVPS EOC Warning Press Standby	High fluence use on 120 VAC demonstration mode—press the Standby Key (○) to continue using laser.
W56: Invalid Handpiece Change Handpiece	Old handpiece from another laser or handpiece not allowed for wavelength selected—Install correct handpiece.
W57: No Handpiece Install Handpiece	Install handpiece.
W58: Handpiece Changed; Press Standby	Handpiece changed—press the Standby Key (○), and then press the (⏏) key directly below "System Check" to continue.
W59: Low Trans. Check Fiber/Handpiece	Fiber, handpiece, or focus lens damaged, but still useable
W65: Energy Out of Range Press Standby	Cap bank did not recharge properly or overcharged—press the Standby Key (○) to continue.
W68: Schedule Lamp Change	Lamps in Alex laser approaching end-of-life—schedule lamp replacement.
W69: Schedule Lamp Change	Lamps in YAG laser approaching end-of-life—schedule lamp replacement.
W70: Coolant Over Temp Let Laser Cool	Water too hot, fans are working to cool laser.

Self Test

During startup, the laser runs a self test. If the fault occurs during this process, consult the fault code chart above for information on resolving the fault.

Troubleshooting Chart

Problem	Possible Cause	Solution
Laser does not start.	Power is not properly connected.	Connect power cables. Check that laser's main circuit breaker is in the on position.
	The keyswitch is OFF.	Turn the keyswitch to ON (|).
Aim beam missing, or diffused or reduced intensity.	Aim beam is off	To turn on aim beam, press (⮝) key directly below "DIAG," and then press (⮝) key directly below "AIM."
	Handpiece or fiber is damaged.	Inspect handpiece for damaged or dirty lenses, inspect fiber for damage.
Laser will not go into Standby Mode.	Lasers not up to operating temperature.	Allow laser to run until WARM UP message is off.
	Check that no other fault messages are displayed.	Correct any conditions as indicated by fault messages.
	Standby Key (○) not activated or not working.	Press Standby Key (○).
Laser will not enter Ready Mode.	Operator switch activated.	Check that finger switch or foot switch is not depressed.
	Ready Key (⊙) not activated or not working.	Press Ready Key (⊙).
Ready LED lit, but laser will not fire outside of cal port.	Laser not properly calibrated as indicated by Front Panel Display	Recalibrate Laser.
	Foot switch not connected.	Check that foot switch connector is properly inserted into foot switch receptacle.
"ADD WATER" appears at start up, or at any time during operation	Low water in system	See "Adding Water to the Reservoir" section on page 42.

NOTE: If any problems occur that are not covered in the troubleshooting chart, or the suggested solutions do not work, call the Cynosure Service, see page 48 for contact information.

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Section 8 CUSTOMER SUPPORT

This section of the manual provides information regarding customer support, such as Warranty, Warranty Claims, Installation, Customer Service and a list of laser accessories.

Direct-Purchase Warranty

Please refer to the signed Warranty information detailed in the Terms and Conditions of your Sales Contract.

Distributor-Purchased Warranty

Since exact terms and periods may vary when a laser system is purchased through a distributor, contact your distributor for warranty information.

Warranty Claims

If merchandise is damaged and you want to return the merchandise for repair or replacement, please be aware of the following:

- You should make the claim as soon as possible.
- Before returning merchandise, obtain prior approval from Cynosure.
- Cynosure will provide shipping instructions.
- Returned merchandise must be sent insured and prepaid.
- The cost of shipping is the responsibility of the customer.
- Cynosure has the sole responsibility to determine the cause of merchandise defect.

Installation

Cynosure or its authorized personnel installs the laser, gives a demonstration of operation, and provides a basic training service for each new customer.

Customer Service

Scope of Service

Cynosure's Customer Service Policy includes the following support for customers:

- On-site customer training for operating the laser
- On-site repair and maintenance of laser
- Telephone troubleshooting

Service personnel make periodic safety checks and functional evaluations as a part of maintenance.

Contacting Customer Service

If there is a technical problem with the laser, contact the Cynosure Service Department.

Normal Business Hours	Monday–Friday, 7:30 am–7:00 pm EST Call: 1-888-523-2233; or fax to (978) 256-6556 or (978) 256-4888.
After Hours and Weekends	Call: 1-888-692-2966.

If there is a question regarding clinical information call Cynosure.

Normal Business Hours	Monday–Friday, 9:00 am–5:00 pm EST Call: 1-800-886-2966 ext. 443

Appendix A — Service Calibration

CAUTION: This procedure should be performed by authorized service personnel only.
See, "Laser Calibration," on page 35 for laser calibration performed by the operator.

Schedule for Calibration

Cynosure calibrates the laser's energy meter at the factory prior to shipment. The energy meter should be calibrated once a year by authorized service personnel. Call your local Cynosure representative to arrange for annual calibration by authorized personnel. The energy meter is calibrated by checking that the displayed fluence value corresponds to the actual laser pulse energy as measured by an independent energy meter of known accuracy.

Overview

The laser is provided with a built-in energy meter that allows the laser to be calibrated by measuring the actual energy delivered from the handpiece. Energy measurements are obtained by inserting the handpiece into the cal port, and then firing the laser. The front panel display indicates the energy per unit area (or fluence in joules per square centimeter, J/cm^2), taking into account the area of the laser focal spot for the handpiece in use.

The energy meter consists of these main components:

- The cal port built into the front panel. The cal port includes an internal switch to sense the presence of the handpiece, which allows the laser to fire while in calibration mode only if a handpiece is inserted.
- A sapphire window that protects the internals of the cal port and is damage resistant. It should be cleaned frequently using a tissue or cloth.
- A pinhole within the cal port that allows only a small fraction of the incident light through a fiber optic cable to an optical sensor.
- An optical sensor that receives the laser light incident on it, and produces an electrical signal proportional to the absorbed optical pulse energy. The signal is amplified and calibrated at the Laser Control PCB.
- A front panel display that shows the selected fluence in $joules/cm^2$.

Required Equipment

CAUTION: The accuracy of the calibration depends completely upon the measurement of laser pulse energy using a separate instrument as an independent calibration standard. If the calibration standard is inaccurate or not used correctly, then the built-in energy meter will also be inaccurate after calibration.

- An accurate, NIST-traceable, laser power meter for use as a calibration standard. The selected calibration standard must be accurate for the appropriate wavelength and range of pulse energies. The meter's sensor element or input attenuator must withstand, without damage, the range of fluence and peak power per unit area typical of the laser.
- A standard service tool kit, e.g., a #2 Phillips screwdriver and a small flat-blade, potentiometer trimming screwdriver.
- Laptop computer with RS-232 interface

Calibration Procedures

There are two detectors in the system: 1) a resonator port that samples the full energy of the beam prior to coupling into the optical fiber and, 2) a calibration port that samples the full energy existing the handpiece. Both detectors must be calibrated as part of a complete service calibration. These calibration procedures are detailed in the following pages.

Before starting the calibration, however, verify that these preparatory steps are taken.

- Verify that the cal port window is clean.

  WARNING: Failure to keep the cal port Window clean may result in incorrect calibration.
- Be sure that the fiber optic is properly routed and secured.
- Install a 7-mm handpiece.

Calibration of the Resonator Port

1. If installed, remove the SMA/lens mount assembly from the rail assembly.
2. Position the laser power meter detector head so that the laser beam from the beam combiner fills approximately 75% of the detector element.
3. Initiate 'CV' mode by pressing and holding the two (⮝) keys to the far right when facing the front display panel. See **Figure 5** on page 24.
4. Set the laser to the following parameters:
   - Voltage = 600
   - Pulse Width = 5 ms
   - Rep Rate = 1 Hz
   - Wavelength = 1064 (or 755 if testing the alexandrite laser)
5. Set power meter to the setting for the laser type /wavelength being tested: Nd: YAG 1064nm or Alexandrite 755nm

6. Fire the laser and adjust the laser voltage until the power meter reads 45W ± 1W. Record the reading.
7. Press lowercase 'm' on the laptop to close the shutter and deflect the beam into the resonator port.
8. After firing into the resonator port, use the "j" key on the laptop to adjust the gain of the Vdump to read between 1.3 and 2.2VDC on the laptop by entering a gain value between 0 and 15. **NOTE:** A value of 0 being the largest gain setting and 15 being the smallest gain setting. Fire the laser with the adjusted gain, and verify it now reads within range.
9. Press lowercase "u" on the laptop and entering the power meter reading.
10. Fire the laser into the resonator port, and verify that the resonator port power as displayed on the computer screen agrees with the power measured on the power meter 45W ± 1W.
11. If testing an Apogee Elite laser, repeat steps 4 through 10 for the other wavelength.
12. Replace the focusing block and verify fiber alignment.

Calibration of the Cal Port

1. Verify that the laser's coolant temperature is at 65 C°.
2. Initiate 'CV' mode by pressing and holding the two (ⓐ) keys to the far right when facing the front display panel. See **Figure 5** on page 24.
3. Set the laser to the following parameters:
   - Voltage = 600
   - Pulse Width = 5 ms
   - Rep Rate = 1 Hz
   - Wavelength = 1064 (or 755 if testing the alexandrite laser)
4. Set power meter to the setting for the laser type /wavelength being tested: Nd: YAG 1064nm or Alexandrite 755nm
5. Position the 7-mm handpiece so it is facing into the power meter detector head.
6. Fire the laser and adjust the laser voltage until the power meter reads 35W ± 1W. Record the reading.
7. Place the handpiece into the cal port.
8. Fire the laser for two shots, and take note of the cal port voltage.
9. Press the uppercase 'J' key on the laptop to adjust the gain of the cal port voltage
10. Fire the laser for two shots into the cal port again, and take note the cal port voltage.
11. Continue to adjust the gain value until the cal port voltage measures from 1.3Volts to 3.0 while firing into the cal port. **NOTE:** A value of 0 being the largest gain setting and 15 being the smallest gain setting.
12. Press the uppercase 'U' and enter the reading from step 6.
13. Fire laser into the cal port and verify that the cal port power as displayed on the computer screen agrees with the power measured on the power meter 35W ± 1W.
14. If testing an Apogee Elite laser, repeat steps 3 through 13 for the other wavelength.

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CE 0050

Declaration of Conformity

We,

Cynosure, Inc., 5 Carlisle Road, Westford, MA USA 01886
declare under our sole responsibility that the product

Type of equipment: Long Pulse Infrared Laser
Model designation: Apogee Elite
Model number: 105-xxxx-xxx

Where xxxx-xxx denotes: 0057-004, 0061-004

to which this declaration applies,
is in conformity with the following European, harmonized, and published standards:
Standards: EN60601-1, EN60601-1-2, EN60601-1-4, EN60601-2-22, EN60825-1

following the provisions of the Directives:
EMC Directive 89/336/EEC
Medical Device Directive 93/42/EEC

Cynosure's applied quality and design systems have been examined and certified per Registration No. MD19.2613 by the notified body, NSAI.

The name, address and phone number of the authorized EU representative is:

Cynosure, GmbH
Robert-Bosch-Strasse 11-11B
D63225 Langen, Germany
Telephone: +49-6103-20111-00
Telefax: +49-6103-20111-11

Stephen Moszka
Quality Assurance Manager

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Appendix C Electromagnetic Compatibility

IMPORTANT: Parameters in Appendix C apply to the Apogee Elite, Apogee 5500 and the Acclaim 7000 laser systems. The Apogee Elite was used only for brevity in the text.

Guidance and Manufacturer's Declaration—Electromagnetic Emissions The *Apogee Elite* is intended for use in the electromagnetic environment specified below. The customer or the user of the *Apogee Elite* should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic Environment—Guidance**
RF emissions CISPR 11	Group 1	The *Apogee Elite* uses RF energy only for its internal function. Therefore, its RF emission is very low and is not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The *Apogee Elite* is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not Applicable	
Voltage Fluctuations / Flicker emissions IEC61000-3-3	Not Applicable	

Guidance and Manufacturer's Declaration—Electromagnetic Immunity The A*pogee Elite* is intended for use in the electromagnetic environment specified below. The customer or the user of the *Apogee Elite* should assure that it is used in such an environment.			
Immunity Test	**IEC60601 Test Level**	**Compliance Level**	**Electromagnetic Environment Guidance**
Electrostatic discharge (ESD) IEC61000-4-2	± 6kV contact ± 8kV air	± 6kV contact ± 8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/burst IEC61000-4-4	± 2kV for power supply lines ± 1kV for input/output lines	± 2kV Not Applicable	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC61000-4-5	± 1kV Line-to-Line ± 2kV Line-to-Earth	± 1kV ± 2kV	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC61000-4-11	< 5% U_t (> 95% dip in U_t) for 0.5 cycle 40% U_t (60% dip in U_t) for 5 cycles 70% U_t (30% dip in U_t) for 25 cycles < 5% U_t (> 95% dip in U_t) for 5 sec	Not Applicable Not Applicable Not Applicable < 5% U_t (> 95% dip in U_t) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the *Apogee Elite* requires continued operation during power mains interruptions, it is recommended that the *Apogee Elite* be powered from an interruptible power supply or a battery.
Power frequency (50/60Hz) magnetic field IEC61000-4-8	3A/m	3A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_t is the AC mains voltage prior to application of the test level.			

Guidance and Manufacturer's Declaration—Electromagnetic Immunity

The *Apogee Elite* is intended for use in the electromagnetic environment specified below. The customer or the user of the *Apogee Elite* should assure that it is used in such an environment.

Immunity Test	IEC60601 test level	Compliance level	Electromagnetic Environment—Guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the *Apogee Elite*, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter Recommended separation distance
Conducted RF IEC61000-4-6	3Vrms 150kHz to 80MHz	3Vrms	d = 1.17*√(p) 150kHz to 80MHz
Radiated RF IEC61000-4-3	3V/m 80MHZ to 2.5GHZ	3V/m	d = 1.17*√(p) 80MHz to 800MHz d = 2.33*√(p) 800MHz to 2.5GHz where (p) is the maximum output power rating of the transmitter in Watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m) Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol. 

NOTE 1: At 80MHz and 800MHz, the higher frequency range applies.

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structure, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the *Apogee Elite* is used exceeds the applicable RF compliance level above, the *Apogee Elite* should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the *Apogee Elite*.

[b] Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Apogee Elite

The *Apogee Elite* is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the *Apogee Elite* can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the *Apogee Elite*, as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter (W)	Separation Distance According to Frequency of Transmitter (m)		
	150kHz to 80MHz $d = 1.17*\sqrt{(p)}$	80MHz to 800MHz $d = 1.17*\sqrt{(p)}$	800MHz to 2.5GHz $d = 2.33*\sqrt{(p)}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance (d) in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where (P) is the maximum output power rating of the transmitter in Watts (W) according to the transmitter manufacturer.

NOTE 1: At 80MHz and 800MHz, the separation distance for the higher frequency range applies.

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Apogee® Elite™
Apogee® 5500
Acclaim 7000™

TECHNICAL GUIDE

(Modular) 850-1261-000, Rev. 1

CYNOSURE®
5 Carlisle Road, Westford, MA, 01886, USA
Phone: 978-256-4200 www.cynosurelaser.com

This technical guide is intended for both U.S. and International distribution.

Document #850-1261-000, Rev. 1, 7/05

TABLE OF CONTENTS

Glossary of Symbols and Abbreviations

The following international symbols and abbreviations may be used on the Apogee Elite/Apogee 5500/Acclaim 7000 laser system and/or in this technical guide.

Symbols

CE	Declaration of Conformity to Medical Device Directive 93/42/EEC CE Mark to Directive 93/465/EEC	○	Off (power disconnection from mains)
	Type B equipment per IEC 513	|	On (power connection to mains)
	Attention		Start (initializes connection to Mains)
	Laser Hazard Warning		Laser Ready Mode
	Dangerous Voltage		Laser Standby Mode
	Remote Interlock Connector per EN60601-2-22: 1996		Foot Switch
	Optical Fiber Applicator per EN60601-2-22: 1996		Hand Switch

Abbreviations

°C	Degrees Celsius	DVM	Digital Voltmeter
A	Amperes	Hz	Hertz
mA	Milliamp	J	Joule
µA	Microamp	J/cm^2	Joules per square centimeter
AC	Alternating current	W	Watts
cm	Centimeter	kW	Kilowatt
mm	Millimeter	µs	Microsecond
nm	Nanometer	ms	Millisecond
CW	Continuous Wave	W	Ohms
V	Volts	mW	Milliohms

Figure 1–Symbols and Abbreviations

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Disclaimer

The *Apogee Elite/Apogee 5500/Acclaim 7000 Technical Guide* is written specifically for service technicians and customers who have received formal training in the servicing of Cynosure laser systems. Cynosure requires that all technicians who plan to service these lasers attend an authorized training program. Information on service training programs may be obtained by calling Cynosure Customer Service at (978) 256-4200.

The *Technical Guide* provides useful information about the maintenance and servicing of the laser. It is not intended to be a complete guide.

Cynosure does not accept responsibility for personal injury or property damage resulting from the servicing of Cynosure equipment by its customers or by third parties, except where such injury or damage is a direct result of Cynosure's negligence. Customers, by accepting the service manual, agree to indemnify Cynosure against any claims alleging personal injury or property damage resulting from the servicing of Cynosure equipment by the customer or by third parties, except where such injury or property damage is a direct result of Cynosure's negligence. These limitations include situations where Cynosure personnel advise customers on the repair of Cynosure equipment over the telephone.

Any servicing of Cynosure equipment by individuals who have not completed a current Cynosure training program for that equipment will void Cynosure's product warranty.

About the Lasers

In 2004, the external appearance of the Apogee 5500/Acclaim 7000 laser system was changed to include a sleeker look and the fiber exiting the upper chassis on an angle to the back. Included in the new laser system is the Apogee Elite, which has both of these resonators, combined and coupled to the same output fiber. In 2005, the internal appearance of the Apogee Elite/Apogee 5500/Acclaim 7000 laser systems was changed to incorporate the modern modular design. All the lasers are built on nearly identical platforms with the only major difference being the optical rail assembly. High voltage systems, fluid systems and control electronics are the same. For this reason, only one manual is required to repair and maintain all three lasers. NOTE If the laser has a latch to open the front door, it is the older design and requires the *Apogee Elite/Apogee 5500/Acclaim 7000 Service Manual, document #850-1261-100.*

The laser display is available in various languages and is configured prior to shipping. If for any reason the language needs to change, first connect a laptop computer, described in "Appendix A". Then start the laser in the testall mode, as described in the *Final Test and Calibration Procedure.* At the laptop TESTALL menu, choose selection "m" to cycle through the available languages. When the desired language is displayed on the screen, cycle the power and the laser will run with the display in that language.

About the Technical Guide

This *Technical Guide* provides service technicians with information on the following topics:

- Equipment Safety
- Installation
- Fundamentals of Laser Operation
- Laser Description
- Service Procedures
- Troubleshooting
- Calibration of Energy Output

This *Technical Guide* applies to the Apogee Elite, Apogee 5500 and Acclaim 7000 lasers, but for reasons of brevity sometimes uses photographs, illustrations and drawings that depict the Apogee Elite laser only. Service personnel are encouraged to familiarize themselves with the laser and its operation. Make sure all components within the laser can be identified. Understand the Performance Criteria as outlined in the on page 43. Follow the Troubleshooting Sequence to restore performance if the laser does not meet or exceed the defined performance criteria.
The complete service manual, 850-1261-100 includes a comprehensive drawing set and procedures that will aid in the understanding of salient mechanical and electrical assemblies in addition to providing electrical schematics and technical illustrations. It is important to check the revision level of controlled drawings as designs change.
Upon request, Cynosure will provide circuit diagrams, component part lists, descriptions, calibration instructions, or other information not already contained within the technical guide, to assist appropriately qualified technical personnel to repair those parts of the laser system that are designated by Cynosure as repairable. "Appropriately qualified technical personnel" refers to personnel who have undergone Cynosure's Service Training Course for the Apogee Elite/Apogee 5500/Acclaim 7000 laser system and have been authorized to repair this laser system.

WARNING: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Introduction

As with any electrical equipment, there are potential hazards involved with the operation and servicing of the Apogee Elite/Apogee 5500/Acclaim 7000 laser systems. This section of the technical guide identifies these potential hazards and suggests precautions to avoid them.

Potential Hazards

Optical Hazard

The Apogee 5500 laser generates laser light at a wavelength of 755 nm with a maximum energy of approximately 45 joules delivered from the handpiece. The Acclaim 7000 laser generates laser light at a wavelength of 1064 nm with a maximum energy of approximately 63 joules delivered from the handpiece. The Apogee Elite laser generates laser light at a wavelength of 755 nm and 1064nm with a maximum energy of approximately 45 joules at 755nm and 63 joules at 1064nm delivered from the handpiece.
Greater energies can be generated from the laser head especially during service operations. At these wavelengths and energy levels, serious and permanent damage to the eyes can occur when there is direct or even indirect optical exposure.
WARNING: These lasers produce laser light each time the flashlamps fire. Do not look directly at laser resonator as the flashlamps fire or severe and permanent eye damage may occur. Make certain to wear the correct laser eyewear for the wavelength you are testing.

Please adhere to the following precautions to avoid optical damage during the operation or servicing of the laser:

- Ensure that everyone present during service procedures wears the appropriate protective eyewear recommended by Cynosure.
- Never look directly into the laser light, even while wearing protective eyewear.
- Mark treatment rooms clearly to avoid unexpected entry during treatment or servicing.
- Limit entry to the treatment or servicing room to trained, necessary personnel only.
- Cover windows and other openings in the treatment room to avoid the inadvertent escape of laser light.
- Cover reflective objects, such as jewelry or mirrors, which could reflect the laser beam to an area other than the intended treatment area.
- Put the laser into the standby mode when the laser is not in use.
- Ensure that everyone present during service procedures can shut down the laser in an emergency.

Electrical Hazard

The system requires 220 VAC ± 10%, 30 A, 50-60 Hz, single-phase electrical service to operate.
WARNING: Even when the laser is off and the AC line cord is disconnected, DC

voltages on various laser components, such as capacitors may exist. This can present a potentially fatal electrical hazard during service procedures. Proceed with caution!

Take the following precautions to avoid an electrical shock during servicing:

- Always turn the laser off and disconnect the AC line cord from the receptacle before removing the protective housing of the laser system.
- With the laser off, allow the dump resistors to dissipate the energy in the Pulse Forming Network capacitors to a safe level, approximately 45 seconds. Monitor the voltage on the capacitors with a DVM probe to ensure it is at a safe level.
- If it is necessary to test or adjust any electrical component while the system power is on, be careful not to touch any electrical components with bare fingers. Use only appropriate probes or insulated tools.
- Become familiar with the electrical schematics and layout of the system before attempting to service the laser.

If the AC must be connected during service routines, exercise caution around mains connected components, such as power supply feeds, circuit breakers, key switches, etc. A remote interlock fault condition will reduce high voltage electrical hazards to service personal. This fault condition disables the high voltage power supply control and simmer circuits, as well as ensuring that the dump relay is closed, grounding the potential of the pulse forming network. When possible, remove the remote interlock plug during "live" service routines.

Grounding

Even when the laser is turned off and the AC line cord disconnected, high DC voltage levels may remain. Before performing any procedure, use a shorting stick to ground all interior components. The main capacitor bank stores large amounts of electrical energy. Measure the voltage on the capacitor bank before attempting any service. Ground the capacitor bank with a shorting stick for at least five seconds.

WARNING: Do not attempt to short directly (i.e., with a screwdriver) or a potentially fatal electrical shock can occur.

Fire Hazard

When the laser beam contacts any exterior surfaces, the surface absorbs the laser energy, which raises the surface temperature of any flammable substance. Service personal must take the following precautions.

- Always keep a small fire extinguisher and water in the treatment room.
- Never direct the laser beam onto any surface except a power meter or an appropriate beam dump.

Hot Water Hazard

The laser system uses a hot water system to maintain the laser medium at 65 °C. This water is very hot and could cause scalding. Do not perform any maintenance on the water system while hot. Always let the system cool down before changing the deionizing filter or adding deionized or distilled water.

Service Equipment

A full complement of tools is required to service this laser system. It is expected that service personnel carry at least the following tools to an installation or laser repair call.

Hand Tools

- Screwdriver set
- Allen Wrench or Hex Head Ball Driver set
- Nut Driver set
- Adjustable wrenches
- Wire cutters
- Wire strippers
- Needle nose pliers
- X-ACTO knife

Electrical Equipment

- Calibrated oscilloscope, 50 MHz or better, 2-channel (LeCroy 9310); or Cynosure # 706-0107-000 TEKSCOPE THS-720 or equivalent
- Calibrated high input impedance hand-held digital multimeter (Fluke 87) or equivalent
- Computer or laptop with any serial communication program, i.e. windows "HyperTerminal" or DOS "COMM," monitor and keyboard. DB9 F-F null modem serial cable

Optical Equipment

- Appropriate protective laser eyewear:
  > 5.5 O.D. at 755 nm (min.) for the Alexandrite lasers;
  > 5.5 O.D. at 1064 nm (min.) for the Nd: YAG lasers
- Laser energy/power meter with carbon head (OPHIR AN2 , F250A-HL-SH Detector or equivalent) calibrated for 755 nm/1064 nm operation. Older Scientech models may not be adequate. Check with Cynosure Technical Support for meter compatibility.

Miscellaneous Equipment

- Funnel or small bottle
- Laser alignment paper (Zap-it)
- Distilled water
- Lens tissue
- Methanol and/or acetone for cleaning optics
- Teflon tape
- Finger cots or lint-free gloves
- Pressurized gas-jet lens cleaner (e.g., Coherent bottled nitrogen gas)
- Magnifying/measuring loupe
- XYZ alignment fixture, Cynosure # 706-0125-000
- Fiber SMA centering pin, Cynosure # 706-0054-002
- Ring stand and clamps or tripod
- Fixture, Mirror Align, YAG, Elite, Cynosure # 706-0175-000
- Wrench, Locknut, Handpiece, Cynosure # 706-0173-000
- Fixture, Spacer Tool, Beam Combiner, Cynosure # 706-0171-000

Main Modules

Section 3 of the manual gives a detailed description of each module for the laser system. The following Modules make up the Elite/Apogee 5500/Acclaim 7000 laser system.

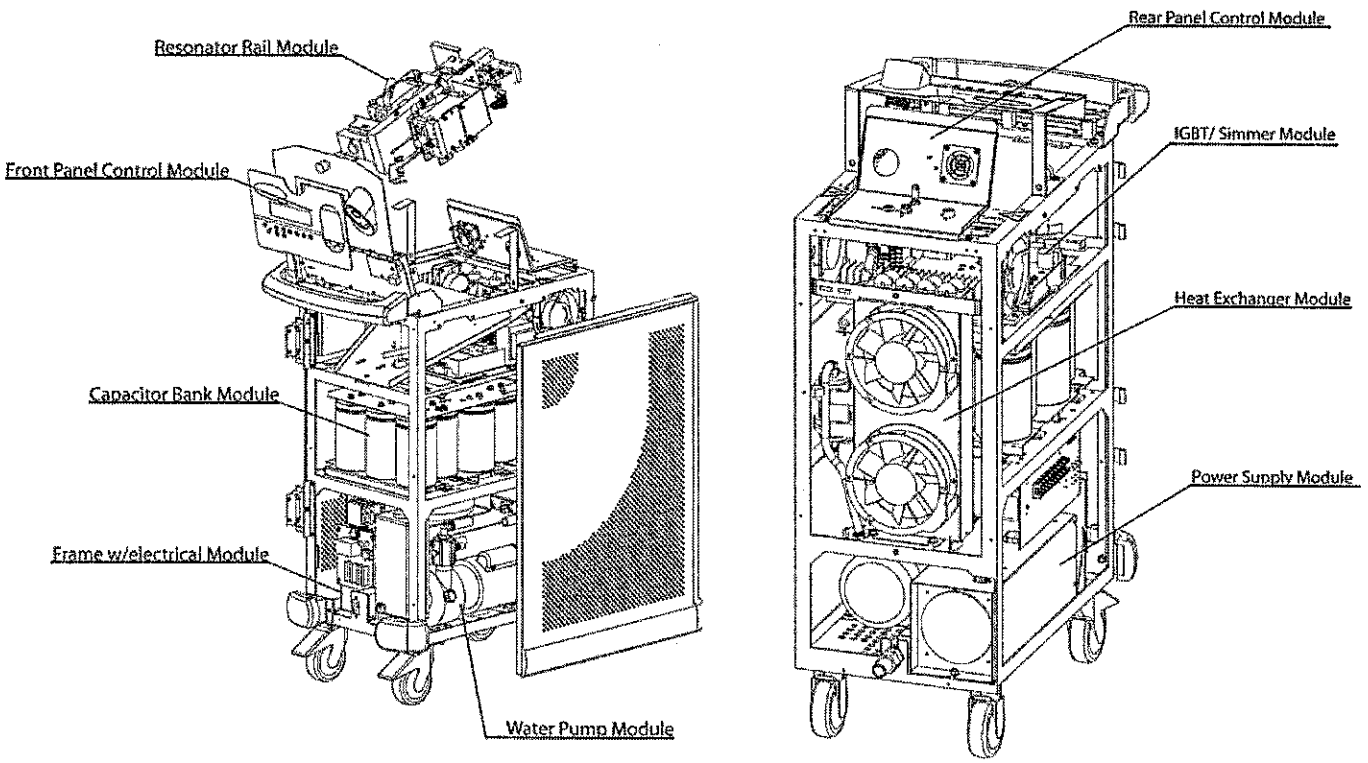

Figure 1–Main Modules

Figure 2A illustrates the system diagram of the Apogee Elite laser with its two laser resonators. The Apogee 5500 and Acclaim 7000 diagram is shown in **Figure 2B**.

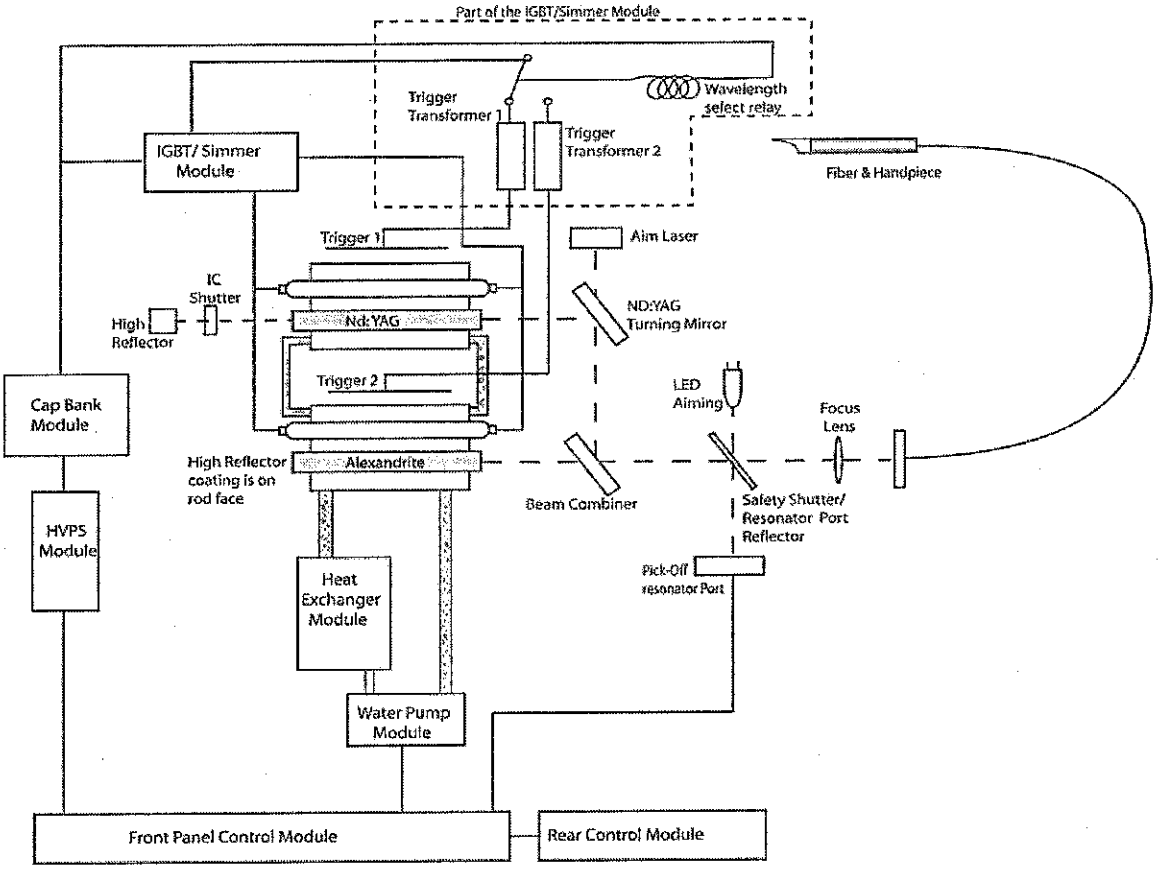

Figure 2A–System Block Diagram, Apogee Elite

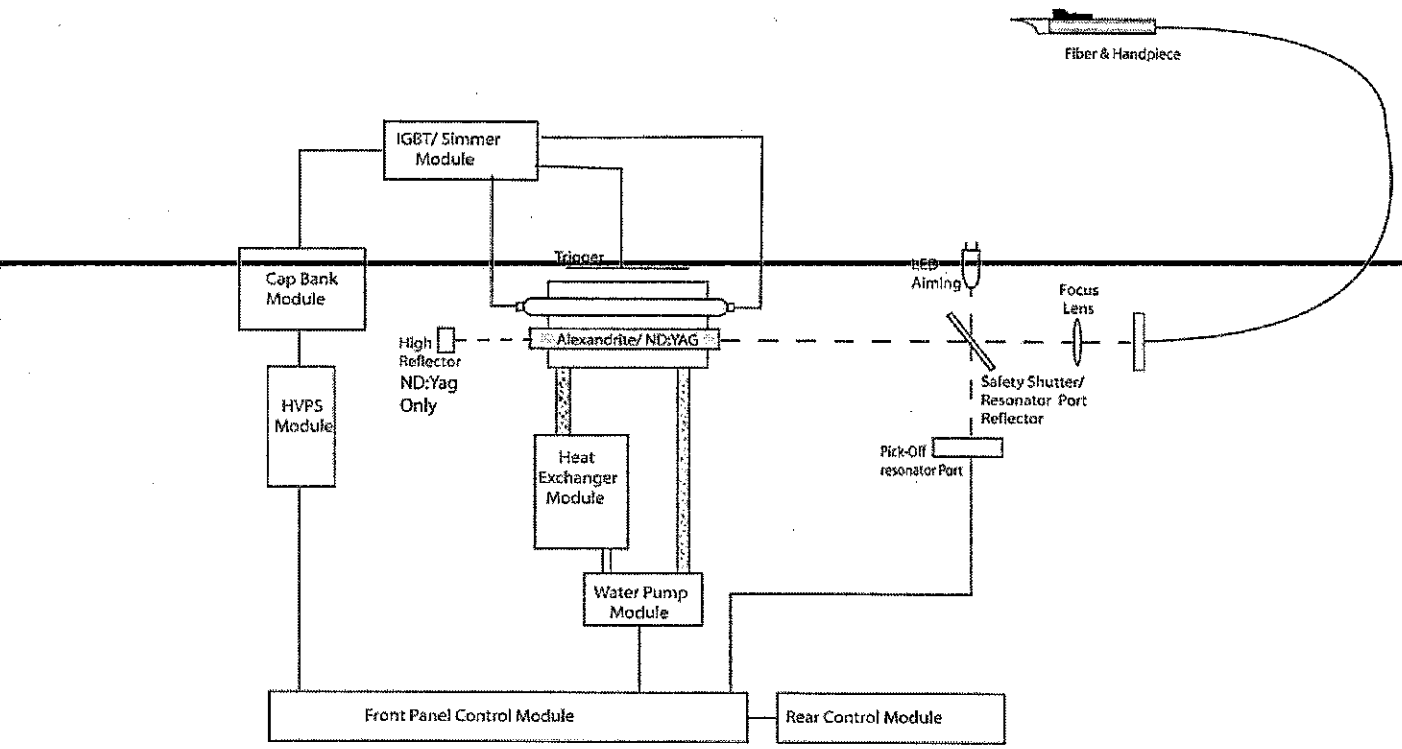

Figure 2B–System Block Diagram, Apogee Elite

High Voltage Power Supply Module

The High Voltage Power Supply (HVPS) is a modular inverter capacitor charging power supply. This device accomplishes the primary energy conversion for the laser. It converts input power of 220 VAC, 50 or 60 Hz, to a controlled, high-voltage direct current. A software controlled low-voltage analog signal is used to set the appropriate HVPS output voltage level during laser operation. When enabled, the power supply charges the capacitor bank through the capacitor bank fuses. The laser control board also inhibits, enables and regulates high voltage output level depending on the state of the laser. The maximum voltage is 900 V and the charge rate is approximately 3800 joules/second. Output current is approximately 4.5amps at 850V with $< \pm$ 0.9 volts ripple at 900V. The module will charge 30,000 μF from 740-900 volts within 0.95sec. For demonstration purposes, the system can be run on 120 VAC 15A Service. In the 120v mode the module will charge 30,000 μF from 680-750 volts with in 1.4 seconds. This will change the laser operation and limit the specifications of the laser. Cynosure recommends the 120v mode is to be used as demonstration purposes only and is not to be used for high volume treatments. To make this change, please contact Cynosure Technical Service at tech_support@cynosurelaser.com.

The control voltage to the module, 0-9 volts signal is equivalent to 0-900 volts to the capacitors. This control voltage goes in to the module through pin 5 on the control interface cable. The ENABLE/RESET signal or the ON/OFF control for the power supply is controlled by grounding pin 1 on the control interface cable. Applying a <1 volt signal to pin 1 the power supply receives an inhibit signal to turn it off and resets the fault latch. Applying greater then 10 volts to pin 1, enables that power supply to turn it on. A read back signal is generated in the power supply and is transmitted to the front control module through pin 7 on the control interface cable. This read back is an analog output of 0-9 volts is equivalent to the supplies 0-900 volts. The End of Charge indication is transmitted through pin 13. This signal goes low when the power supply has reached the programmed output voltage registered at pin 5. If the power supply charges for more than 20 seconds and does not reach the program voltage, pin 2 goes low indicating an overload condition. This will provide a power supply fault and the laser will go into a fault condition.

Capacitor Bank Module

WARNING: High Voltage Danger! The capacitor bank stores dangerous voltage and energy levels during laser operation. Please handle with extreme caution.

The capacitor bank module, see Figure 3, consists of twelve 10,000 μF, 450-volt capacitors coupled together in a series/parallel configuration to provide a 900-volt, 12-kilojoule stored energy source. This large amount of stored energy must be regarded carefully.

Only a fraction of this stored energy is drained off for a given laser pulse. In a fault condition, the stored energy is discharged through an electronic dump circuit within the module.

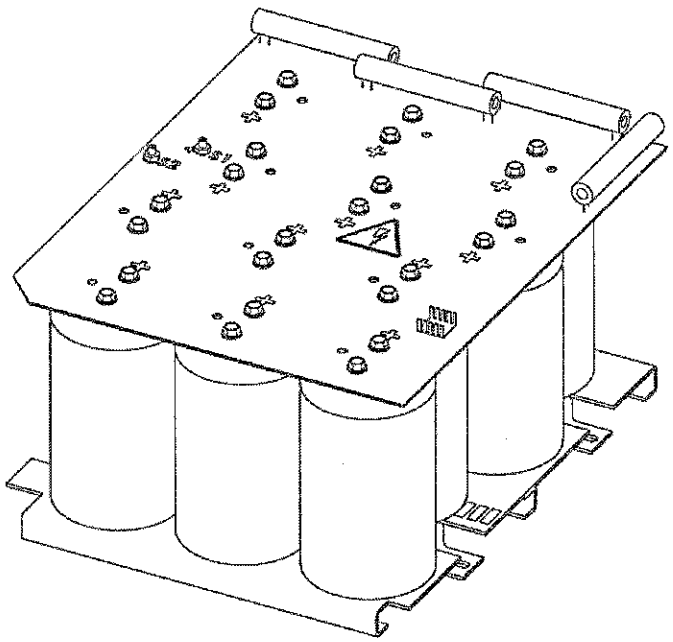

Figure 3–Capacitor Bank Module

To protect the power supply from damaged capacitors, there is fuse protection in the module. There are six 30-amp, 1000volt, slow-blow fuses. Each fuse is connected to one of the six pairs of high voltage capacitors. The fuse is designed to protect the storage capacitors against any excessive current draw that may occur with a short, such as a flashlamp or another capacitor shorting to ground.

The capacitor bank module also houses the electronic dump circuit. The electronic dump is turned ON and OFF by an optical signal from the control board through fiber # RX1 to RX1 op-to transistor on the capacitor fuse bank PBC. An optical signal is illuminated when the laser goes into standby and ready. The optical signal turns on RX1, which shorts Capacitor C11 keeping SCR Q1 off. The HVPS capacitors can charge up to required voltage. When the signal to RX1 is turned OFF, the op-to transistor will turn off causing C11 to charge through R17 to about 30-34 volts allowing the voltage to dump through the Diac (D1). This discharge is the trigger to turn on the SCR (Q1). This allows a direct circuit from the capacitors through four 100w, 50-ohm resisters to the ground plane and the high voltage will discharge through the dump. When all of the Capacitor voltage goes to zero volts, the current through the SCR stops and the SCR turns off. There is also a signal that goes through TX1 to tell the CPU/Control PCB that the laser is in dump mode. TX1 is also used for the fuse short signal. If TX1 turns on and the laser is not in the dump mode a fuse short condition is recorded and displayed on the front panel.

IGBT/Simmer Module

WARNING: Exercise extreme caution while working in the high voltage subsystem. High voltage may be present at any time! Electrical shock or burns can occur. Limit access to factory-trained personnel.

The IGBT/Simmer module, see Figure 4, consists of the low voltage power supply, IGBT Driver, IGBT, IGBT Snubber, Simmer transformer, and the Simmer Trigger transformers.

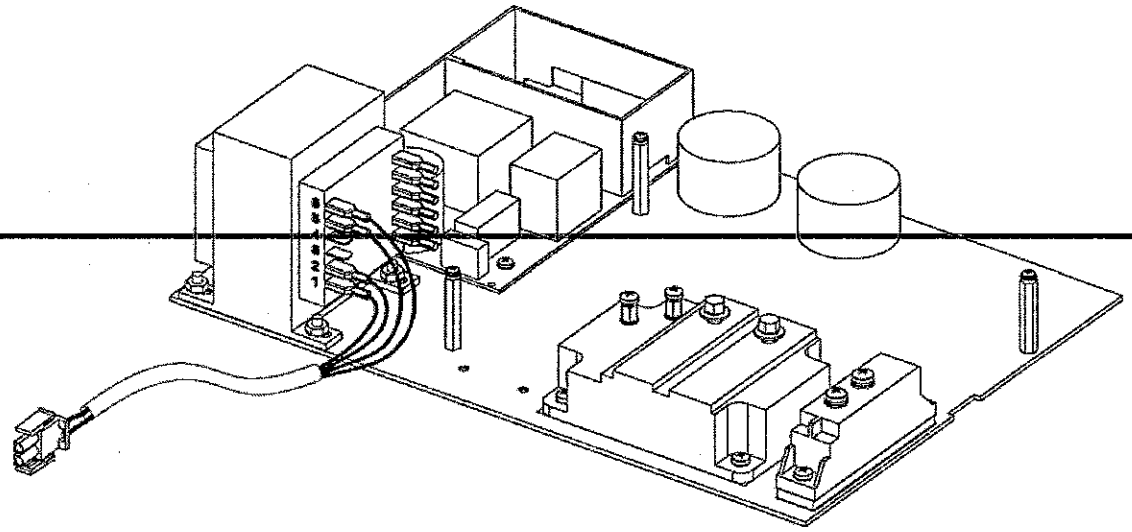

Figure 4–IGBT/Simmer Module

The low voltage power supply provides + 5v ±0.05v to the CPU. This voltage is extremely critical to the microprocessor operation. The voltage adjustment is directly ion the power supply it's self. The power supply also supplies the +12volts and -12volts that is required to turn the other components on and off.

The IGBT Driver is on the IGBT driver & Simmer PMC PCB. The primary function of the Integrated Gate Bipolar Transistor (IGBT) driver board is to control, monitor and report operation of the IGBT using fiber optic input and outputs. For example, if an optical pulse of 5 milliseconds is received by the IGBT driver board from the laser control board, the driver board will generate an electrical gate pulse for 5 msec, which then turns on the IGBT device for 5 msec. Optical transmitters on the board relay, at CR3, CR4, and CR5, monitor the status. They will detect any fault in operation and signals back to the laser control board. These faults are monitored by the system control electronics.

The Integrated Gate Bipolar Transistor (IGBT) is a high voltage, high current switching device that controls the current flow through the flashlamps. When turned on, a ground path from the "+" capacitor bank through the flashlamps to the "–" of the capacitor bank is completed, allowing current to flow. The IGBT used in the Apogee Elite/Apogee 5500/Acclaim 7000 modular, is a single IGBT module. High voltage is always on the flashlamps and the collector of the IGBT, therefore use extreme caution when high voltage is present.

The snubber circuit, see Figure 5, functions as a resistor capacitor diode (RCD) clamp. When the IGBT is turned off, the snubber diode is forward biased and the snubber is activated. The energy trapped in the stray inductance of the PFN is absorbed by the snubber capacitor. When the IGBT is turned on, the snubber capacitor that was charged

to bus voltage has a discharge path through the IGBT and the snubber resistor. This reduces the reverse recovery voltage transient, protecting the IGBT from harmful voltage spikes.

The simmer board provides a low level (~100 mA) DC current through the flashlamps. This pre-ionization of the flashlamps improves pulse-to-pulse stability and increases flashlamps lifetime. Simmer is initiated on the simmer board by sending a low energy trigger pulse to the trigger transformer. The transformer steps up this signal to a high voltage trigger pulse on the pump chamber. This high voltage pulse ionizes the gas near the flashlamp electrodes by capacitively coupling through the flashlamps glass envelope. Once breakdown is achieved, a low DC current from the simmer board is maintained through the simmer ballast resistor allowing continuous current flow through the lamps. A current sensing circuit on the simmer board verifies that this current is present. An optical transmitter located on the simmer board will then turn on, sending an optical signal to the laser control board as an indication of simmer status.

Wavelength selection on the Apogee Elite laser is done using a relay to select two separate trigger transformers. When the relay is in default mode—inactive, the Nd: YAG head trigger transformer is connected. When the Alexandrite wavelength is chosen, the capacitor bank is dumped, the trigger select relay activated, and the simmer started through the Alexandrite head.

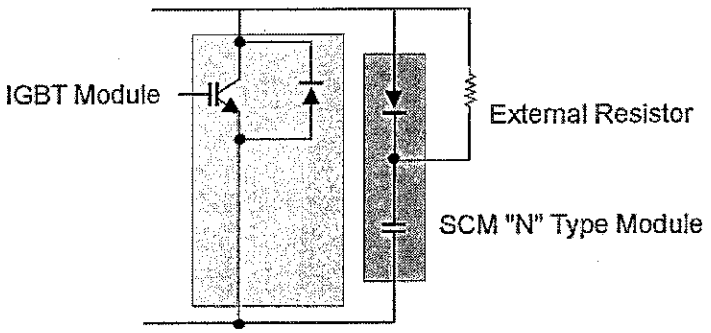

Figure 5–Snubber Circuit

The capacitor bank module and the IGBT/Simmer module combined together comprise the pulse-forming network (PFN).

Front Control Panel Module

The system control electronics are located in the Front Control Module. It consists of a laser control interface board, microprocessor, front panel display, calibration port, emergency stop switch, hardware, software and associated wiring. This module is responsible for system controls. It produces the pulse train trigger signal, regulates pulse energy, ensures safety, provides appropriate controls and status displays to the operator, and controls all of the other modules.

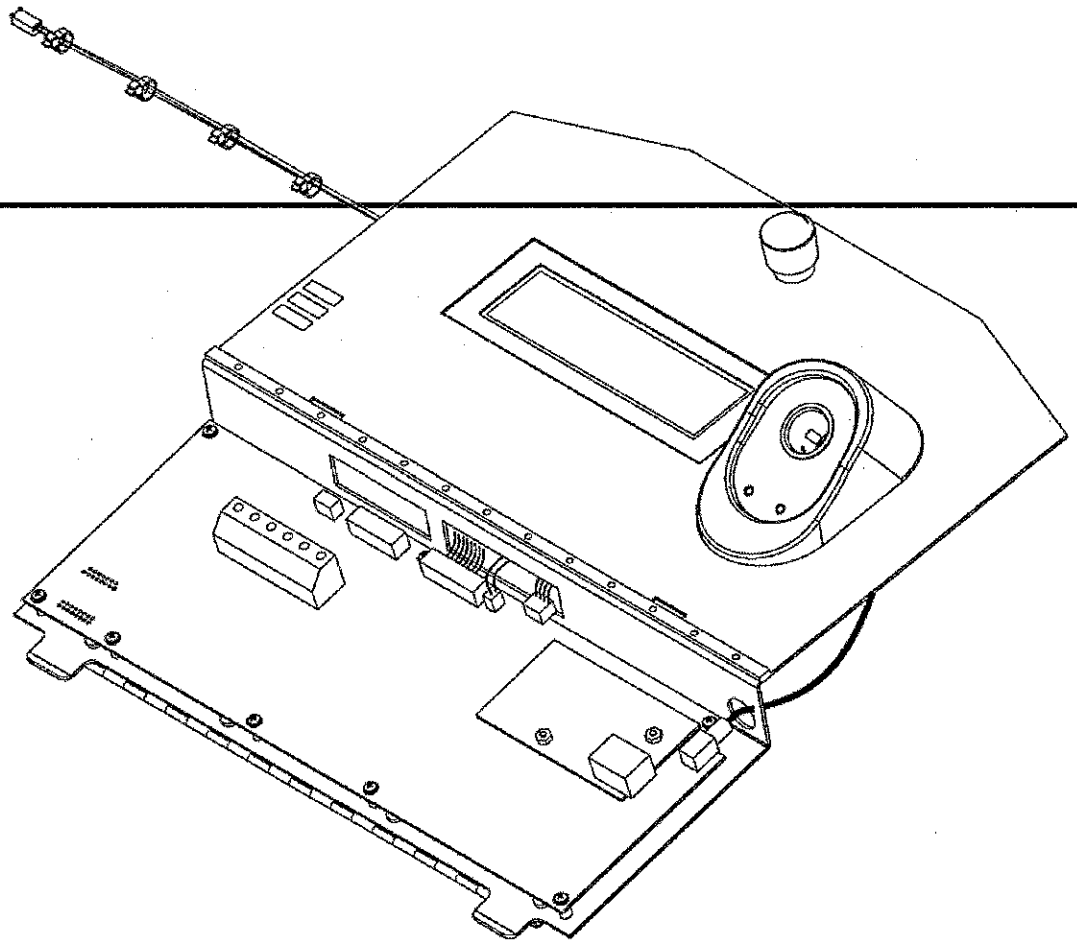

Figure 6–Front Panel Control Module

The microcontroller is mounted on the laser control board. The software is on the board in flash memory, which can be updated through a serial port and a laptop. This controller is known as a Rabbit Microprocessor. A laptop can be connected through the RS-232 connector at J8.

The laser control board includes the microcontroller, as well as the digital and analog circuits to control laser operation. The Control PCB for all three lasers is the same. S2 Dip switches are used to select for differences specific to a particular laser system. For an Elite laser switches 1 & 2 should be in the off position. An Apogee 5500 will have the switch 1 in the off position and switch 2 in the on position. An Acclaim 7000 laser will have switch 1 in the on position and switch 2 in the off position.

The optical detectors for the internal monitor and the cal port reside on the right edge of the control electronics PCB.

The high voltage controls, read back controls, resonator port, and cal-port are set by the microcontroller by using the laptop in service mode. In idle state, TP 4 will have > 10 volts applied to pin one of the power supply control cable. This signal enables the power supply to turn on. A program voltage, TP10, of 0-9v, which corresponds to a HVPS output of 0 to 900 volts is sent out on pin 5 of the power supply control cable. TP13 is the HVPS read back signal of 0-9v, which corresponds to a HVPS output of 0 to 900 volts.

The software controls the pulse timing to the IGBT control board through U9C. The trigger pulse is transmitted through TX2, through a fiber to the IGBT/Simmer module to trigger the IGBTs. The control board monitors IGBT faults and status through DR1 and DR2. It also monitors simmer sense through DR3 and fuse fault through DR4. DR4 is also used to tell the CPU that the laser is dumping the high voltage through the SCR. The microprocessor will wait for an additional 15 seconds after the SCR is turned off before enabling the HVPS.

The thermister temperature sensor located in the heat exchange module measures the water temperature. A 0 to 5 V = 0 to 100 °C signal on the control board through JC2. The microcontroller then uses this information to regulate the temperature and check for faults. A board temperature probe is installed on the Control board to compensate for effect temperature has on output power.

The LCD and keypads are located on the top of the front control panel module. The key pad controls all user functions along with diagnostic screen and service modes.
The lasers utilize an integrating sphere with a small aperture that is used for fiber optic sampling of a portion of the lasers delivered energy—a true energy meter. This fiber optic is connected to the laser control PCB (Figure 7). A sapphire window is used to protect the ceramic diffuser against damage from dirt and debris. This window should be cleaned periodically to ensure consistent and accurate measurement of laser energies.
When the handpiece is inserted into the cal port, two series wired micro-switches detect the presence of the handpiece, and this switch closure is detected and monitored by the laser control PCB.

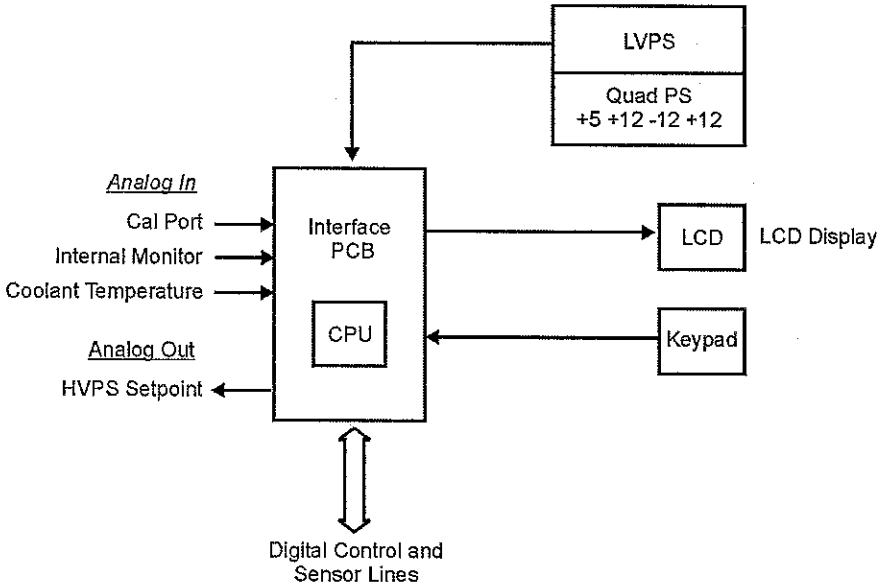

Figure 7–Laser Control PCB

Rear Control Panel Module

The rear control Module consists of the key switch, handpiece filter PBC, bellows trigger switch, and mounting hardware. The key switch turns the laser on and applies power to the frame module and front control panel module. The handpiece filter board interfaces with the laser control board and provides information as to which handpiece is connected to the laser's delivery fiber. The finger switch signal is also transmitted through this board. A DC cooling fan pulls hot air out of the chassis, through the rear panel to help lower the internal temperature, see Figure 8.

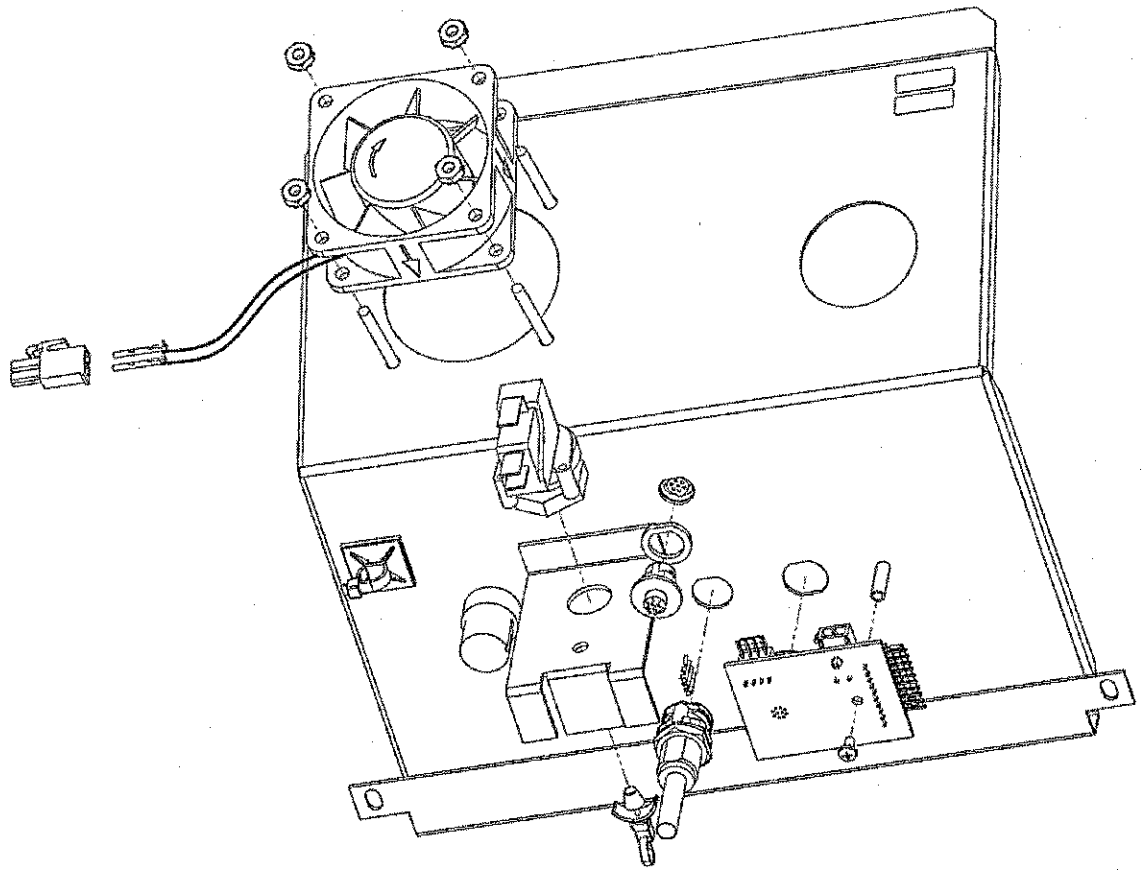

Figure 8–Rear Control Panel Module

Frame Assembly w/ Electrical Module

The frame module is the main support for the laser. It consists of the frame itself, wiring harness, AC distribution PCB, voltage selection PCB, Isolation transformer, simmer ballast resistor, AC line cord, optical detector PCB, and the drip shield to protect the electronics from a leak in the rail, see Figure 10.

The frame is pre-wired from the AC line cord through the Isolation transformer to connections for the other modules. The AC distribution PCB contains 4 solid-state relays that turn on the heater, simmer, heat exchanger fans and the water pump. Additionally on the PCB are all of the system fuses.

The voltage selection PCB is used to set the tap setting on the isolation transformer. This will provide the secondary voltage of 230VAC for the system.

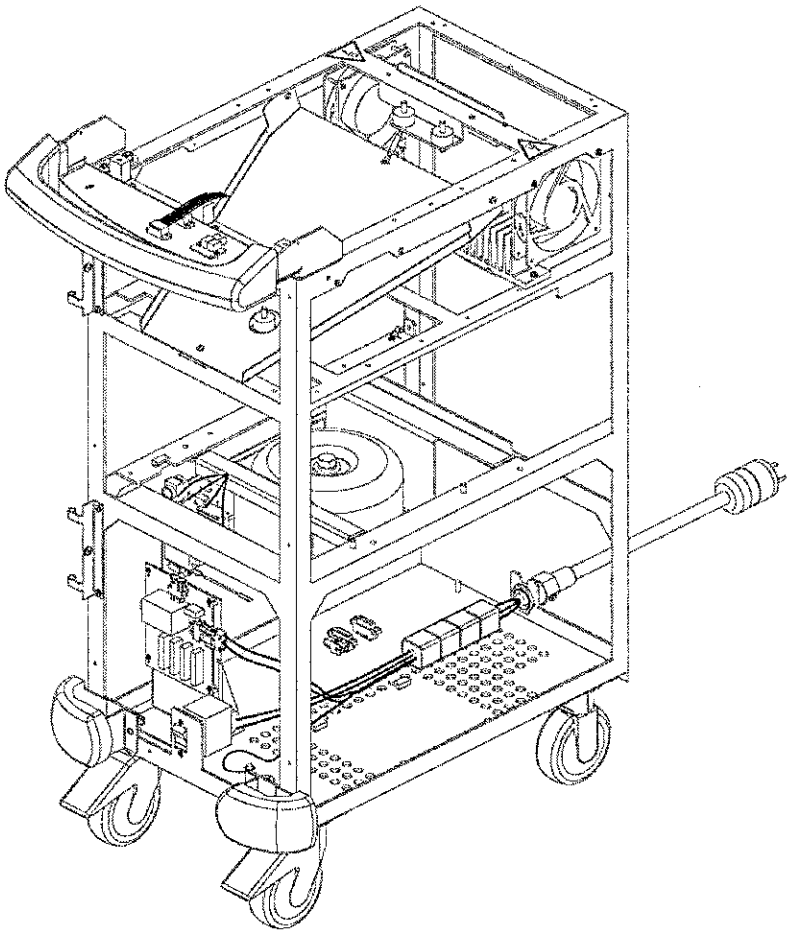

Figure 10– Frame Assembly w/ Electrical Module

Resonator Rail Module

The Resonator Rail Module consists of the ND:YAG laser head, the Alex laser head, turning/alignment mirror, beam combiner, beam shutter solenoid assy, orange aiming led, focusing lens, and the ND:YAG max reflector, see Figure 13.

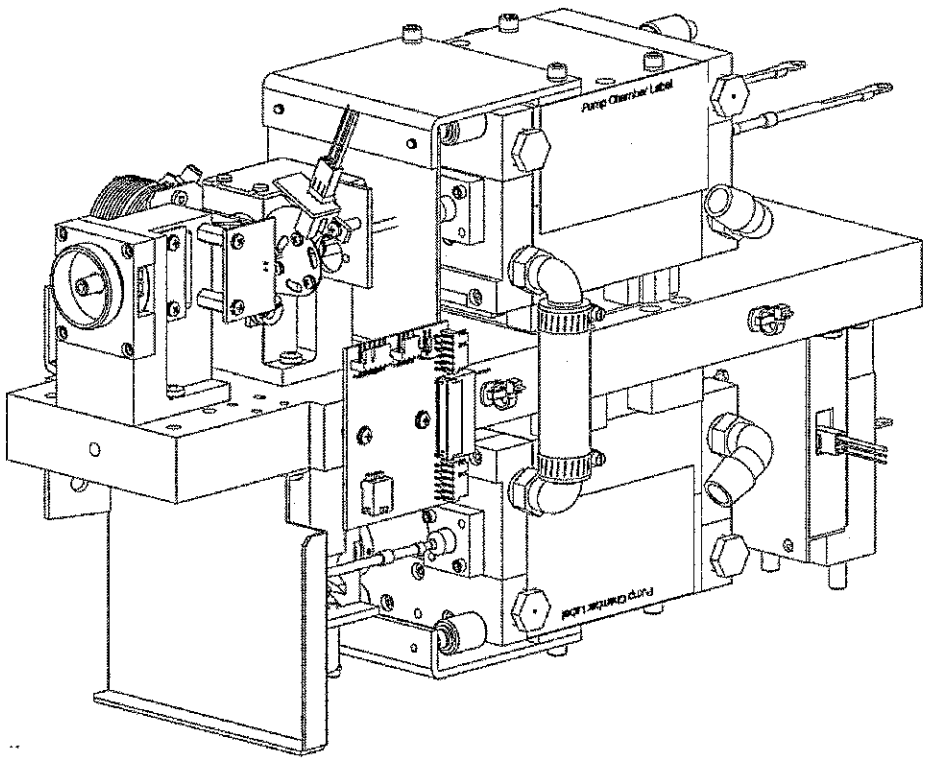

Figure 13– Resonator Rail Module

ND:YAG Laser Head

The ND:YAG laser head is the diffuse reflector that couples the light energy from the flashlamps into the solid state laser crystal rod. The two flashlamps (per head) emit brief, intense bursts of white light when excited by pulses of electrical current. This intense light provides the pump energy source for the lasing medium. The anode or positive lead is identified by a crimp lug on the wire. Always use finger cots when handling or cleaning the flashlamps. The ND:YAG rod has an anti-reflective (AR) coating @ 1064 nm at one end and is uncoated on the other end simulating the output coupler. An external maximum reflector is used to complete the optical cavity. This laser head assembly consists of a two-piece main body and end plates that secure and seal the precision glass flow tubes. The flashlamp and rod keepers are secured to the end plates to provide fluid seals. The upper half of the pump chamber can be removed for a visual inspection of the diffuse reflective coating and flow tubes. The laser head is not considered a field serviceable item and must be replaced as an assembly with the exception of the flashlamps. The flashlamps need to be replaced at appropriate intervals.

Alex Laser Head

Alex laser head is also a diffuse reflector that couples the light energy from the flashlamps into the solid state laser crystal rod. The two flashlamps (per head) emit brief, intense bursts of white light when excited by pulses of electrical current. This intense light provides the pump energy source for the lasing medium. The anode or positive lead is identified by a crimp lug on the wire. Always use finger cots when handling or cleaning the flashlamps. The Alexandrite rod ends are coated for maximum and partial reflectivity @ 755 nm. There are no external optics required for lasing action. So there is no optical head alignment. This laser head assembly consists of a two-piece main body and end plates that secure and seal the precision glass flow tubes. The flashlamp and rod keepers are secured to the end plates to provide fluid seals. The upper half of the pump chamber can be removed for a visual inspection of the diffuse reflective coating and flow tubes. The laser head is not considered a field serviceable item and must be replaced as an assembly with the exception of the flashlamps. The flashlamps need to be replaced at appropriate intervals.

Rear Total Reflector, Nd: YAG only

NOTE: This section is for Nd: YAG lasers only.
The rear total (max) reflector, is the back half of the optical cavity.
It reflects all 1064nm light that strikes the mirror face. The mirror, when mounted, tilts on two orthogonal axes. For the laser to function properly, it must be absolutely parallel to the front partial reflector (uncoated surface of the Nd:YAG rod), and perpendicular to the axis of the Nd:YAG rod. This reflector may require adjustment after replacement of the flashlamps, reflector, or pump chamber.

Turning/Alignment Mirror

The turning mirror is setup to reflect the Yag laser beam through the rail to the beam combiner. The mirror is coated for maximum reflection at 45 degrees, 1" Dia, maxr@1064 nm.

Beam Combiner/Beam Shutter Solenoid Assembly

The beam combiner is designed to combine the Yag laser beam with the Alex laser beam. The beam combiner is used to align the Yag laser beam into the fiber because the focusing lens is fixed. Both sides of the beam combiner are coated. One side uses an AR coating maximized for 755nm and the other side is coated for maximum reflection at 45 degrees.

The resonator port is part of the beam combiner/ beam shutter solenoid assembly. The beam shutter has a reflective mirror tape attached to direct the total power from the laser beam into the resonator port when the shutter is closed. Also there is an orange LED used for aiming purposes. The orange color is designed to show the shutter is closed to the operator.

The shutter is opened to allow the laser beam and the red laser aiming diode into the focusing block and the fiber.

Focus Lens Mount

The focusing lens is fixed inside the focus lens mount. There is no adjustment for the focusing lens. The laser beam will need to be verified through the SMA using a Centering Pin and a black marker. The focusing lens mount has a slit for a microscope slide. When verifying the laser beam's position, slide the cover of the slot up and insert the microscope slide. Note: energy levels at this step need to be 1-2 watts. If the energy is higher, damage to the centering pin will occur.

Delivery System

Approximately 80% of the energy, which has been coupled into the fiber, reaches the distal or output end of the fiber and enters the handpiece. The handpiece images the light from the fiber into a magnified spot of a specific diameter. The handpiece incorporates a push-button switch for firing the laser, as well as an electrical means of providing identification of the spot diameter to the laser control system. Refer to **Figure 9** for an overview of delivery system components.

Trigger Switches

When the laser system is in ready mode and the delay has passed, activate the laser beam by pressing one of the following trigger switches:

1. The finger switch is an electrical push button on the handpiece.
2. The foot switch is a pneumatic switch. To connect it, insert the foot switch port on the rear of the laser.

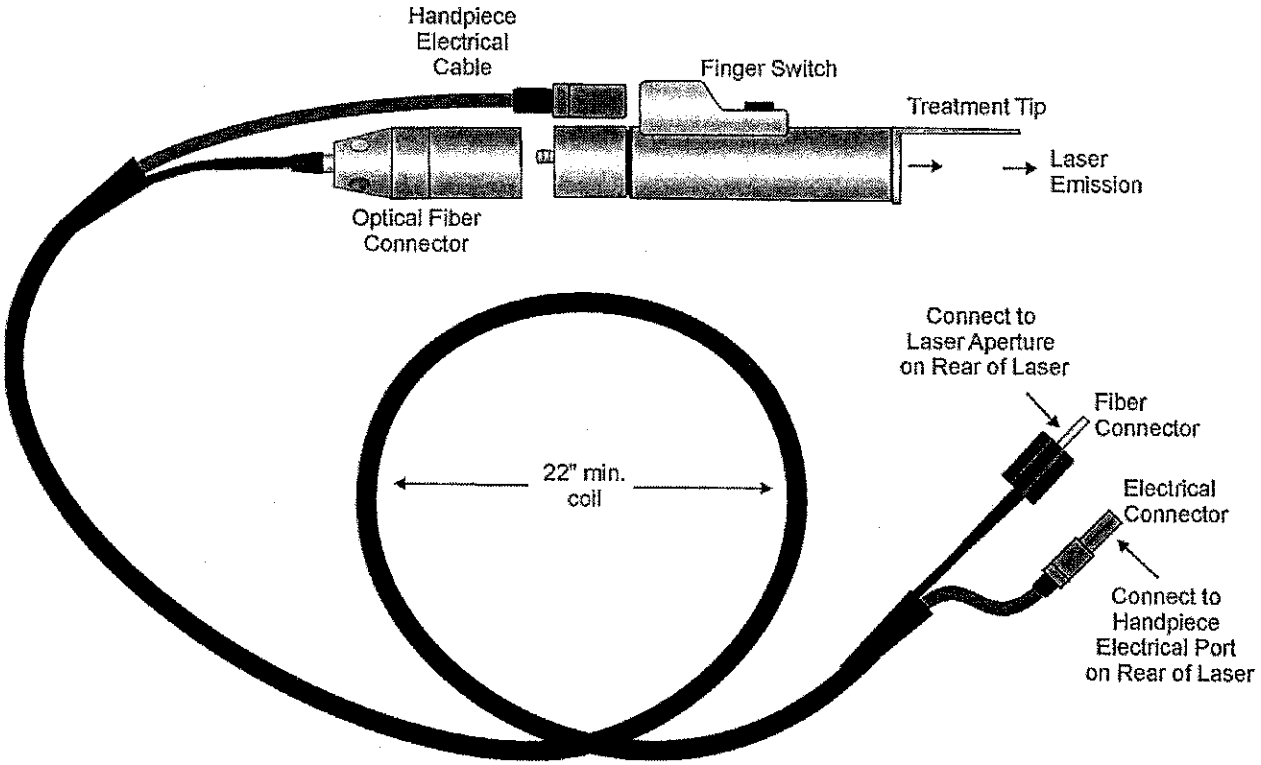

Figure 9–Delivery System

Coolant Circulation System

The water circulation system, as diagrammed in **Figure 11**, maintains the flashlamps, rod and laser head at a temperature of 65 °C.

The water pump circulates the deionized water through the laser head, heat exchanger and a flow switch. A bypass loop contains a deionizer cartridge that helps maintain low electrical conductivity of the coolant. A heater is incorporated into the coolant systems of all three lasers, but the Alexandrite lasers require a warm up period before laser operation. **NOTE:** When turned on the Apogee Elite defaults to Nd: YAG laser mode, which requires no warm up period. Level switches located in the upper reservoir are used to provide water level status information to the systems control electronics. The upper level switch indicates when water must be added. The lower level switch, when activated, will not allow laser operation until water is added.

The solid-state temperature sensor measures the water temperature and provides temperature information back to the microcontroller.

NOTE: When adding water use deionized or distilled water only.

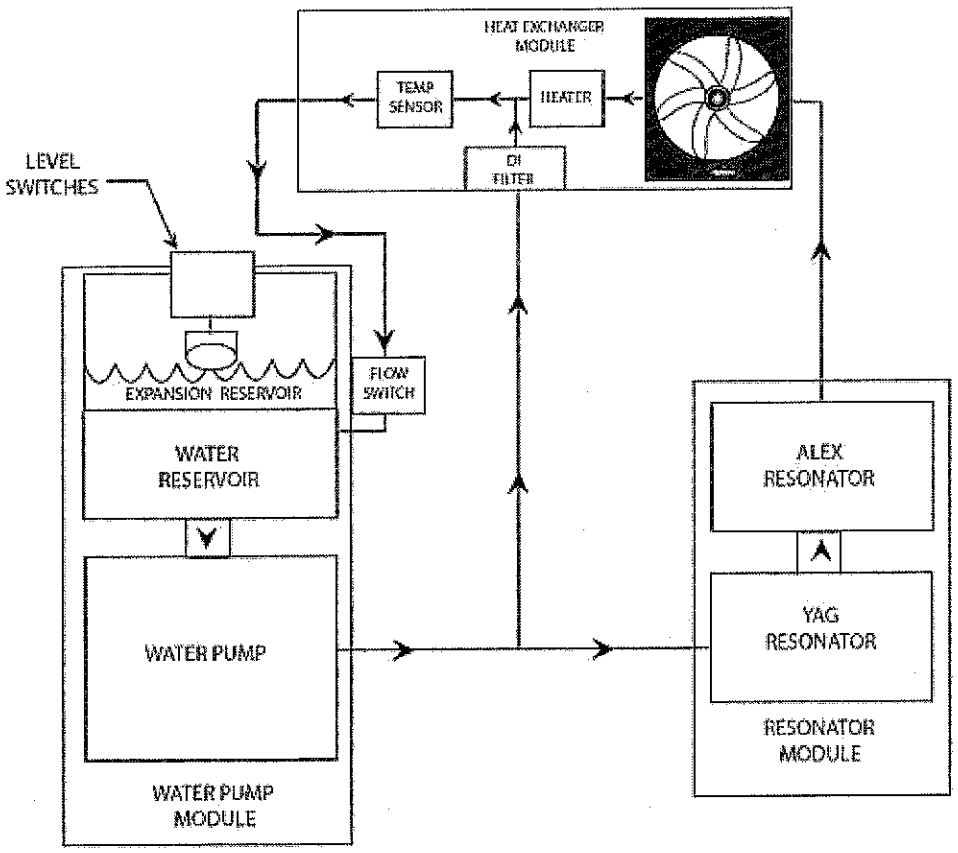

Figure 11–Coolant Flow Diagram

Heat Exchanger Module

The heat exchanger module is the unit that controls the temperature of the system. It contains the heater cartridge, temperature sensor, reset able temperature sensor, de-ionizing cartridge, air-to-air heat exchanger, and two cooling fans.

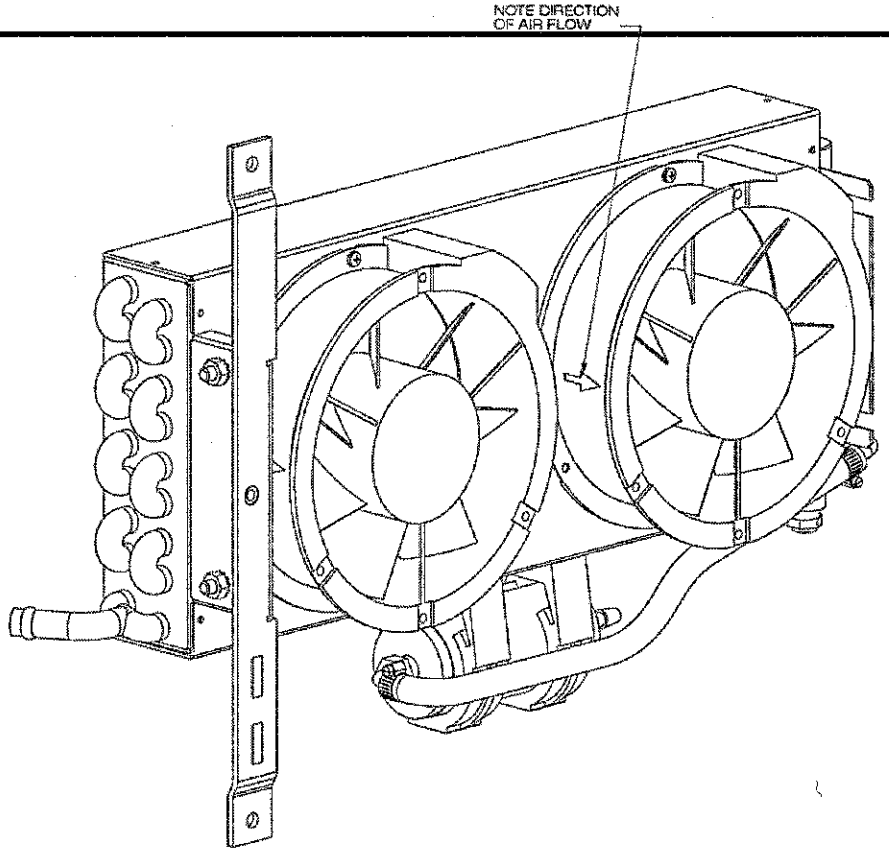

Figure 11–Heat Exchanger Module

The heat exchanger fans operate on 220 volts that is supplied from the AC Distribution board located on the frame module. The CPU will regulate the operating temperature at 65° C by turning on the heat exchanger fans at 66°C and then off at 64°C. The temperature sensor sends analog data to the control board so that the CPU can maintain the operating temperature. The reset able temperature sensor is in place to turn off the heater cartridge at 75°C. It keeps the heater from going into a run away state and over-heating the system by creating an open circuit on one of the legs of the heater. Once the sensor is tripped, the sensor will have to be reset before the laser would operate the heater.

The heater is turned on during the 755nm (Alexandrite) mode only. It will heat the system up to 50°C before the laser will allow the operator to use the laser. At approximately 63°C the heater will turn off until the temperature goes back down below 63°C. The signal to turn on the heater is initiated in the CPU and the system control PCB. The signal is sent to the AC distribution PCB to turn on the solid state relay. When the relay turns on, the heater circuit is closed and the voltage is applied to the heater and resettable temp sensor. Please note that there needs to be water flowing in-order to keep the temp sensor from tripping.

Water Pump Module

The Water Pump Module consists of the water reservoir/expansion tank, float/level switch, flow switch, manifold, and the water pump. The water pump receives 230volts the AC distribution PCB. This voltage turns on the water pump and will engage the flow switch if the system has enough water in the system. The flow switch is rated for 1 gal/min. Inside the expansion tank there is a float or level switch. This switch will indicate a low water level condition. The operator will need to fill system up until the low water condition is reset.

The manifold on the water pump directs the water into the main system and a restricted path to the DI Cartridge.

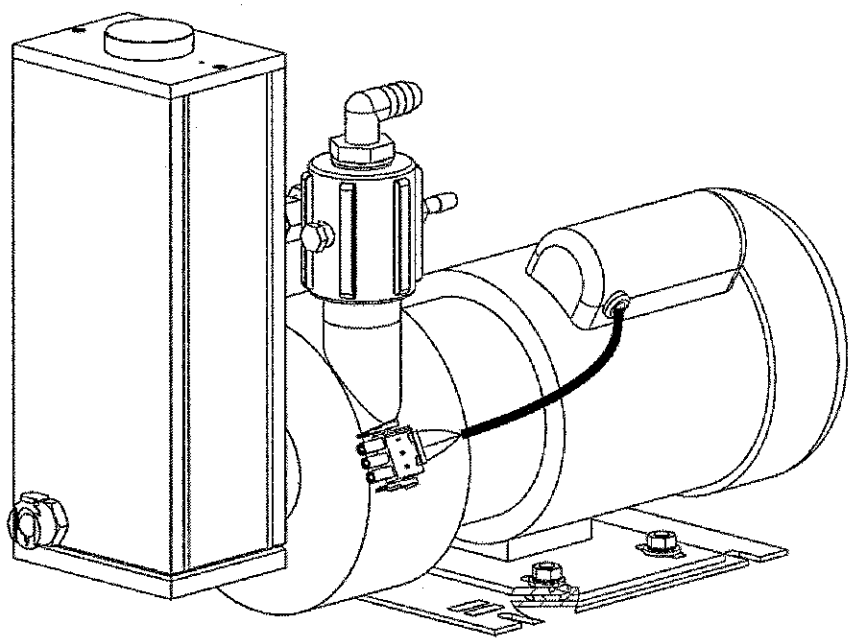

Figure 11–Heat Exchanger Module

CV Mode Hot keys

Key Stroke	Lower case	Upper Case
C	Cal Values	
D	Cal Data	
E	Lock up	
F	Cal Info	
G	Hp factor	
J	Resonator Port Gain	Calport Gain
M	Force shutter closed	
N	Normal Mode	
S	Cal Status	
U	Resonator Port Cal	Calport Calibration
V	Alex FOM	

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This section provides instruction in installing the Apogee Elite/Apogee 5500/Acclaim 7000 lasers.

Tools

Screwdrivers: slotted and Phillips
Fluke 87 Multimeter or equivalent

Facilities Requirements

The laser unit should not share a power line with other heavy power-load equipment such as air conditioners or elevators. Ideally, the laser unit should be on a separate power line with a separate circuit breaker.

The electrical requirements are as follows:

30 AMP service, single phase;
Wall receptacle voltage between 200-245 VAC;
50/60 Hz;
U.S and Canada: NEMA L6-30 Plug; International: Countries Equivalent
Power receptacles must be within 15 feet of the laser site;
Power receptacle must be grounded.

Procedure

NOTE: If performance results cannot be obtained for any step, contact Cynosure Technical Support Group +978-256-4200 or your distributor representative.

1. Check the shipping crate for damage.

   If the crate is damaged, leave the laser inside the crate. Immediately notify Cynosure or your distributor representative of any damage to the laser system. Do not continue installation until you have received clearance from Cynosure or your distributor representative.

   If there is no visible damage, follow the steps below.

2. Check the shipping list to ensure that all the items on the list have been delivered. If the shipping list and items delivered do not match, notify Cynosure Technical Support or the distributor representative immediately.
3. Check the accessories and the exterior of the laser for any signs of damage. If the laser is damaged, do not continue installation.

Note:Immediately notify Cynosure Technical Support or your distributor representative of any damage to the laser system.

4. Plug the pneumatic footswitch into the jack at the rear of the laser.
5. Install the Remote Interlock Plug on the rear of the laser.
6. Setting Primary Tap Connections for Proper AC Line Voltage
7. Set digital multimeter to measure AC voltage ('AC Volts' or 'V RMS' scale).
8. Measure the voltage at the wall outlet by attaching the leads of the multimeter to the 'hot' and 'neutral' terminals of the outlet into which the laser's AC line will be plugged. It should read 220 ± 10% VAC.
9. Locate the AC voltage selection PCB #710-0057-010, mounted behind the access panel on the rear of the laser. It can be removed with two, 8-32 screws. There are five 8-position receptacles on the board for the voltage selection.
10. Use the following table as a guide to achieve a secondary voltage of 230 ± 10 VAC.

Line Voltage	Receptacle
90–109V	100V Rec.*
110–125V	120V Rec.*
195–209V	200V Rec.
210–230V	220V Rec.
231–245V	240V Rec.

Requires that the power supply charge rate be reduced (switch setting). Contact Cynosure for detailed instructions.

11. Connect the 8-pin plug to the appropriate receptacle based on the line voltage measured in step 7.
12. Attach the fiber to the laser and a 7.0 mm handpiece.
13. Connect the funnel assembly to the quick-disconnect on the front of the water tank behind the front door panel. Fill the reservoir with distilled water.

14. Plug in the laser and turn on the main circuit breaker.
15. Cycle the power with the key switch to establish flow. Fill the reservoir back to the top with distilled water and cycle power using the key switch. Fill water to the top rim of the overflow bottle of the water reservoir, if needed. Monitor the water status from the diagnostics screen until "full" is reached.
16. Make sure the laser recognizes the 7mm handpiece on the display.
17. Check to see if there is any sign of water leakage in the coolant system.

NOTE: Allow the laser to warm up so that temperature reaches ~ 65 (°C), by waiting ten (10) minutes.

18. Recheck laser for any possible water leaks.
19. Press Standby.
20. Press System Check. Laser will run through a system check by firing the flashlamps. The laser will ask you to press ready if it passes the system check.

Note: If the laser does not pass system check it will ask for a Calibration.

21. Press ready or Calibrate, then continue.
22. Set pulse width to 20 ms, rep rate of 1Hz, fluence to 10.0 J/cm^2. Insert the 7.0 mm handpiece into the cal port.
23. Press STANDBY,
24. Press READY,
25. Verify that the Ready Light blinks three times, (the system beeps with each blink)
26. Set fluence to 25.0 J/cm^2, fire the laser in the cal port, and verify the selected fluence.
27. Set fluence to 50.0 J/cm^2, fire the laser in the cal port and verify the selected fluence.
28. Press Wavelength to change from 1064 to 755nm.
29. Press Standby.
30. Press System Check. Laser will run through a system check by firing the flashlamps. The laser will ask you to press ready if it passes the system check.

Note: If the laser does not pass system check it will ask for a Calibration.

31. Press ready or Calibrate, then continue.

32. Set pulse width to 20 ms, rep rate of 1Hz, fluence to 10.0 J/cm^2. Insert the 7.0 mm handpiece into the cal port.
33. Press STANDBY,
34. Press READY,
35. Verify that the Ready Light blinks three times, (the system beeps with each blink)
36. Set fluence to 25.0 J/cm^2, fire the laser in the cal port, and verify the selected fluence.
37. Set fluence to 50.0 J/cm^2, fire the laser in the cal port and verify the selected fluence.

NOTE: If performance results cannot be obtained for any step, contact Cynosure, Inc., Technical Support (see page 35 for contact info), or distributor representative.

In order to ensure proper operation of the Apogee Elite/Apogee 5500/Acclaim 7000 laser systems, Cynosure recommends that yearly routine maintenance be performed by factory-trained authorized personal.
This maintenance should include the following operations:

- ◊ A visual inspection of the lasers overall condition and appearance. The laser should be clean and in a clean environment. Inspect all optical components for dust or damage, including the laser resonator, beam combiner, focusing lens, delivery fiber and handpieces. Replace any component as necessary.
- ◊ Flushing of the coolant system and replacement of the deionizer cartridge. Inspect plumbing and tube fittings for leaks.
- ◊ Inspection and replacement of the air filter.
- ◊ Calibration verification of the water temperature sensor. Check for proper operation of the temperature regulation circuit as controlled by the heater and heat exchanger fans.
- ◊ Calibration verification of factory set points, such as the one shot gate signal, pulse widths, repetition rates, etc.
- ◊ Check laser resonator performance as determined by slope efficiency.
- ◊ Fiber alignment and fiber coupling efficiency.
- ◊ Inspection and calibration verification of the cal port.
- ◊ Inspection and cleaning of the high voltage power supply.

Detailed procedures and specifications for the above mentioned items, as well as all factory presets can be found in the *Final Test and Calibration Procedure.*

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Section 6 SERVICE PROCEDURES—PANEL REMOVAL

Removing the Dress Panels

This section of the technical guide details how to remove the dress panels for accessing and servicing internal components.

For most common service procedures, such as accessing the control electronics or laser resonator, it is only necessary to remove the side rails and raise the top cover. The resonator is located under the top plate that is secured to the laser chassis.

Exercise care when removing any of the dress panels. Handle all painted items carefully to avoid scratching or damaging them. Always store panels away from work area until service is complete.

WARNING: Even when the laser is off and the AC line cord is disconnected, DC voltages on various laser components, such as capacitors may exist. This can present a potentially fatal electrical hazard during service procedures. Proceed with caution!

Take the following precautions to avoid an electrical shock during servicing:

- ◊ Always turn the laser off and disconnect the AC line cord from the receptacle before removing the protective housing of the laser system.
- ◊ With the laser off, allow the dump resistors to dissipate the energy in the pulse forming network's capacitors to a safe level (approximately 45 seconds). Monitor the voltage on the capacitors with a DVM probe to ensure it is at a safe level.
- ◊ If it is necessary to test or adjust any electrical component while the system power is on, be careful not to touch any electrical components. Use only appropriate probes or insulated tools.
- ◊ Become familiar with the electrical schematics and layout of the system before attempting to service the laser.

If the AC must be connected during service routines, exercise caution around mains connected components, such as power supply feeds, circuit breakers, key switches, etc. A remote interlock fault condition will reduce high voltage electrical hazards. This fault condition disables the high voltage power supply control and simmer circuits, as well as ensuring that the dump relay is closed (grounding the potential of the pulse forming network). When possible, remove the remote interlock plug during "live" service routines.

Removing the Top Cover

1. Disconnect the AC line cord from the receptacle.
2. Remove the four screws that attach the top cover to the top of the laser chassis. **NOTE:** Two screws are located behind the front door and two screws are located on the rear panel of the laser.
3. Carefully lift the cover off the top of the laser.

Accessing the Laser Resonator

1. Remove the top cover, as detailed in the previous section.
2. Lift the top control/display panel to the stops exposing the resonator rail. **NOTE:** For ease of serviceability, a piano hinge allows access to the upper chassis.

Removing the Side Panels

1. Remove the two screws, located on the rear of the laser, that attach each side panel to
   the laser.
2. Slide each panel toward the rear of the laser, and then lift panel off of the laser.

Removing the SMA Access Panel

1. Unscrew the plastic SMA trim nut.
2. Remove the two screws holding the rear control panel to the main chassis.
3. Slide the rear control panel to the side in order to clear the resonator.

Removing the Front and Rear Panels

1. Remove the two retaining screws that hold each panel to the laser. **NOTE:** The front panel is located behind the front door.
2. Lift off the front and back panels.

Section 7 SERVICE PROCEDURES–PERFORMANCE

One of the most frequent causes of a service call is for "high voltage power supply limit reached," which is basically a low energy condition. It is important to understand, evaluate and diagnose this problem accurately.
This section includes information on the following topics that should be used to determine the cause of the problem.

1. Understanding performance criteria,
- Verifying the resonator performance and fiber coupling efficiency,
- Checking the condition of fiber,
- Checking the condition of the handpiece,
- Checking the condition and alignment of the focusing lens.

Performance Criteria

There are two performance criteria that must be met to define a properly working laser: system performance and resonator performance.

System Performance

System performance is defined from the point of view of the laser operator with a totally assembled laser. The laser must meet all fluence specifications as outlined in the *Operator's Manual.*

Resonator Performance

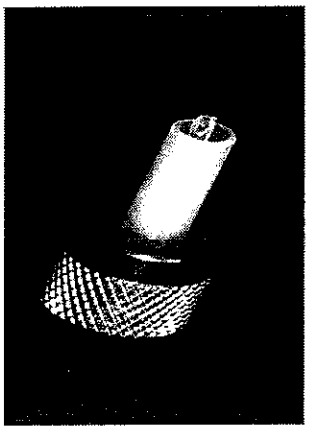
A separate performance standard for each laser has been established for the resonator output. In order to meet the system performance criteria, the resonator must generate approximately 20% more output to compensate for losses in coupling to the delivery system.
For the Alexandrite lasers, the resonator must be capable of generating a minimum of 55 joules/pulse @ 1Hz or 55 Watts. This is based upon a system performance criteria of 25 J/cm^2 with a 15-mm handpiece, which equals 44 joules/pulse out of the handpiece. Adding a nominal 20% for delivery system losses, this means that the resonator must produce 55 joules/pulse. If the system cannot meet this criterion, the efficiency of the laser must be improved.
For the Nd: YAG lasers, the resonator must be capable of generating a minimum of 78.5 joules/pulse @ 1Hz or 78.5 Watts. This is based upon a system performance criteria of 80 J/cm^2 with a 10-mm handpiece, which equals 62.8 joules/pulse out of the handpiece. Adding a nominal 20% for delivery system losses, this means that the resonator must produce 78.5 joules/pulse. If the system cannot meet this criterion, the efficiency of the laser must be improved.

Checking the Condition of the Fiber

The fiber ends should be inspected to insure that they are round, smooth, clean and slightly recessed. If any chips, dust, corrosion, or obvious concentricity errors are apparent, replace the fiber. Generally, the laser does not cause fiber wear, but at times the ends of the delivery fiber can be chipped due to rough handling.

WARNING: Never look directly into the distal end of the fiber while the laser is on, even when wearing protective eyewear; serious eye injury can occur.

1. Turn off laser if laser is on.
2. Disconnect the fiber by unscrewing the fiber from the handpiece and unscrewing the SMA connector from the laser.
3. Using a 7-10X eye loupe, examine both fiber ends. The ends should be slightly recessed (~0.5 mm), clear of debris and round and smooth. See examples below.



Protruding Fiber

Good Fiber

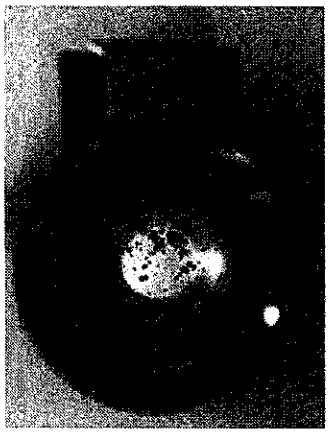
4. If either fiber end is missing, protruding, dirty, blackened, chipped or rough in appearance, do not use. Replace with a new fiber.
5. Hold one fiber end to a bright source, a ceiling light, sunny window, etc., and look at the other end. The fiber end should be illuminated brightly as compared to when it is not pointed at a light source.

Checking the Condition of the Handpiece

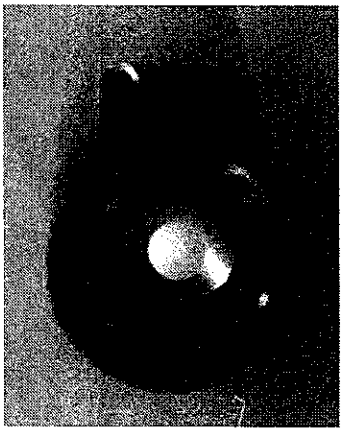
Some optics within the system are more susceptible to damage than others. After a long period of use, certain optics need to be inspected and unless their condition is pristine, replaced. The first optics to inspect are the handpiece lenses. Any dirt or discoloration in the coating surface will affect the handpiece transmission and thus the overall efficiency of the laser.

WARNING: Never look directly into the handpiece while the laser is on, even when wearing protective eyewear; serious eye injury can occur.

1. Turn off laser if laser is on.
2. Disconnect the fiber from handpiece. Remove the treatment tip if attached. Inspect the window and replace if damaged.
3. Examine the condition of the handpiece lenses, by sighting down the barrel. A handpiece in good working order provides a clear, unobstructed view through the lens. See examples below.



Dirty Lenses, Unacceptable



Clean Lenses, Good

4. If the handpiece lenses appear dirty, scratched, discolored, or pitted, then test the laser with a good handpiece and repair or replace the damaged lenses.
5. If handpiece lenses are replaced, verify spot size. If necessary re-spot the actual spot size of the handpiece in accordance with Cynosure's recommended procedures for handpiece repair.

Checking the Focus Lens

Additional optics that are susceptible to wear and optical damage are the focus lens, turning mirror and the beam combiner. It is important when working with these optics that the parts stay clean and free of oils and fingerprints. Follow the procedure for aligning the focusing lens as described in the *Final Test and Calibration Procedure.* The fiber coupling transmission should be approximately 80% of resonator energy with new or good quality optics.

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Performance Test Sequence/Field Evaluation

1. Perform a system performance check.
2. Does system meet those system specifications?
   - 2.1 If yes, fill out the service and repair report.
   - 2.2 If no, continue this test sequence.
   - 2.3 Inspect fiber and handpiece for any damage.
   - 2.4 If no damage is found, continue this test sequence.
3. Access the resonator.
4. Check beam combiner, focusing lens and fiber alignment as detailed in "Checking and Replacing the Focusing Lens" If no damage is found, continue this test sequence.
5. Does system meet requirements of "Resonator Performance,"?
6. Verify the Resonator port calibration.
7. Check resonator output as detailed in *Final Test and Calibration Procedure.*

   If resonator output acceptable, establish a "figure of merit" for the Resonator.

   If resonator output unacceptable, continue this test sequence.

   For the Nd:YAG lasers, check the alignment of the resonator. Realign, and establish a "figure of merit" for the resonator

   Verify fiber alignment and aim beam adjustment as detailed in the *Final Test and Calibration Procedure.*
8. Verify fiber transmission is at least 75% of resonator energy.
9. Verify the accuracy of the cal port.

Pump Chamber Maintenance

This section of the technical guide describes the maintenance of the pump chamber and includes removing and replacing the flashlamps, cleaning and inspecting the laser rod. If severe damage to the rod or the rod's reflective coating occurs, then the pump chamber including the rod must be replaced as an assembly. The pump chamber is not considered a field serviceable item.

Removing the Pump Chamber

CAUTION: Before removing the pump chamber, always remove the lasers AC line cord from the wall receptacle. Use a digital volt meter to make certain that there is no voltage present on capacitor bank.

1. Access the resonator.
2. Disconnect the coolant lines from the pump chamber being serviced.
3. Disconnect the two PFN wires from the ceramic standoffs from the pump chamber. (Ceramic standoffs are extremely brittle.)
4. Disconnect the red wire from the trigger transformer that is attached to the pump chamber.
5. Slide the front dust tube forward into the safety shutter mount.
6. Remove the
7. Remove the four 8-32 socket head screws that secure the pump chamber to the resonator rail.
8. Carefully remove the pump chamber from the laser.

Replacing the Flashlamps

Before replacing the flashlamps, always record the flashlamp pulse count on the *Service and Repair Report* along with the voltage at 50W for the Alexandrite laser and 60W for the Nd: YAG laser. Note the location of the crimp lug on the flashlamp wire lead of each lamp. This indicates the anode or "+" electrode of the lamp. Remove the pump chamber as described in the section above. The flashlamps can be removed without removing the pump chamber. The flashlamps for the Nd:Yag will be removed toward the back of the laser and the flashlamps on the Alex will be removed toward the front of the laser. The Turning mirror mount has slots to accommodate the flashlamp removal.

1. Remove the 4-40 socket head screws and lock washers that secure the flashlamp keepers to the pump chamber.
2. Carefully remove the flashlamp keepers from the lamps.
3. Remove the old lamps, noting the correct position of the flashlamp anode.
4. Clean the new lamps with methanol before installing.
5. Inspect and replace the flashlamp keeper O-rings if necessary.

6. Inspect and clean rod, if necessary, as detailed on page 50.
7. Reverse this section for installation of lamps and pump chamber.

CAUTION: Do not handle the flashlamps with bare fingers. Skin oils can damage the quartz envelope of the lamp. Always use finger cots or cotton gloves.

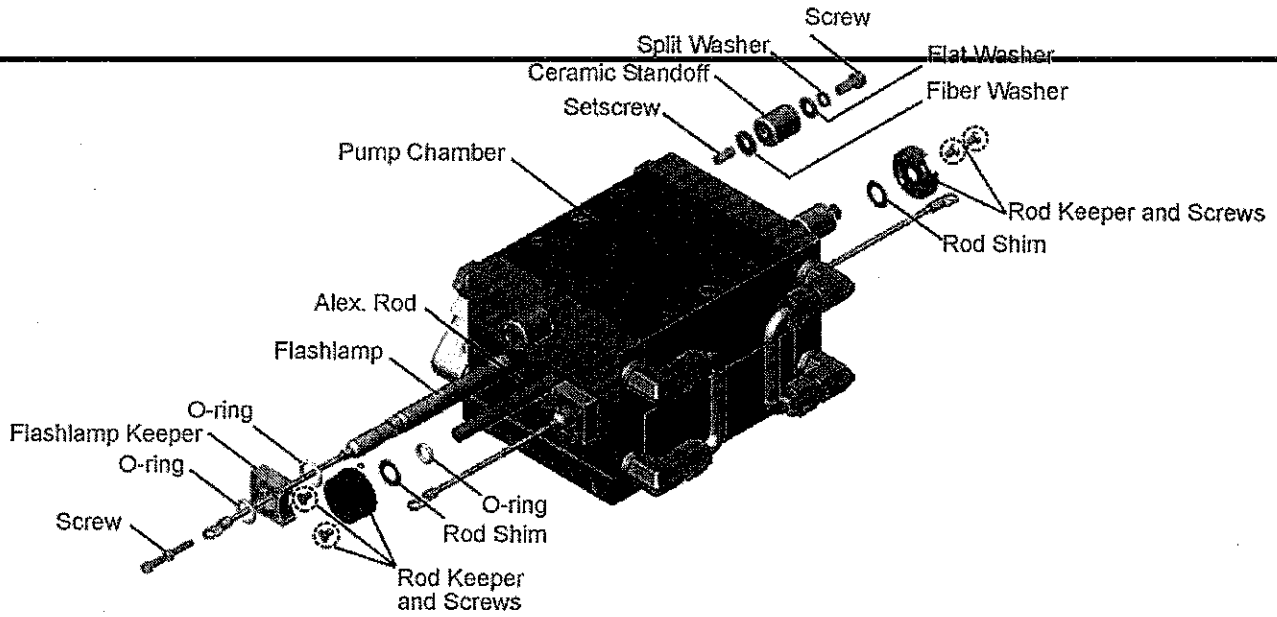

Figure 12A–Pump Chamber, Apogee Elite

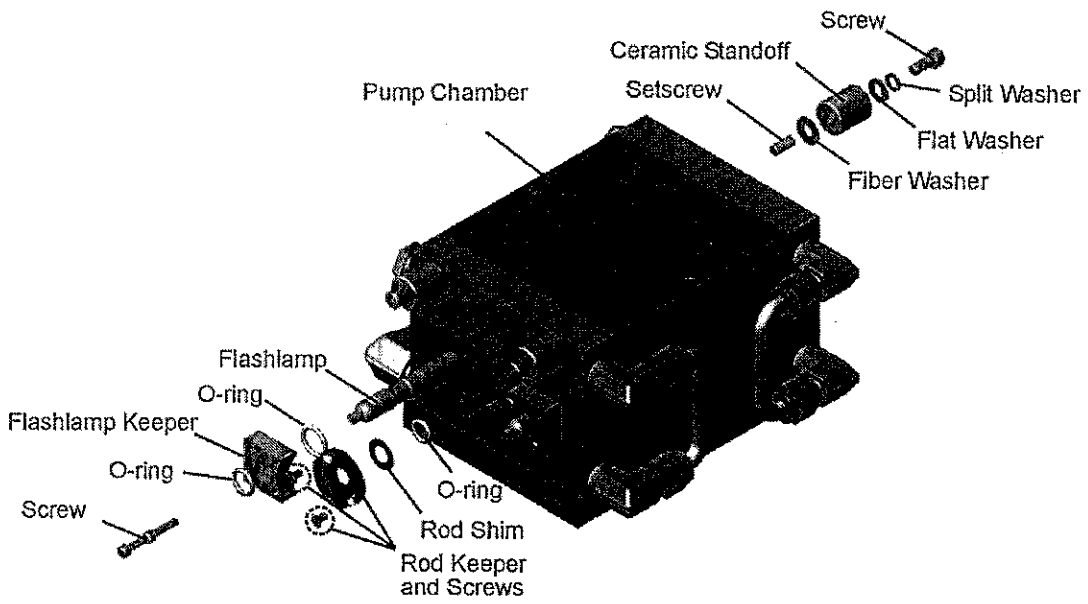

Figure 12B–Pump Chamber, Apogee 5500/Acclaim 7000

Inspecting and Cleaning the Laser Rod

Inspect both surfaces of the rod using at least a 7x eye loupe for scratches, pinholes, burns, etc. If there is any problem with the rod, note the location and severity of damage on the service report.

If dirt is present, clean the end of the rod very carefully as detailed in the steps below. Use only optics grade methanol, or acetone for heavy-duty spots, and tightly wound cotton swabs. Make certain that the cotton swabs do not contain an adhesive.

1. Soak the end of cotton swab with methanol.
2. Shake off any excess methanol from the swab.
3. Using light pressure, move the swab in a circular motion starting in the middle of the rod, and then gradually working outward to the edge of the rod.
4. Dispose of the swab when finished.
5. Reinspect the rod, and repeat as necessary. **NOTE:** Use a new cotton swab each time the rod surface cleaning is repeated.

Checking and Replacing the Focusing Lens

IMPORTANT: At each service call, the focusing lens must be inspected.

1. Verify that the laser is off.
2. Access the resonator rail module.
3. Remove the two 1/4-20 socket head screws that secure the Focus lens mount to the resonator rail.
4. Inspect the surface of the focusing lens. Use a bright lamp for inspection. Haze might not be easily detected with poor lighting. Any pitting or discoloration to the antireflection coating constitutes damage and requires that the optic be replaced.
5. Loosen and remove the locking ring with the lens holder key.
6. Wearing finger cots or gloves, clean all parts with methanol and allow them to dry.
7. Carefully drop a new, clean lens into the lens holder. The lens is plano-convex, so orientation is critical. NOTE: The curved side of lens faces the laser resonator.
8. Reinstall the locking ring. Gently blow out any debris or dust. Reinspect the lens for cleanliness.
9. Install the focus lens mount on the rail.
10. Verify the alignment of the focus lens as described in the *Final Test and Calibration Procedure.*
11. Verify that fiber transmission is at least 75% of the resonator energy.

Aligning the Resonator

Alexandrite Lasers

The Apogee 5500 Alexandrite Rod, is coated for maximum and partial reflectivity. No external optics are required for lasing. Alignment is fixed.

Nd: YAG Lasers

The Nd:YAG resonator uses only one external laser optic the maximum reflector. Before aligning, inspect the rod and maximum reflector for damage. Remove the turning mirror mount..

WARNING: High voltage, hazardous high temperatures and rotating fan blades are exposed when the panels are off, and laser is running. Exercise extreme caution when operating the laser. Always wear appropriate Laser Safety Glasses when operating the laser systems.

1. Initiate 'CV'.
2. 'CV' mode is indicated on the Laser Display when the Fluence Display
3. Position the Ophir enrgy detector head approximately 18" from ACCLAIM resonator chamber. Align the energy detector so it is facing towards the Resonator output.

   Set: NOVA II meter
   Menu = Power(Watts)
   Range = Auto
   Average = 1-second
   Laser wavelength = 1064.

   Set: LASER
   Voltage = 350 V.
   Pulse width = 5 ms
   Rep rate = 1 Hz

4. Center a piece of 'ZAP-IT' laser alignment paper in front of the energy detector disk. Fire a single shot into the 'ZAP-IT' paper. Verify the burn on the energy detector disk. Re-position the energy detector if necessary so that the burn pattern on the 'ZAP – IT' paper is centered on the energy detector disk.
5. Press and hold down the footswitch to fire the laser, while adjusting the two max. reflector adjustment screws for a maximum reading on the Energy/Power meter.
6. Release the footswitch.
7. Examine the burn pattern. It should be circular with sharp edges.
8. Adjust the YAG maximum reflector to optimize the quality of the burn, on burn paper.

9. Power should be between 3 to 7 watts when the burn is symmetric and uniform. There should be no internal structure, such as rings or spots.
10. Fire a single shot on an unexposed area of the burn paper after each adjustment, until proper exposure is obtained.
11. Once satisfied with the burn pattern, lock the mirror adjustment crews in position.
12. Fire one more laser pulse onto paper to make sure that tightening the mirrors did not affect the burn pattern.

Inspecting and Replacing the Resonator Mirror, Nd:YAG

NOTE: This section applies to the Nd: YAG lasers only.

1. Inspect the maximum reflector carefully for burns or other degradation. Use a flashlight and compressed air to aid in the inspection. If any damage is noted, remove the optic with the mount and clean it.
2. Clean the optic carefully using methanol and a lens tissue or cotton swab. If the optic cannot be cleaned, rotate it in the mount to an undamaged area of the optic, otherwise, replace it.
3. Reinspect the mirror carefully for filth, streaks or specs. Use a flashlight and compressed air to aid in the inspection. Clean the optic again if necessary.
4. Install the optic with the mount, and then verify alignment. Align the resonator if necessary.

   For aligning and measuring resonator energy, please refer to the *Final Test and Calibration Procedure.* When making energy measurements, the entire beam profile must fill at least 75% of the detector area. Take a burn to confirm the size of the beam, and to confirm that it is centered on the detector face.

   CAUTION: Be sure that the burn paper is inside a plastic bag to prevent any burn residue and smoke from depositing on the laser rod or other optics.

Aligning the Turning Mirror, Apogee Elite Nd:YAG

The Apogee Elite Nd:YAG resonator uses a tuning mirror and beam combiner to align the Nd:YAG beam to the fiber assembly. Before aligning the mirror, inspect the turning mirror and beam combiner for damage Elite Modular Lasers — Aligning the Nd:YAG Turning Mirror. Install the YAG Turning Mirror Assembly onto the resonator rail. If the aiming beam assembly is attached to the turning mirror, remove it.

On the Resonator Interconnect PC board, Jumper across JR6 pin 1 to pin 4 using a jumper wire with clips. Install Alignment fixture # 706-0175-000 cross hair fixture to the rail location in front of the Apogee chamber.

Set Laser:
Voltage = 350
Pulse Width = 20msec
Rep Rate = 1Hz
WL = 1064nm

Fire the YAG laser beam at low energy, 2-4 watts, through fixture # 706-0175-000 and use the 3 turning mirror mounting screws to center the burn pattern on the Zap it paper through the cross hair fixture.

Remove alignment fixture # 706-0175-000 (Cross Hair Fixture).

IMPORTANT NOTE: Aligning the turning mirror is a critical function.

Replacing the Beam Combiner Glass

CAUTION: Verify calibration of the energy monitor when replacing the beam combiner glass. Recalibrate if necessary, or the laser may operate incorrectly.

Replacing the Glass Only, Apogee Elite

1. Remove the holder as described in the section above.
2. Remove and replace the glass assembly by removing the three holding screws and the wavy washer.
3. Install a new combiner glass and verify alignment of the Nd: YAG laser beam and aiming LED, and then realign if necessary.
4. Recalibrate as described in the *Final Test and Calibration Procedure.*

   NOTE: The beam combiner is coated on both sides. It is important to have the anti-reflective side face the Alex pumpchamber.

Replacing the Glass Only, Apogee 5500/Acclaim 7000

1. Remove the holder as described on page **Error! Bookmark not defined.**.
2. Remove the damaged glass and any adhesive remaining on the holder. Clean with methanol.

   NOTE: The beam combiner is coated on one side only. This coated surface must face the laser rod. A black dot on the glass indicates the uncoated surface. Remove this dot using methanol and a lens tissue or cotton swab before gluing the new glass in place.
3. Use optical grade adhesive to secure the new glass to the holder so that the coated surface is toward the laser rod. Let it dry.
4. Reinstall the holder and glass in the beam combiner mount in the correct orientation.
5. Reverse above steps for installation.
6. Verify alignment of the aim LED, and then realign if necessary.
7. Verify the energy monitor, and if necessary, recalibrate as described in the *Final Test and Calibration Procedure.*

Establish Figure of Merit for Resonator(s)

WARNING: Do not look directly at laser resonator. The lasers produce laser light every time the flashlamps fire.

1. For Acclaim Pump chamber: Setup
   Voltage = 600v
   Pulse Width = 20msec
   Rep Rate = 1Hz
2. While firing laser, slowly increase the high voltage until a power level of 60 Watts is achieved. The resonator must produce 60 watts @ < = 720 volts. NOTE: (DO NOT EXCEED 80 Watts). Record actual voltage on the Data Sheet.
3. For Apogee pump chamber: Setup
   Voltage = 600v
   Pulse Width = 20msec
   Rep Rate = 1Hz
4. While firing laser, slowly increase the high voltage until a power level of 50 Watts is achieved. The resonator must produce 50 watts @ < = 750 volts. NOTE: (DO NOT EXCEED 60 Watts). Record actual voltage on the Data Sheet.
5. If laser does not meet the following criteria, the laser rod needs to be replaced.

Calibrate the Resonator Port

1. Remove the SMA focusing mount from the rail assembly.
2. Initiate 'CV' mode by
3. On the Resonator Interconnect PC board, Jumper across JR6 pin 1 to pin 4 using a jumper wire with clips or use a centering pin
4. Set Laser:
   Laser Voltage = 600
   Pulse Width = 5 ms
   Rep Rate = 1 Hz
   *wavelength = 1064
5. Set NOVA II power meter:
   *laser type = "NIR" or "1064"
   Average = 1 second
6. Fire the laser and adjust the laser voltage until the NOVA II power meter reads 45W +/- 1W.
7. Press lower case 'm' DO NOT press the <Return> key. This will keep the EXT shutter closed while firing the laser and deflect the beam energy into the Resonator Port.
8. Fire the laser a couple of shots and make note of the Resonator(dump) voltage.
9. Press the Lower case 'j' key and enter a gain value of 8
10. Fire the laser again and verify if the resonator(dump) voltage measures between 1.3 and 1.5 volts.
11. Continue to adjust the gain value until the resonator voltage measures between 1.3 and 1.5 volts (0 = most gain, 15 = least gain).
12. Press Lower case 'u' and enter 45Watts.
13. Fire laser into the Resonator Port and Verify resonator energy is reading 45Watts +/- 2 Watts and the resonator voltage measures between 1.3 and 1.5 volts.
14. Press Lower case 'n' to return Ext shutter to normal function.
15. Repeat steps 1-13 (*substitute 755 laser wavelength and 755 for laser type).

For most electrical procedures involving the replacement, recalibration and/or test of a component, refer to the *Apogee Elite/Apogee 5500/Acclaim 7000 Final Test and Calibration Procedure* for complete instructions.

Replacing the Front control panel Module

16. Turn off the laser power and disconnect the AC from the wall.
17. Remove all connectors from the control PCB.
18. Unplug the fiber sensors from the control PCB
19. Remove three screws securing the front control module to the top of the frame. The screws are located on the hinge of the module.
20. Replace the module by reversing the above steps.
21. Perform the following sections of the *Final Test and Calibration Procedure*:
    - HVPS Calibration
    - Temperature Settings
    - Calibrating the Resonator Port
    - Calibrating the Cal Port

Replacing and Calibrating the Control PCB

1. Turn off the laser power and disconnect the AC from the wall.
2. Follow the section above to remove the front panel display from the Front control panel PCB.
3. Remove all connectors from the PCB.
4. Remove the six 4-40 screws that attach the PCB to the sheet metal.
5. Replace the PCB by reversing the above steps.
6. Perform the following sections of the *Final Test and Calibration Procedure*:
    - HVPS Calibration
    - Temperature Settings
    - Calibrating the Resonator Port
    - Calibrating the Cal Port

Programming the Microcontroller

For updating laser software, follow the instructions found in the *Apogee 5500/Acclaim7000 Software Update Procedure Using a Laptop Computer.*

Replacing the High Voltage Power Supply Module

1. Disconnect the laser from the AC service.
2. Unplug PV1 from the voltage selection PCB.
3. Unplug high voltage cables from the top of the power supply.
4. Unscrew the flat ribbon control cable from the power supply.
5. Remove the holding nut and slide the module out of the laser.
6. Reverse the above steps when installing a new module.
7. Recalibrate the high voltage power supply and the high voltage readback as described in the *Final Test and Calibration Procedure.*

Replacing Simmer/IGBT Module

1. Unplug PS2 to the IGBT driver and simmer PCB.
2. Remove HV cable from CAP+, CAP-, LAMP+, and LAMP- connections on the IGBT driver and simmer PCB.
3. Remove the Trigger wire from the Nd:YAG laser head.
4. Remove the Trigger wire from the Alex laser head.
5. Unplug two low voltage power supply connectors from the low voltage power supply.
6. Unplug connector PT1 from the simmer transformer.
7. Slowly slide the module out and unplug the PS5 in the middle of the IGBT driver and simmer PCB.
8. Remove four optical fibers – CR2, CR4, CR6, and U4
9. Slide the module out of laser.
10. Reverse the above steps when installing a new module.
11. Verify the low voltage power supply and the simmer as described in the *Final Test and Calibration Procedure.*

Replacing Low Voltage Power Supply

There is one low voltage power supply (LVPS) on this system mounted to simmer/IGBT module. This supply has two +12 V outputs, -12V and 5 V that is used for the logic control and power for the different solenoids. The 5V is extremely important at it is used to power the Rabbit Microprocessor. To replace the low voltage power supply.

1. Removed the Simmer/IGBT module, this will allow access to the mounting screws.
2. Remove the four mounting screws and remove from Module.
3. Install new power supply in it's place.
4. Verify Low Voltage Power Supply
   - ◊ Attach multimeter negative (black) probe to TP5,TP28,or TP30 (GND) on the Laser Control PCB.
   - ◊ Attach the multimeter positive (Red) probe to J15 pin 4; verify voltage measures between **+4.95 and +5.05 volts**. If out of range, adjust "OUT 1V.ADJ" on the power supply.
   - ◊ Attach the multimeter positive (Red) probe to J15 pin 2; verify voltage measures between **+11.9 and +12.3 Volts**. If out of range adjust "OUT 2 V.ADJ" on the power supply.
   - ◊ Attach the multimeter positive (Red) probe to J15 pin 9; verify voltage measures between **–12.3 and - 11.7 VDC**.
5. Verify the simmer on in all laser heads.

Replacing the Simmer Trigger Transformer

1. Removed the Simmer/IGBT module, this will allow access to the mounting screws.
2. Unscrew the mounting screw from the underside of the module.
3. Remove the old simmer trigger transformer.
4. Attach the new simmer trigger transformer.
5. Reinstall the Simmer/IGBT module.
6. Verify Low Voltage Power Supply
7. Verify the simmer on in all laser heads.

Section 12 Servicing–Cap Bank Module

WARNING: Even when the laser is off and the AC line cord is disconnected, DC voltages on various laser components, such as capacitors may exist. This can present a potentially fatal electrical hazard during service procedures. Proceed with caution!

Removing the Cap bank module

1. Turn off and unplug the laser.
2. Remove the two high voltage wires from the power supply and two high voltage wires to the Simmer/IGBT module.
3. Disconnect the two signal fibers form the cap bank module.
4. Remove the two holding screws and slide the module out of the laser.
5. Reassemble by reversing the previous steps.
6. Recalibrate the High voltage power supply and the high voltage readback as described in the *Final Test and Calibration Procedure.*

WARNING: Do not attempt to short directly (i.e., with a screwdriver) or a potentially fatal electrical shock can occur.

Replacing a cap bank fuse

1. Turn off and unplug the laser.
2. Using a shorting stick, discharge each capacitor unto zero volts is reached.
3. Remove the fuse. If the fuse is unable to be reached, remove and cap bank module.
4. Install the new fuse and reassemble.

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Draining the Coolant System

When it becomes necessary to drain the coolant system, use one of the two quick disconnect fluid couplings provided. One is located on the main water reservoir of the water pump assembly. The second is located underneath the front left of the laser system. This drain is attached to the air-to-fluid, heat-exchanger inlet tube and is accessible without removing dress panels.

CAUTION: When the laser is transported or shipped it is important that the coolant system is completely drained to avoid damaging the laser components. Use the quick disconnect underneath the laser for this purpose only.

Draining the Water

1. Place a pan under the front of the laser under the stainless steel quick disconnect.
2. Snap a mating 3/8" quick disconnect fitting into the fitting. This will drain the system.
3. Run the pump for a few seconds by holding the key in START to purge more fluid.
4. Disconnect the quick disconnect fitting.

NOTE: Before performing the following procedures the front and side panels need to be removed to access the components.

Replacing the Water Pump

1. Drain the system.
2. Disconnect all electrical connectors for the following:
   - ◊ Water Pump AC line
   - ◊ flow switch
   - ◊ level sensors
3. Remove the following water lines from the manifold:
   - ◊ 1/2" line to head
   - ◊ 3/8" line to D.I. cartridge
4. Remove the following water lines connected to Flow switch assembly:
   - ◊ 1/2" line from heat exchanger to flow switch
5. Remove the two nuts holding the pump plate to the laser chassis. Remove the water pump module.
6. Reassemble by reversing the previous steps.

Replacing the Flow Switch

1. Drain water from the tank.
2. Unplug PA5 from the AC distribution PCB.
3. Disconnect 1/2" tube from the switch.
4. Unscrew the flow switch from the water reservoir.
5. Clean any residual Teflon tape from the threads of the fitting connected to the tank. Rewrap the fitting with Teflon tape.
6. If the wires of the new flow switch have not been terminated with a 2-pin plug, cut the wires from the old switch, and then butt-splice onto the new switch.
7. Replace with a new flow switch. Plug PA5 back into the AC distribution PCB.
8. Fill the tank with water. Check for leaks.

Replacing the Heat Exchanger Module

1. Drain water from the tank.
2. Unplug P10 from the AC distribution PCB.
3. Unplug the heater wires from heater and resettable temp sensor
4. Removing the tubing at the fittings of the Deionizer Cartridge.
5. Remove the tubing from the resonator rail.
6. Remove the tubing going to the flow switch.
7. Remove four nuts that hold the heat exchanger to the frame.
8. Slide heat exchanger off the mounts and remove from the laser
9. Reassemble by reversing the previous steps.
10. Recalibrate the temperature as described in the *Final Test and Calibration Procedure.*

Replace the Temperature Sensor

11. Drain water from the tank.
12. Unplug P10 from the AC distribution PCB.
13. Unscrew the temperature switch from the Manifold.
14. Wrap the threads of the new temperature sensor with Teflon tape.
15. Install the new temperature sensor into the tank.
16. Plug P10 back in into the AC distribution PCB.
17. Fill the tank with water. Check for leaks.
18. Recalibrate the temperature as described in the *Final Test and Calibration Procedure.*

Replacing the Deionizer (DI) Cartridge

1. Drain the water.
2. Remove the Right side panel.
3. Remove the old deionizer (located on the right side of the heatexchanger assembly) by removing the tubing at the fittings and opening the clamp. Remove the old cartridge.
4. Insert a new cartridge and attach the tubing to it. If the cartridge does not have fittings, the fittings must be transferred. Clean the threads of any old Teflon tape, and then place approximately 1.5 turns of new Teflon tape on the male threads turning by hand until tight.

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Note that the frame module can only be replaced at the factory.

AC Fuses and AC Relay

The AC fuses and the AC relay PCB are located under the Cap Bank module, Left side of the laser, on the AC distribution plate. The fuses are all labeled and Fuse 1 (F1) is on the right side. See *System Wiring Diagram* for a description, part number and designation of each fuse and relay. There is no calibration for this board.

Replacing the Voltage Selection PCB

1. Disconnect the laser from the wall.
2. Disconnect all wire connectors from the PCB.
3. Remove the four mounting screws from the central portion of the PCB.
4. Replace the PCB and reverse the precious steps. Make sure the correct line voltage is selected.
5. This board also has no calibration.

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Calibration of the Resonator Port

Schedule for Calibration

Cynosure calibrates the laser's energy meter at the factory prior to shipment. The energy meter should be calibrated once a year by authorized service personnel. Call your local Cynosure representative to arrange for annual calibration by authorized personnel. The energy meter is calibrated by checking that the displayed fluence value corresponds to the actual laser pulse energy as measured by an independent energy meter of known accuracy.

Overview

The laser is provided with a built-in energy meter that allows the laser to be calibrated by measuring the actual energy delivered from the handpiece. Energy measurements are obtained by inserting the handpiece into the cal port, and then firing the laser. The front panel display indicates the energy per unit area (or fluence in joules per square centimeter, J/cm2), taking into account the area of the laser focal spot for the handpiece in use.

The energy meter consists of these main components:

♦ The cal port built into the front panel. The cal port includes an internal switch to sense the presence of the handpiece, which allows the laser to fire while in calibration mode only if a handpiece is inserted.

♦ A sapphire window that protects the internals of the cal port and is damage resistant. It should be cleaned frequently using a tissue or cloth.

♦ A pinhole within the cal port that allows only a small fraction of the incident light through a fiber optic cable to an optical sensor.

♦ An optical sensor that receives the laser light incident on it, and produces an electrical signal proportional to the absorbed optical pulse energy. The signal is amplified and calibrated at the Laser Control PCB.

♦ A front panel display that shows the selected fluence in joules/cm2.

Required Equipment

CAUTION: The accuracy of the calibration depends completely upon the measurement of laser pulse energy using a separate instrument as an independent calibration standard. If the calibration standard is inaccurate or not used correctly, then the built-in energy meter will also be inaccurate after calibration.

♦ An accurate, NIST-traceable, laser power meter for use as a calibration standard. The selected calibration standard must be accurate for the appropriate wavelength and range of pulse energies. The meter's sensor element or input attenuator must withstand, without damage, the range of fluence and peak power per unit area typical of the laser.

♦ A standard service tool kit, e.g., a #2 Phillips screwdriver and a small flat-blade, potentiometer trimming screwdriver.

♦ Laptop computer with RS-232 interface

Calibration Procedures

There are two detectors in the system: 1) a resonator port that samples the full energy of the beam prior to coupling into the optical fiber and, 2) a calibration port that samples the full energy existing the handpiece. Both detectors must be calibrated as part of a complete service calibration. These calibration procedures are detailed in the following pages. Before starting the calibration, however, verify that these preparatory steps are taken.

♦ Verify that the cal port window is clean.

WARNING: Failure to keep the cal port Window clean may result in incorrect calibration.

♦ Be sure that the fiber optic is properly routed and secured.

♦ Install a 7-mm handpiece.

Calibration of the Resonator Port

1. If installed, remove the SMA/lens mount assembly from the rail assembly.

2. Position the laser power meter detector head so that the laser beam from the beam combiner fills approximately 75% of the detector element.

3. Initiate 'CV' mode by pressing and holding the two keys to the far right when facing the front display panel..

4. Set the laser to the following parameters:

- ♦ Voltage = 600
- ♦ Pulse Width = 5 ms
- ♦ Rep Rate = 1 Hz
- ♦ Wavelength = 1064 (or 755 if testing the alexandrite laser)

5. Set power meter to the setting for the laser type /wavelength being tested: Nd: YAG 1064nm or Alexandrite 755nm

6. Fire the laser and adjust the laser voltage until the power meter reads 45W ± 1W. Record the reading.

7. Press lowercase 'm' on the laptop to close the shutter and deflect the beam into the resonator port.

8. After firing into the resonator port, use the "j" key on the laptop to adjust the gain of the Vdump to read between 1.3 and 2.2VDC on the laptop by entering a gain value between 0 and 15.

NOTE: A value of 0 being the largest gain setting and 15 being the smallest

gain setting. Fire the laser with the adjusted gain, and verify it now reads within range.

9. Press lowercase "u" on the laptop and entering the power meter reading.

10. Fire the laser into the resonator port, and verify that the resonator port power as displayed on the computer screen agrees with the power measured on the power meter 45W ± 1W.

11. If testing an Apogee Elite laser, repeat steps 4 through 10 for the other wavelength.

12. Replace the focusing block and verify fiber alignment.

Calibration of the Cal Port

1. Verify that the laser's coolant temperature is at 65 C°.

2. Initiate 'CV' mode by pressing and holding the two ( ) keys to the far right when facing the front display panel. (while power up laser)

3. Set the laser to the following parameters:

- Voltage = 600
- Pulse Width = 5 ms
- Rep Rate = 1 Hz
- Wavelength = 1064 (or 755 if testing the alexandrite laser)

4. Set power meter to the setting for the laser type /wavelength being tested: Nd: YAG 1064nm or Alexandrite 755nm

5. Position the 7-mm handpiece so it is facing into the power meter detector head.

6. Fire the laser and adjust the laser voltage until the power meter reads 35W ± 1W. Record the reading.

7. Place the handpiece into the cal port.

8. Fire the laser for two shots, and take note of the cal port voltage.

9. Press the uppercase 'J' key on the laptop to adjust the gain of the cal port voltage

10. Fire the laser for two shots into the cal port again, and take note the cal port voltage.

11. Continue to adjust the gain value until the cal port voltage measures from 1.3Volts to 3.0 while firing into the cal port. **NOTE:** A value of 0 being the largest gain setting and 15 being the smallest gain setting.

12. Press the uppercase 'U' and enter the reading from step 6.

13. Fire laser into the cal port and verify that the cal port power as displayed on the computer screen agrees with the power measured on the power meter 35W ± 1W.
14. If testing an Apogee Elite laser, repeat steps 3 through 13 for the other wavelength.

The section of the technical guide is to make certain that repaired Apogee Elite/Apogee 5500/Acclaim 7000 lasers pass all functional and physical performance requirements before being released back to a customer.

Final Check Procedure

NOTE: If a laser fails a step, record the discrepancy on a *Service & Repair Report*, as well as the corrective action taken.

1. Verify that the system contains distilled water. Turn on the laser with the key switch and verify that the front control panel features light.

1. Test the automatic energy regulation and slope efficiency of the laser.
2. Verify that laser meets all system performance specifications for maximum fluence and rep. rates for each handpiece provided.

Warning fault Codes

These faults are operational errors, often caused by improper operation or state of the laser. For example, an attempt to fire the laser without a fiber present is a fault. The operator can usually correct this type of fault. These faults will generate a fault code that will appear on the front display panel as shown in the following table.

W50	W50:Open Interlock; Check Interlock	Install remote interlock connector or if using interlock, close room door.
W51	W51:No Fiber; Connect Fiber	Install delivery fiber and handpiece.
W52	W52:Wavelength Unavailable	
W53	W53:Low Water; Add Water	Add Water to reservoir
W54	W54:HVPS EOC Warning	High fluence use on 120 VAC demonstration, press standby to continue using laser.
W55	W55:Calibration Required; Press Standby	
W56	W56:Invalid Handpiece; Change Handpiece	Old handpiece from another laser or handpiece not allowed for wavelength selected. Install correct handpiece.
W57	W57:No Handpiece; Install Handpiece	Install handpiece.
W58	W58:Handpiece Changed; Press Standby	Handpiece changed, press standby then Sys Check to continue.
W59	W59:Low Trans; Check Fiber and Handpiece	Fiber, handpiece, or focus lens damaged, but still useable
W60	Not used	
W61	W61:Calibration Failed; Call Service	
W62	W62:Check Fiber and Handpiece	
W63	W63:Fluence Meter Error; Call Service	
W64	W64:Internal Meter Error; Call Service	
W65	W65:Energy Out of Range	Cap bank did not recharge properly or overcharged, press standby to continue.
W66	W66:Handpiece Removed	
W67	W67:Unable to Reach Fluence; Decrease	
W68	W68: Schedule Lamp Change	Lamps in Alex laser aproaching end-of-life, schedule lamp replacement.
W69	W69: Schedule Lamp Change	Lamps inNd:YAG laser aproaching end-of-life, schedule lamp replacement.
W70	W70:Coolant Over Temp; Let Laser Cool	Water too hot, fans on to cool laser.

W50: Interlock Open Check Interlock	Install remote interlock connector or if using interlock, close room door.
W51: No Fiber Connect Fiber	Install delivery fiber and handpiece.
W53: Low Water Add Water	Add water to reservoir
W54: HVPS EOC Warning Press Standby	High fluence use on 120 VAC demonstration mode—press the Standby Key (○) to continue using laser.
W56: Invalid Handpiece Change Handpiece	Old handpiece from another laser or handpiece not allowed for wavelength selected—Install correct handpiece.
W57: No Handpiece Install Handpiece	Install handpiece.
W58: Handpiece Changed; Press Standby	Handpiece changed—press the Standby Key (○), and then press the (⏏) key directly below "System Check" to continue.
W59: Low Trans. Check Fiber/Handpiece	Fiber, handpiece, or focus lens damaged, but still useable
W65: Energy Out of Range Press Standby	Cap bank did not recharge properly or overcharged—press the Standby Key (○) to continue.
W68: Schedule Lamp Change	Lamps in Alex laser approaching end-of-life—schedule lamp replacement.
W69: Schedule Lamp Change	Lamps in YAG laser approaching end-of-life—schedule lamp replacement.
W70: Coolant Over Temp Let Laser Cool	Water too hot, fans are working to cool laser.

Error Faults codes

Error faults are critical faults that will cause the laser system to stop operating and to generate a fault code that appears on the front display panel. Contact Cynosure Service if necessary.

Error #	Message Text	Manual Suggestions
E01	E01: Water Flow Fault Cycle Power	Broken pump or blown fuse, needs service.
E02	E02: Open Shutter Fault	Safety shutter stuck open, do not use laser until serviced.
E03	E03: Closed Shutter Fault	Safety shutter stuck closed, do not use laser until serviced.
E04	E04: Fuse Open Call Service	Cap bank blown fuse or shorted dump circuit, needs service.
E05	E05: Check Sum Error Call Service	Computer memory error, needs service.
E06	E06: IGBT Module Short	IGBT shorted, needs service.
E07	E07: IGBT Module Fault	IGBT overload sensed, cycle power to continue.
E08	E08: Heater Fault Call Service	Open thermostat or heater. Blown heater fuse, needs service.
E09	E09: Coolant Sensor Fault Call Service	Open thermistor or unplugged, needs service.
E10	E10: No High voltage	Cap bank or HVPS wire shorted, no readback voltage, needs service.
E11	E11: Open Shutter Fault YAG	Yag shutter stuck open, do not use laser until serviced.
E12	E12: Closed Shutter Fault YAG	Yag shutter stuck closed, do not use laser until serviced.
E13	E13: No Simmer	Broken lamp or blown fuse, needs service.
E14	E14: HVPS Fault	HVPS overtemp or disconnected, cycle power.
E21	E21: Alex Meter Error Call Service	Wrong Res Port or Cal Port calibration, needs service.
E22	E22: Alex Cal Failed Call Service	Resonator energy too low to use or YAG fired, needs service.
E23	E23: Low Trans. Replace Fiber/Handpiece	Damaged fiber, handpiece or focus lens, needs replacement.
E24	E24: YAG Meter Error Call Service	Wrong Res Port or Cal Port calibration, needs service.
E25	E25: YAG Cal Failed Call Service	Resonator energy too low to use or Alex fired, needs service.
E26	E26: No Energy check Fiber/Handpiece	Broken fiber or severly damaged focus lens, needs replacement.

Troubleshooting Chart

Problem	Possible Cause	Solution
Laser does not start.	Power is not properly connected.	Connect power cables. Check that laser's main circuit breaker is in the on position.
	The keyswitch is OFF.	Turn the keyswitch to the ON.
Laser will not go into Standby Mode.	Lasers not up to operating temperature.	Allow laser to run until WARM UP message is off.
	Check that no other fault messages are displayed.	Correct any conditions as indicated by fault messages.
	Standby Key (◯) not activated or not working.	Press Standby Key (◯).
Laser will not enter Ready Mode.	Operator switch activated.	Check that finger switch or foot switch is not being pressed.
	Ready Key (⊙) not activated or not working.	Press Ready Key (⊙).
Ready LED lit, but laser will not fire outside of Cal Port.	Laser not properly calibrated as indicated by Front Panel Display	Recalibrate Laser.
	Fiber cable not connected.	Check that handpiece fiber cable is properly connected.
	Foot switch not connected.	Check that foot switch connector is properly inserted into foot switch receptacle.

NOTE: If any problems occur that are not covered in the troubleshooting chart, or the suggested solutions do not work, call the Cynosure Service Department at (888) 523-2233, FAX (978) 256-6556 or Service FAX at (978) 256-4888.

Attaching a Laptop Computer

For communication and diagnosis of the laser, a laptop computer with a Windows DB9 to DB9 Null-modem serial cable (pins 2-3 swapped), and HyperTerminal or an equivalent serial terminal program is needed.

The laptop must have a RS232 serial port and operate on COM1. For USB adaptors, the adaptor must be setup to operate on COM1 so that HyperTerminal will operate correctly. When upgrading the laser software, COM1 must be setup.

NOTE: The following section is for setting up HyperTerminal the first time only. Other RS232 terminal programs should be setup using the same parameters.

HyperTerminal Setup

1. Start HyperTerminal program (from start menu–programs–accessories–communications).
2. Set 'CONNECT USING' to 'DIRECT TO COM1:' or the com port being used. Click OK. (screen changes)
3. Set 'Bits per second' (BAUD) to **38400.**
4. Set 'Data bits' to **8.**
5. Set 'Parity' to **NONE.**
6. Set 'Stop bits' to **1.**
7. Set 'flow control' to **NONE.** Click OK.

NOTE: HyperTerminal should be running and the laser status should be displaying on the computer.

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FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

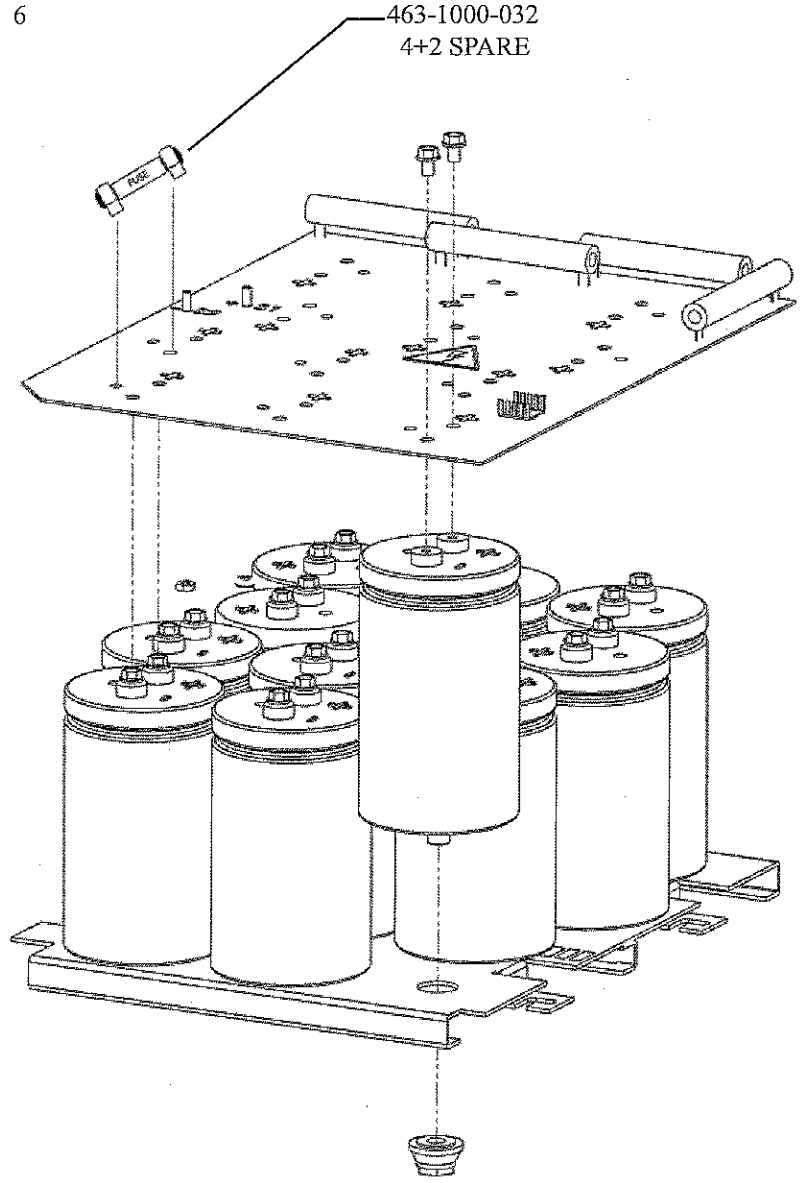
ILLUSTRATED BREAK OUT

101-7001-090 Rev 6

CAPACITOR BANK, MODULAR
ELITE

Legend
Item number
Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
463-1000-032	FUSE (4+2SPARE)	6



FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

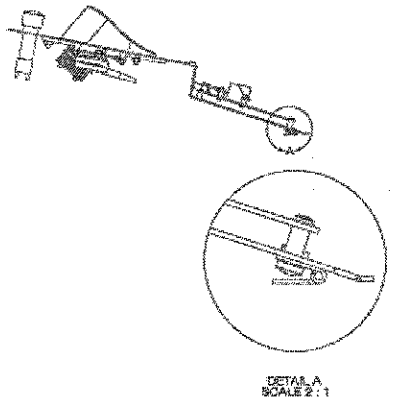
ILLUSTRATED BREAK OUT

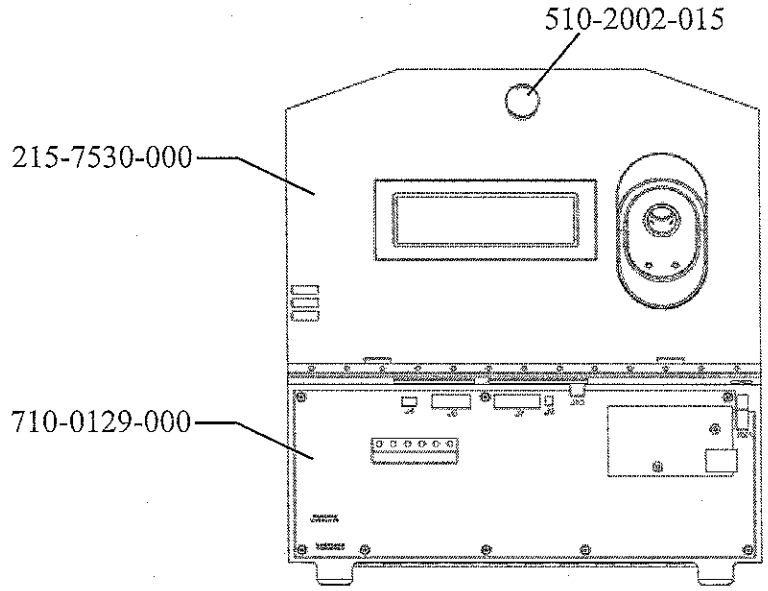
100-7001-100 Rev 7

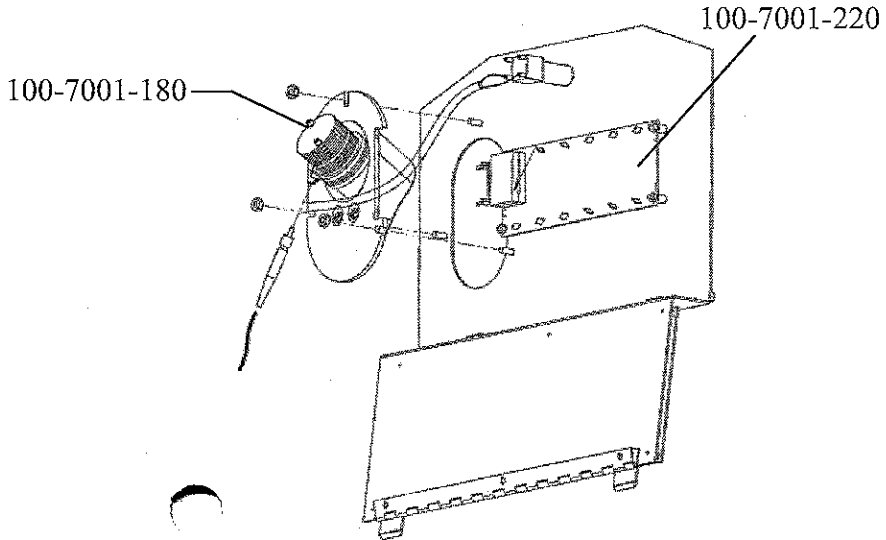
CONTROL PANEL, MODULAR
ELITE

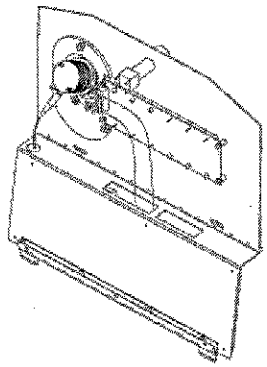
Legend
— Item number
— Quantity per assembly

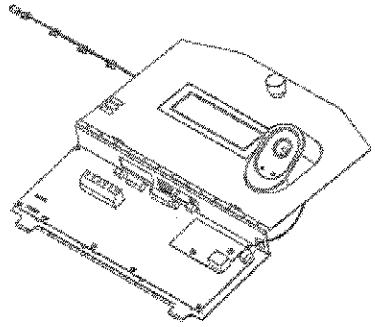
PART NUMBER	DESCRIPTION	QTY
S100-7001-220	ASSY,LCD,ELITE,MD	1
510-2002-015	SWITCH,PB,MOM,W/CAP,E-STOP	1
710-0129-000	ASSY,PCB,LSR CNTRL ELECTRONICS	1
215-7530-000	OVERLAY,CONTROL PANEL,MD	1
100-7001-180	CAL-PORT ASSY	1











FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

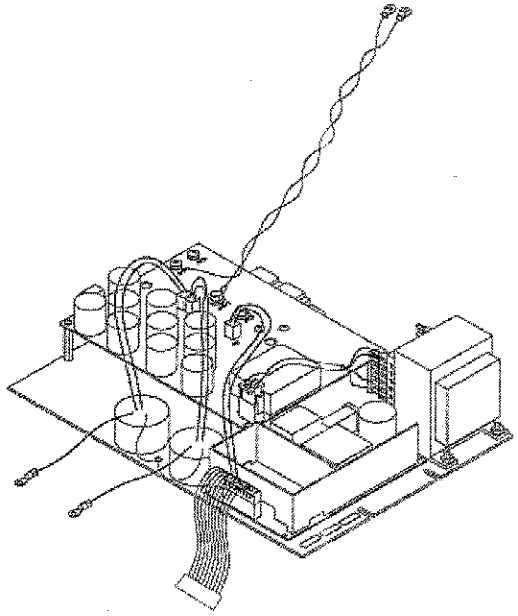
ILLUSTRATED BREAK OUT

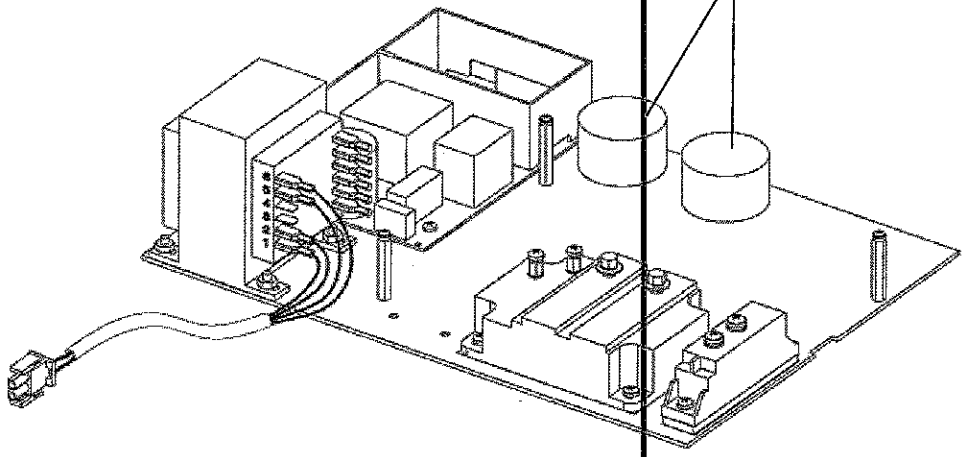
101-7001-130 Rev 6

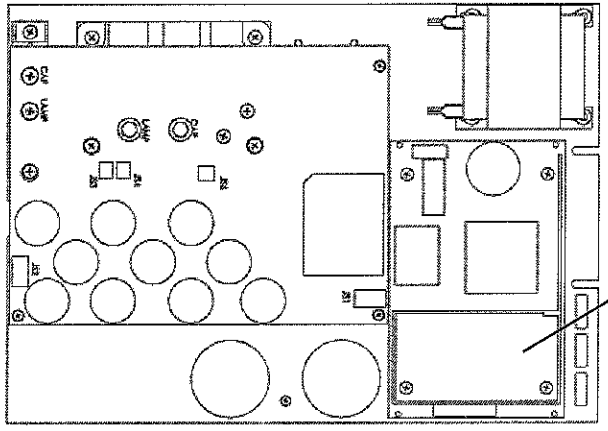
IGBT/SIMMER, MODULAR
ELITE

Legend
— Item number
— Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
100-7001-860	ASSY,TRIGGER TRANSFORMER,MD	2
400-0013-000	PWR SUPLY,+5,+12,+12,-12,55W	1







FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

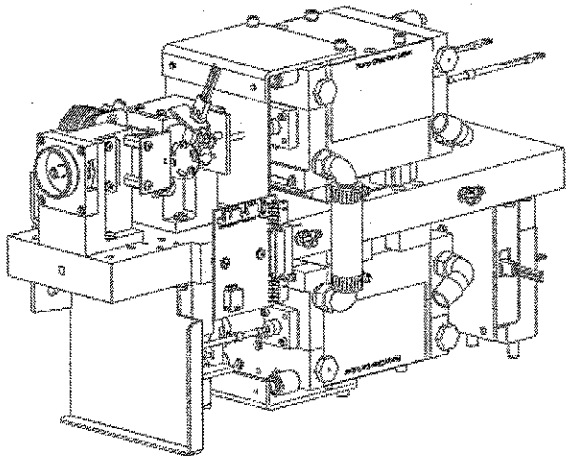
ILLUSTRATED BREAK OUT

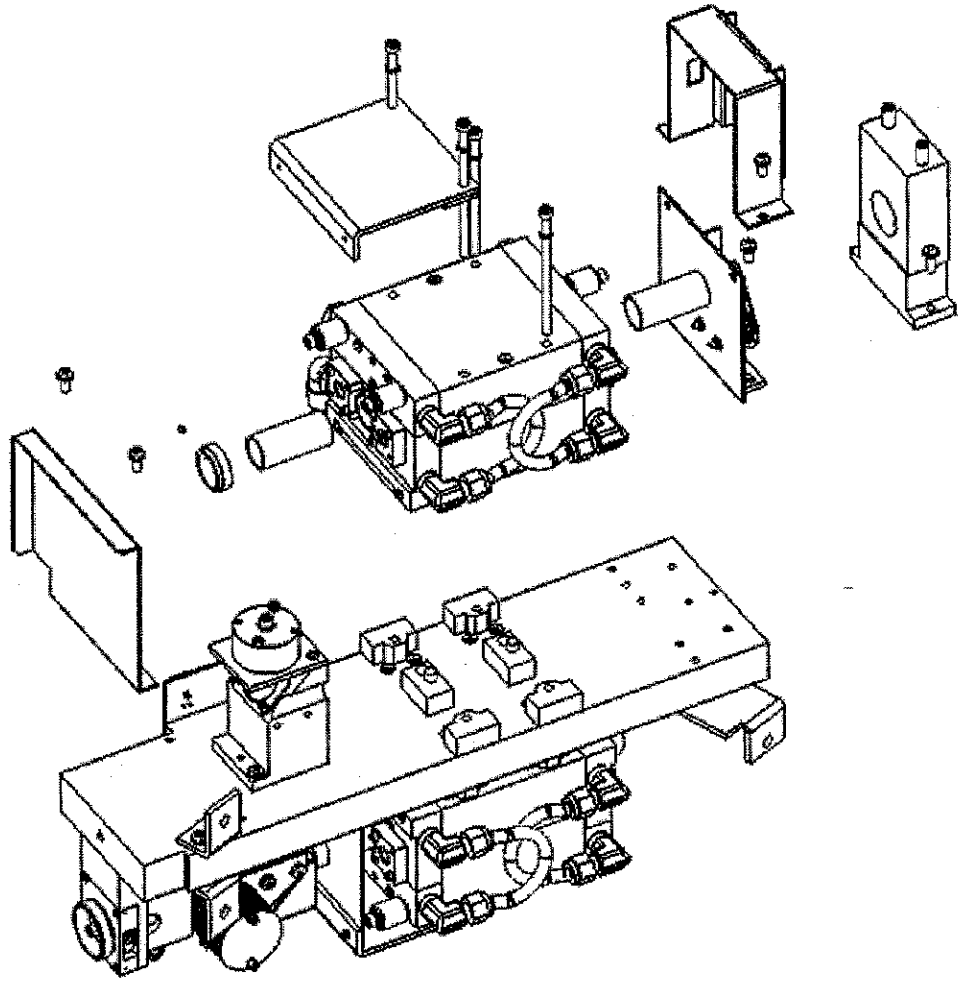
100-7001-140 Rev 9

RESONATOR RAIL, MODULAR
ELITE

Legend
Item number
Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
100-7001-940	ASSY,PUMP CHAMBER,ALEX,MD	1
100-7001-950	ASSY,PUMP CHAMBER,YAG,MD	1
100-0592-100	ASSY,INTRACAVITY SHUTTER,MD	1
800-5010-010	TURNING MIRROR	1
809-5000-014	BEAM COMBINER	
990-9003-589	FLASHLAMPS	
316-0022-010	O-RINGS	
316-0022-011	O-RINGS	
316-0022-014	O-RINGS	
805-1836-003	FOCUSING LENS	
800-5010-009	YAG MAX REFLECTOR	
710-0592-100	AIMING LED-ORANGE	1
710-0127-000	BEAR SOLENIOID ASSY	





FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

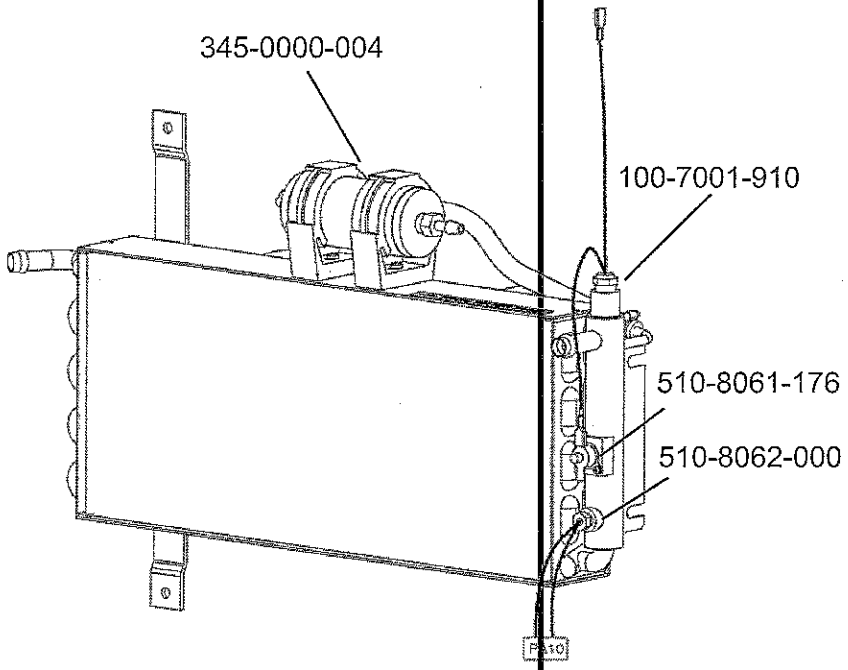
ILLUSTRATED BREAK OUT

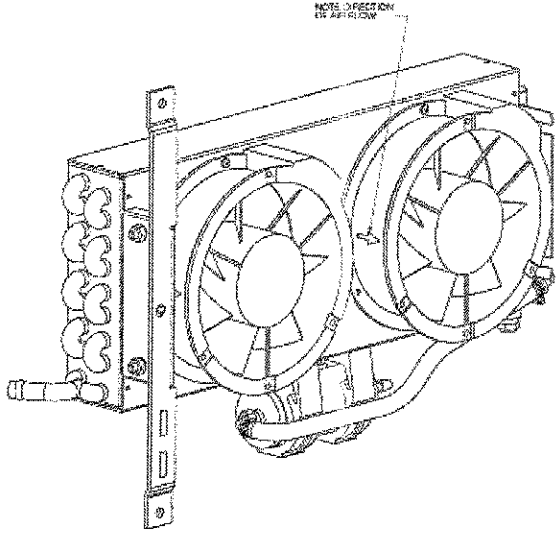
100-7001-150 Rev 5

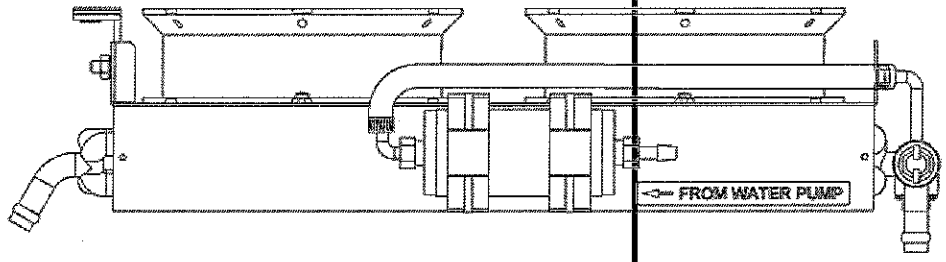
HEAT EXCHANGER, MODULAR
ELITE

Legend
Item number
Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
510-8062-000	SENSOR,THERM,15-80 C,W/CONN	1
100-7001-910	ASSY,HEATER CARTRIDGE,MD	1
510-8061-176	THERMO,MNL RESET,OPENS @176F	1
345-0000-004	FILTER,DEIONIZER W/BARB,MD	1







FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

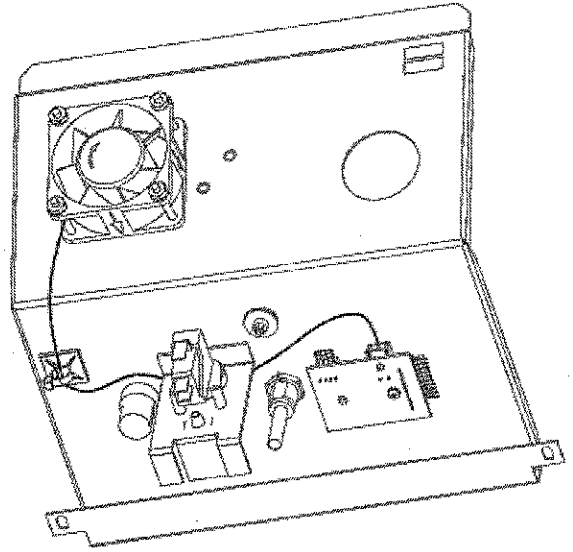
ILLUSTRATED BREAK OUT

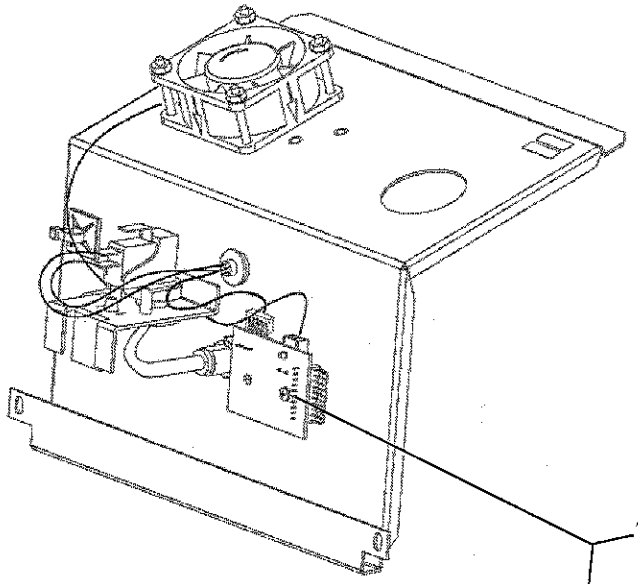
100-7001-410 Rev 5

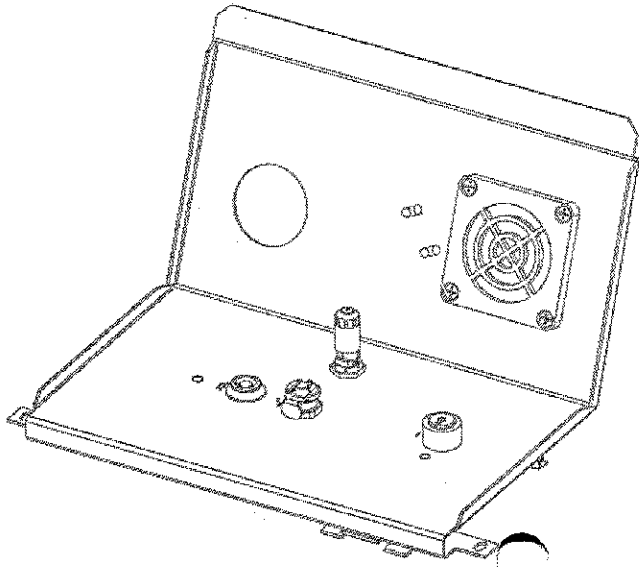
REAR CONT PNL, MODULAR
ELITE

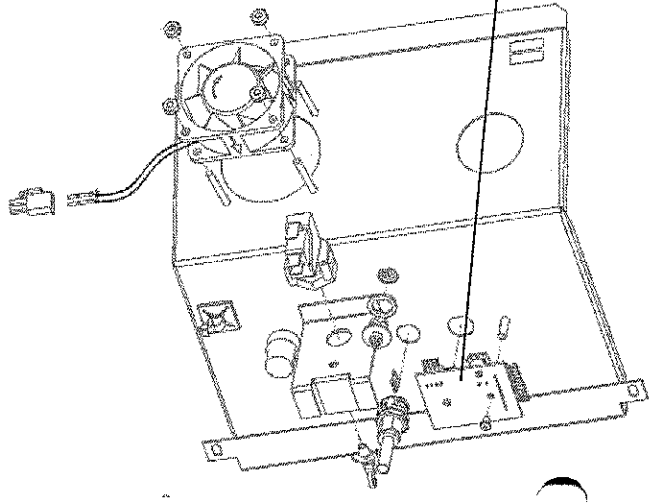
Legend
— Item number
— Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
710-0130-000	ASSY,PCB,REAR INTERCONNECT	1









FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

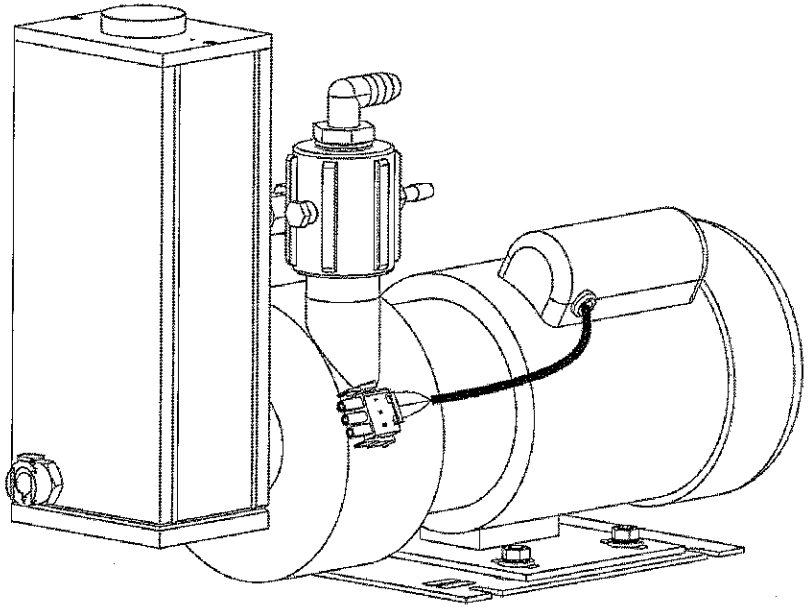
ILLUSTRATED BREAK OUT

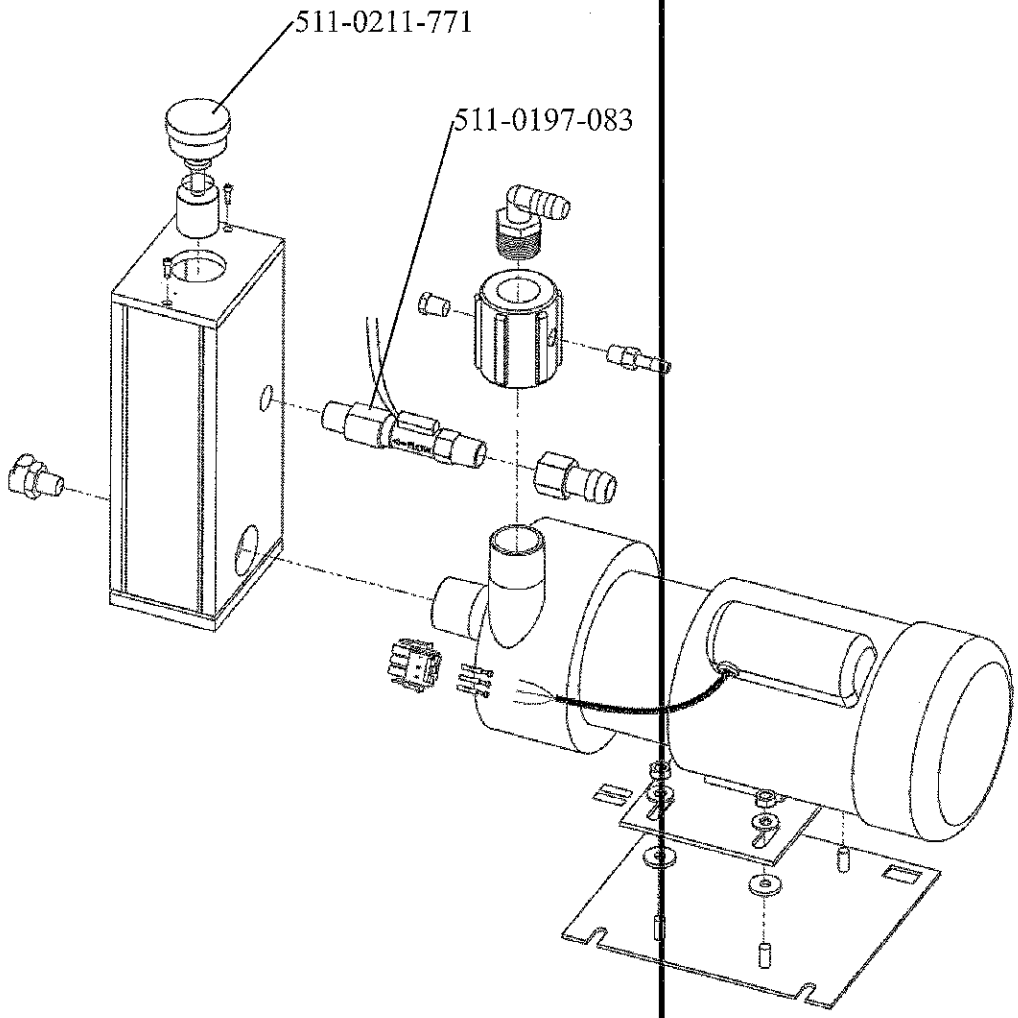
100-7001-550 Rev 4

WATER PUMP, MODULAR
ELITE

Legend
Item number
Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
511-0197-083	FLOW SWITCH	1
511-0211-771	FLOAT SWITCH	1





FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

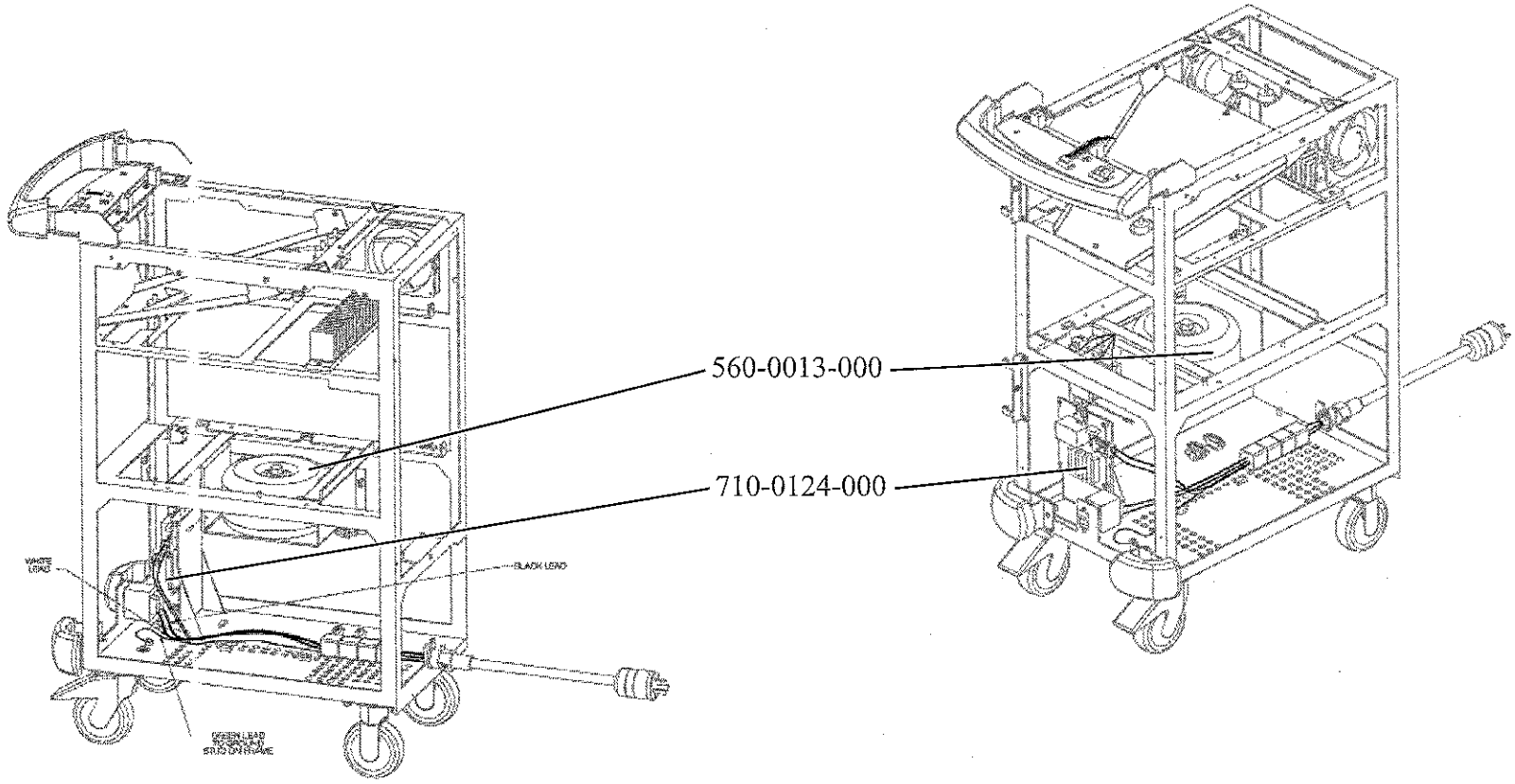
ILLUSTRATED BREAK OUT

100-7001-560 Rev 9

FRAME W/ELECTRIC, MODULAR
ELITE

Legend
Item number
Quantity per assembly

PART NUMBER	DESCRIPTION	QTY
710-0124-000	ASSY,PCB,MAINS AC VOLT.SELECT	1
560-0013-000	XFMR,ISOLATION,1KVA,W/CONN,MD	1
710-0125-000	ASSY,PCB,AC DIST.AND FUSES	1
710-0123-000	ASSY,PCB,SNGL FBR OPTIC DET,NL	1
100-7001-600	ASSY,AIMING BEAM,MD	1
463-0111-040	FUSE,.40A,250 VAC	?
463-0111-050	FUSE,.50A,250 VAC	?
463-0111-080	FUSE,.80A,250 VAC	?
463-0111-500	FUSE,5.0A SLO-BL250	?



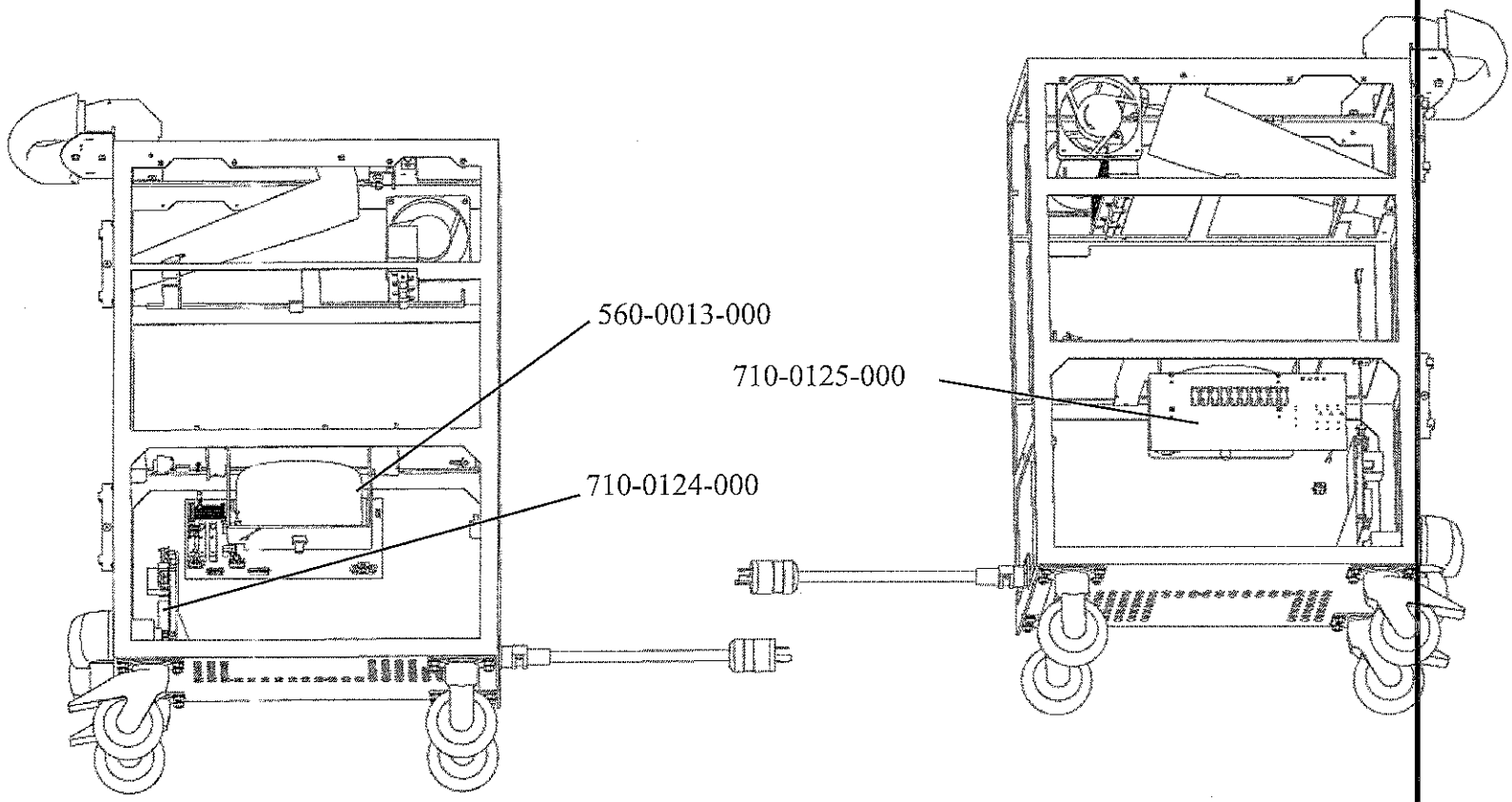
FOR REFERENCE ONLY
CHECK FOR CURRENT REVISION

ILLUSTRATED BREAK OUT

100-7001-560 Rev 9

FRAME W/ELECTRIC, MODULAR
ELITE

Legend
Item number
Quantity per assembly



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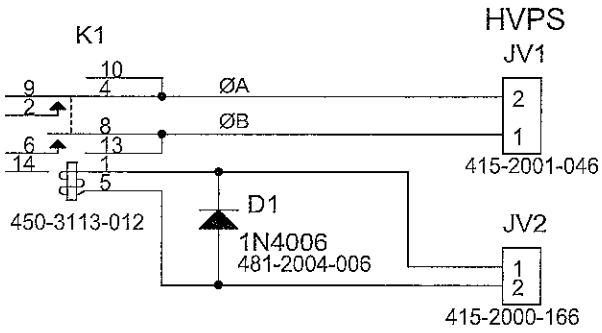

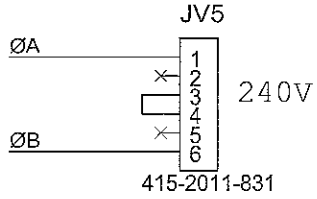

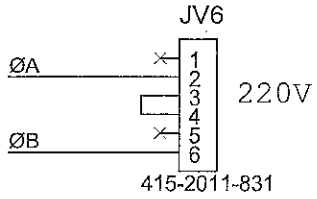

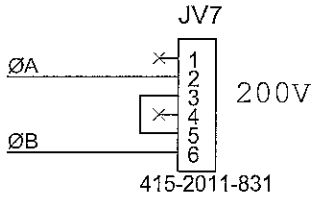

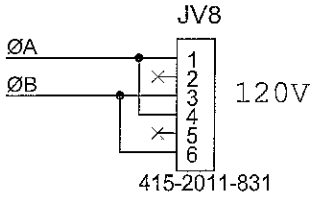

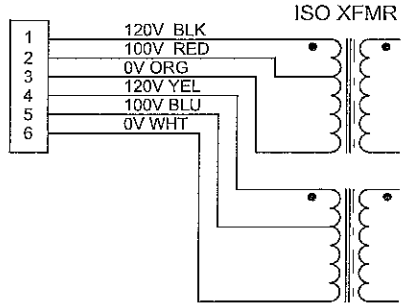

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DO NOT SCALE THIS DRAWING

DIMENSIONS IN INCHES [MM]

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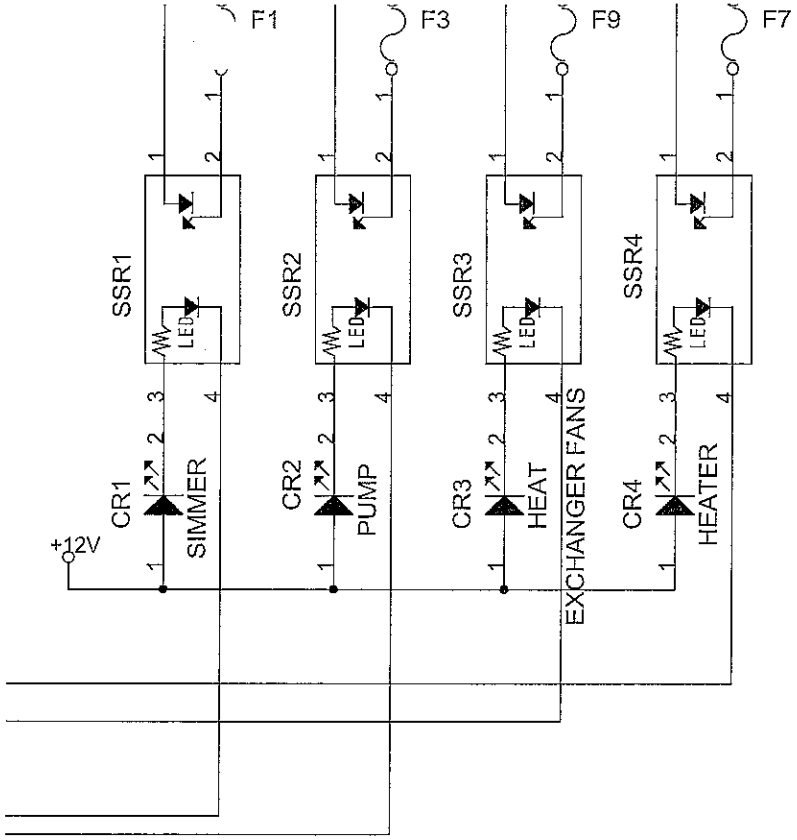

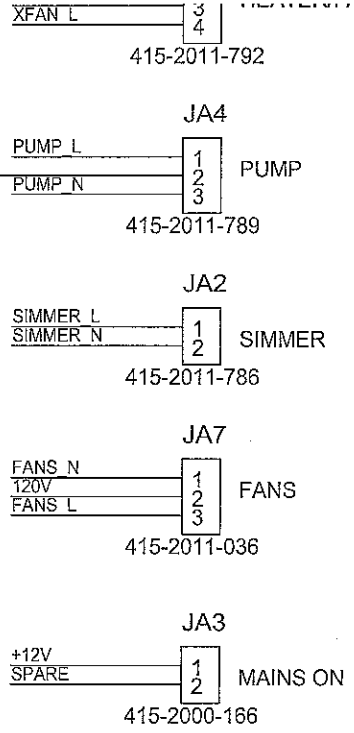

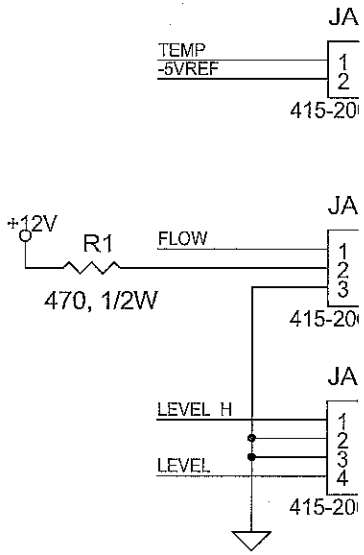

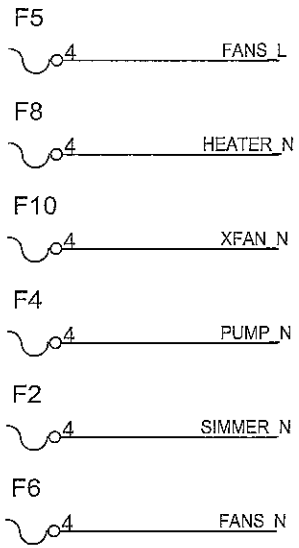

FUSE TABLE	
REF	USE
F1, 2	SIMMER IGBT
F3, 4	PUMP
F9, 10	HEAT EXCHANGER FANS
F7, 8	HEATER
F5, 6	FANS

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DIMENSIONS IN INCHES [MM]

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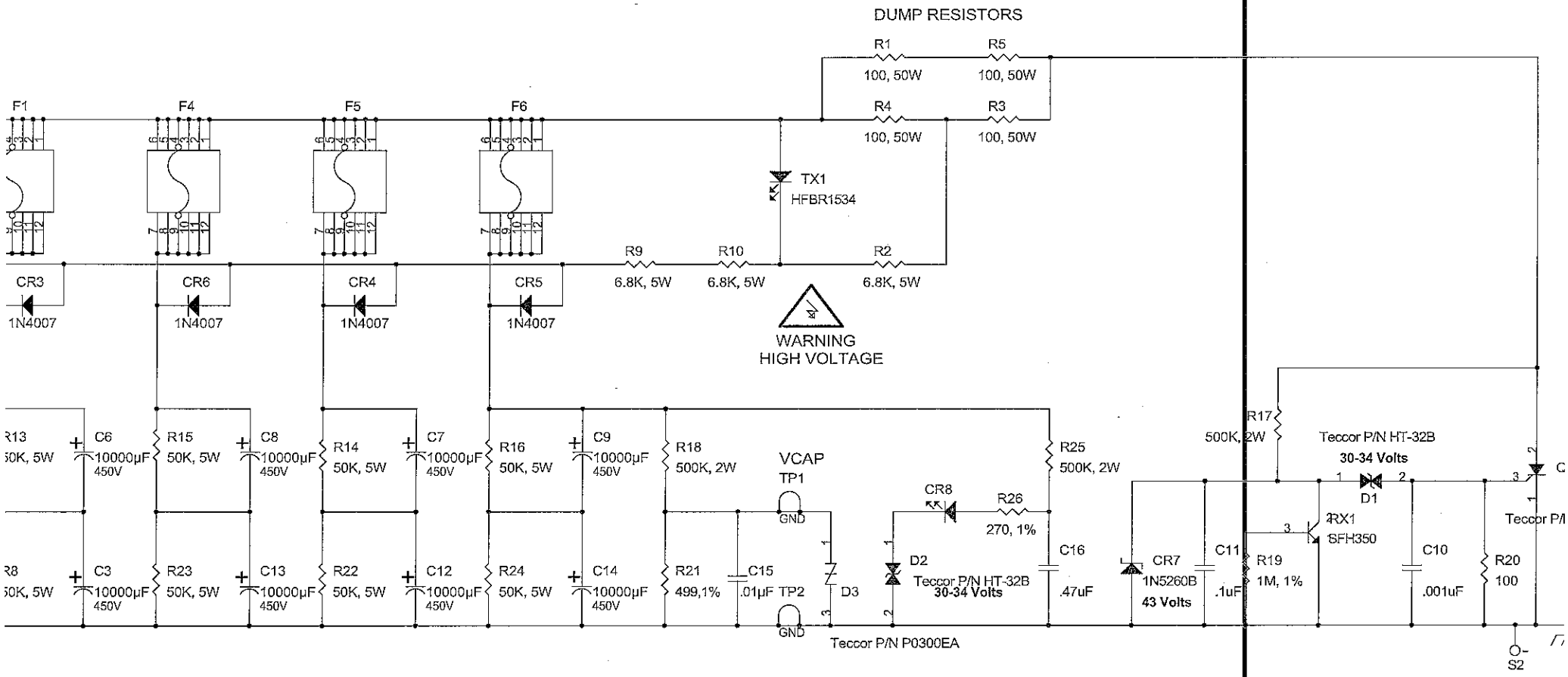

PROPRIETARY	DO NOT SCALE	Cynosure, Inc.

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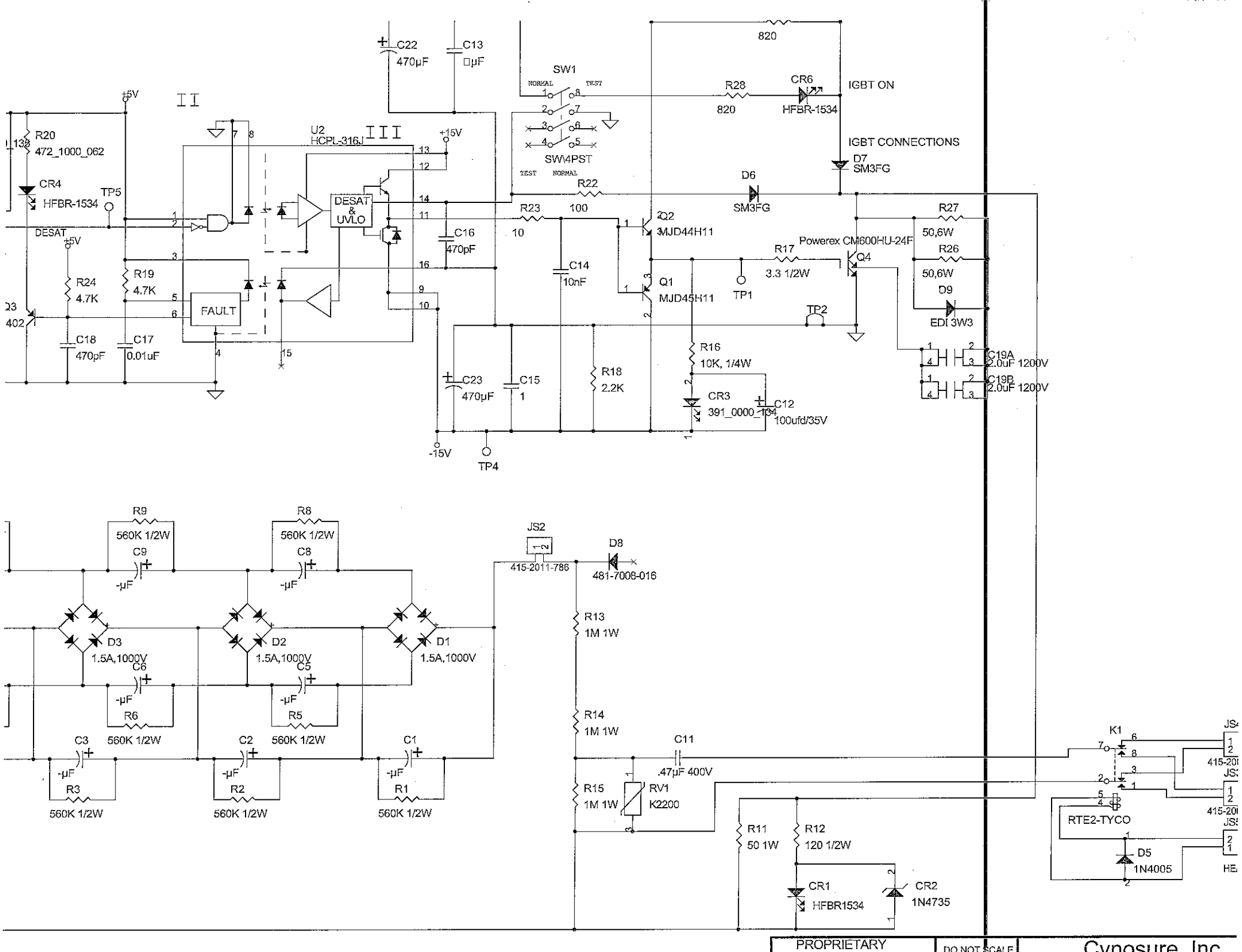

PROPRIETARY

DO NOT SCALE

Cynosure, Inc

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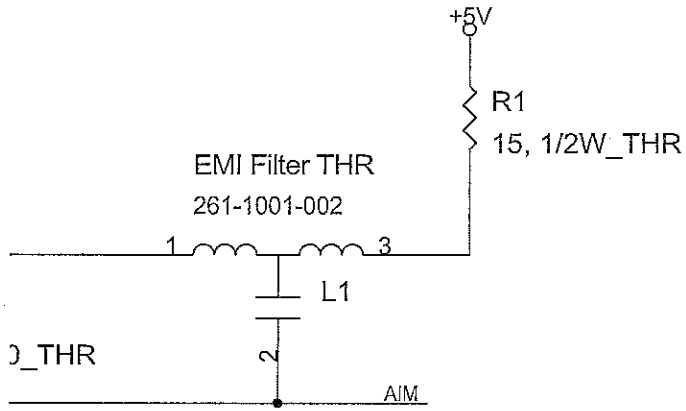

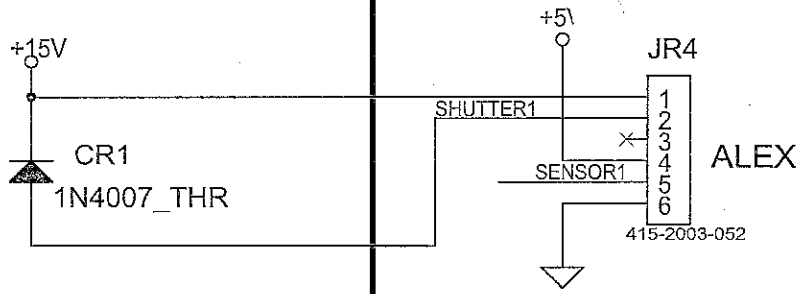

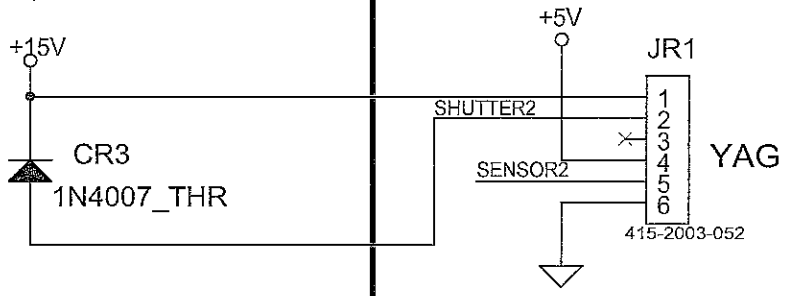

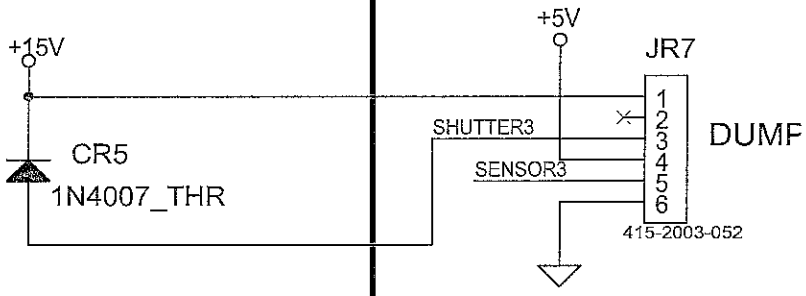

1/4 WATT, 5% UNLESS OTHERWISE SPECIFIED.

E IN uFARADS UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE THIS DRAWING

DIMENSIONS IN INCHES [MM]

UNLESS OTHERWISE SPECIFIED

DESIGNER: E. Koschmann

DATE 6-19-2004

10 Eliza

RESON

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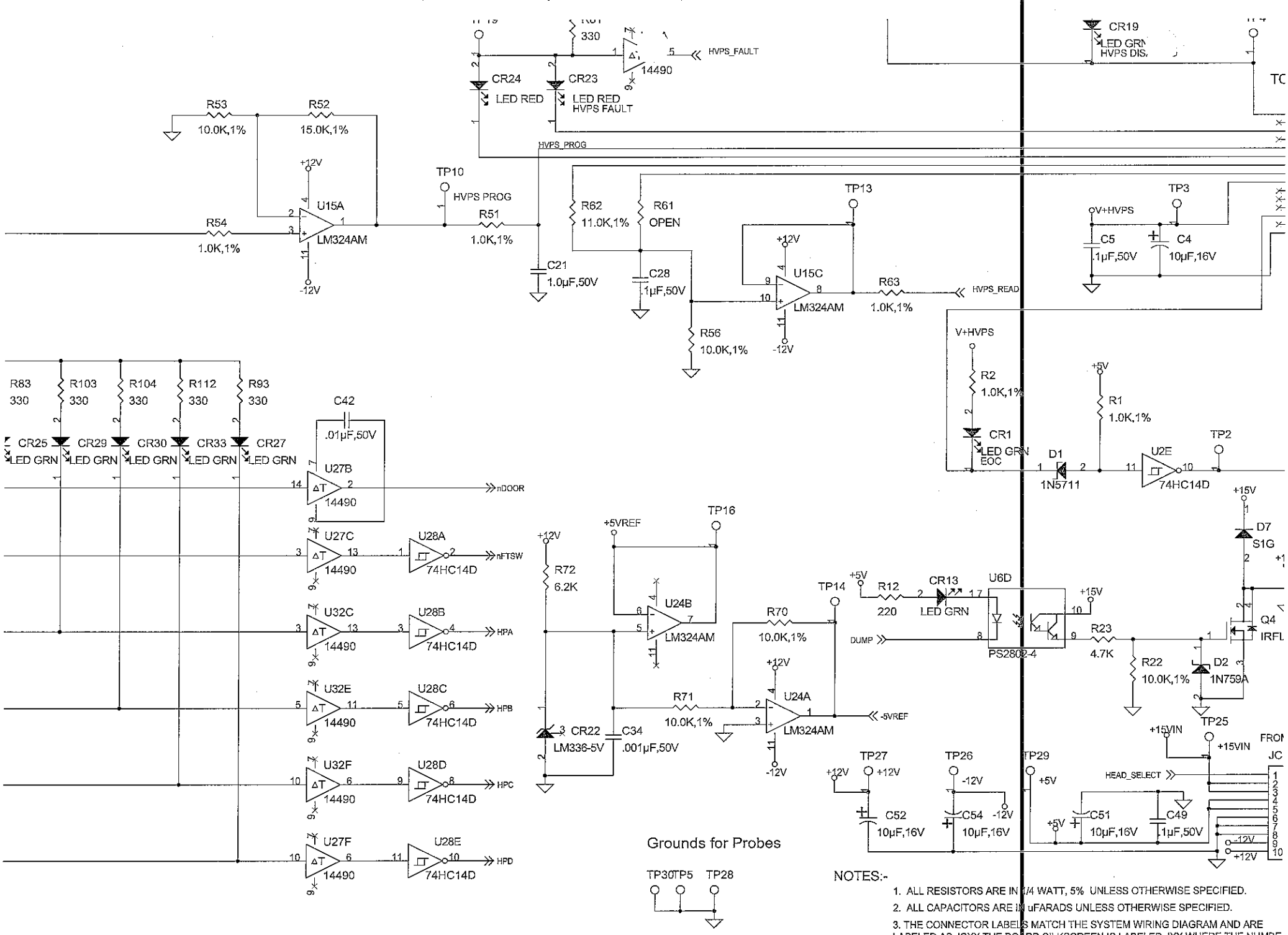

NOTES:-

1. ALL RESISTORS ARE IN 1/4 WATT, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN uFARADS UNLESS OTHERWISE SPECIFIED.
3. THE CONNECTOR LABELS MATCH THE SYSTEM WIRING DIAGRAM AND ARE LABELED AS JCXX.THE BOARD SILKSCREEN IS LABELED JXX WHERE THE NUMBE MATCH JCXX DESIGNATION.

DECOUPLING CAPS

PROPRIETARY	DO NOT SCALE	Cynosure, Inc.

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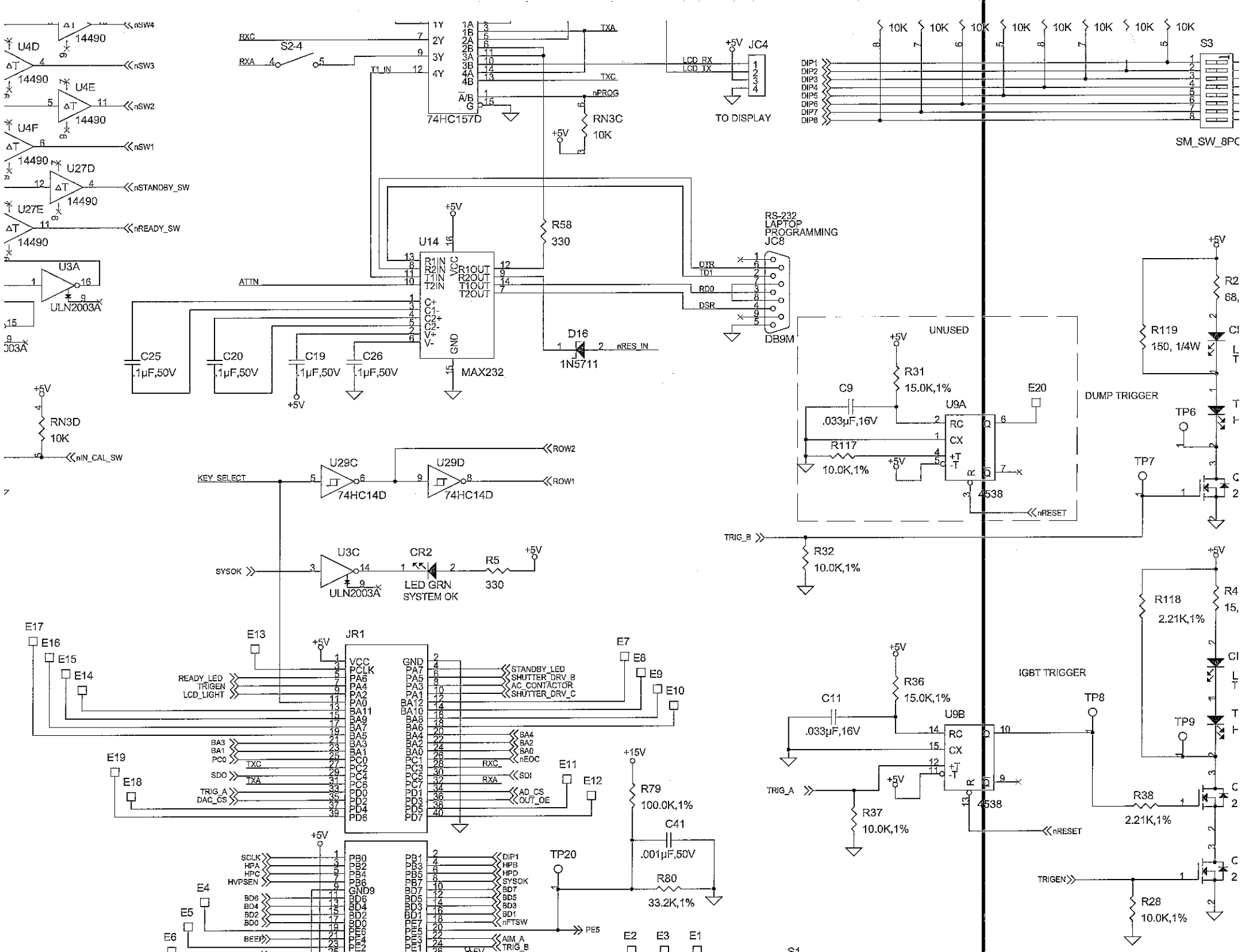
U4D
U4E
U4F
U27D
U27E
14490
nSW4
nSW3
nSW2
nSW1
nSTANDBY_SW
nREADY_SW
U3A
ULN2003A
RXC
RXA
S2-4
74HC157D
TXA
TXC
nPROG
LCD_RX
LCD_TX
JC4
TO DISPLAY
RN3C
10K
SM_SW_8PC
S3
DIP1
DIP2
DIP3
DIP4
DIP5
DIP6
DIP7
DIP8
U14
MAX232
ATTN
R58
330
C25
C20
C19
C26
.1µF,50V
D16
1N5711
nRES_IN
RS-232
LAPTOP
PROGRAMMING
JC8
DB9M
DTR
TD1
RD0
DSR
RN3D
nIN_CAL_SW
U29C
U29D
74HC14D
KEY_SELECT
ROW2
ROW1
U3C
SYSOK
CR2
LED GRN
SYSTEM OK
R5
JR1
READY_LED
TRIGEN
LCD_LIGHT
STANDBY_LED
SHUTTER_DRV_B
AC_CONTACTOR
SHUTTER_DRV_C
BA3
BA1
PC0
TXC
SDO
TXA
TRIG_A
DAC_CS
BA4
BA2
BA0
nEOC
RXC
SDI
RXA
AD_CS
OUT_OE
SCLK
HPA
HPC
HVPSEN
BD6
BD4
BD2
BD0
BEEP
DIP1
HPB
HPD
SYSOK
BD7
BD5
BD3
BD1
nFTSW
PE5
AIM_A
TRIG_B
R79
100.0K,1%
C41
.001µF,50V
R80
33.2K,1%
TP20
UNUSED
R31
15.0K,1%
C9
.033µF,16V
R117
10.0K,1%
U9A
4538
nRESET
DUMP TRIGGER
TP6
TP7
R119
150, 1/4W
R32
10.0K,1%
R36
15.0K,1%
C11
.033µF,16V
R37
10.0K,1%
U9B
IGBT TRIGGER
TP8
TP9
R38
2.21K,1%
R118
2.21K,1%
TRIGEN
R28
10.0K,1%
E17
E16
E15
E14
E13
E7
E8
E9
E10
E19
E18
E11
E12
E4
E5
E6
E2
E3
E1
+5V
+15V

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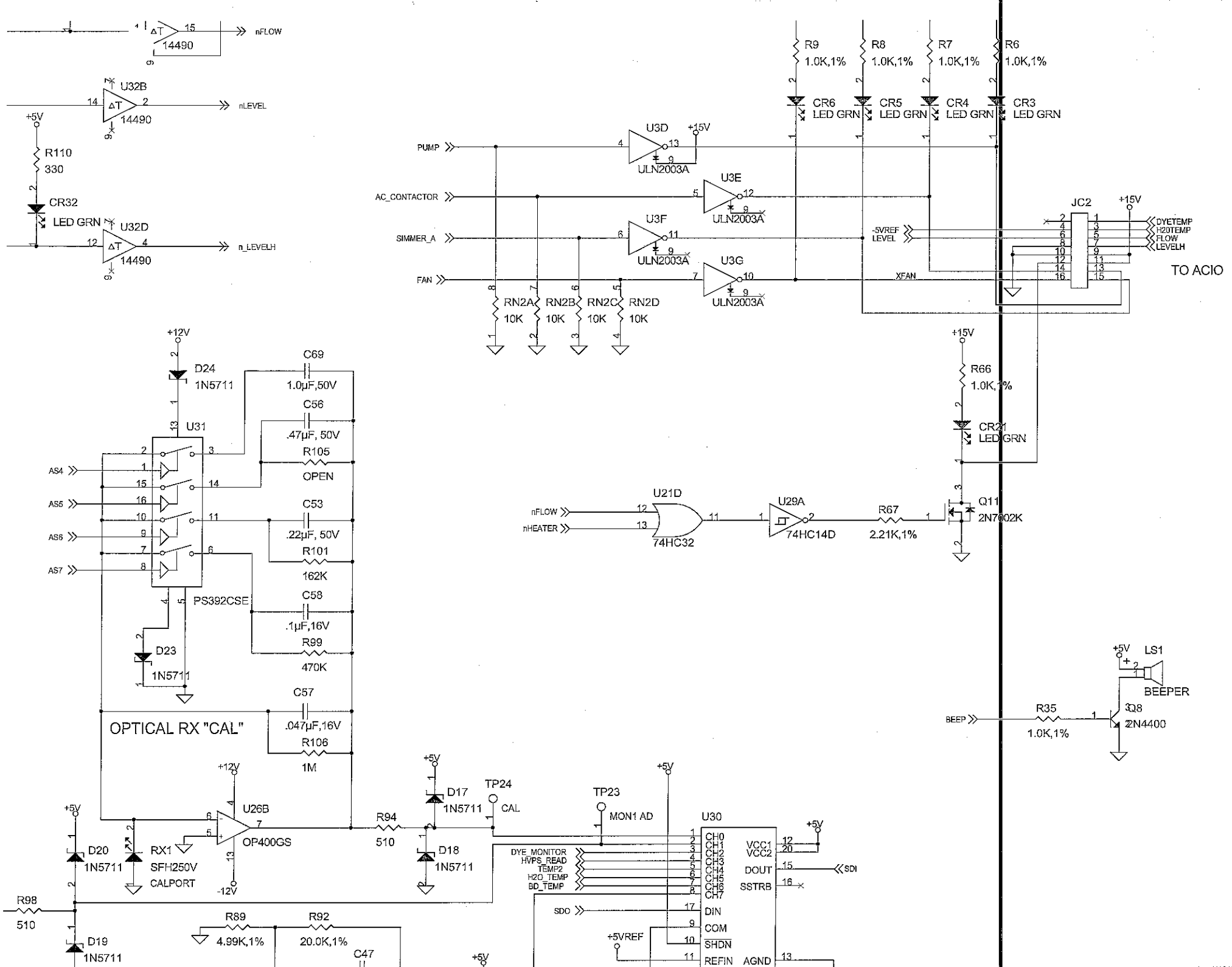
nFLOW
14490
U32B
nLEVEL
+5V
R110
330
CR32
LED GRN
U32D
n_LEVELH
R9
1.0K,1%
R8
1.0K,1%
R7
1.0K,1%
R6
1.0K,1%
CR6 LED GRN
CR5 LED GRN
CR4 LED GRN
CR3 LED GRN
U3D
+15V
PUMP
ULN2003A
U3E
AC_CONTACTOR
U3F
SIMMER_A
U3G
FAN
RN2A 10K
RN2B 10K
RN2C 10K
RN2D 10K
JC2
-5VREF LEVEL
XFAN
DYETEMP
H2OTEMP
FLOW
LEVELH
TO ACIO
+12V
D24
1N5711
C69
1.0µF,50V
C56
.47µF, 50V
U31
R105
OPEN
AS4
AS5
AS6
AS7
C53
.22µF, 50V
R101
162K
PS392CSE
C58
.1µF,16V
R99
470K
D23
1N5711
C57
.047µF,16V
R106
1M
OPTICAL RX "CAL"
R66
1.0K,1%
CR21
LED GRN
U21D
74HC32
nFLOW
nHEATER
U29A
74HC14D
R67
2.21K,1%
Q11
2N7002K
+5V
LS1
BEEPER
BEEP
R35
1.0K,1%
Q8
2N4400
U26B
OP400GS
-12V
D20
1N5711
RX1
SFH250V
CALPORT
R94
510
D17
1N5711
TP24
CAL
D18
1N5711
TP23
MON1 AD
U30
DYE_MONITOR
HVPS_READ
TEMP2
H2O_TEMP
BD_TEMP
SDO
SDI
DOUT
SSTRB
DIN
COM
SHDN
REFIN
AGND
+5VREF
R98
510
D19
1N5711
R89
4.99K,1%
R92
20.0K,1%
C47

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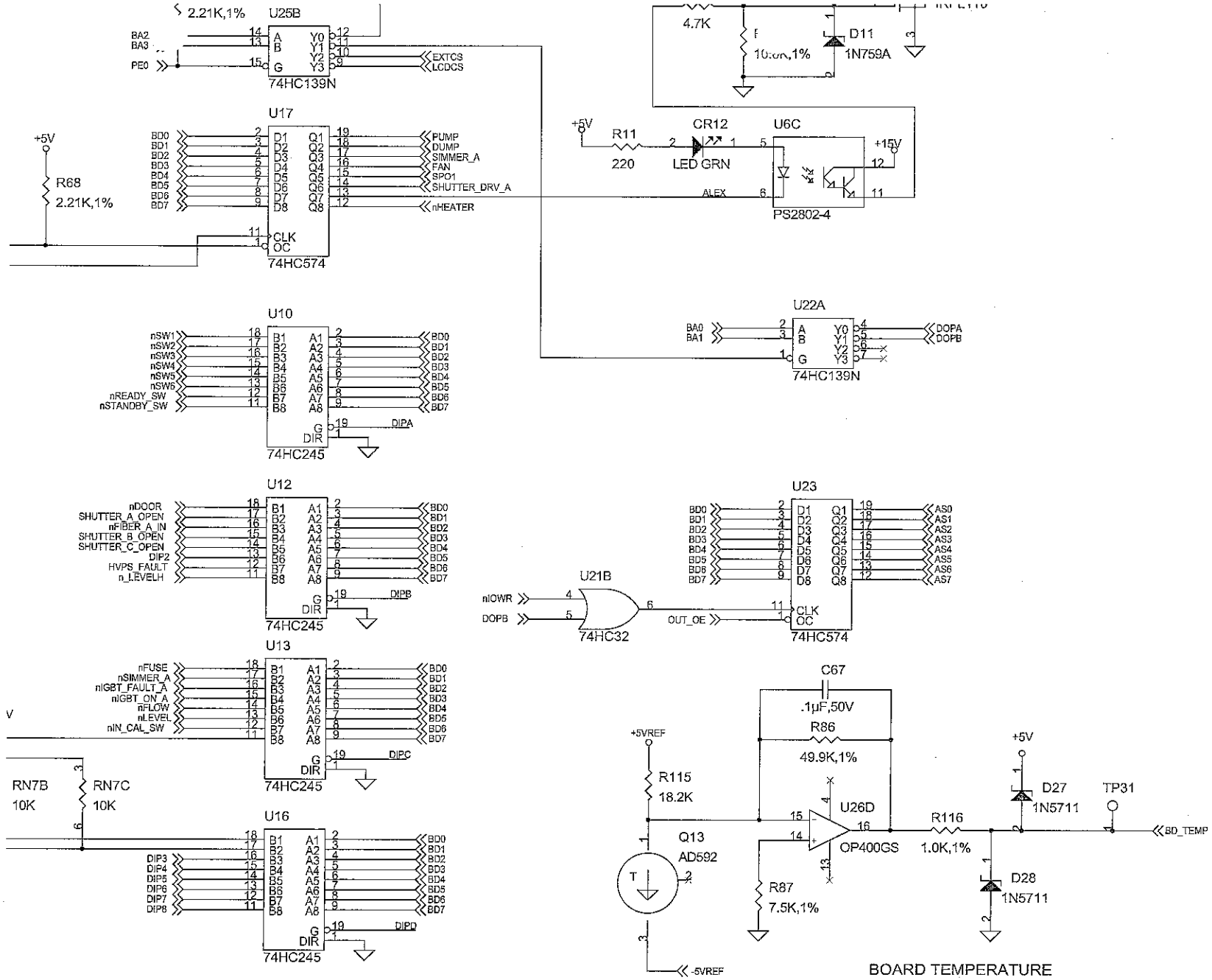
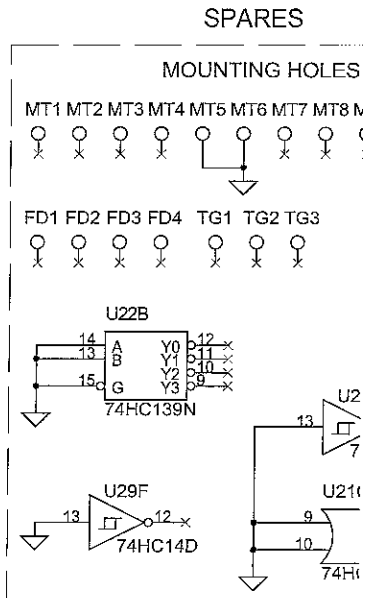


TP4	HVPS
TP5	GND
TP6	TRIG2 LED
TP7	TRIG2 ONE-SHOT
TP8	TRIG1 ONE-SHOT
TP9	TRIG1 LED
TP10	HVPS DAC 0-10V
TP11	DYE CONC INTENSITY ADJ
TP12	LCD Contrast Voltage
TP13	HVPS VMONITOR
TP14	-5VREF
TP15	DYE TEMP
TP16	+5VREF
TP17	H2O TEMP
TP18	+12V "DIRTY" from E-STOP SW
TP19	HVPS FAULT
TP20	+12V "DIRTY" sense
TP21	DYE MON
TP22	DYE REF
TP23	MONITOR A INPUT
TP24	CAL SIG
TP25	+12V "DIRTY" from power supply
TP26	-12V
TP27	+12V
TP28	GND
TP29	+5V
TP30	GND
TP31	BOARD TEMP



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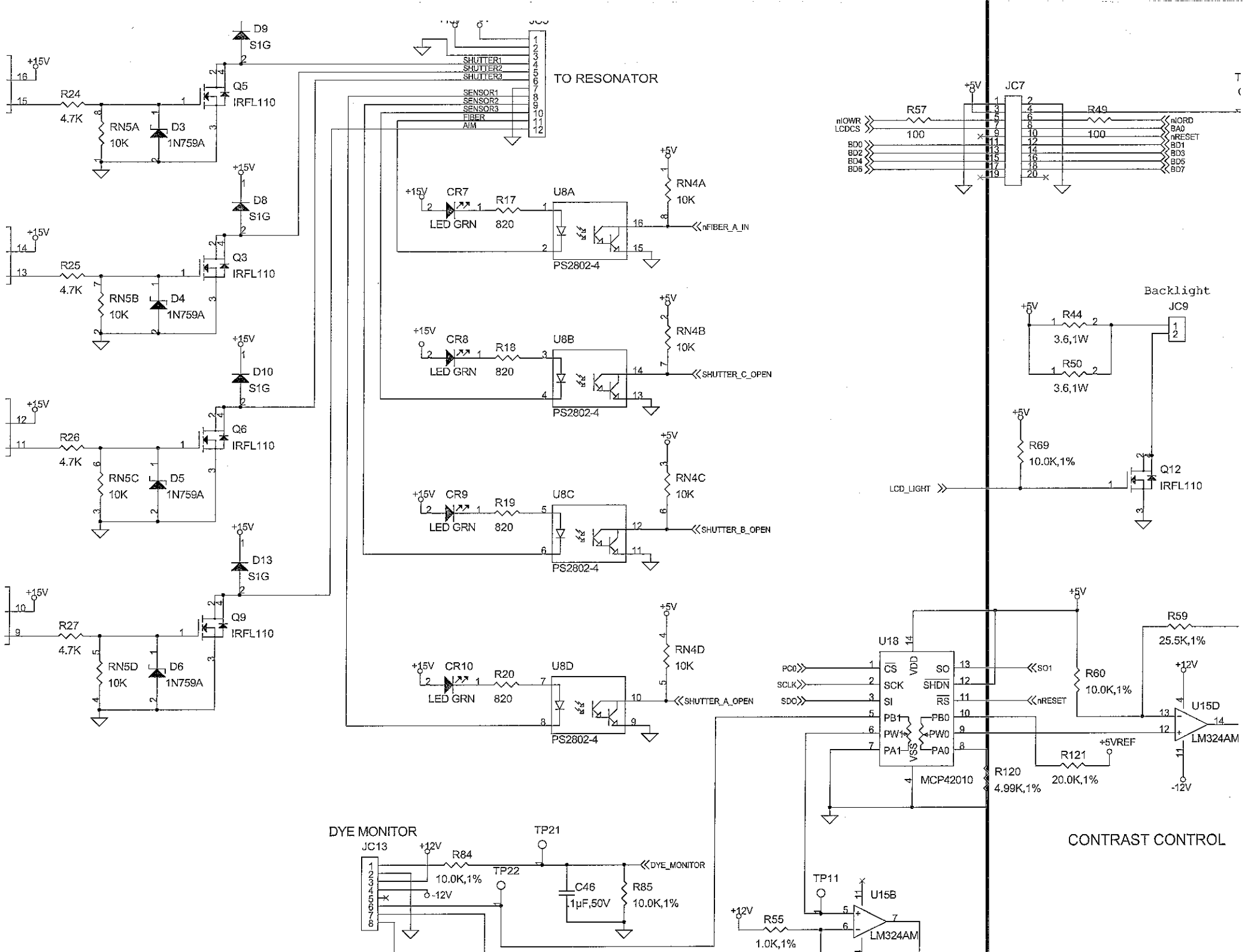
D9
S1G
+15V
R24
4.7K
RN5A
10K
D3
1N759A
Q5
IRFL110
D8
S1G
R25
4.7K
RN5B
10K
D4
1N759A
Q3
IRFL110
D10
S1G
R26
4.7K
RN5C
10K
D5
1N759A
Q6
IRFL110
D13
S1G
R27
4.7K
RN5D
10K
D6
1N759A
Q9
IRFL110
SHUTTER1
SHUTTER2
SHUTTER3
SENSOR1
SENSOR2
SENSOR3
FIBER
AIM
TO RESONATOR
CR7
LED GRN
R17
820
U8A
PS2802-4
RN4A
10K
nFIBER_A_IN
CR8
R18
U8B
RN4B
SHUTTER_C_OPEN
CR9
R19
U8C
RN4C
SHUTTER_B_OPEN
CR10
R20
U8D
RN4D
SHUTTER_A_OPEN
+5V
JC7
nIOWR
LCDCS
BD0
BD2
BD4
BD6
R57
100
R49
nIORD
BA0
nRESET
BD1
BD3
BD5
BD7
Backlight
JC9
R44
3.6,1W
R50
3.6,1W
R69
10.0K,1%
Q12
IRFL110
LCD_LIGHT
U18
MCP42010
PC0
SCLK
SDO
SO
SHDN
RS
PB1
PW1
PA1
PB0
PW0
PA0
SO1
nRESET
R59
25.5K,1%
R60
10.0K,1%
R121
20.0K,1%
R120
4.99K,1%
+5VREF
+12V
-12V
U15D
LM324AM
CONTRAST CONTROL
DYE MONITOR
JC13
R84
10.0K,1%
TP21
TP22
C46
1µF,50V
R85
10.0K,1%
DYE_MONITOR
TP11
U15B
R55
1.0K,1%

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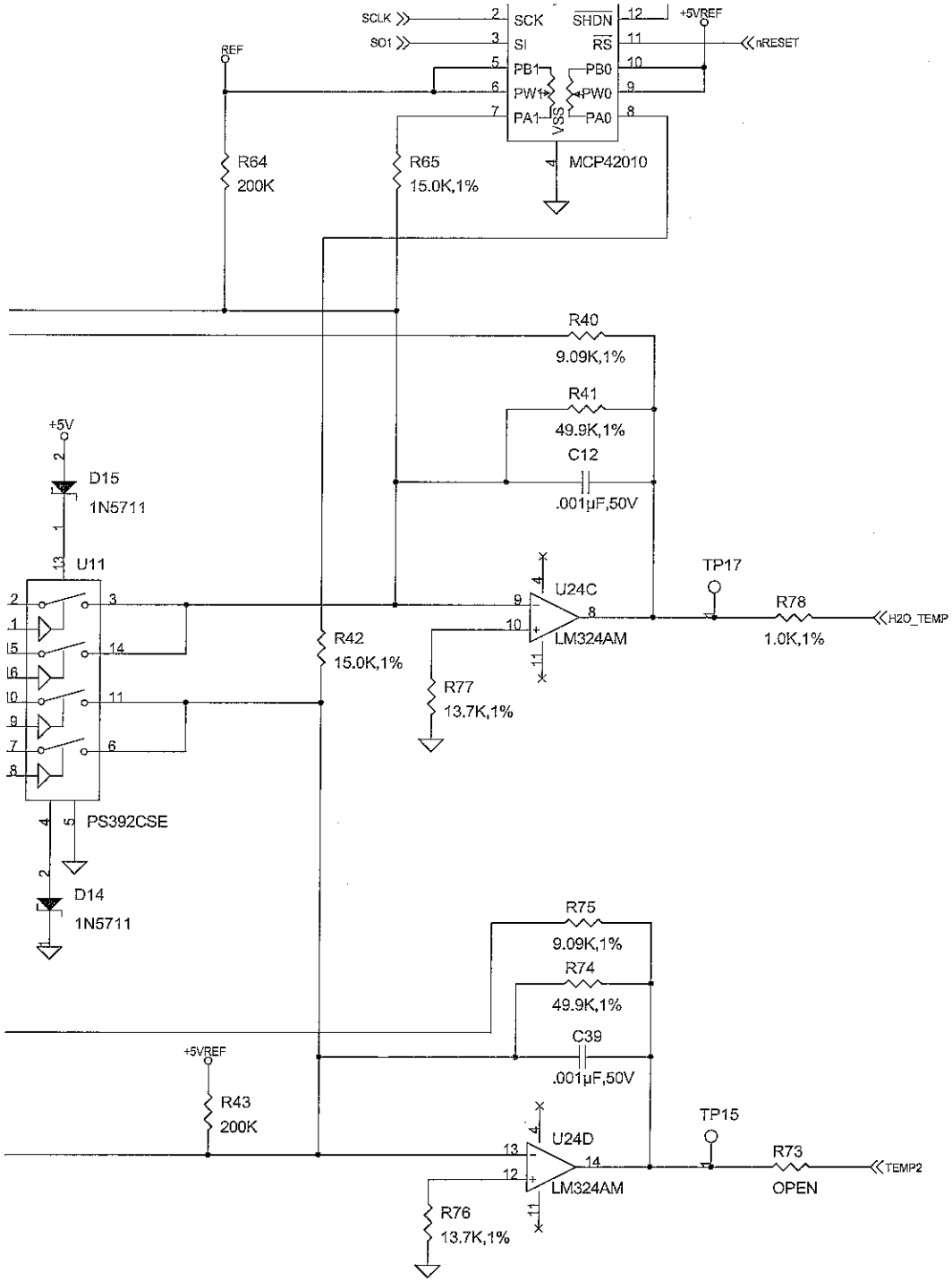

S2 DIP SWITCH FUNCTIONS		
SWITCH #	OFF	ON
1	Laser Type=ELITE	Laser Type=YAG
2	Laser Type=ELITE	Laser Type=ALEX
3	not used	not used
4	In-House Programming	Normal

Note: S2-1&2cannot both be ON

S3 DIP SWITCH FUNCTIONS		
SWITCH #	OFF	ON
1	Show Fluence Setting	Show Actual Energy
2	Display Energy (joules) if Sw 1 is on	Display Fluence if Sw 1 is on
3	Normal Warmup	Bypass Warmup
4	Normal	Fiber & shutter fault disable
5	Normal	Dont wait for EOC in CV
6	Normal	Keep EXT shutter closed in CV
7	Run CV if S1 is pressed on power up	Run Testall if S4 is pressed on power up
8	Normal	Screen Programming mode

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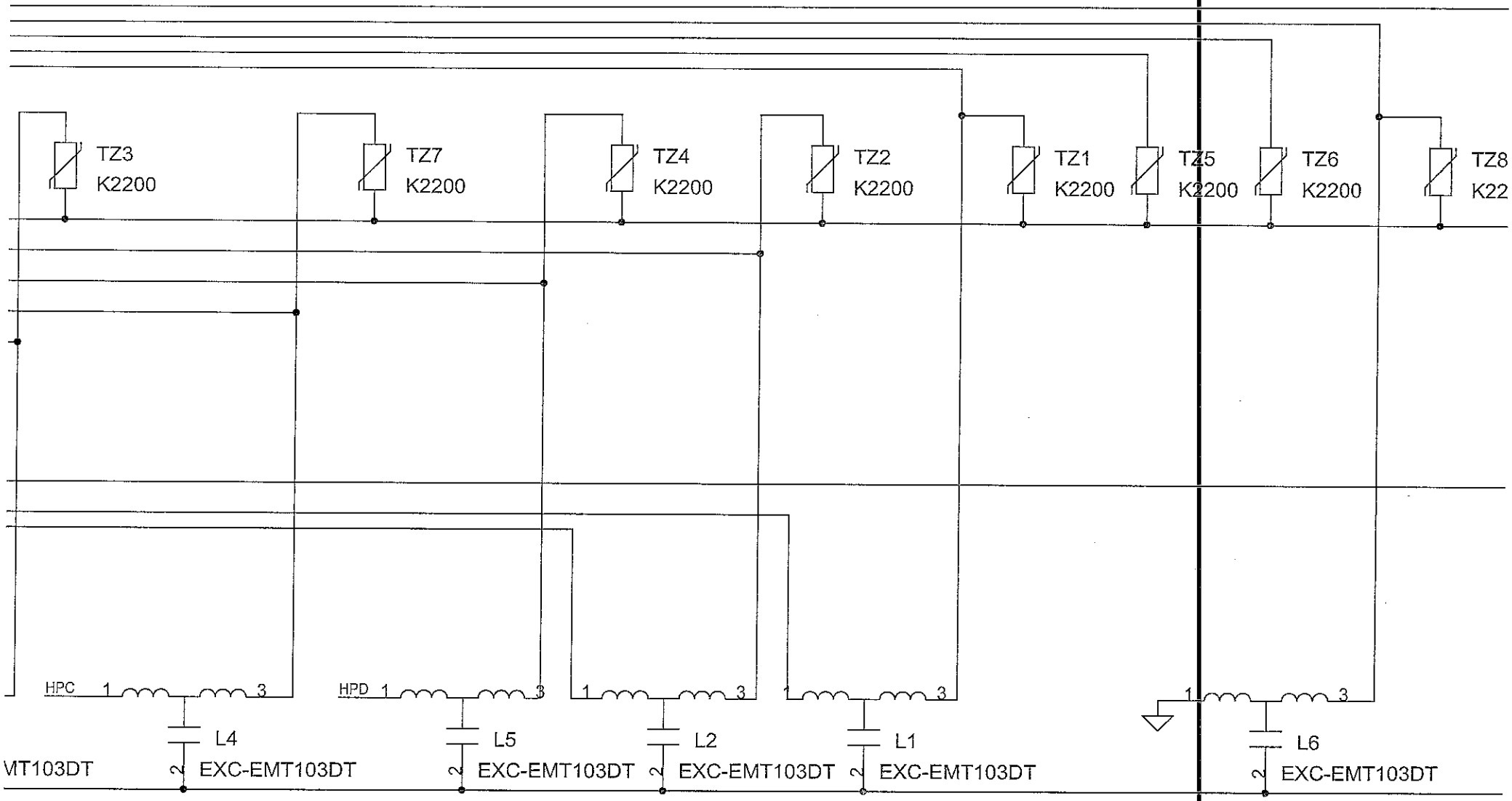

1/4 WATT, 5% UNLESS OTHERWISE SPECIFIED.

E IN uFARADS UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE THIS DRAWING

DIMENSIONS IN INCHES [MM]

UNLESS OTHERWISE SPECIFIED

DESIGNER: E. Koschampp

DATE 8/20/2004

10 Eliza

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