SECTION SEVEN: MAINTENANCE AND TROUBLESHOOTING

Maintenance Overview

In order to maximize the lifetime of the M5C LMT system a routine maintenance schedule must be followed. This section covers the specifics of which components require maintenance, how often each component must be inspected or replaced, and the proper procedures for replacement.

Remember that the M5C LMT system contains a Class 4 laser system with inherent hazards. Serious injury, blindness or death can result if general safety and common sense are ignored. The systems Main Circuit Breaker must be off before attempting any of the maintenance procedures in this section.

NOTICE!
Only those technicians and operators familiar with the system operation should perform any of the following maintenance procedures outlined in this section.

Review the Safety Section and fully understand the hazards associated with this product before attempting any work.

Maintenance Procedures

Following are maintenance procedures that should be performed regularly by the user as specified in Table 7-1.

Table 7-1. Recommended Frequency of Maintenance Procedures

SYSTEM FEATURE	PROCEDURE	FREQUENCY
Purge Gas	Replace desiccant filter cartridge	Annually (or more)
Nozzle	Clean (replace as necessary)	Daily
Focus Lens	Inspect (clean as necessary)	Daily
M4 Mirror	Clean	Weekly (or more)[a]
Vision Camera Lens	Clean	6 Months
Vision Camera LEDs	Inspect	6 Months
Door Struts	Check	6 Months
Clean Plenum and Pallet	Clean	Weekly (or more)
Pallets	Check grip tape	6 Months
X-Belt	Check frequency	6 Months
Water and Gas Hoses	Check hoses	6 Months
Exhaust Duct and Hoses	Check	6 Months
Coolant Water	Perform coolant water service	6 Months
CHS	Calibration	Only if parts are replaced

a. Based on condition of the focus lens.

General Maintenance

Purge Gas System Maintenance

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Maintenance will depend upon the type of purge gas system used.

If using the optional purge air filter dryer unit, as shown in Appendix A: Parts, Tools and Accessories, replace the filters annually or sooner (depending upon quality of inlet air and hours of operation). On the two coalescing filter housings, press the automatic bowl drain up to make sure the drain valve moves freely.

Replacement desiccant filter cartridges available from Coherent. See the Appendix A: Parts, Tools and Accessories for contact information.

If using another filter assembly, contact the supplier for specific maintenance instructions.

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Cable, Hose and Connection Check

NOTICE
Operators must be certified by Coherent to perform the following procedure.

1. Turn off the LMT system and close all breakers.

2. Open the top cover and check the gantry area for broken or damaged cables, loose connections and loose screws (see Figure 7-1).

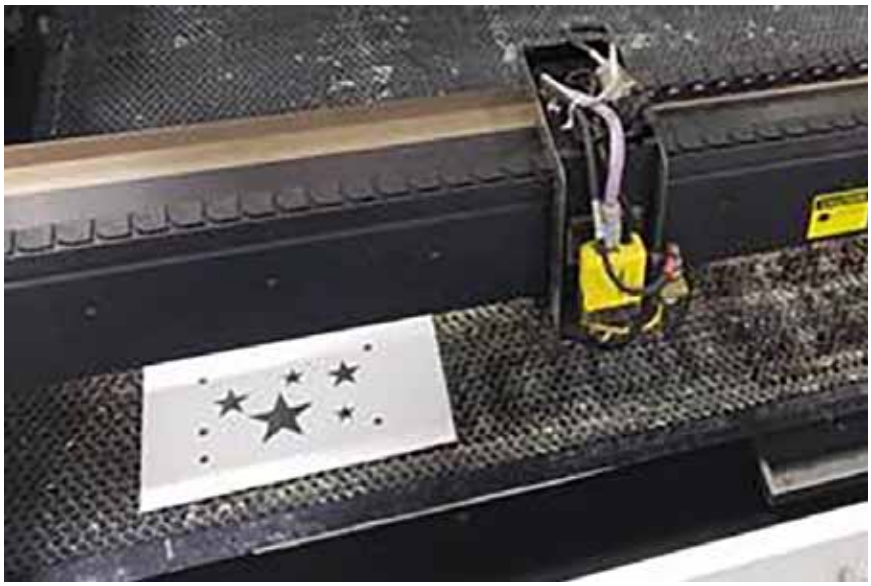


Figure 7-1. Gantry Area

3. Make sure the cables in the X-axis e-chain are seated properly and are not kinked (see "Coolant Water Service" on page 7-3).

Coolant Water Service

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Use only distilled water with Optishield Plus at 9:1.

NOTICE
Do not use Optishield 2 Plus; it reacts with the aluminum in the system and will cause irreversible damage.

Optishield®: First Time Use

1. Flush cooling circuit with distilled water.
2. Calculate system capacity/volume in gallons. Fill chiller with a 5% solution of Optishield® Plus and distilled water (example: 1 gallon of Optishield® Plus to 19 gallons of water).
3. Turn on the chiller and let this solution circulate for approximately 30 minutes.
4. Drain the fluid. Do NOT rinse the system.
5. Fill chiller with a 10% solution of Optishield® Plus and distilled water (example: 1 gallon of Optishield® Plus to 9 gallons of water).
6. System is ready for use. Change fluid every 6 months. Store Optishield® at room temperature, above 60°F. Keep container closed when not in use.

Optishield®: After First Time Use

1. Drain used fluid from system. Dispose of according to local, state and federal regulations.
2. Fill chiller with a 10% solution of Optishield® Plus and distilled water (example: 1 gallon of Optishield® Plus to 9 gallons of water).
3. System is ready for use. Change fluid every 6 months. Store Optishield® at room temperature, above 60°F. Keep container closed when not in use.

Notes

If the system has known corrosion problems, it should first be treated and flushed with a mild cleanser. Contact OPTI TEMP for more details.

If the system has algae problems, flush it with a strong solution of hydrogen peroxide to kill the algae.

Pointing Diode Inspection

NOTICE
Operators must be certified by Coherent to perform the following procedure.

WARNING
Class IV laser present. Wear Personal Protective Equipment (PPE) while performing this procedure.

1. Turn on the LMT system.
2. Remove copper tip.[1]
3. Jog the cutting head over a flat sheet of material, such as cardboard.
4. Look for the red dot of the pointing diode laser.
5. If the diode laser is faint or not visible on the material (see Figure 7-2), remove the cutting head and inspect the Focal Lens. Clean or replace the lens as necessary, then re-test the pointing diode.
6. Repeat this inspection process for the M4 and M3 mirrors.
7. Repeat this inspection process for the Beam Expander.
8. Repeat this inspection process for the M1/M2 periscope.
9. If the beam is still faint or not visible, contact a Coherent service engineer.

1. In case nozzle centering is off.

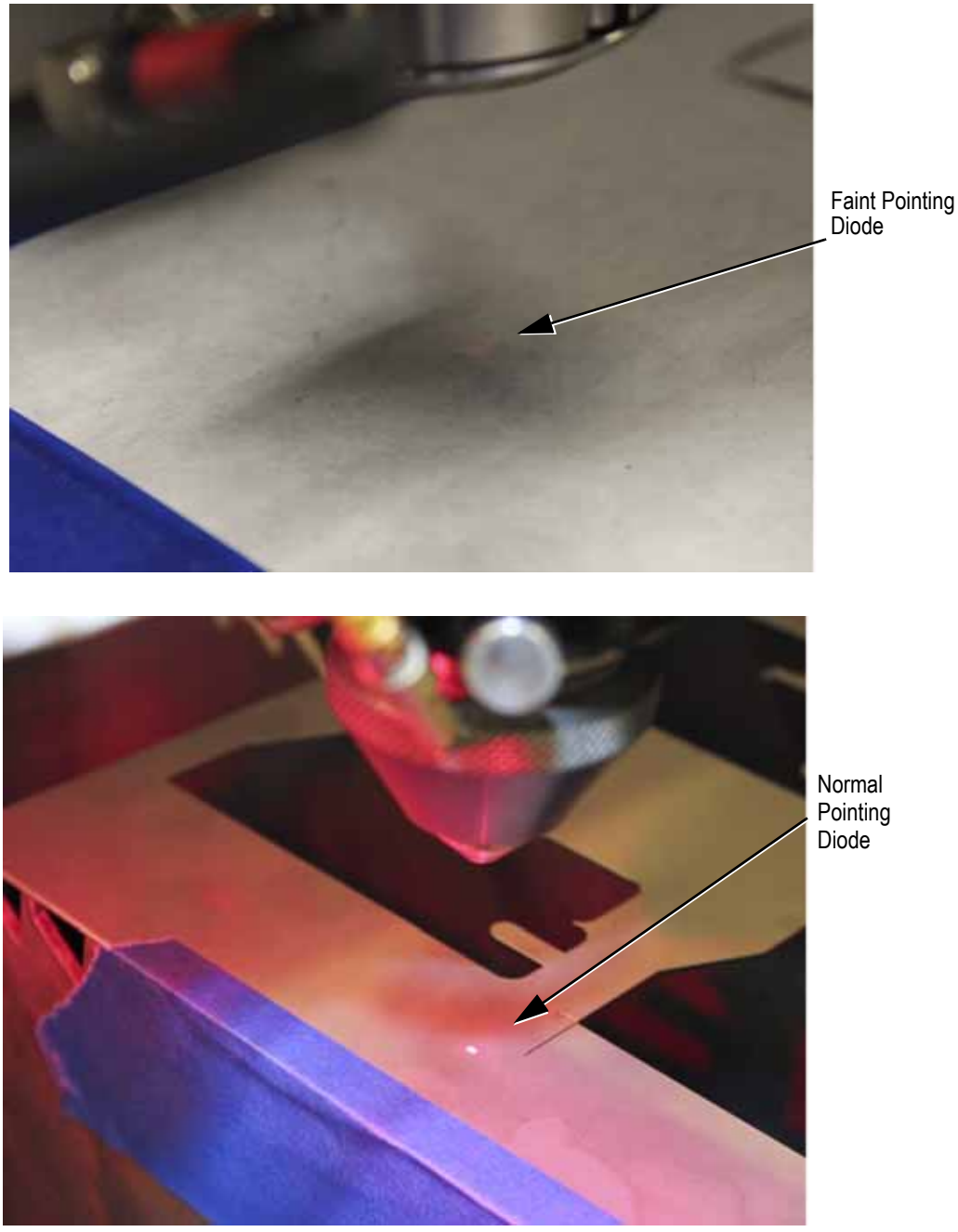


Figure 7-2. Pointing Diode (Faint Compared to Normal)

Ball Screw Greasing

1. Remove lower covers and lower the pallet to lowest limit in order to expose the ball screws (see Figure 7-3).
2. Inspect the ball screws for dust, dirt and debris.

Figure 7-3. Ball Screw

3. Wipe the ball screws if necessary.
4. Add grease[1] to each ball screw. Cycle pallet from lower to upper limit several times. Reinspect ball screw and add grease as necessary.

1. Mobilgrease XHP 220 or equivalent

Optics / Alignment & Focus

Focus Test and Adjustment Procedure

NOTICE
Operators must be certified by Coherent to perform the following procedure.

WARNING
Class IV laser present. Wear Personal Protective Equipment (PPE) while performing this procedure.

This test should be performed from time to time to check the focus of the machine, and every time a focus lens is changed or cleaned.

Introduction

The focus of the LMT system is a very important parameter to maintain for consistent process results. As the focus changes the beam diameter will increase reducing the energy density therefore reducing the power. The focus profile is shaped like an hourglass. Small changes in focus have little affect however as the focus reaches +/- 0.06” the beam diameter will start to change quickly. (See figure below.) The objective for adjusting the focus is to give your process the biggest latitude. This is done by setting the middle of the hourglass at zero focus. This will allow for the largest variation in height change during a given cut. The focus test procedure can be performed every day if it is performed before running the first job of the day if process-critical applications are being used. Otherwise the process can be run at any appropriate interval depending on the process.

Focus Test

1. Prepare a 1/4” sheet of plywood or MDF (Micro Density Fiberboard), or acrylic. A piece of card stock can also be used. Open the Advanced Tab in the HMI and hit Focus Test. 9 lines will be scored in the material at 9 different focus offsets[1] (See

Figure 7-4). There are two settings. Coarse and Fine. The Coarse setting cuts lines at Z offset of .08" to -.08" in increments of .02". The Fine setting cuts lines at Z offset of .04" to -.04" in increments of .01".

NOTICE!
Remove the copper nozzle before running this routine to avoid a head crash.

Notice that the line thicknesses are paired from the center line, at 0.0 focus offset. A properly set focus height will result in each of these pairs having the same thickness. A line at the Z offset of 0.02" should have the same thickness as the line at Z offset of -0.02". As the offsets become greater the pairs will have greater widths. If these pairs are not matched, the focus offset must be adjusted. When inspecting line pair thicknesses, look to the left of the lines, as the material may be warped and the LMT system focuses to the left of the lines.

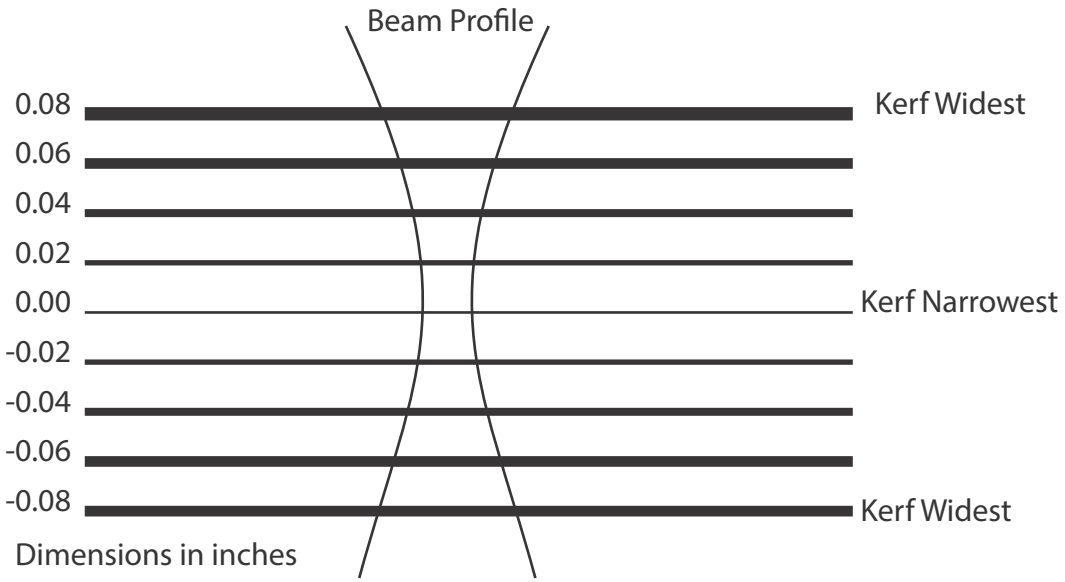


Figure 7-4. Ideal Beam Profile in Coarse Setting

2. From the Advanced Tab, select the Focus Test button.

1. The offset is the distance between the end of the focus sensor and the optimal focus.

3. Enter the parameters[1].

Table 7-2. Focus Test Parameters

PARAMETER	VALUES
Power	10%
Frequency	8kHz
Speed	10”/s
Quality	Coarse

4. Hit Start Routine. The M5C will start cutting lines.
   - If the thinnest lines are offset towards the bottom, the offset must be increased. The cutting bed must be moved in the -Z direction (lowered).
   - If the lines are offset towards the top the offset must be decreased. The cutting bed must be moved in the +Z direction (raised).
5. To move the Z offset, go to Settings>User Settings> Machine Focus Offset and enter the determined value.
6. Repeat this operation until the thinnest line is in the center and the thicknesses of the lines are paired.
   - Focus offset for the material will be set in the Material Library at a later step (see “Setting Nozzle Gap and Focus Offset” on page 4-32).

Final Optic (Focus Lens)

NOTICE
Operators must be certified by Coherent to perform the following procedure.

The final optic must be inspected each day. If it is fogged or dirty it must be cleaned before using the Coherent Laser Machining Tool. A special spanner wrench is supplied to remove the optic. Please reference the “M1-M3 Cleaning Procedures” on page 7-12 and “Lens and Mirror Cleaning Procedures” on page 7-16 for proper installation and cleaning instructions for all external optics in the system.

1. These parameters are approximate and may be adjusted.

NOTICE!
Failure to maintain this optic can lead to serious failure of other optical components. If the LMT system appears to be losing power and is not cutting a previously experienced stop using the LMT system and inspect this optic.

M1-M3 Cleaning Procedures

WARNING
Chemical exposure

Tools

Compressed Air, Isopropyl, Cotton Swabs

1. Remove the TOP and SIDE cover on the Y_a side of the machine to access mirrors M1-M3.

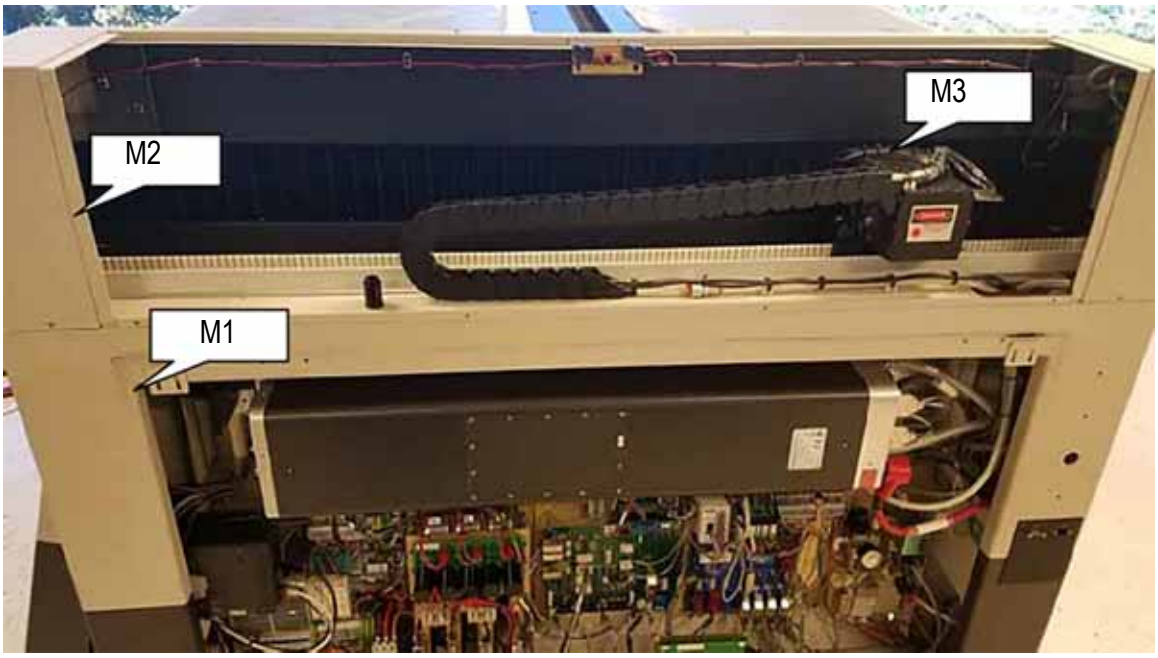


Figure 7-5. M1-M3 Locations

2. Use compressed air or pump to blow off any dust or debris that may be on the mirrors.

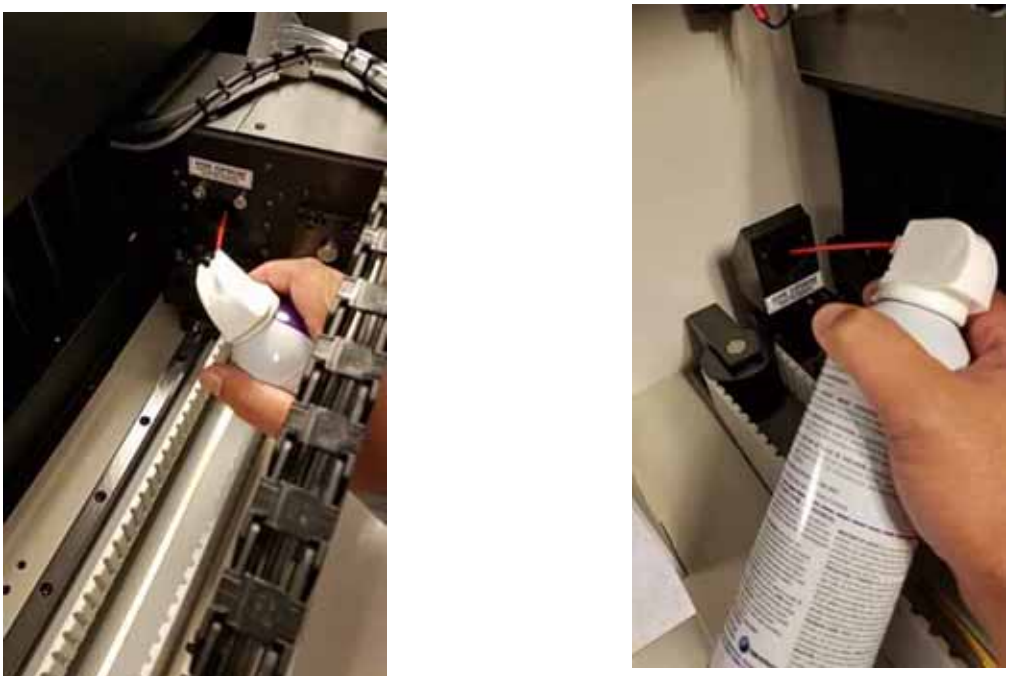


Figure 7-6. Use Compressed Air to Clean Off Debris

3. Add a few drops of Isopropyl alcohol onto a cotton swab.

Figure 7-7. Use Isopropyl Alcohol on Swab

4. Gently brush the surface of the mirror. Take care not to push or rub too hard on the mirror as that can remove the protective coating. Use compressed air to dry mirror.

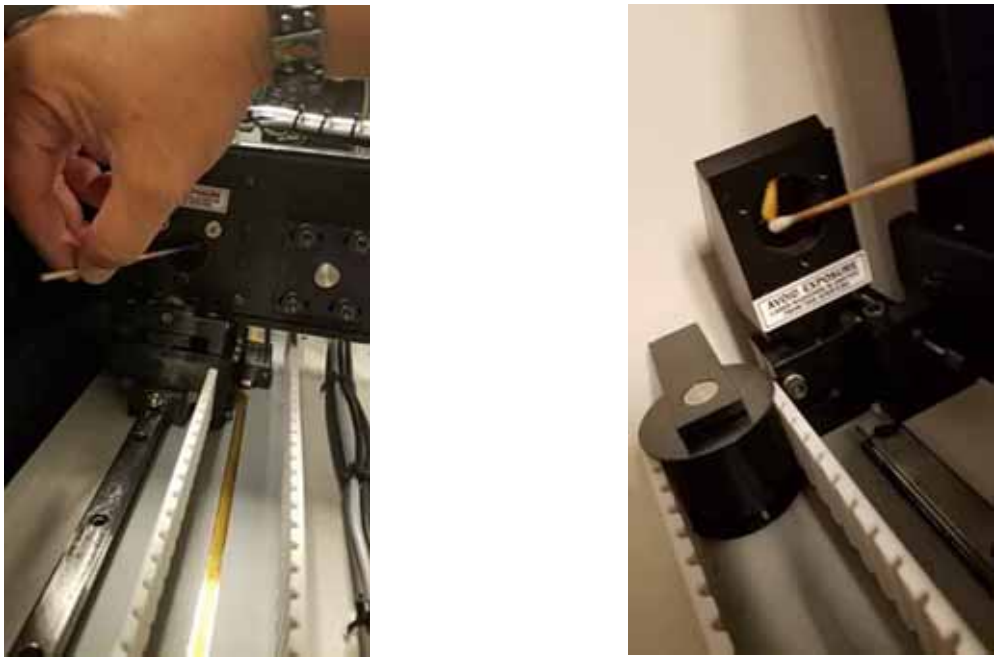


Figure 7-8. Gently Brush Mirror

5. To access the M1 Mirror, first slide the collar from the sealing tube to one side.

Figure 7-9. Access M1 Mirror

6. Unscrew the tube connected to the M1 Mirror Block and follow step 1.- step 4. to clean the mirror.

Figure 7-10. Clean M1 Mirror

Lens and Mirror Cleaning Procedures

WARNING
Chemical exposure

Tools

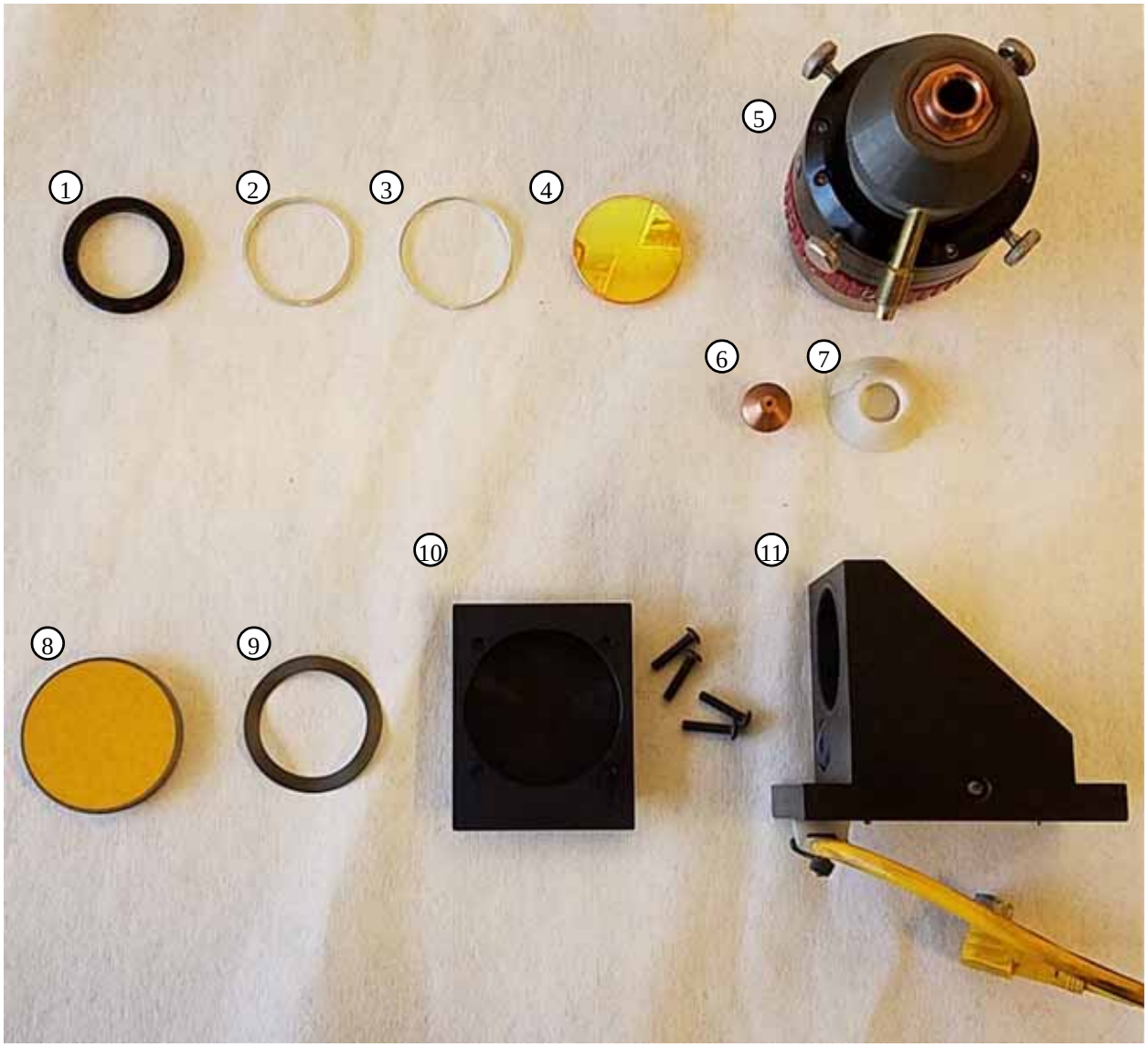
Lens Paper, Optic Nut Wrench, Isopropyl, Standard Allen Wrench Set, Canned Air

Introduction

Without proper care, optics can be damaged. When they become dirty, the foreign matter will absorb the laser energy and cause local heating to the optic. By-products from the laser cutting process such as dust, gas, or other particulate can find their way and settle or adhere to the optics. Regular inspection and maintenance will reduce the risk of premature damage.

Procedure

1. Used canned air to blow off any dust or particles that may be resting on the optic. This will reduce the risk of scratching the optic during the cleaning process.
2. Add a couple drops of isopropyl alcohol to the surface of the optic. This will help loosen up any adhesives from materials that have been cut that were turned into a gas and eventually found their way onto the optic.
3. Place the lens paper on top of the optic. The isopropyl alcohol should spread and cover the optic completely.
4. Use a tool to support the optic as the lens paper is gently pulled towards you. Some resistance will felt as the paper grabs the optic. Pull until the isopropyl alcohol is completely off of the surface of the optic. This acts similar to a squeegee. The method above is known as the "Drag Wipe Method". Although there are alternative ways to clean an optic, this is the safest and recommended way of cleaning.
5. Repeat the above steps until the optic is clean.



1. Optic Nut
2. Clamp
3. Centering Ring
4. Lens Window
5. Cutting Head
6. Copper Tip
7. Ceramic Shield
8. Zero Phase Mirror
9. Wavy Washer
10. Mirror Block
11. Focus Head

Table 7-3. Optics

Figure 7-11. Clean with Compressed Air

Figure 7-12. Methanol on Lens

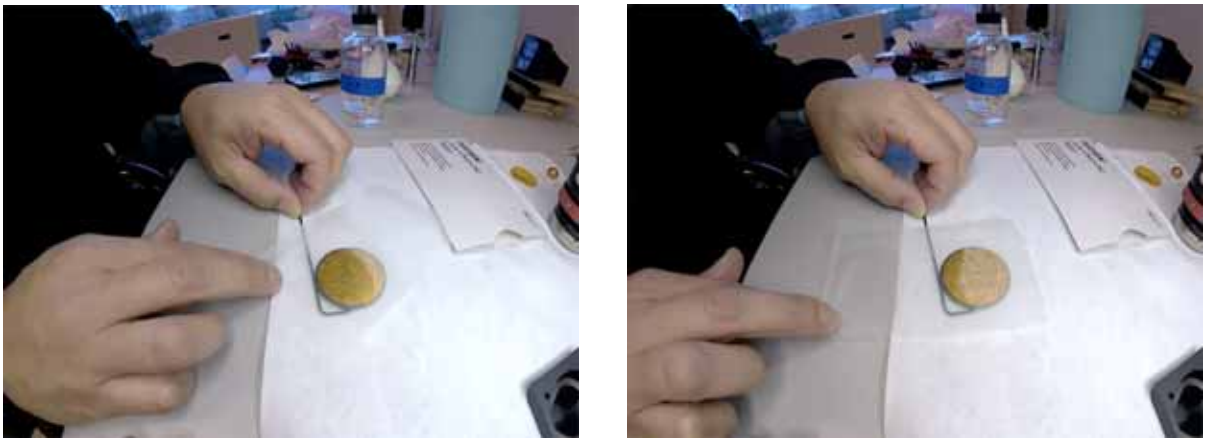


Figure 7-13. Support Optic while Dragging Lens Paper

Y-Square Test

NOTICE
Operators must be certified by Coherent to perform the following procedure.

WARNING
Class IV laser present. Wear Personal Protective Equipment (PPE) while performing this procedure.

When the LMT system is re-leveled, the squareness of the system will need to be verified. To test the squareness, use the Y-Square feature to cut out a 5 inch square and measure the diagonal length of the square. If the diagonal lengths are equal (within .003 inches), the system is squared. If not, the Y-axis offsets must be adjusted in the software.

1. Place a test material (for example, cardboard) >1/8" on the cutting bed.
2. Home the cutting head onto the sample.
3. Open the Advanced Tab
4. Hit "Square Test" (see Figure 5-19)
5. Enter the parameters [100% power, 4"/s, medium (see Figure 5-22)
6. Hit "Start Routine"
7. Once the square piece is cut, remove it from the cutting bed.
8. Measure the diagonals of the square (see Table 7-4).
9. If the diagonal lengths, $\overline{AC}$ and $\overline{BD}$, are within .003 inches, the system is squared. If the difference in the diagonal lengths are more than .003 inches, adjust the Y-axis offset.
10. The correction value can be calculated with the equation below.

Correction Value= $(5-\overline{BD}^2/10)x12.6$

11. To adjust the Y-axis offset, open the Controller Web Interface (Figure 5-2), open Parameters and login as operator, password is "46130".
12. Add the correction value to the Dual XY Square Value.

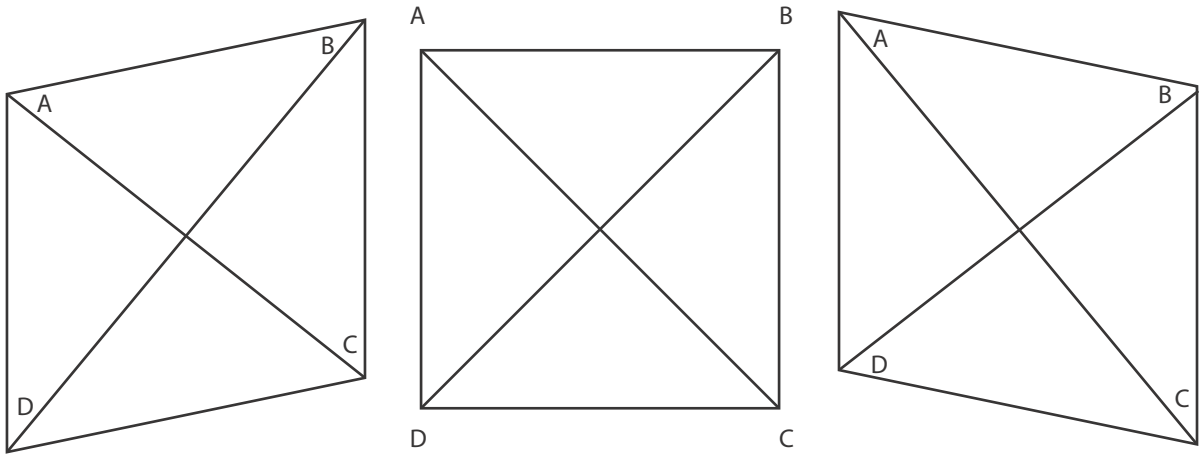


Table 7-4. Measure Diagonal Lengths

13. Repeat these steps until the diagonal lengths, $\overline{AC}$ and $\overline{BD}$, are within.003 inches.

In general, if BD is longer, decrease the Dual CY Square Value.

Top Cover & Doors

NOTICE
Operators must be certified by Coherent to perform the following procedure.

The Top Cover of the LMT system should be regularly cleaned, inside and outside. DO NOT use abrasive cleaners, such as Windex® on the transparent plastic (Lexan™). This can scratch or cloud the material.

We recommend using Brillianize® brand plastic cleaner and polish. For a distributor, call: (800) 445-9344. If the plastic panel is damaged, it can be replaced.

The gas struts that assist in opening the cover may need to be periodically replaced. These are easily installed and can be ordered from Coherent (see Parts List).

Gas Strut Inspection

NOTICE
Operators must be certified by Coherent to perform the following procedure.

1. Raise the top covers and ensure that the struts are assisting the lifting process. You should be able to open the covers a few inches and let go - the struts will open the covers the rest of the way.
2. Once opened, make sure that the covers stay open (see Figure 7-14). Failed struts will cause the covers to immediately close due to gravity.

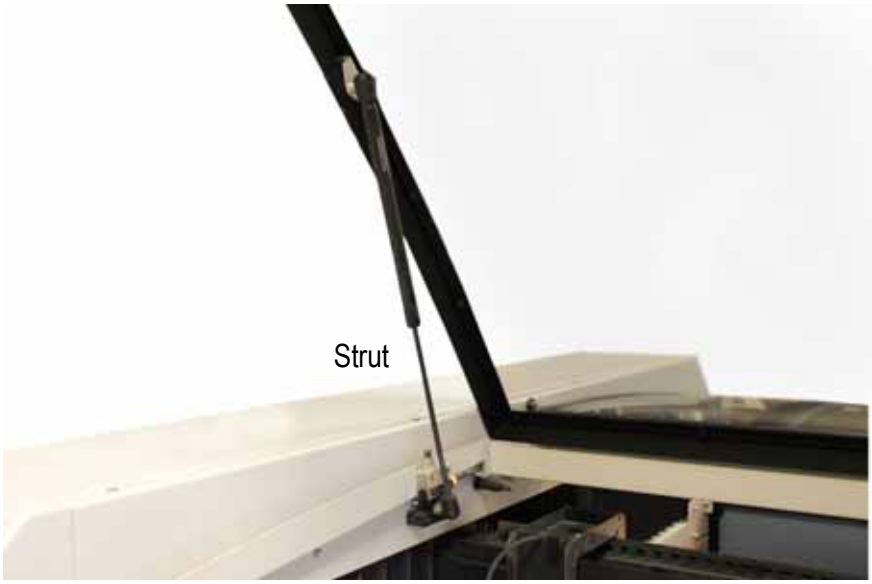


Figure 7-14. Top Cover Strut

3. Close the covers and make sure they stay closed (see Figure 7-15). Failed struts will result in the covers staying open.

If the covers fail to stay open and stay closed, replacing the gas struts is necessary.

Figure 7-15. Fully Closed Top Cover

Inspection

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Inspect the door stop for the absorptive material and the door stop itself for damage (see Figure 7-16).

Inspect the tops of the front and rear doors and ensure each door has two magnets (see Figure 7-17).

Door Stop Inspection

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Figure 7-16. Door Stop Inspection

Figure 7-17. Door Magnet

Remove the damaged door stop (see Figure 7-18).

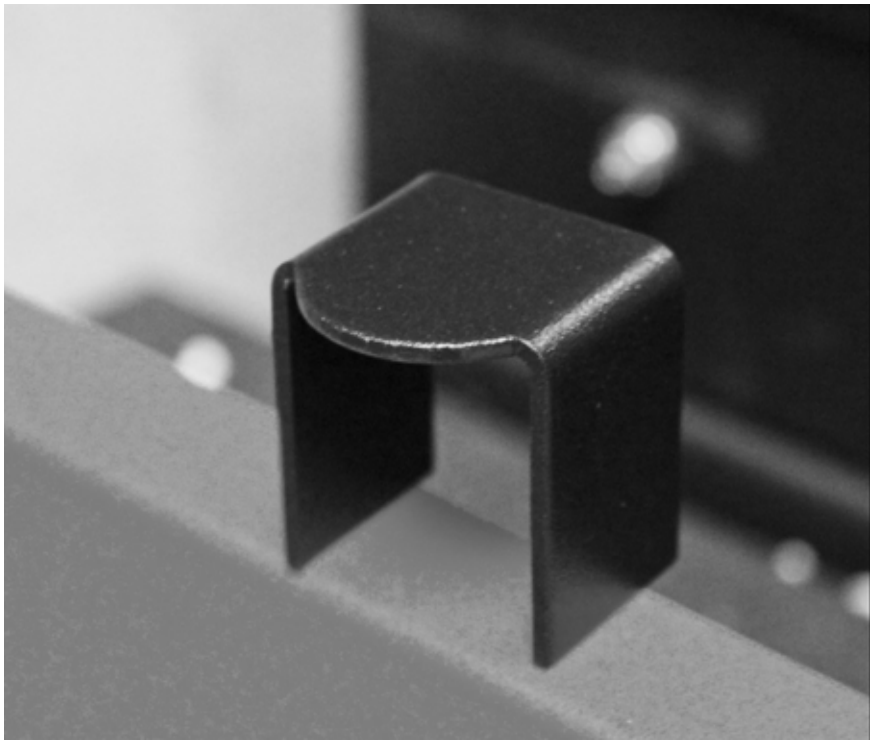


Figure 7-18. Removed Door Stop

Slide the new door stop into place and check the doors for smooth and complete closure.

Magnet Replacement

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Place a dab of Hysol 20 epoxy on the top edge of the door in the location of the missing magnet.

Make sure the orientation of the magnet is correct, then push it down over the epoxy to secure the magnet in place.

Allow time for the epoxy to cure before testing the magnet.

NOTICE!
The magnet's purpose is to ensure that the door does not fall due to gravity. It does not take much downward pressure to defeat the force of the magnet.

Cutting Bed

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Honeycomb

The aluminum honeycomb cutting surface should be routinely cleaned, rotated and have dents straightened. The honeycomb sheet can be replaced (see Parts List) but its life can be significantly lengthened by routine maintenance.

To remove the honeycomb, remove the cutting pallet from the M5C LMT system and unscrew the top frame. Turn the Pallet upside down and note if the honeycomb is held flat by wires or clips (these are only installed if the sheet does not lie flat). Untwist or cut these wires to remove them.

Carefully remove the honeycomb (gloves are recommended) and set it on a flat surface. Be careful not to bend the honeycomb sheet while handling it.

CAUTION!
Use gloves while handling honeycomb sheets. Sharp edges can cause cuts.

After removing the honeycomb, clean the supporting structure in the Pallet using cleaners such as 409. Remove all scraps of material from the support structure. Using compressed air, blow scraps and residue from the honeycomb sheet.

The honeycomb sheet is square and can be rotated or turned over to prolong its life. Typically, most wear on the honeycomb occurs near the machine's origin (lower, left corner).

When replacing the honeycomb, carefully set it into the pallet frame. Do not force or bend the sheet while inserting it. Replace the wire tie-downs in several locations (or as needed) to hold the sheet flat. The wire should cross at least two honeycomb cells and should not be over-tightened, or it will cut through the honeycomb.

To straighten dents in the honeycomb, carefully use needle-nose pliers and use caution not to bend adjoining cells.

Cleaning

The Cutting Bed and exhaust plenum should be routinely cleaned.

1. Remove the Cutting Pallet. At the bottom of the plenum is a screen to keep scraps from the exhaust fans. Vacuum scraps out of the plenum and remove and clean the screen.
2. Dirt and dust inside the Cutting Bed should be wiped off using cleaners such as 409.

WARNING!
Failure to regularly clean the cutting bed and exhaust plenum may result in a fire hazard.

3. With the Pallet removed, check the V-wheel rollers that the Pallet slides on. Make sure they are clean and turn freely. Wheels on the left side also should “float” sideways at least 1/16. If necessary, lubricate the V-wheels with a light machine oil.

Parts Drawer

The parts drawer should be cleaned periodically to remove cutting debris.

Nozzle

Nozzle Cleaning and Replacement

NOTICE
Operators must be certified by Coherent to perform the following procedure.

The Cutting Nozzle assembly should be routinely removed and cleaned. The nozzle assembly is designed to "break away" by tilting it to the side. After pulling the nozzle away, disconnect the airline pushing the green ring towards the nozzle and gently pulling on the hose.

On the top of the Nozzle assembly is a cover slide that protects the rest of the focusing optics. Be careful no to touch or scratch this cover slide.

To remove the nozzle, unscrew it. See "Nozzle Height Adjustment" on page 9 of Section 4: Operation for instructions on resetting the nozzle height when it is reinstalled.

NOTICE!
Be sure to set the nozzle height correctly when reinstalling it. Setting it too low can cause the nozzle to crash and may damage the machine.

Wipe all residue from inside and outside of the nozzle. If necessary, soak the nozzle in alcohol or acetone to remove excess residue.

Check the inside of the nozzle chamber and window for dust or cutting residue. If necessary, clean the window with alcohol and gently wipe it with soft lens cleaning tissue.

If the nozzle is damaged or warped, causing the gas flow to be uneven or the beam to be clipped, unscrew it and replace with a new nozzle.

Nozzle Centering

NOTICE
Operators must be certified by Coherent to perform the following procedure.

WARNING
Class IV laser present. Wear Personal Protective Equipment (PPE) while performing this procedure.

It is important for the beam to pass through the nozzle without being impinged, otherwise power and cut quality may be negatively affected.

The following procedure centers the beam in the nozzle.

1. Apply some clear, glossy tape to the end of the nozzle (see Figure 7-19).

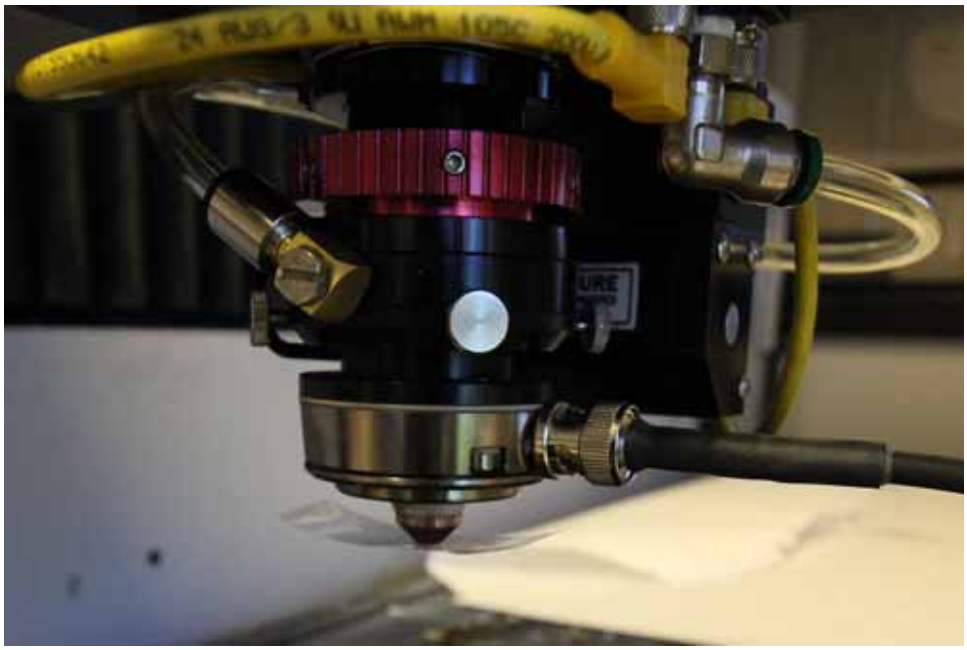


Figure 7-19. Nozzle With Tape

1. Open the Coreo Suite
2. Open the Web browser to get to the ExtraTech Website.
3. Login as manufacturer with the password "oem1234"
4. Open the Diagnostics tab.
5. Enter values into the parameter fields. For this test, the following values are recommended.

Table 7-5. Nozzle Centering Laser Parameters

PARAMETER	VALUE
Power	15 %
Frequency	1000 Hz
Time	15 ms

6. Hit “Fire Laser”. If you do not see the sparks from the laser piercing the tape, increase the power.

7. Carefully remove the tape from the nozzle and inspect the hole position in relation to the center of the nozzle and the adjusting screws (see Figure 7-20).

Figure 7-20. Outline of Nozzle with Centered Beam

If clipping is suspected, as evidenced by an elongated beam hole or a missing hole, check the aiming beam brightness. If it is dim, the beam is most likely clipping.

8. Adjust the nozzle using the 4 screws on the cutting head (see Figure 7-21).

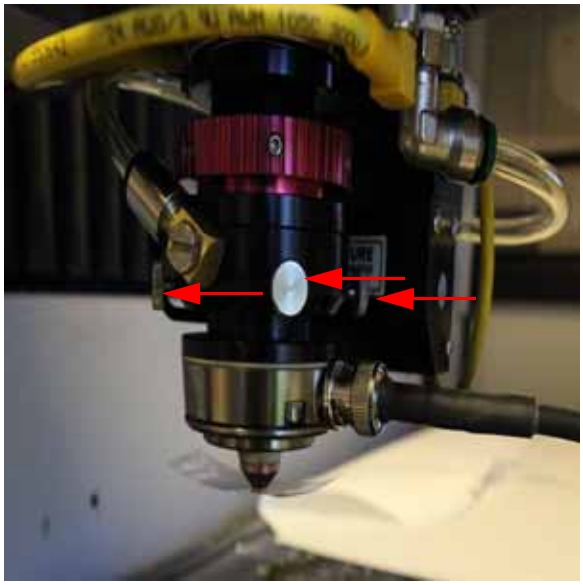


Figure 7-21. Nozzle Centering Adjustment Screws

9. Repeat steps until the beam is centered in the nozzle. The ability to adjust the seating of the M4 mirror block is limited. If the beam still is not centered, perform a Short Beam Alignment.

Laser Power Test

NOTICE
Operators must be certified by Coherent to perform the following procedure.

WARNING
Class IV laser present. Wear Personal Protective Equipment (PPE) while performing this procedure.

The power test is conducted at 100% power at three frequencies (1000 Hz, 8000 Hz and 16000 Hz) for a duration determined by sensor calibration.

1. Put the thick dark gray heating element disc under cold water over for a few minutes to zero the power meter. Dry the disc thoroughly, then hold the gauge at its black plastic base and turn the gauge to zero it.
2. Remove the copper nozzle from the nozzle assembly.
3. Lower the cutting bed to Z = -5 or -6 using the HMI or control panel if using a 3.5" FL lens.

The height of the bed should be such that the laser is out of focus when it contacts the power meter.

---

4. Place the power meter below the focus head assembly (see Figure 7-22). Use the power meter test stand or a piece of material to hold the meter in place. Use the aiming beam to center the power meter with respect to the beam path.

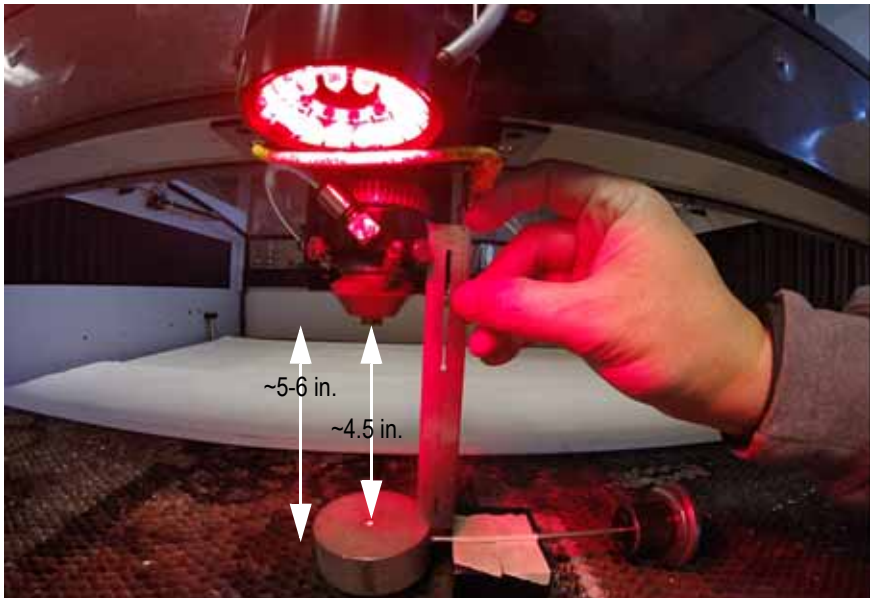


Figure 7-22. Power Test Near Focus Head Assembly

5. Go to the Coreo Connect and select the gear icon to open the Controller Web Interface.

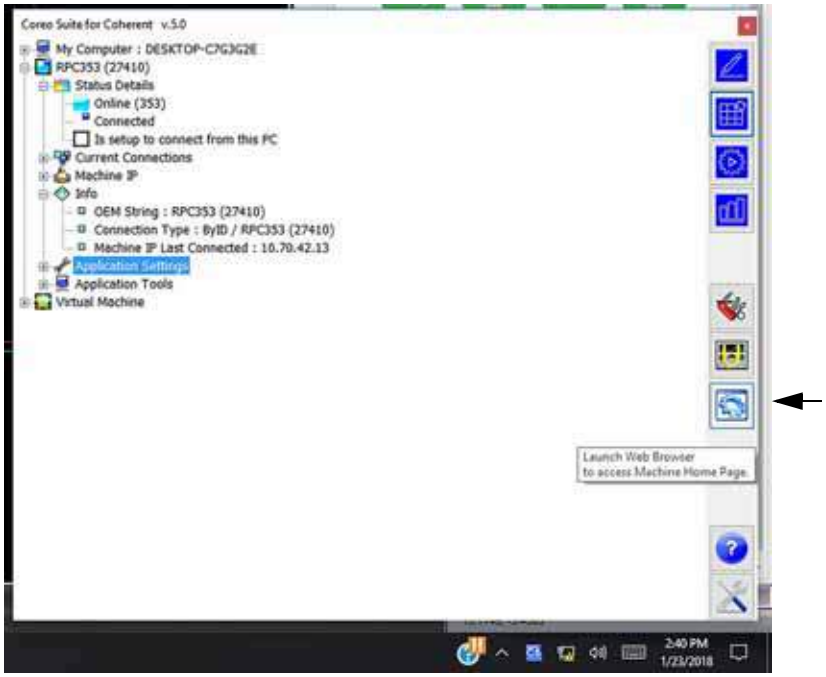


Figure 7-23. Gear Icon

6. Select the Diagnostics Tab on the Controller Web Interface.

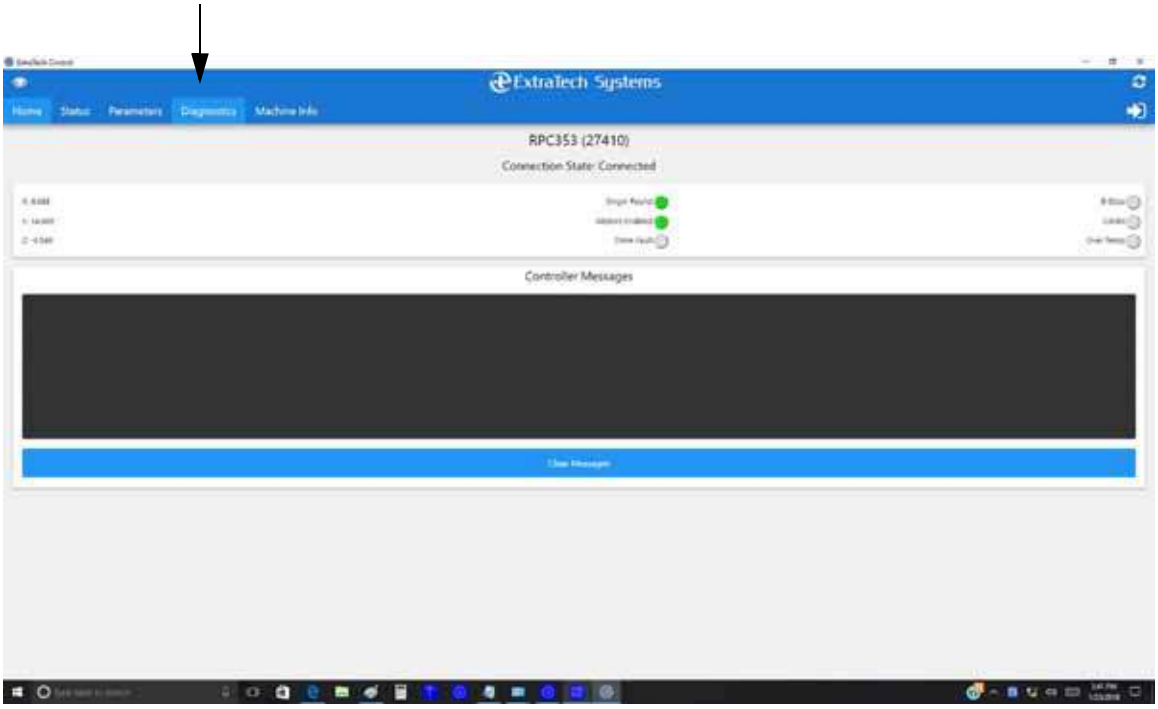


Figure 7-24. Diagnostics Tab

7. In the Laser Power Test section, set the desired laser power (e.g. 100%), desired frequency (e.g. 8,000 Hz) the time to fire the laser that the power meter is calibrated for (e.g. 30,000 ms), and a gas pressure if desired (gas flow is not required for a power test).

8. Once the parameters are set and the doors are closed, press the fire laser button.

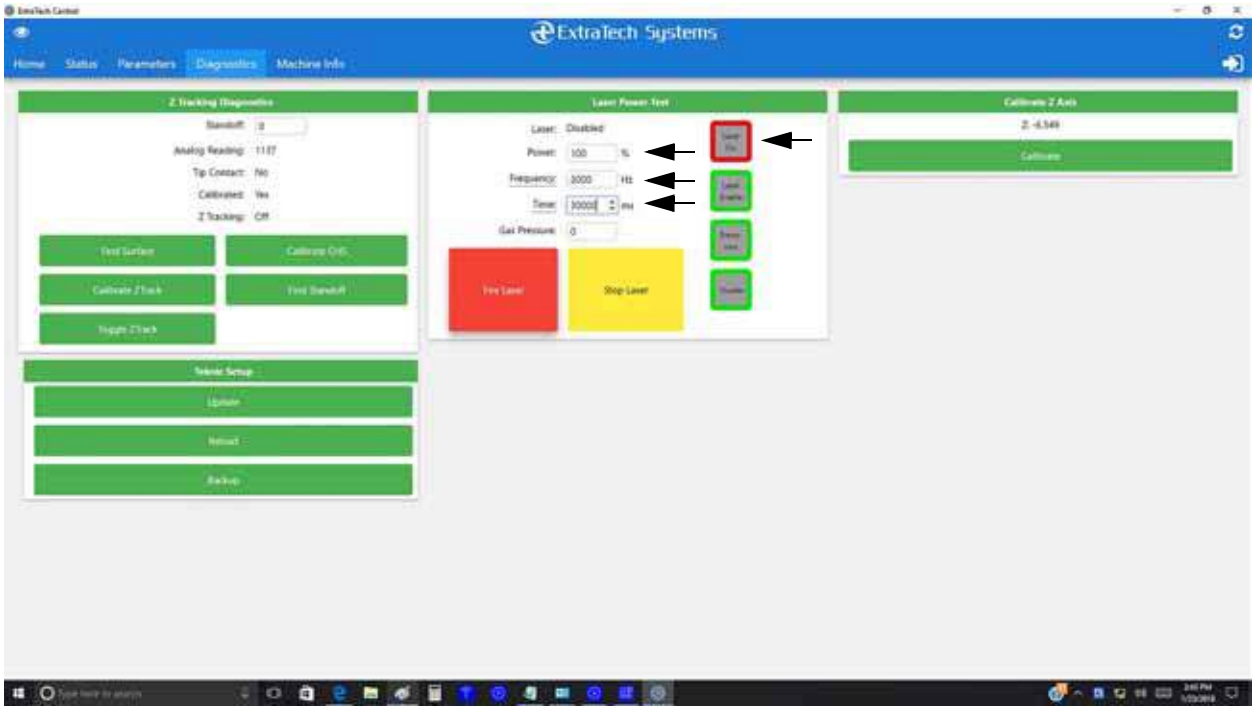


Figure 7-25. Fire Laser

At the start of the test you will hear the shutter open.

NOTICE
Do not open the doors on the machine until you hear the shutter close and see the laser enable indicator in Laser Power Test area on the screen is green again. Opening the doors will abort the power test.

---

9. Open the doors and observe the power meter. Wait for the maximum number to appear on the meter (there is a delay).

Note the maximum power in a table like the one provided below.

Table 7-6. Example Table for Use with Power Test

SET POWER	FREQUENCY	TIME	MAXIMUM MEASURED POWER
100%	1000 Hz	Dependent on sensor. Typically 15,000-30,000ms.	
	8000Hz		
	16000Hz		

10. Compare measured maximum power against data sheet provided with the system.
11. If the measured power is 10% less than what is stated on the data sheet, contact Coherent Service.
12. If the measured power is marginally below rated power, check the optics. They may need to be cleaned, adjusted or replaced.

Inspecting Copper Tip

NOTICE
Operators must be certified by Coherent to perform the following procedure.

1. Remove copper tip.
2. Inspect threads for excessive wear.
   Excessive wear can cause tip to wobble in operation.
3. Inspect orifice for circularity.
   Elliptical orifices can cause edge quality issues and dross.
4. Verify bottom of tip for flatness and cleanliness.
   Rough surfaces and buildup can cause issues with clearance and CHS operation.
5. If necessary, polish tip with Burgundy 3M™ cloth or equivalent.

Maintenance Parts

Parts commonly replaced during preventive maintenance are listed throughout "Appendix A: Parts, Tools and Accessories".

For 3rd-party accessories used in conjunction with the system (e.g. chiller), refer to the manufacturer's product literature for safety information, maintenance recommendations and procedures.

Emergency Stop Switch Test

NOTICE
Operators must be certified by Coherent to perform the following procedure.

The Emergency Stop switches must be periodically tested to determine that it functions properly.

1. Turn the system on.
2. Press the Emergency Stop button on the front of the system control unit and check that the system shuts down properly. Make sure button locks into place.
3. Repeat for all other switches.

Troubleshooting

Following procedures are meant as guidelines to aid in troubleshooting the LMT system and its performance. Should there be no improvement, contact Product.Support@Coherent.com.

Capturing System Data

NOTICE
Operators must be certified by Coherent to perform the following procedure.

Prior to troubleshooting or contacting a Coherent representative for troubleshooting, capture and send the system data.

1. In Coreo Command, click on the orange bubble icon on the top right of your screen.
2. Check the “Include QC Capture” and hit OK.
3. Specify the location to save the data. Hit OK.
4. If contacting Coherent, send file to customer.support@coherent.com along with the serial number of your system and a description of the issue.

Applications Troubleshooting

Laser is not cutting through the material:

- Make sure the beam is centered in the nozzle, as it may be clipping the nozzle.
- Try to cut at slower speed.
- Check the nozzle standoff and focus position.
- Check the cutting frequency.
- Check the assist gas pressure, as it may be low.
- Check that the focal lens is not dirty.
- Run the focus test.
- Check that the mirrors are not contaminated.

Laser is not firing:

- Make sure the Dry Run setting in the settings tab of the HMI is set to 0.
- Check the warning LEDs on the front panel:
  - Assist Gas
  - Cooling Water
  - Exhaust System
- Check nozzle centering. Beam may be completely obstructed and may be firing.

Dross on bottom of cut material:

- Partial dross (not on all of the edges):
  - Check the nozzle centering.

- Check the nozzle gap and focus offset.
- Try higher assist gas pressure.
- Try faster / slower cutting speed.
- Check the cutting frequency.
- Check that the lens is clean.
- Run the focus test.
- Check that the mirrors are clean.

Cut edge of acrylic isn't flame-polished:

- The cutting speed is too fast.
- The laser power is too low.
- The cutting frequency is too low (16 kHz gives the best result).
- The copper tip hasn't been removed from the nozzle and the assist gas flow is too intense (causing hazy cutting edge).
- The assist gas is the incorrect type. Typically, compressed air is used.
- The honeycomb below the sheet is causing tick marks:
    - Add spacing blocks to make about 1" gap between the honeycomb and the acrylic.

Cut edges of plastics are discolored:

- Lower the power.
- Lower the frequency
- Use masking on the material.
- Use nitrogen as the assist gas instead of compressed air.
- Try both low and high assist gas pressures (15 psi – 60 psi).
- If lower pressure gives better results, try cutting without the copper tip.
- Make sure the exhaust system is working properly.
- Cover the whole cutting bed using material such as paper sheets to maximize the vacuum below the material.

APPENDIX A: PARTS, TOOLS AND ACCESSORIES

Replacement and Spare Parts

The following parts can be ordered by contacting our Product Support Hotline at (800) 367-7890 or (408) 764-4557 outside the USA; or through e-mail at Customer.Support@Coherent.com; or your local Coherent service representative.

When communicating with our Product Support Department by telephone or e-mail, the model and serial number of your laser system is required by the Support Engineer responding to your request.

Table A-1. Accessory Kit

ITEM	QTY	PART NUMBER	TITLE	REFERENCE
1	1	01-0504-101	Optic Nut Wrench	
2	1	01-0644-101	Cutting Bed Leveling Gauge	
3	1	02-0124-101	Water Filter Kit	
4	1	02-0358-101	Lens Cleaning Assembly	
5	2	11-0000	Thermal Paper	Testing paper
6	1	11-0030-001	Beam Alignment Targets	Nozzle
7	2	11-0030-002	Beam Alignment Targets	M4 Target
8	1	12-0135	Redhead Spacer	
9	1	12-0136	Renishaw Gauge	
10	1	13-0004-008	Brass Male Connectors	Control Air
11	1	13-0004-009	Brass Male Connectors	Assist Gas
12	180	13-0007-014	Polyurethane Tubing	Control Air
13	24	13-0007-187	Polyurethane Tubing	Exhaust Sensor
14	180	13-0009-375	Nylon Tubing	Assist Gas Line
15	2	13-0029-001	Reducing Bushing	
16	300	13-0030-500	Polyethylene Tubing	
17	2	13-0081-001	Brass Male Connector	Chiller
18	15	14-0043-001	8-32 Truss Head Phillips Screw	Extra

Table A-1. Accessory Kit (Continued)

ITEM	QTY	PART NUMBER	TITLE	REFERENCE
19	3	14-0043-003	8-32 Truss Head Phillips Screw	Extra
20	3	14-0044-001	Nylon Washer	Extra
21	3	14-0045-002	Acorn Nuts Zinc Plated Steel	Extra
21	1	26-0014	Cat-5 Patch Cord	
23	1	30-0080-101	External Exhaust Relay Cable Assembly	Remote Switch

Table A-2. Parts

ITEM NUMBER	DESCRIPTION
Nozzle	
12-0303	M8 Series Nozzle, M8 Series Nozzle 1.5
01-0907-101	Assist Gas Nozzle .08" bore
Lens	
11-0040	Lens, Plano Convex, 1.1"OD x 3.5"FL, ZnSe
11-0010	Lens, Plano Convex, 1.1"OD x 5"FL, ZnSe
Mirror	
11-0005	90 DEG, PHASE SHIFT MIRROR, 1" O.D., 90 DEG
11-0006	Mirror, Zero Phase Shift, 1"OD, 0°, SiliconMirror
11-0009	Mirror, Zero Phase Shift, 1.5"OD, 0°, SiliconMirror
1332576	Mirror, CU REFL 1.0"DIA .250"THK PO/SPT ATFR/UCMirror
Window	
11-0011	Window, AR, 1.1"OD, >0.118"T, ZnSeWindow

WARRANTY

Warranty Overview

Following are Coherent's standard warranty terms. However, the warranty terms for your systems may vary. Please refer to the signed Sales Quotation for actual warranty for your system.

Coherent warrants items manufactured by it to be free from defects in materials and workmanship for a period of one year (12 months). This warranty applies only to the original Buyer, for equipment installed at the original location. Major sub-systems manufactured by other companies (e.g. the motion controller, chiller) are covered only by their original manufacturers' warranty and Coherent does not make any warranty in respect to such items.

Conditions of Warranty

Coherent's liability under valid warranty claims is limited to repair or replacement at a Coherent facility or Buyer's location at the discretion of Coherent. Buyers are responsible for any shipping charges, insurance, and travel expenses incurred by Coherent while providing warranty service. Coherent does not provide on-site service outside of the domestic United States.

Warranty claims must be made within thirty (30) days of occurrence of the circumstances giving rise thereto. Such claims must be in writing and must fully disclose all related circumstances giving rise to the claim. Before any products are returned for warranty service, written authorization and written shipping instructions must be obtained from Coherent. The Buyer shall be responsible for all shipment and related costs, as well as any damage due to improper packing or handling of products being returned for warranty service. Coherent reserves the right to reject any warranty claim for products that have been damaged in shipment or shipped by a non-acceptable means of transportation.

If it is found that products have been returned without cause, the Buyer will be responsible for all return shipping charges and may, at Coherent's sole discretion, incur charges for testing and examination.

Responsibilities of the Buyer

The Buyer is responsible for providing the specified utilities and an operating environment as outlined in the product literature. Damage to the LMT system caused by failure of Buyer's utilities or failure to maintain an appropriate operating environment, is solely the responsibility of the Buyer and is specifically excluded from any warranty, warranty extension, or service agreement.

The Buyer is responsible for prompt notification to Coherent of any claims made under warranty. In no event will Coherent be responsible for warranty claims made later than seven (7) days after the expiration of warranty.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from any of the following:

- Components and accessories manufactured by companies, other than Coherent, which have separate warranties,
- Improper site preparation or installation by the Buyer,
- Buyer-supplied interfacing,
- Operation outside the environmental specifications of the product,
- Operating with improper or inadequate cooling, exhaust or purge,
- Improper or inadequate maintenance,
- Unauthorized modification or misuse,
- Opening the laser head housing, or
- Service or repair of product by unauthorized personnel.

Coherent assumes no responsibility for customer-supplied material.

Coherent considers hoses and cables that are frequently flexed or bent to be consumable parts. As such, these parts are not covered under the warranty.

The obligations of Coherent are limited to repairing or replacing, without charge, equipment which proves to be defective during the warranty period. Replacement sub-assemblies may contain reconditioned parts. Repaired or replaced parts are warranted for the duration of the original warranty period only. The warranty on parts purchased after expiration of system warranty is ninety (90) days. Coherent's warranty does not cover damage due to misuse, negligence or accidents, or damage due to installations, repairs or adjustments not specifically authorized by Coherent.

This warranty applies only to the original purchaser at the initial installation point in the country of purchase, unless otherwise specified in the sales contract. Warranty is transferable to another location or to another customer only by special agreement which will include additional inspection or installation at the new site. Coherent disclaims any responsibility to provide product warranty, technical or service support to a customer that acquires products from someone other than Coherent or an authorized representative.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, AND DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL LOSS. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

GLOSSARY

°C	Degrees Celsius
°F	Degrees Fahrenheit
µ	Micro(s) = (10^{-6})
µs	Microsecond(s) = (10^{-6} seconds)
A or Amp	Amperes
AC	Alternating current
accessible radiation	Radiation to which it is possible for the human eye or skin to be exposed in normal usage
Amp	Amperes
average power	The total energy imparted during exposure divided by the exposure duration
Assist gas	A gas or gas mixture used to clear debris from the beam path during a cut, minimize Heat Affected Zones (HAZ), shield the material processing area from contamination and protect the LMT system optics from debris, smoke and particles during the machining process. The gas or gas mixture used, as well as the pressure, will change depending upon the material used, process characteristics and the desired results.
CDRH	Center for Devices and Radiological Health
circuit breaker	An automatically operated electrical switch that protects an electrical circuit from damage caused by overload or short circuit. Can be manually reset or turned off and on.
cm	Centimeter(s)
controlled area	An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards
CHS	Capacitive Height Sensing
CPU	Central processing unit
cutting head	A mechanical assembly suspended from the gantry that moves along the X-axis of the LMT and includes the nozzle, CHS, Vision camera (optional), focus sensor and assist gas delivery.
cutting pallet	Flat platform that provides a surface for placing job materials. Moves vertically on the Z-axis.
cutting speed	The speed of the cutting nozzle as it passes over the workpiece.
DC	Direct current

dross	A mass of solid impurities formed from molten metals that are recast on the workpiece, usually on the bottom edge.
dwell	See *pierce*
edge quality	Smoothness and cleanliness of the material's processed edge.
ejecta	Material expelled from the kerf by the assist gas.
Emergency Stop	A button or buttons, usually red, that interrupts power to the LMT system in case of an emergency or hazardous situation.
energy	The capacity for doing work; energy content is commonly used to characterize the output from pulsed lasers, and is generally expressed in joules (J)
ESD	Electro-static discharge
feed rate	See *cutting speed*
ft.	foot (feet)
focal length	The distance from the secondary nodal point of a lens to the primary focal point; in a thin lens, the focal length is the distance between the lens and the focal point
focal point	The point toward which radiation converges or from which radiation diverges or appears to diverge
focus offset	Distance between the top of the workpiece and the focal point of the laser beam, with positive distances resulting in the focal point being below the surface of the workpiece. This is advantageous for certain cutting applications.
focus sensor	A swing-arm sensor that allows the LMT system to determine the height of the cutting nozzle above the material and set the focal point and focus offset.
gantry	A mechanical assembly providing overhead beam delivery using the X-axis carriage / cutting head. The gantry spans the X-axis of the LMT and moves on the Y-axis.
gpm	Gallons per minute
HAZ	Heat Affected Zone
Heat Affected Zone	The area of the process material that has had its properties altered by heat from the cutting process.
HMI	Human Machine Interface
hold down	A function of the LMT system during which the exhaust is activated, causing the process material to be forced down on the cutting pallet, reducing the chance for errors in the job; see *part mask*
Human Machine Interface	Touch-panel display that allows interfacing with the LMT system.
Hz	Hertz or cycles per second (frequency) (= 1/pulse period)
I/O	Input/Output
ID	Inside diameter
in.	inch (inches)
installation	Making the LMT system ready for operation; includes vital procedures that ensure the system is functioning to the same specification as when it left the factory.

IR	Infrared (wavelength); electromagnetic radiation with wavelengths which lie within the range 0.7 µm to 1 mm
job	Also: process. The action of performing a material processing application using the LMT system, in which the system follows a set of instructions specified in an .LMC file.
job file	An .LMC file used by the LMT system to perform a job.
kerf	The width of the resulting cut from laser processing.
kg	Kilogram(s) = 10^3 grams
kHz	Kilohertz = 10^3 Hertz (1000 Hertz)
kV	Kilovolt(s) = 10^3 volts
LASER	A device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels; an acronym for Light Amplification by Stimulated Emission of Radiation
Laser Safety Officer	One who has authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards
laser system	An assembly of electrical, mechanical, and optical components which includes a laser
LCD	Liquid Crystal Display
LED	Light Emitting Diode
limiting exposure duration	An exposure duration which is specifically limited by the design or intended use(s)
LMC	The file extension for job files used by the LMT system.
LMT	Laser Machining Tool
lpm	Liters per minute
LSO	Laser safety officer; see *laser safety officer*
maximum permissible exposure	MPE; the level of laser radiation to which a person may be exposed without hazardous effects of adverse biological changes in the eye or skin
m	Meter(s)
mA	Milliamperes = 10^{-3} Amperes
mask	See *part mask*
max.	maximum
min.	minimum
mm	Millimeter(s)
MPE	Maximum permissible exposure; see *maximum permissible exposure*
ms	Millisecond(s)
mV	Millivolt(s)
NHZ	Nominal hazard zone; see *nominal hazard zone*
nm	Nanometers = 10^{-9} m (wavelength)
nominal hazard zone	NHZ; the space within which the level of the direct, reflected or scattered radiation during normal operation exceeds the applicable

	MPE; exposure levels beyond the boundary of the NHZ are below the appropriate MPE level
nozzle gap	See *nozzle offset*
nozzle offset	Distance between the cutting nozzle and the workpiece.
NPT	National pipe thread
OD	Outside diameter, or Optical density; see *optical density*
OEM	Original equipment manufacturer
optical density	Logarithm to the base ten of the reciprocal of the transmittance
pallet	See *cutting pallet*
part mask	Material, such as tape, paper or plastic, used to cover areas of the cutting pallet not used in a particular job. This maximizes the hold down pressure.
pierce	Extra power and time required at the starting location of the cut to assist in the initial penetration of the material when cutting thick materials, usually metals, starting from locations other than the edges. The pierce time is often called dwell time, as it specifies the amount of time required for the cutting head to dwell at that particular location.
power	The rate at which energy is emitted, transferred, or received in units of watts (joules per second)
RH	Relative humidity
RMA	Return material authorization
rms	Root mean square
SP	Static Pressure
step and repeat	A method of job automation in which a part or parts are repeated in a configurable grid.
top cover	Two transparent covers that magnetically seal to the front and rear doors and protect the operator from laser radiation, gas and mechanical hazards.
typ.	typical
Upper Control Panel	Panel on the front of the machine that contains the Emergency Stop Button, keyswitch, indicator LEDs and assist gas pressure gauge.
V	Volt(s)
VAC	Volts, alternating current
VDC	Volts, direct current
visible radiation	Light; electromagnetic radiation which can be detected by the human eye; this term is commonly used to describe visible wavelengths which lie in the range of 0.4 µm to 0.7 µm
W	Watt(s)
watt (W)	The unit of power or radiant flux. 1W = 1 joule per second

wavelength	The distance between two successive points on a periodic wave which have the same phase
X-axis carriage	See *cutting head*
Z-axis platform	See *cutting pallet*

INDEX

Coherent M5C Operator's Manual

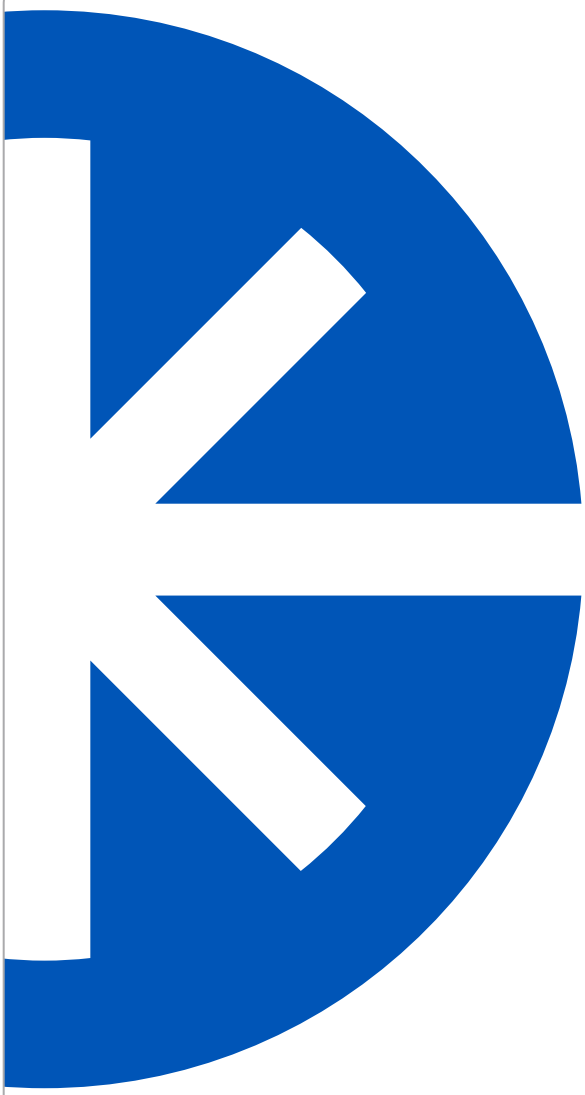
Part No.1371432 Rev. AA

COHERENT®

Superior Reliability & Performance

Coherent M5C Operator's Manual

Part No. 1371432 Rev. AA



META 10C™
Laser Machine Tool System

Operator's Manual

COHERENT®
Superior Reliability & Performance

Operator's Manual
META 10C™
Laser Machine Tool System

COHERENT
5100 Patrick Henry Drive
Santa Clara, CA 95054

Patents referenced in this manual are active when the manual is printed (see last page for date). You are advised to check to see if the patents are still active **http://portal.uspto.gov/external/portal/pair**.

Every effort has been made to ensure that the data given in this document is accurate. The information, figures, tables, specifications, part numbers, and schematics contained herein are subject to change without notice. Coherent makes no warranty or representation, either expressed or implied, with respect to this document. In no event will Coherent be liable for any direct, indirect, special, incidental, or consequential damages resulting from any defects in its documentation.

Technical Support

In the USA:

Should you experience any difficulties with your machine or need any technical information, please visit our web site **www.Coherent.com**. Additional support can be obtained by contacting our Technical Support Hotline at 800-367-7890 (408-764-4557 outside the U.S.) or e-mail at **MPTBeamService@Coherent.com**. Telephone coverage is available Monday through Friday (except U.S. holidays and company shutdowns).

If you call outside our office hours, your call will be taken by our answering system and will be returned when the office reopens.

If there are technical difficulties with your machine that cannot be resolved by support mechanisms outlined above, please E-mail or telephone Coherent Technical Support with a description of the problem and the corrective steps attempted. When communicating with our Technical Support Group, via the web or telephone, the model and machine serial number of your machine will be required by the Support Engineer responding to your request.

Outside the USA:

If you are located outside the USA, visit our web site for technical assistance or contact, by phone, our local Service Representative. Representative phone numbers and addresses can be found on the Coherent web site, **www.Coherent.com**.

Coherent provides telephone and web technical assistance as a service to its customers and assumes no liability thereby for any injury or damage that may occur contemporaneous with such services. These support services do not affect, under any circumstances, the terms of any warranty agreement between Coherent and the Buyer. Operation of any Coherent laser with any of its interlocks defeated is always at the operator's own risk.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

Preface

This manual contains user information for the META 10C Laser Machine Tool (LMT) manufactured by Coherent.

WARNING!
Read this manual carefully before operating the laser for the first time. Special attention must be given to the material in "Section One: Safety", that describes the safety features built into the laser.

CAUTION!
Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

WARNING!
Use of the system in a manner other than that described herein may impair the protection provided by the system.

U.S. Export Control Laws Compliance

It is the policy of Coherent to comply strictly with U.S. export control laws.

Export and re-export of lasers and laser-based systems manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations.

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained before resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification must be obtained from Coherent or an appropriate U.S. Government agency.

Signal Words and Symbols in this Manual and on the Laser System

This documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and ISO 7010.

Signal Words

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and ***NOTICE***.

The signal words **DANGER**, **WARNING** and **CAUTION** designate the degree or level of hazard when there is the risk of injury:

DANGER!
Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING!
Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION!
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

The signal word "***NOTICE***" is used when there is the risk of property damage:

NOTICE!
Indicates information considered important, but not hazard-related.

Messages relating to hazards that could result in both personal injury and property damage are considered safety messages and not property damage messages.

Symbols

The signal words **DANGER**, **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level:

This symbol is intended to alert the operator to the presence of important operating and maintenance instructions.

This symbol is intended to alert the operator to the danger of exposure to hazardous visible and invisible laser radiation.

This symbol is intended to alert the operator to the presence of dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

This symbol is intended to alert the operator to the danger of Electro-Static Discharge (ESD) susceptibility.

This symbol is intended to alert the operator to the danger of crushing injury.

This symbol is intended to alert the operator to the danger of a lifting hazard.

This symbol is intended to alert the operator to the danger of a fire hazard.

SECTION ONE: SAFETY

NOTICE!
This user information is in compliance with section 1040.10 of the CDRH Performance Standards for Laser Products from the Health and Safety Act of 1968.

This laser safety section must be reviewed thoroughly before operating the META 10C Laser Machining Tool (LMT) system. Safety instructions presented throughout this manual must be followed carefully.

Certification

The META 10C LMT system is a Class I (Class 1) laser product and complies with 21 CFR Chapter 1, Sub-chapter J. These safety standards have been established by the US Food and Drug Administration, Center for Devices and Radiological Health (CDRH).

The META 10C LMT system complies with all CDRH standards for Class I systems including labeling, protective housing, and safety interlocks. The system also includes a beam shutter, key control, and manual reset that are extra safety features and are not required for systems in this class.

For more information on laser safety standards refer to *Regulatory Requirements for Laser Product Manufacturers* or the *American National Standard for Safe Use of Lasers* (ANSI Z136.1). Both publications are available from the Laser Institute of America, 12424 Research Parkway Suite 125, Orlando, FL 32826. Phone: (407) 380-1553.

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

Declaration of Conformity

The declaration of conformity for the META 10C LMT system is available upon request from Coherent Product Support (see page ii).

Safety Guidelines

This section describes the hazards associated with operating the META 10C LMT system and the proper safety guidelines that must be followed. Read this section carefully and thoroughly before operating this laser product. Several hazards are associated with this product:

- Electrical shock/electrocution hazard
- Laser radiation hazard (ocular damage, skin burns and fire)
- Mechanical hazards (pinch/crush)
- Hot workpieces
- Coolant system hazards
- Purge/Shield gas hazards
- Other Hazards

Each hazard is explained in the following paragraphs.

NOTICE!
READ THIS SECTION CAREFULLY AND THOROUGHLY BEFORE OPERATING THE SYSTEM.

Electrical Electrocution / Shock Hazard

The META 10C LMT system requires three-phase, 5 wire 400VAC "WYE" power input. The input is connected to a circuit breaker located on the rear, bottom-right panel. Even when the circuit breaker is open ("disconnected"), hazardous voltages are still present at the inputs to the circuit breaker.

DANGER!
Lethal voltage exists inside the machine. Do not tamper with or bypass safety interlocks. Disconnect and Lock-out/Tag-out (LOTO) all electrical supplies to the machine before removing any service enclosures.

WARNING!
The fan side of the Remote Fan Relay may still have voltage present even when both machine input power connections are locked out. The fan side of the relay is supplied by a separate customer power connection. Disconnect power from the Remote Fan Relay by removing the cable from the input, located on the right side, bottom-rear of the machine.

Electrical Safety Precautions and Guidelines

The following precautions must be observed by everyone when working with potentially hazardous electrical circuitry:

1. Disconnect main power lines before working on any electrical equipment. Make sure it is not necessary for the equipment to be operating before working on it.
2. Do not short or ground the electrical supply. Protection against possible hazards requires proper connection of the ground terminal on the power cable and an adequate external ground. Check these connections at the time of installation and periodically thereafter.
3. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent to administer CPR/First Aid.
4. When possible, keep one hand away from the equipment to reduce the danger of current flowing through the body if a live circuit is accidentally touched.
5. Always use approved, insulated tools.
6. Special measurement techniques are required for this system. A technician who has a complete understanding of the system operation and associated electronics must select ground references.

WARNING!
Only those persons who are “electrically qualified” should work on an energized system.

Laser Radiation Hazard to Eyes and Skin

During normal operation all hazardous laser radiation is contained within the system enclosure, and there is no possibility of exposure to this hazard. However, during installation, maintenance and servicing, it is often necessary to perform specific activities where exposure to hazardous laser radiation is possible. Therefore, the following safety guidelines must be followed at all times while installing, maintaining, or servicing the META 10C LMT system.

WARNING!
Proper laser safety eyewear must always be worn during installation, maintenance and servicing of this product and whenever service panels are removed. Always wear properly rated safety eyewear when required by safety placards within the area and whenever instructed to do so.

The laser radiation emitted by the laser source within this system is hazardous at all power levels, and therefore extreme caution must be exercised to prevent injury to the eyes and skin.

Eye Hazard

At low power levels, whether operating in a pulsed or continuous mode, the infrared CO_2 laser beam is invisible to the human eye. Optical radiation in the CO_2 laser wavelength range is absorbed by the cornea. As a result, corneal burns are a likely result if the eye is exposed to a CO_2 laser beam. Severe skin burns may also occur depending on length of exposure.

WARNING!
Laser safety eyewear protects the user from eye damage by blocking light at the infrared laser wavelengths. However, some eyewear may also prevent the wearer from seeing alignment beams or colored controls or indicators. Exercise extreme caution even while wearing laser safety eyewear.

CAUTION!
Infrared radiation is emitted by the laser source within this product. Avoid eye or skin exposure to direct and scattered radiation.

Skin Hazard

The laser source generates sufficient power that both direct and scattered radiation can cause severe skin burns or photosensitive reactions. Any person being treated with photosensitive drugs for cancer or other illnesses must not be exposed to the laser radiation emitted by this system.

Class 4 Laser Recommended Precautions and Guidelines

The META 10C LMT system is classified as a Class 1 laser system under normal use. However, when the META 10C LMT system is operated while performing specific activities where exposure to hazardous laser radiation is possible, such as during installation, maintenance, or servicing, the system is then classified as a Class 4 laser system, and the following precautions must be followed at all times:

- Observe all safety precautions in the product manuals.
- All personnel should wear laser safety eyewear rated to protect against the specific wavelengths being generated. Protective eyewear vendors are listed in the *Laser Focus World*, *Lasers and Optronics,* and *Photonics Spectra* Buyer's guides. Consult the ANSI, ACGIH, or OSHA standards for guidance.
- Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
- Be aware of the laser beam path, particularly when external optics are used to steer the beam.
- Use appropriate energy-absorbing targets for beam blocking.
- Block the beam before applying tools such as Allen wrenches or ball drivers to optical mounts.
- Limit access to the machine to qualified persons who are familiar with laser safety practices. When not in use, the machine should be shut down completely and made off-limits to unauthorized personnel (key removed).
- Terminate the laser beam with a light-absorbing material. Laser light can remain collimated over long distances and presents a potential hazard if not confined. It is good practice to operate the machine in an enclosed room.
- Post warning signs in the area of the laser beam to alert those present.
- Exercise extreme caution when using solvents in the area of the laser.
- Never look directly into the laser light source or at scattered laser light from any reflective surface. Never sight down the beam.

- Avoid direct exposure to the laser light. Laser beams can easily cause flesh burns or ignite clothing.
- Advise all those working with or near the machine of these precautions.

Fire Safety

Laser cutting and engraving systems represent a significant fire hazard due to the extremely high temperatures generated by the laser beam. While the objective of most cutting and engraving operations is to vaporize material without burning, most materials capable of being cut or engraved are inherently combustible and can easily ignite. Usually, ignition is a small flame of burning material issuing from the cut zone that self-extinguishes due to the air assist or de-energizing of the beam. However, it is possible for the flame to propagate and set fire to the machine and threaten its surroundings.

Experience shows that vector cutting with the laser has the most potential to create an open flame. Acrylic, in all its different forms, has been shown to be especially flammable when vector cutting with a laser. Please also be aware that stacking materials (especially organic materials such as paper) can lead to increased risk of flame propagation or work piece ignition.

WARNING!
NEVER leave the machine unattended during operation.

WARNING!
KEEP the area around the machine CLEAN and FREE of clutter, combustible materials, explosives, or volatile solvents such as acetone, alcohol, and gasoline.

WARNING!
ALWAYS use gas assist when cutting. Failure to use gas assist can result in a buildup of flammable or explosive material.

WARNING!
BE CAREFUL when cutting. Many materials have the potential to burst suddenly into flame—even materials that may be very familiar to the user. Always monitor the machine when it is operating.

WARNING!
KEEP YOUR MACHINE CLEAN - A build up of cutting and engraving residue and debris is dangerous and can create a fire hazard. Keep your machine clean and free of debris. Regularly remove the cutting grid to clean any small pieces that have become stuck or have fallen into the mechanism.

Fire Extinguisher

Coherent recommends a Carbon Dioxide fire extinguisher or a multi-purpose dry chemical fire extinguisher. Carbon Dioxide extinguishers are more expensive than a dry chemical extinguisher but offer definite advantages if you ever need to use an extinguisher. The Carbon Dioxide extinguisher discharges a clean, easily removable substance that is not harmful to the mechanics or wiring of the laser system. The dry chemical extinguisher discharges a sticky, corrosive powder that is very difficult to clean up.

WARNING!
ALWAYS keep a properly maintained and inspected fire extinguisher on hand.

Fire/Explosion Hazard

The processes of laser cutting and engraving often involve heating the target material to or beyond its flash point, resulting in the generation of vaporized and/or molten material, sparks and flame.

Some vapors may be flammable or explosive, and some materials, once heated to their flash points, may not self-extinguish. Always refer to the Manufacturer's Safety Data Sheet (MSDS) of the materials being cut or engraved before laser cutting or engraving.

WARNING!
The processes of laser cutting and engraving often involve heating the target material to or beyond its flash point, resulting in the generation of vaporized and/or molten material, sparks and flame. A Fire / Explosion hazard exists when using the laser cutting system.

WARNING!
Never leave an operating laser unattended. Always have a properly rated fire extinguisher nearby.

Mechanical Pinch/Crush Hazard

The META 10C LMT system contains a motor/belt/pulley driven X/Y-Axis optical gantry and a motor/belt/pulley/lead-screw driven Z-Axis material transport table.

DANGER!
Moving parts inside the machine can cause bodily injury. Many components move at high speed and have potential lethal force. Do not tamper with or bypass safety interlocks. Disconnect and Lock-out/Tag-out (LOTO) electrical service to the machine before maintaining or servicing any mechanical components.

CAUTION!
Remove all jewelry (watches, rings and chains), neck ties and any loose-fitting clothing before performing maintenance or service on or near any moving component.

Hot Material Hazard

Some target materials (especially metals), whether workpieces or scrap, may be hot after the cutting or engraving process. Wear leather gloves when handling recently cut material, or allow enough time for the material to cool before handling.

Reflectivity Hazard

Some target materials, such as copper and PVC, are highly reflective to the wavelength of the laser used in the META_10C LMT system. Use of these materials with the META_10C LMT system is discouraged, as the reflection of the laser beam can damage the META_10C LMT system.

NOTICE
Use of copper or any other target material that is highly reflective to the wavelength of laser used in the META_10C LMT system can damage the system! Do NOT use these materials.

Cooling System Hazards

Some cooling systems may contain high pressure or temperature coolant circuits and moving parts (pump and fan motor drive belts and pulleys). Additionally, spilled coolant may pose a slip and/or electrocution hazard. Clean up all spills immediately. Refer to the documentation provided by the cooling system/chiller manufacturer or contact a qualified heating/refrigeration service technician for additional information.

Purge/Shield Gas Hazard

High pressure purge air, compressor oil, gas under pressure (in gas bottles/cylinders), hot surfaces (typical in piston compressor heads), and moving parts (compressor motor drive belts and pulleys) present hazards associated with compressed air systems. Refer to the documentation provided by the purge system manufacturer or the bottle/cylinder supplier for safety requirements and precautions. Make sure you contact them for any necessary additional information.

WARNING!
All gas supplied to the META 10C LMT must be oil-free. If oil is introduced into the system, there is a risk of optical component contamination and heating due to laser beam absorption that could cause a machine fire!

CAUTION!
Compressed gases can cause gas embolisms. Do not place any body parts near or under the gas nozzle when the assist gas is on.

Ventilation Safety

Laser cutting or engraving of materials can create hazardous fumes. These fumes may be dangerous to breathe and can damage the META 10C LMT system. Consult the Manufacturer's Safety Data Sheets (MSDS) for all materials before laser cutting.

The user of the META 10C LMT system is responsible for external ventilation and removing cutting fumes from the work area. Before operating the META 10C LMT system, make sure that ventilation systems are installed, connected, and working properly.

The user of the META 10C LMT system is also responsible for making sure the output from any laser cutting ventilation system complies with local air quality or other regulatory standards.

WARNING!
Laser cutting can create dangerous or lethal fumes. Make sure ventilation systems are in place and working properly before operating the system. Use of PVC or any other corrosive material can damage the system!

Other Hazards

WARNING!
A risk of structural damage and personal injury exists if the laser system weight exceeds the floor or elevator weight capacity!

All floors on the proposed transport route or at the proposed storage/installation location must be checked to ensure they can withstand the weight of the META 10C LMT system.

Before installation, the customer must provide Coherent with

- Accurate information regarding floor loading capacities. This information is needed to determine the type of transportation to be used within the production facility.
- Elevator loading capacities. When elevator transport is intended, the loading capacity of the elevator must be verified.

WARNING!
Risk of crushing exists if shipping containers or laser system components are dropped or tipped during lifting and transportation!

When lifting and transporting the META 10C LMT system or its components, always follow all standard safety precautions and practices for the transportation and handling of heavy equipment. A suitable fork-lift truck or similar device is required to lift and transport the system. Ensure that the fork length and lifting capacity are sufficient to safely lift and transport the system.

All passageways, corridors and access points along the transport route must have sufficient clearances to enable the safe, unimpeded transportation of the system. This is especially important after the rigid transport packaging is removed.

WARNING!
Under some operating condition, the A-weighted emission sound pressure level at workstation is maximum 80dB(A). Protective equipment for hearing may need to be considered for prolonged exposure to the system itself or due to nearby sources of sound emissions in the system's environment.

LMT Labels & Label Placement

The product nameplate, product ratings and certification, and safety labels used on the META 10C LMT system, along with placement of each label, are shown on the following pages.

Primary Labels

Figures 1-1 through 1-3 show the locations of most labels on the META 10C LMT system.

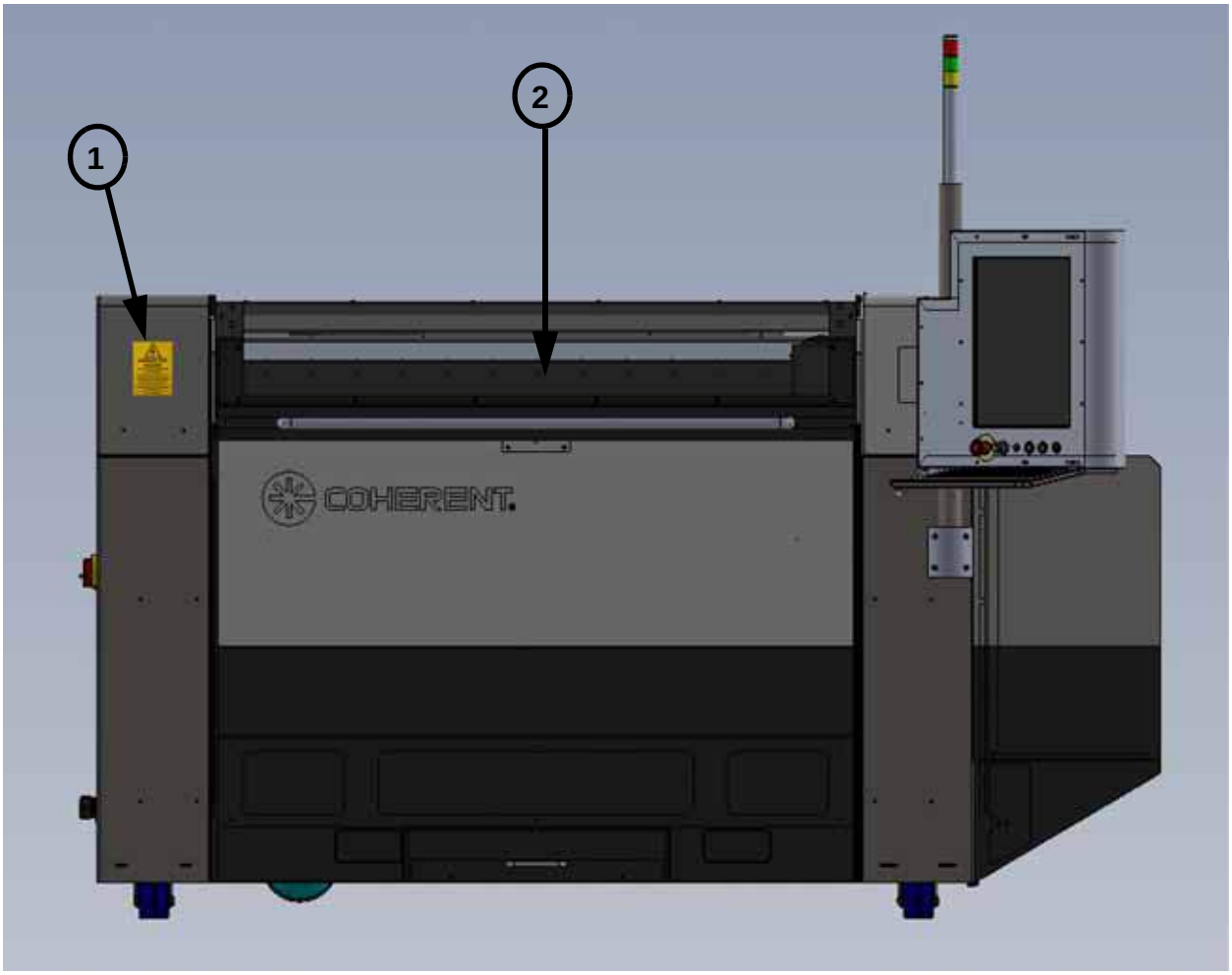


Figure 1-1. META 10C Label Locations (Sheet 1 of 4)

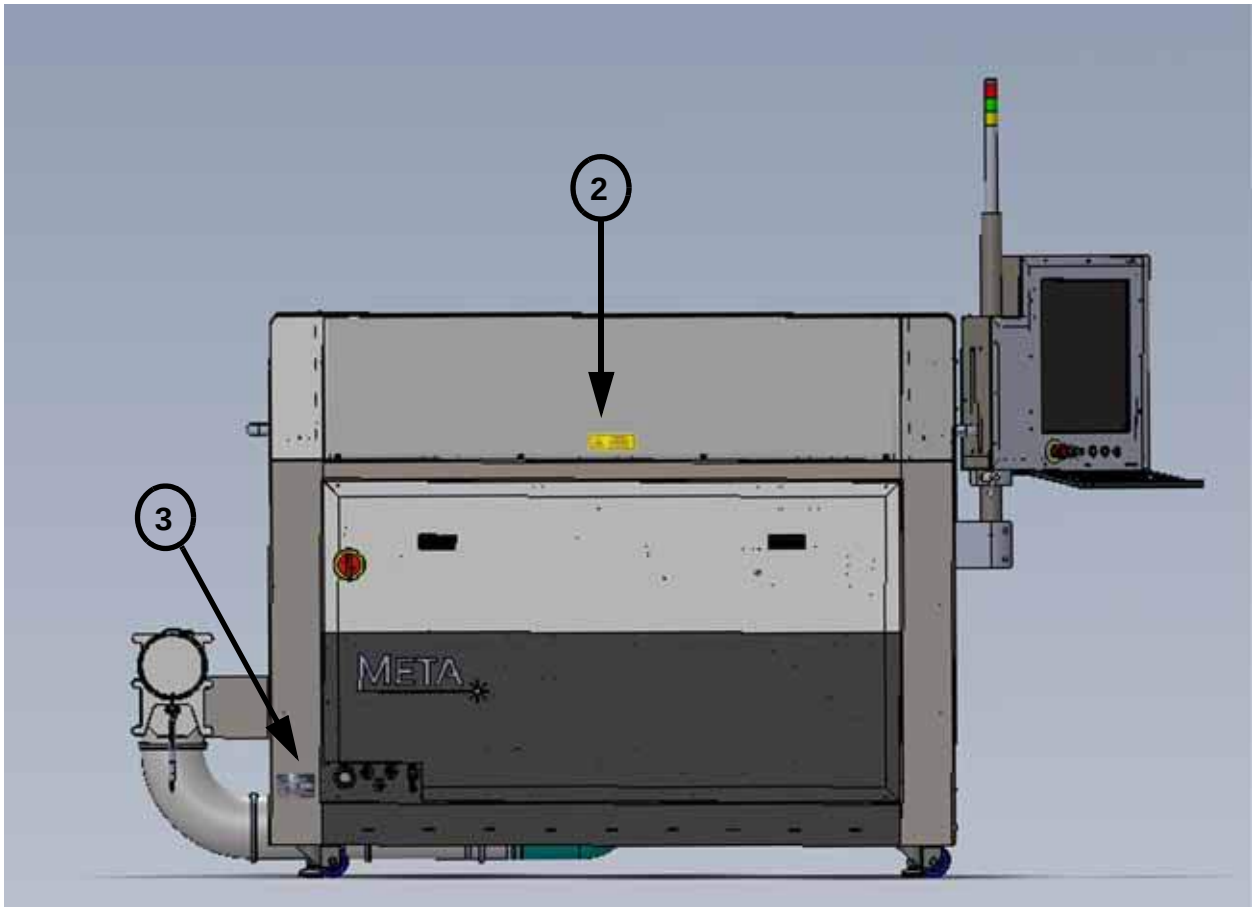


Figure 1-1. META 10C Label Locations (Sheet 2 of 4)

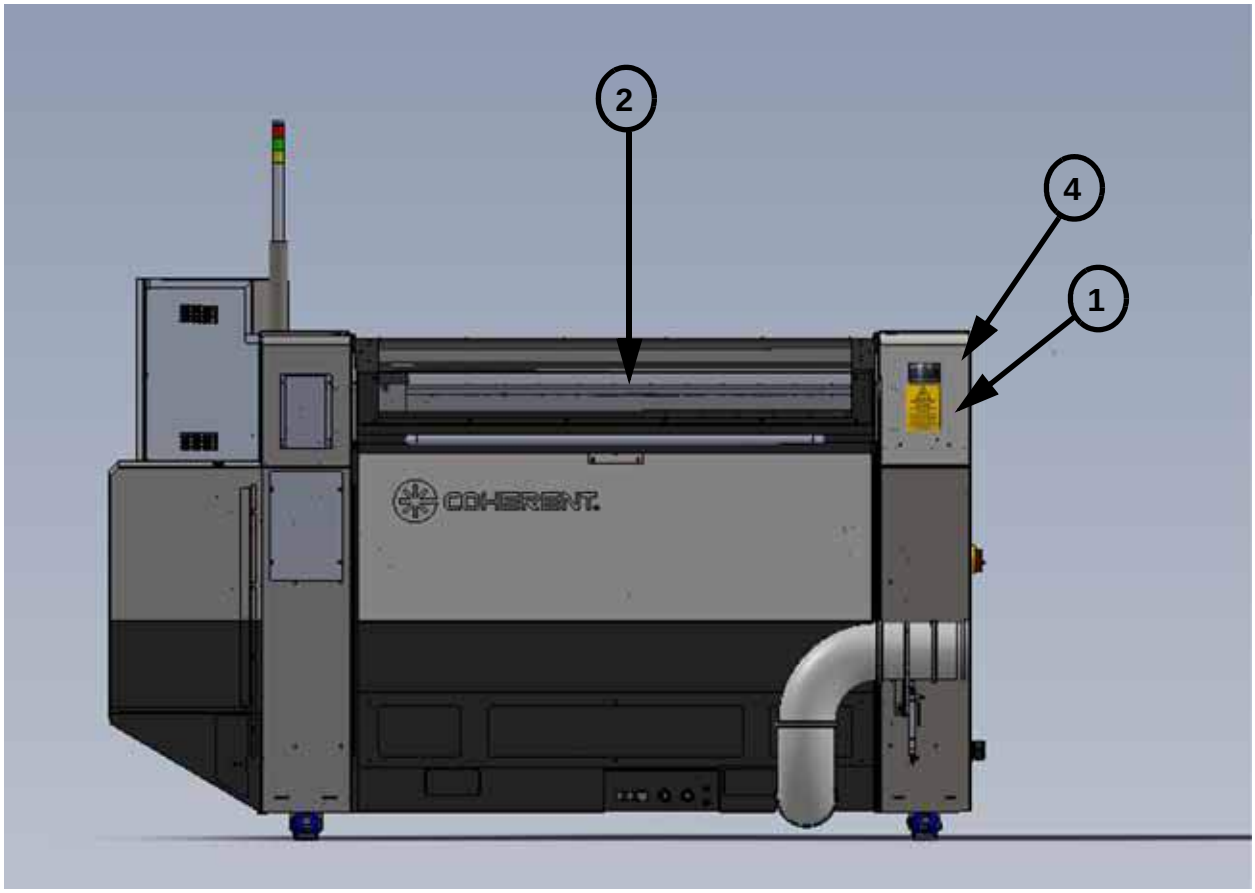


Figure 1-1. META 10C Label Locations (Sheet 3 of 4)

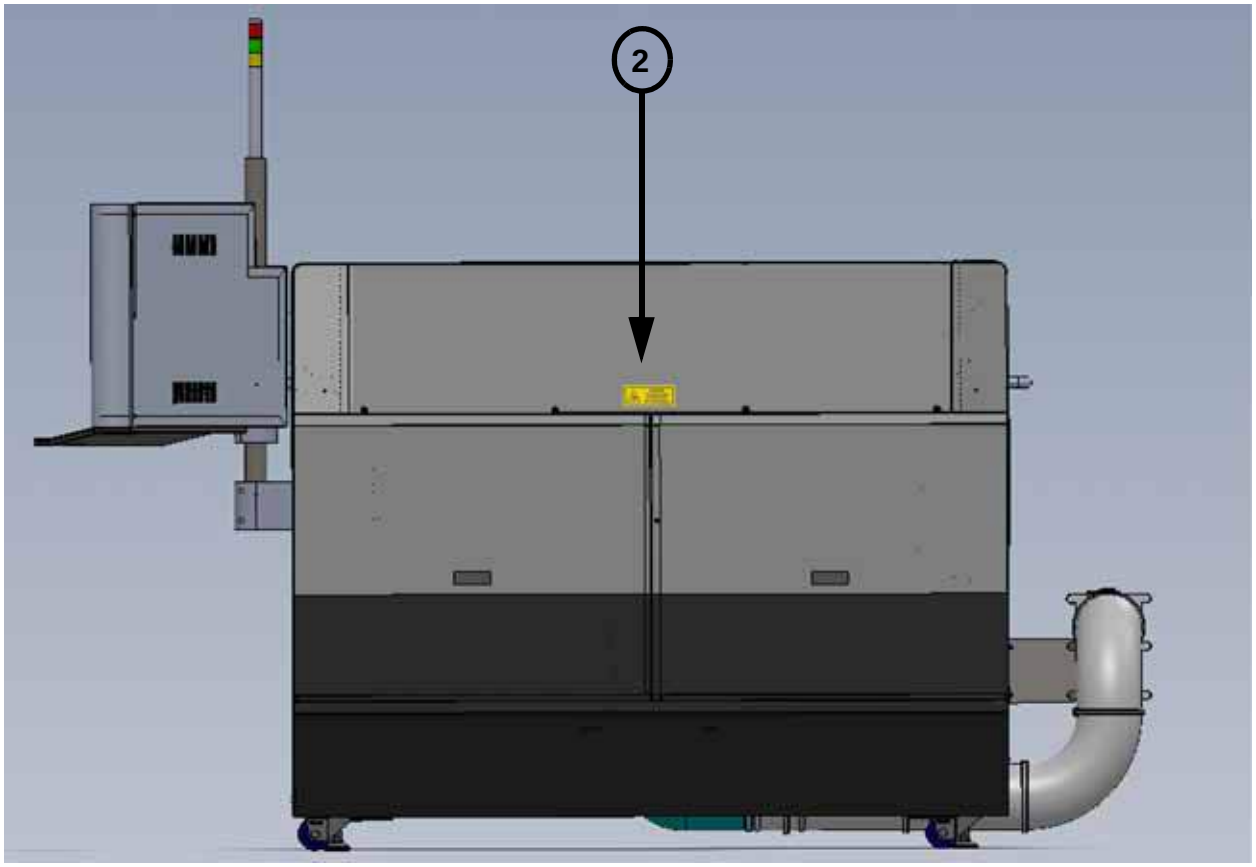


Figure 1-1. META 10C Label Locations (Sheet 4 of 4)

Safety Labels

See Figure 1-1for label locations.

1. Fire Hazard Label

2. Visible and Invisible Radiation Label

Figure 1-2. Safety Labels

3. System Utilities Label

4. System Nameplate Label

Figure 1-2. Safety Labels (Continued)

Aperture Warning Labels

The following images supply closeup views of the radiation exposure warning labels located on the beam bending mirror and on the gantry aperture (both located inside the top left service panel).

Radiation Exposure Warning Label on Beam Bending Mirror

Radiation Exposure Warning Label on Gantry Aperture

Radiation Exposure Warning Label Closeup

Figure 1-3. Aperture Warning Label and Locations

Additional Safety Labels

An additional safety label is also located on the META 10C LMT system. A closeup view of the label and its location are shown in Figure 1-4, below.

Moving Parts Warning Location on the Exhaust Vent

Moving Parts Warning Label

Figure 1-4. Moving Parts Warning Label and Location

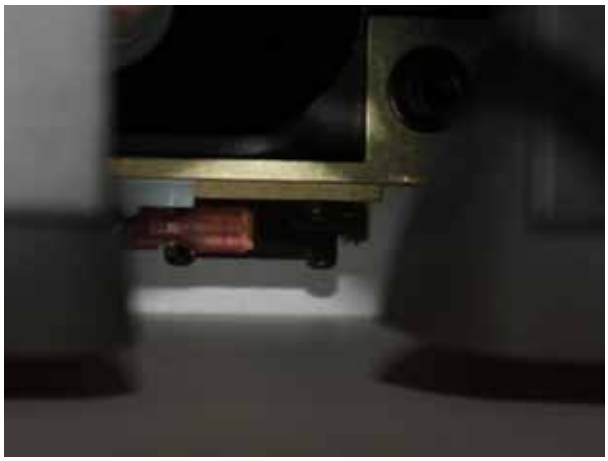
Redundant Interlock Safety Feature

For added safety the META 10C LMT system is equipped with four redundant interlocks. These interlocks are located in the front and rear covers and the front and rear doors and are shown in Figure 1-5, below.

These interlocks protect the operator from being exposed to the laser beam and also from flying mechanical objects and debris.

Top Cover Interlocks

Each of the two top covers has a pair of redundant interlocks located next to the hinges.



Front and Rear Door Interlocks

Each of the two doors has a redundant interlock located inside the bottom-center of the door.

Figure 1-5. Top Covers and Doors Redundant Interlock Locations

When a cover door is opened, the interlocks:

- activate a brake on the Z-axis,
- prevent the laser shutter from opening, and
- turn off the red aiming laser, and
- prevent power from reaching the system motors.

SECTION TWO: DESCRIPTION AND SPECIFICATIONS

Introduction

The Coherent META 10C Laser Machining Tool (LMT) system is a versatile and powerful system designed for cutting and engraving a wide range of materials. The Coherent META 10C is a Class 1 laser product.

The system features a 1000 watt sealed CO_2 laser, a 1.22 x 1.22 m (48 x 48 in.) cutting area, high-speed and high-precision motion control using linear encoders, vertical travel of over 254 mm (10 in.), automatic focusing, gas assist cutting nozzles, removable cutting pallets, exhaust with vacuum material hold-down, and Laser-Link™, a custom CAM interface software.

Figure 2-1. META 10C Laser Machining Tool System

Appropriate materials to cut include plastics, paper products, wood product, composites and sheet metals (cut quality will depend on the particular material and setting used). Do not use copper or PVC with the META_10C LMT system.

Purpose of this Manual

This manual is intended to provide the customer with site preparation information for the META 10C.

This manual is intended to be used by persons trained in safe and proper techniques for handling high voltage, high pressure gasses, liquid cooling and exhaust systems, high temperature materials and laser light.

NOTICE!
Read and understand this manual thoroughly before operating the LMT system. Optical, electrical and mechanical hazards exist. The system should only be operated by properly trained and authorized personnel.

System Description

This section outlines the major features and components of the META 10C. Many of these features are covered in more detail in the Site Preparation section of this manual and the Operation section of the Operator's Manual. The main components are described below.

- HMI
- Top Cover
- Front/Rear Doors
- Utility Interface Panel
- Main Disconnect Switch
- Service Panels
- Exhaust Ducts
- Cutting Pallet/Z-Axis Platform
- Y-Axis Gantry
- X-Axis Carriage/Cutting Head
- Laser Beam Delivery System

The major external component locations are shown in Figure 2-2. Major internal component locations are shown in Figure 2-3.

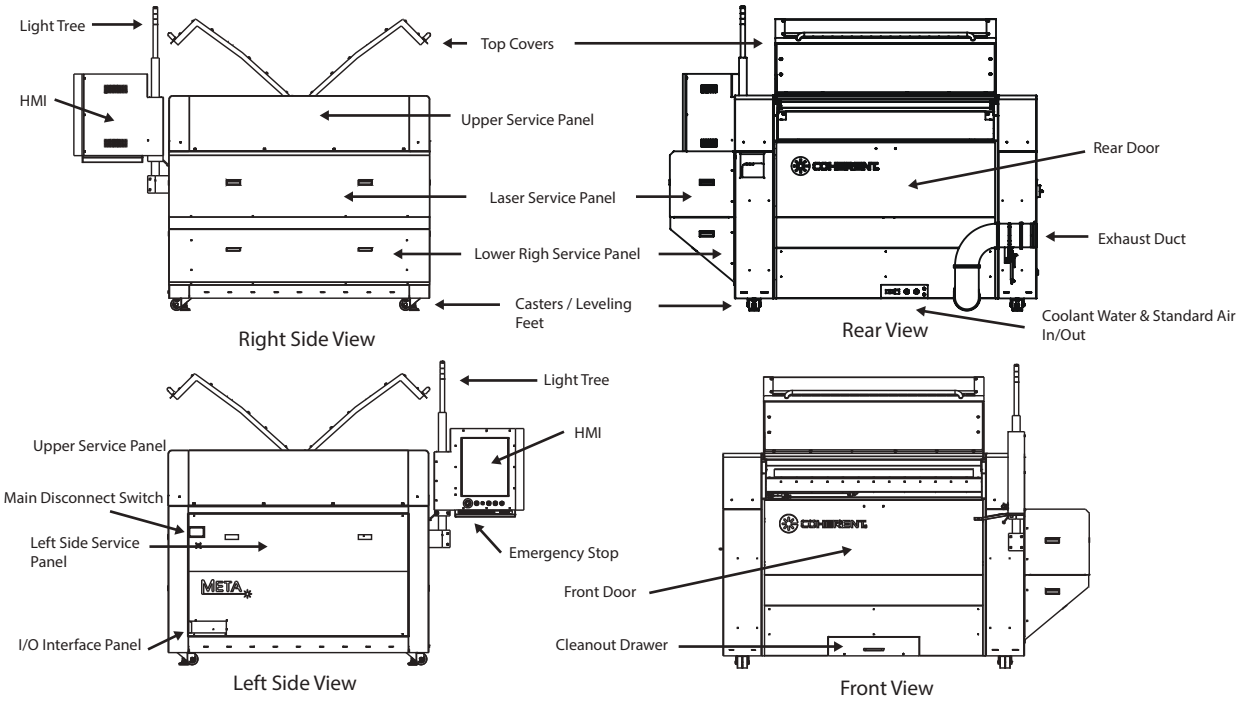


Figure 2-2. Location of Major External Components

User Controls

All META_10C LMT systems include a Human Machine Interface (HMI) which consists of a computer, a touch screen monitor, BeamHMI machine control software and a keyboard. These components are mounted on the front right of the META_10C LMT system. The HMI is used to control the META_10C LMT system locally, as the META_10C LMT system is like any networked computer peripheral (such as a laser printer) that requires a host computer to send it a job. The META_10C LMT system communicates with the HMI via an Ethernet network connection. In both cases the host computer is running a communication program that allows them to share files and information. During operation this process is run in the background and will not affect the other operations or uses for the HMI.

In order to create job files the user is supplied with a dedicated CAD/CAM program called LaserLink™. LaserLink™ is used to import files, edit geometry, assign settings from a user editable database and automatically creates the job. This software can be loaded on any computer that has access to the same network as the HMI. Once the files are created they can be placed in a file directory that is accessible to the META 10C LMT system. The operator of the META 10C LMT system can access the files directly from the touch panel display on the META 10C LMT system.

Top Covers

The Top Covers give access to the cutting area of the machine. The covers consists of transparent polycarbonate (Lexan) mounted in a steel frame. When closed, the polycarbonate prevents scattered laser radiation from escaping from the cutting area.

The Top Covers are safety interlocked. Opening the covers stops the motion of the machine, disables the laser and closes the safety shutter.

Front/Rear Doors

The Front and Rear Doors slide up and down vertically, allowing the cutting pallet to be removed. When closed, the Front Cover mates with the Top Cover and is safety interlocked. The Front and Rear Doors cannot move below the height of the cutting platform.

Utility Interface Panel

This panel is located on the left side of the META_10C LMT system, on the lower, rear corner. This includes input for the AC wiring, gas supply input and a communications cable port.

Main Disconnect Switch

This switch must be turned off in order to access the breaker panel.

H_20 Interface Panel

This panel is located at the lower center rear of the LMT system. The chiller coolant water enters and leaves the system at this panel.

Service Panels

The Upper Service Panels enclose the mechanical components for the Y-Axis Gantry as well as Beam Delivery components for the laser system.

The Right Side Service Panel encloses the laser unit, beam conditioning, delivery optics and the laser DC power supply.

The Left Side Service Panel encloses the system electronics, including the motion controller, laser power controller and motor amplifiers.

The Lower Access Panels provide access to the Exhaust Plenum and exhaust ducting and Z-Axis mechanisms.

NOTICE!
The service panels are interlocked and should only be removed by qualified service technicians. Never operate the system without all service panels installed.

Exhaust Duct

The Exhaust Duct connects to the output from the exhaust blower used for the material hold-down.

This connector is ducted to an external exhaust fan or air filtering system.

Cutting Pallet/Z-Axis Platform

The META_10C LMT system has a unique, removable Cutting Pallet system. The standard pallet uses a replaceable cutting surface. The pallet can be removed for cleaning and maintenance purposes. The Cutting Pallet can roll out the front or back of the machine (by lowering the Front or Rear Doors) and can be interchanged with other pallets or used with an automatic pallet loading system.

Figure 2-3. Location of Major Internal Components

When installed, the pallet locks into the cutting position on the Z-Axis Platform. The platform moves vertically up to 254 mm (10 in.). This allows automatic focusing, large clearance for parts with fixturing and adjusting the load height of the pallet. The pallet also can lock into an unloading position, approximately 2/3 extended from the machine. This allows easy material loading without fully removing the pallet.

Y-Axis Gantry

The Y-Axis Gantry travels the full length of the machine, controlled by the motion control computer. The gantry is driven by two drive systems (one on each side) that assure precision and allow the system to automatically square itself. Each drive has high resolution linear encoders that ensure precise repeatability.

X-Axis Carriage/Cutting Head

The X-Axis Carriage and Cutting Head travel inside the Y-Axis Gantry. The carriage travels on precision rails with linear encoder feedback.

The Cutting Head (see Figure 2-4) includes the focusing lens and Cutting Nozzle for controlling assist gas. The Cutting Head includes a crash sensor and can break away without damage. It also includes two types of focus sensor: a mechanical sensor and a capacitive height sensor (CHS).

Mechanical Sensor

When material is loaded on the Cutting Pallet, the Elevator Platform raises the bed until the mechanical Focus Sensor touches the material. This allows automatic focusing regardless of the material thickness.

Capacitive Height Sensor (CHS)

The capacitive height sensor only functions on metal substrates. It measures the distance from the cutting tip to the substrate by measuring the capacitance between the two. When this option is in use, the gap from the cutting tip to the substrate is dynamically adjusted during the cut to keep it always at the optimum distance.

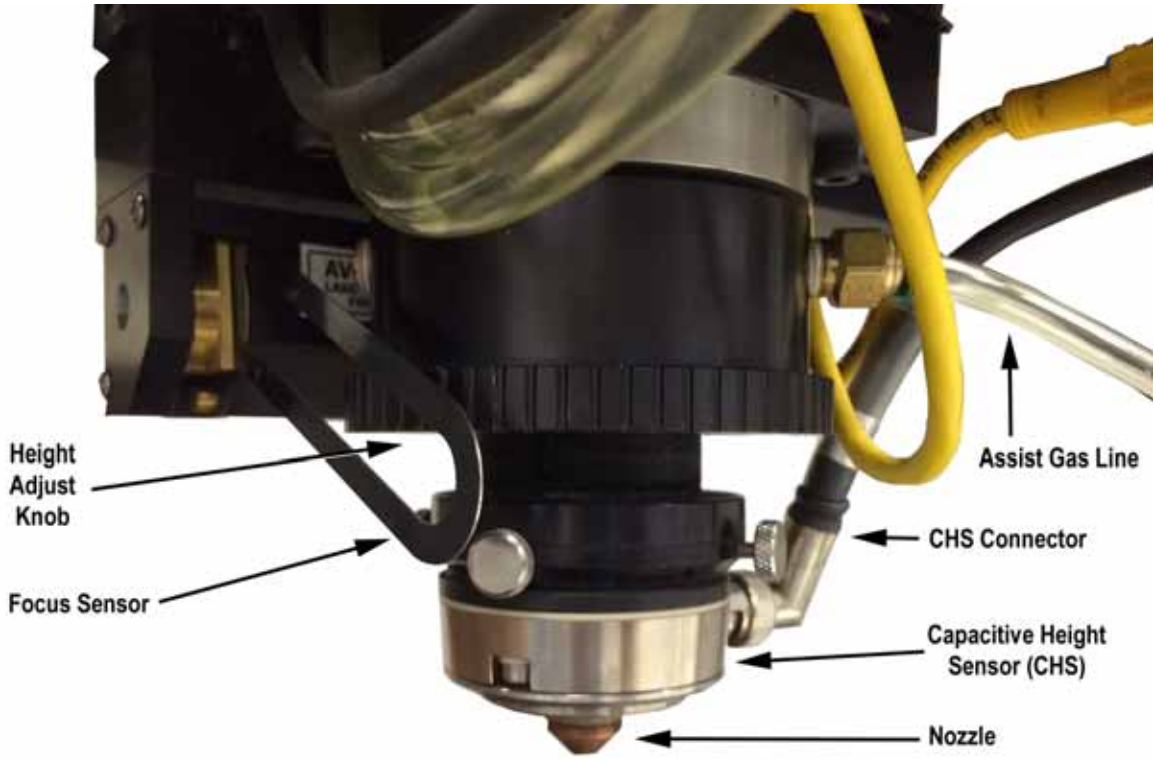


Figure 2-4. Cutting Head

Laser Beam Delivery System

The META 10C LMT system uses a “flying optic” system with a stationary laser unit and moving mirrors that deliver the beam and focus it at the cutting point. The laser unit is located inside the Right Service Panel of the META 10C LMT system. The laser beam exits the laser unit towards the rear of the machine and travels through a polarizer / isolator. The first mirror sends it up into the upper right corner of the machine (inside the Upper Right Service Panel). It then is directed towards the right side of the Y-Axis Gantry. The beam then travels through the gantry towards the X-Axis Carriage. The carriage contains the final mirror and 3.75” Focal Length lens which directs the focused beam through the Cutting Nozzle to the material to be cut.

Simplified Block Diagram

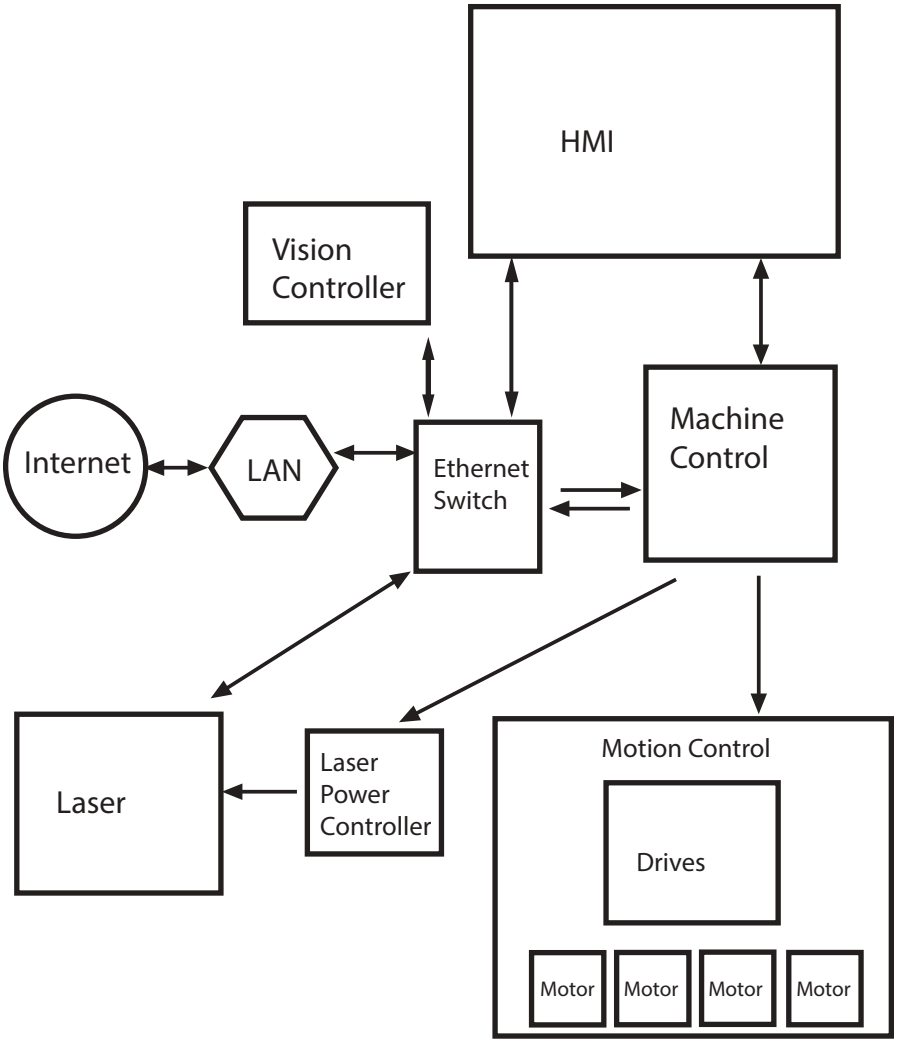


Figure 2-5. Simplified Block Diagram

Mechanical Drawing(s)

See Figure 2-6, Figure 2-7 and Figure 2-8.

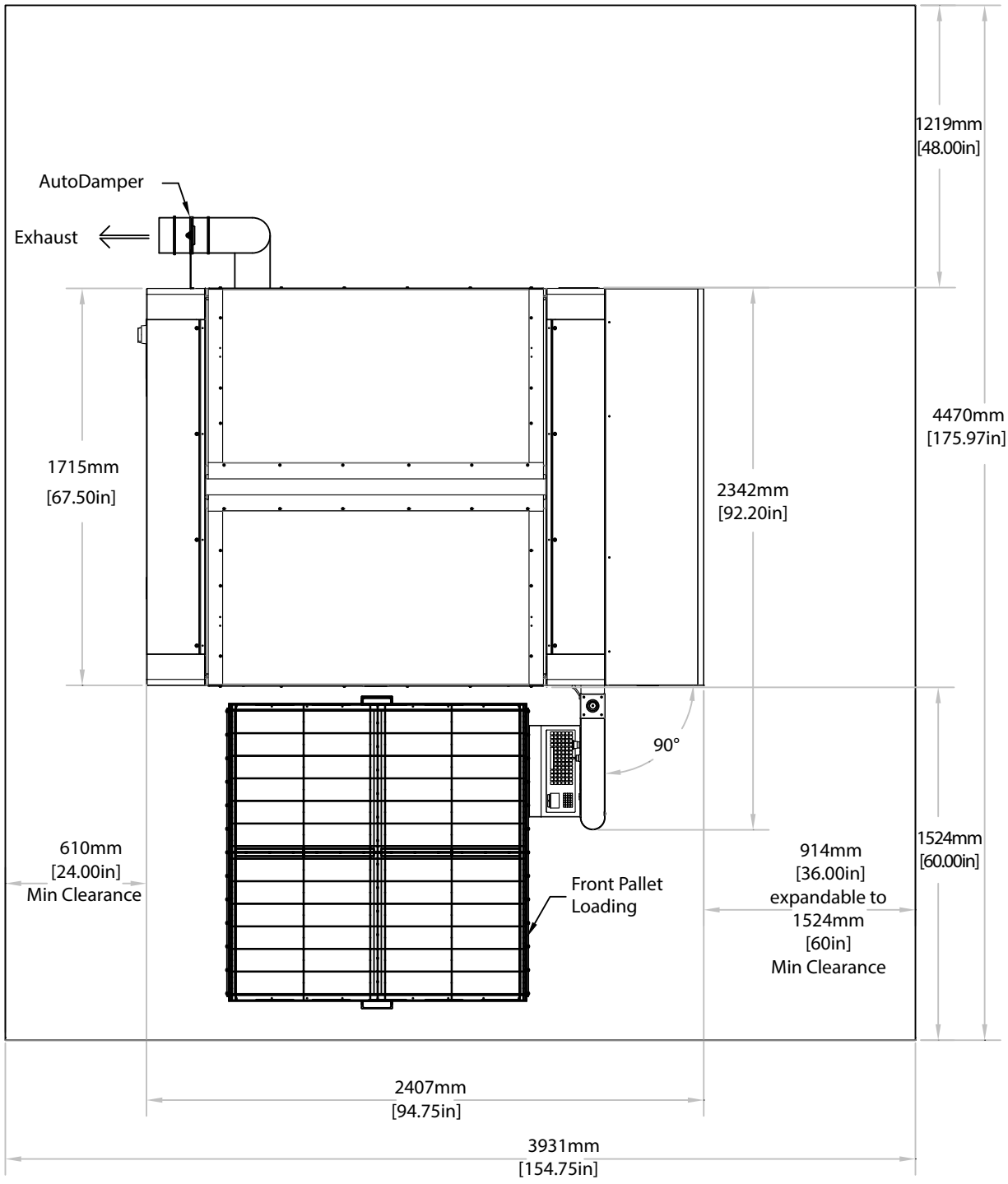


Figure 2-6. External Dimensions

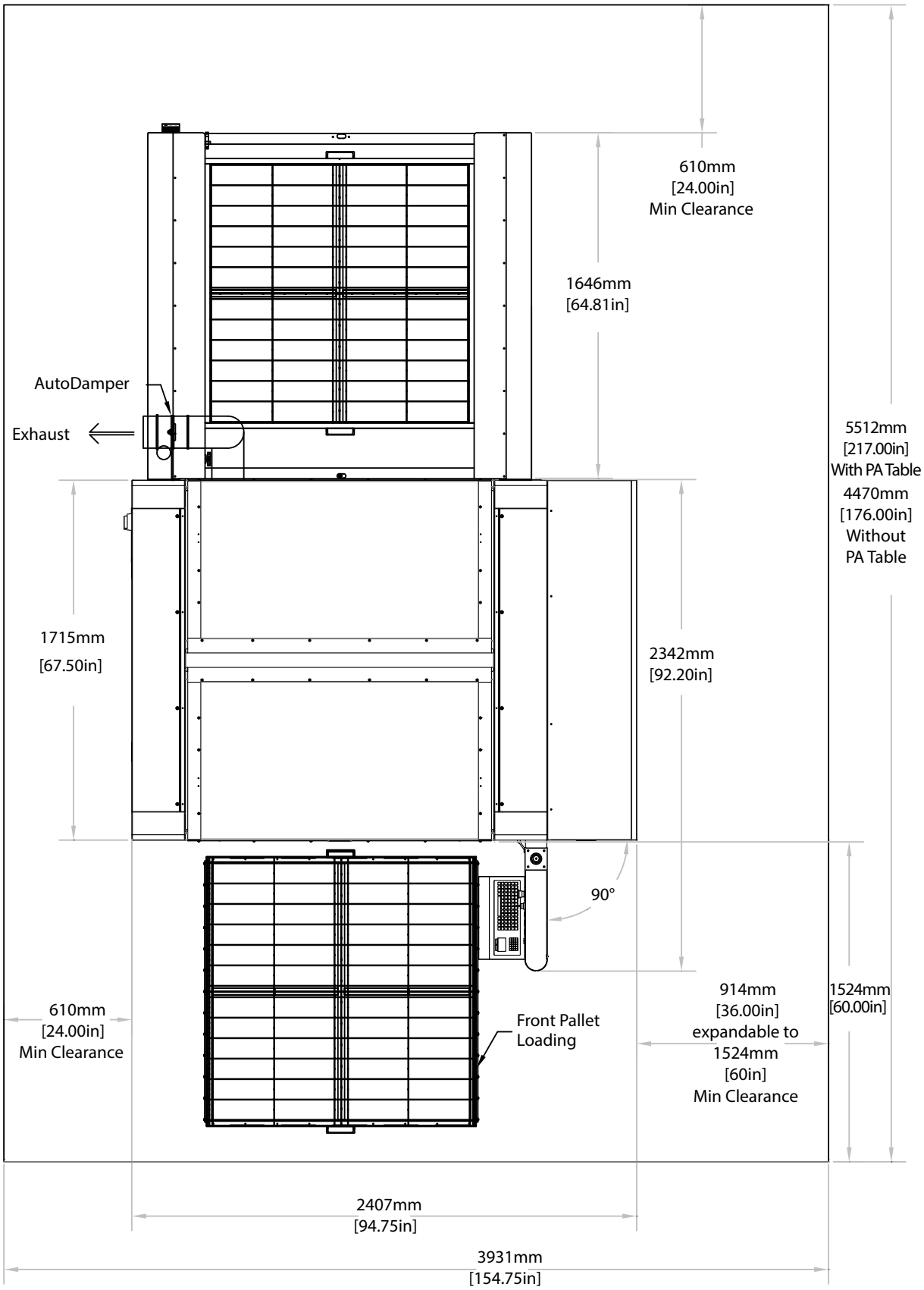


Figure 2-7. External Dimensions with PA Table

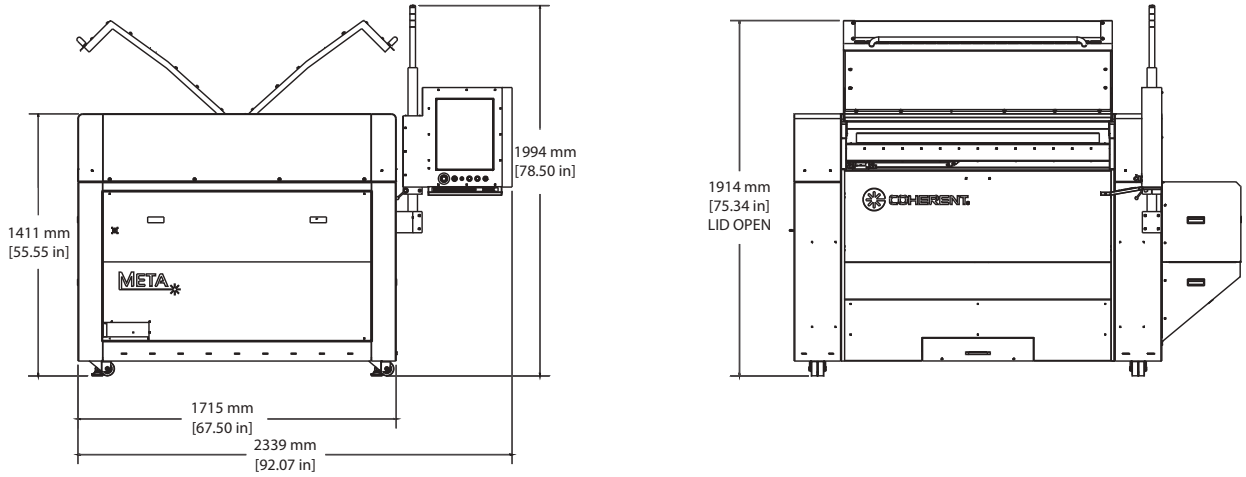


Figure 2-8. Front and Side View with System Dimensions

Product Specifications

Table 2-1. Specifications

PARAMETER	VALUE
Speed (maximum)	50,800 mm (2000 in.)/min cutting 91,500 mm (3600 in.)/min rapid positioning 91,500 (3600 in.)/min raster engraving
Material Size (maximum)	1.25 m x 1.25 m (49.2 x 49.2 in.)
Material Types	Metal, Plastics, Wood, Paper, Composites, Fabric, Rubber*
Spot Size (at working distance)	3.75 in. (95 mm) focal length lens: 0.004 in. (0.107 mm)
Kerf Width (typical)	0.10 - 0.20 mm (0.004 - 0.008 in.)
Focal Length	3.75 (95 mm)
Working Range	x = 1219.5 mm (48 in) y = 1219.5 mm (48 in.) z = 254 mm (10 in.)
Laser Wavelength	10.6µm
Laser Power	>1000 W
System Dimensions (L xW x H)	2407 x 2342 x 2000 mm (94.75 x 92.2 x 78.7 in.)
System Weight	1136 kg (2500 lbs.)
The above specifications are subject to change without notice. Refer to the Coherent web site (**www.coherent.com**) for the most current specifications. * - Consult with Coherent on material type specifics. Do not process copper due to a reflectivity hazard. Do not process PVC due to corrosive vapor emission from the cutting process. Consult your MSDS for other material safety factors	

Facility Requirements

See Table 2-2 for details regarding the facility requirements of the LMT system.

Table 2-2. Facility Requirements

PARAMETER	VALUE
Operating Environment	
Temperature	10-35°C (50-95°F)
Humidity	< 90% and non-condensing
Atmosphere	breathable air, no flammable or explosive gases
Floor Space (area includes minimum service access)	Front Loading Only: 3931 x 4470 mm (154.75 x 176 in.) Front & Rear Loading: 3931 x 5512 mm (154.75 x 217 in.)
Floor Vibration	1 G static acceleration 0.2 G RMS vibration
Floor Slope	Flat within± 12.7 mm (0.5 in.) over the installation area
Heat Load (into room)	2000 W (6.83 kBTU/hr) (machine alone), 35000 W (120 kBTU/hr) with chiller in room and at full power.
Electrical Service (System)	
Voltage	380-420 VAC (3-phase + N + PE)
Current	32A
Frequency	47-63Hz
Assist (Cutting) Gas	
Type	CDA, Inert Gas, Oxygen (metal only)
Flow Rate	400 lpm (14 SCFM)
Pressure	551-2070 kPa (80–300 psi)*
System Connection Size/Type	9.525mm (3/8”) tube x 6.35mm (1/4”) NPT
The above specifications are subject to change without notice.	
* The machine will function within this range; your specific application may have a minimum input pressure significantly above this minimum.	

Table 2-2. Facility Requirements (Continued)

PARAMETER	VALUE
Control / Laser Purge Gas	
Gas & Quality	99.95% nitrogen or Clean, dry compressed air, < 0.7 ppm total hydrocarbons, CFCs or contaminants. Dew point at or below inlet cooling fluid temperature. **No gases other than those specified above can be used as purge gas.**
Flow Rate (maximum)	120 lpm (4.24 SCFM)
Pressure (maximum)	551 kPa (80 psi)
System Connection Size/Type	6.350mm (1/4") flexible tube
Liquid Cooling System	
Chiller Cooling Capacity	20 kW (68 kBtu/hr)
Chiller Static Pressure (maximum)	827 kPa (120 psi)
Chiller Flow Rate (minimum)	24.6 lpm (6.5 gpm) @ 344.7 kPa (50 psi)
Chiller Water Temperature Set-point	23°C (73°F) Dew point of workplace must be 5°C (9°F) lower than chiller set point.
Coolant	Distilled or deionized water and 10% corrosion inhibitor
Coolant Maximum Particle Size	< 30 microns in diameter
System Connection Size/Type	19.05mm (3/4") NPT
Exhaust System	
Volume/Flow	minimum 17000 lpm (600 cfm)
System Connection Size/Type	152mm (6") diameter duct
Sound Pressure Level	Less than 70 dB at workstation
The above specifications are subject to change without notice.	
* The machine will function within this range; your specific application may have a minimum input pressure significantly above this minimum.	

Transportation and Storage

The LMT can be transported by air freight. If the system is to be temporarily stored before installation, the storage area must meet the requirements specified in this section.

NOTICE!
Incorrect packing, storage or transportation can cause serious damage! Use the original crates and packing materials, and always observe the conditions specified in Table 2-3 when transporting or storing the laser system.

The mechanical requirements of the laser device are such that the parameters specified in IEC 721-3-2 class 2M1 (A through H) must be complied with during temporary storage as well as transportation.

Table 2-3. Transportation and Storage Requirements

PARAMETER	VALUE
LMT System Crate Dimensions (L xW x H)	255 x 206 x 174 cm (100.5 x 81x 68.5 in.)
LMT System Crate Weight (fully loaded)	1134 kg (2500 lbs.)
Temperature	5–50°C (41–122°F)
Humidity - relative	< 95% and non-condensing
Shock - maximum acceleration	1 G static acceleration 0.2 G RMS vibration
Coolant(1)	drained
The above specifications are subject to change without notice. (1) All liquid coolant must be completely drained from the LMT system prior to shipment or storage.	

NOTICE!
Freeze/burst warning! The coolant used in this laser system is de-ionized water which will freeze if subjected to temperatures at or below 0°C (32°F). All coolant (water) must be completely drained from all system components prior to transporting or storing the laser system.

SECTION THREE: INSTALLATION

Overview

The META 10C Laser Machining Tool (LMT) system must be installed or reinstalled by a Coherent authorized representative. To maintain the precision of the machine, advanced beam alignment and leveling must be done whenever the machine is moved or shipped.

This section contains information required to plan the installation site, unpack and inspect the system, perform the physical installation, perform alignments and verifications necessary to confirm proper system operation, and provides a list of topics to be covered during basic operator training.

NOTICE!
Before installation, it is essential that the customer read this manual thoroughly. It is important that the customer become familiar with all aspects of the installation of the META 10C LMT system.

Pre-installation Checklist

All META 10C LMT systems are delivered with all of the hardware and software required for operation. However, there are space, environmental and specialized utility requirements that the customer must provide before installation.

Coherent provides a Pre-installation Checklist of the META 10C LMT system site requirements, which must be met prior to the installation by a Coherent service technician. The installation should be scheduled only after all listed requirements are satisfied. During the installation, the technician will precisely level the machine, confirm utilities, perform system tests and provide basic operator training.

Refer to the pages indicated in the Pre-installation Checklist for more detailed specifications for each site requirement.

The following topics follow the order of the Pre-installation Checklist.

Floor and Space Requirements

Machine Tool and Exclusion Zone

The META 10C LMT system requires a floor with a smooth, flat surface that is free from excessive vibration. Vibration-producing equipment should be dampened at the source. The machine includes leveling feet and precise leveling of the machine will be performed by the installation technician.

The META 10C LMT system requires a minimum clearance on all sides and additional space in the front and back for removing the cutting pallet (removing the pallet from the rear of the machine is optional, but allows for easier access). Additional space and clearance will be required if the optional Pallet Automation Table is used. Refer to Figure 2-6 and Figure 2-7 for operational and service clearance dimensions.

NOTICE!
Providing the recommended service access will provide ease and speed of service and repair of the LMT system.

The exhaust ducting connects to the META 10C LMT system at the left rear corner, near the bottom of the machine. Water connects to the META 10C LMT system at the center rear, near the bottom of the machine. All other utilities (AC power, air, data cable) connect at the I/O Panel, on the left side, lower rear corner.

Figure 2-6 shows the minimum space required for the META 10C LMT system to allow front removal of the cutting pallet. Add another 1042 mm (41 in.) to the length if the pallet will also be loaded from the rear (See Figure 2-7).

System Location and Environment

Your LMT system should be installed in an area that is free of solvents and fork truck traffic.

This includes liquid fuels, forklift exhaust, floor polishing compounds, dust and other material contaminations that will adversely affect the performance of the LMT system.

The compressor(s) that provide control air and cutting assist gas to the machine must take in air that is free of these same contaminants.

Chiller

The chiller recommended by Coherent requires a minimum of 610 mm (24 in.) clearance on all sides and additional space to allow operation and refilling. Service and operational clearance required by other models of chiller may vary. The chiller must not be placed within the exclusion zone of the META 10C LMT system or that of any other system component or accessory.

The chiller places a substantial thermal load on the surrounding area. It is recommended that it be located in an area where this load will not be an issue.

Transformer

The transformer (if one is needed to meet the electrical requirements) must be remain outside of the system's exclusion zone. Service and operational clearance required by the transformer will vary by model. Refer to the manufacturer's information for details. The transformer must not be placed within the exclusion zone of the META 10C LMT system or that of any other system component or accessory.

See "Electrical Utilities" on page 3-6 for details on electrical requirements.

Exhaust Blower and/or Fume Extractor

The exhaust blower recommended by Coherent requires minimum clearance of 610 mm (24 in.) on all sides. Service and operational clearance required by other models of exhaust blower and/or fume extractor may vary. The exhaust blower must not be placed within the exclusion zone of the META 10C LMT system or that of any other system component or accessory.

Control Interfaces

The I/O Panel (located on the left side of the machine at the lower, rear corner. See Figure 3-1) includes the following connections:

- Network Communications (Ethernet) Input – This is a standard RJ-45 Ethernet connector to an external PC or network.
- Remote Exhaust Relay – The META 10C LMT system can control external devices such as the blower (See "Exhaust Blower and/or Fume Extractor" on page 3-3). This connection allows the LMT to switch an external exhaust fan that has an appropriate motor starter or relay to start the motor. The switch (pilot duty relay - dry contacts) inside the machine does not supply power and cannot pass sufficient current to run a motor directly.
- AC Input
- Control Air Input (dry air)
- N2 Gas Input
- Assist Gas Option (Process Gas 2) Input

Figure 3-1. I/O Panel

The coolant water inputs are located in the bottom rear-center of the META 10C LMT system:

- Inlet from Chiller- ¾” (19.05 mm) tubing
- Outlet to Chiller - ¾” (19.05 mm) tubing
- Compressed Air for exhaust gate (Open & Closed) - tubing supplied

Figure 3-2. Coolant Water and Control Air Inputs

Fittings Size Table

Table 3-1. Fittings Size Table

CONNECTOR	FITTING TYPE	QUANTITY
Nitrogen	3/8 FNPT	1
Assist gas option	3/8 FNPT	1
CDA	1/4 FNPT Push-lock compression fitting	1
Chiller, in Chiller, out	3/4 FNPT	2
Exhaust	125mm (6 in.) duct	as needed
Ethernet	RJ45	1

Facilities Schematic

See Figure 3-3for a summary of the META 10C LMT system facilities connections.

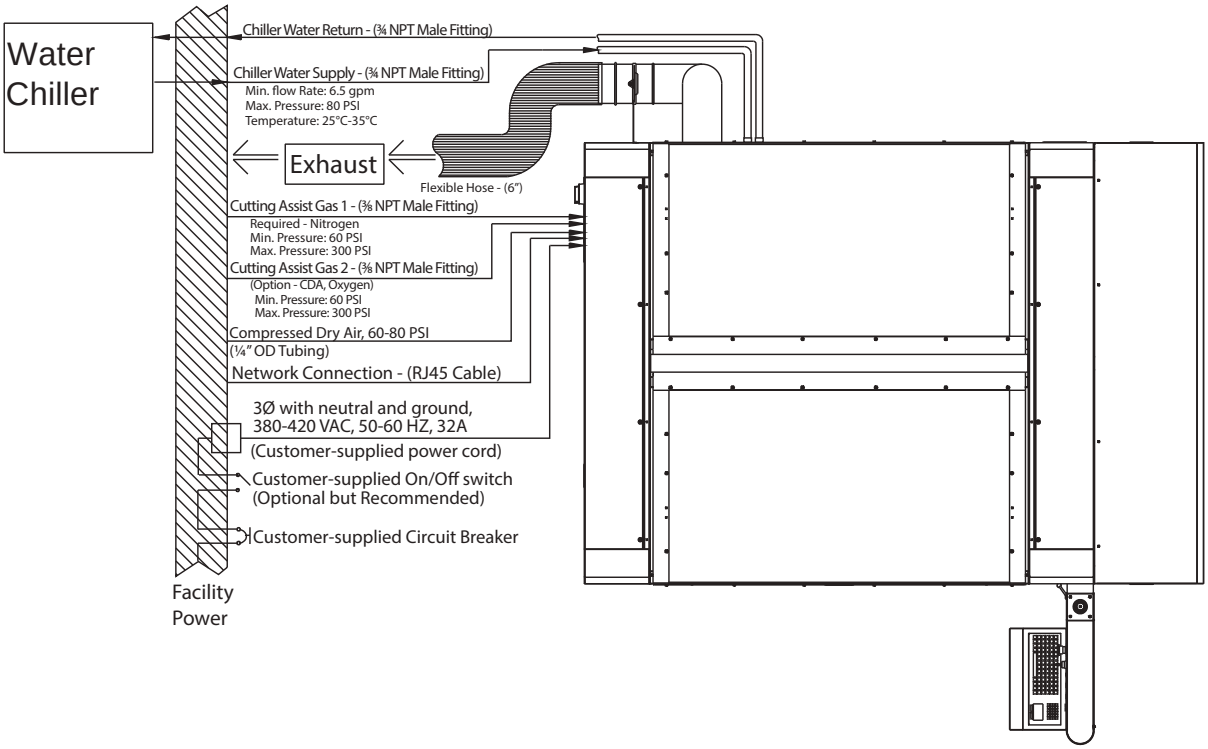


Figure 3-3. META Platform Facilities Schematic

Electrical Utilities

AC Power is connected to the LMT on the left side of the machine, near the lower, rear corner. The LMT includes a standard electrical connection box and terminals for electrical connections, but does not include external field wiring (branch circuit).

Electrical service must be provided by a qualified electrician and must meet National Electric Code (NEC) standards or local regulations, whichever take precedence.

NOTICE!
COHERENT MAKES NO RECOMMENDATION FOR PLUGS OR SOCKETS FOR ANY CONNECTION, AND ACCEPTS NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR THE ELECTRICAL CONNECTION BETWEEN THE LMT SYSTEM COMPONENTS AND PRIMARY ELECTRICAL POWER SUPPLY. IT IS SOLELY THE CUSTOMER'S RESPONSIBILITY TO EFFECT SAFE AND CODE-COMPLIANT ELECTRICAL CONNECTIONS.

The LMT requires a dedicated mains branch circuit (not shared with other loads). The LMT requires a 3-phase, 380–420 VAC, 32 Amps, 47-63 Hz electrical supply. Use 10 mm^2 (6 AWG), 4 conductor copper wire for the LMT main supply. Torque terminals for L1, L2, L3 to 2.0 Nm (17.5 in.-lb.) and N to 2.5 Nm (25 in.-lb). Torque PE (ground) to 3.4 Nm (30 in.-lb.). No power cord or mating connectors are provided with the system.

Table 3-2. Electrical Requirements

	AC VOLTAGE	PHASE	FREQUENCY	CURRENT
META PLATFORM	**380-420V**	**3Φ WYE/ N / PE (GROUND)**	**47-63 HZ**	**32A**

To power a laser power meter, external laptop computer, power tools and other test equipment, it is recommended to provide additional standard power receptacles near the LMT system.

Other systems (e.g. exhaust system, blower, liquid-cooling, gas supply, ventilation) will also require electrical power for operation. Refer to the manufacturer’s literature for specifications and site planning recommendations.

Exhaust Blower and/or Fume Extractor

The LMT system requires an external ventilation fan (referred to as a blower) or an air cleaning system (referred to as an air scrubber). This blower can be connected to the LMT via hard or flexible ducting. For typical installations, we recommend that the blower be roof mounted. This will result in a system that has negative pressure in the ducting that is run inside the building.

The external ducting connects to a 6" diameter duct at the rear of the machine. We recommend that the ducting size be increased to 8 to 10 inches in cases where the ducting is to be run more than 10 feet from the machine.

The blower must supply adequate air flow for the internal exhaust system to work properly.

The blower must provide a minimum of 17 m^3/min (600 cfm) at the inlet to the machine. Machines used for cutting of organic materials (acrylics, wood, etc.) may require up to 42.5 m^3/min (1500 cfm) to reduce preventative maintenance (PM) requirements and environmental odors. A long length of ducting may impede the airflow and reduce the static pressure, requiring a bigger fan.

Supplied exhaust components (See Table 3-3) are to be connected by the customer prior to LMT installation. For detailed installation instructions, refer to the exhaust component installation documentation that is included with the META platform.

Each installation may require specific conditions be met such as local regulations for heating, air conditioning and ventilation. Be sure to consult with an experienced HVAC contractor in your area for specific advice for your location.

Table 3-3. Supplied LMT Exhaust Components

QUANTITY	TITLE
2	90° Elbow
4	Clamps
1	Exhaust damper gate
1	Hose extension
1	Bracket

Liquid Cooling System

The LMT system requires an external, closed loop water cooling system. This can be satisfied by a commercially available chiller, or an existing cooling system. Coherent supplies chillers from third parties or can recommend models to match your laser power.

Table 3-4 below lists the cooling requirements for the LMT system.

Table 3-4. Chiller Requirements

	CHILLER COOLING CAPACITY (MIN)	TEMP. CONTROL	MIN. FLOW
META 10C	20 kW (68 kBTU/h)	±1.67°C (3°F)	24.6 lpm (6.5 gpm) @ 344.7 kPa (50 psi) differential

The temperature of the cooling water should never be set below 23°C (73°F) or less than 5°C(9°F) above the dew point. The maximum rated operating temperature for the laser system is 35°C (95°F). The laser itself is aligned and tuned at 23°C (73°F). If the dew point of the surrounding air can be controlled such that it is consistently below 18°C (64.4°F), this will maximize system performance.

Install the filter, then connect:

- Outlet of chiller to input of LMT
- Inlet of chiller to output of LMT

Coolant Composition

The recommended coolant composition is a mixture of water and OPTISHIELD®, a low-toxicity corrosion inhibitor available from Opti Temp, Inc. and which can be shipped worldwide. Contact information is provided in Table 3-5. Visit the Opti Temp, Inc. website (**www.optitemp.com**) for complete product information on OPTISHIELD®.

The required mixture is a 10% solution of OPTISHIELD® and water (example: 1 liter of OPTISHIELD® to 9 liters of water). Contact Opti Temp, Inc. (see Table 3-5) for detailed water recommendations.

OPTISHIELD is the recommended corrosion inhibitor, however it may not be readily available outside the US, or may be regulated by local environmental legislation. Coherent suggests using TRAC100 by Nalco as an alternative. Please visit **www.nalco.com** for more information.

Table 3-5. Recommended Coolant for LMT Systems

PRODUCT NAME	MANUFACTURER'S NAME AND CONTACT INFORMATION	HEAT TRANSFER FLUID TYPE	REQUIRED HEAT TRANSFERRED FLUID CONTENT	FREEZING BURST PROTECTION
OPTISHIELD®	Opti Temp, Inc. **www.optitemp.com** US/Canada 1-213-946-2931	Corrosion Inhibited Water	10% Solution in Water	Does not reduce water freezing point.
TRAC100	Nalco **www.nalco.com** US (630) 305-1000	Corrosion Inhibited Water	2500 ppm in Water (2.5ml per 1l of water)	Does not reduce water freezing point!

Filtering

The coolant water supplied to the LMT system must be filtered to 50 µm.

NOTICE!
The chiller temperature should never be set below 5°C (9°F) above the ambient dew point. Operating in this condition can cause condensation that will permanently damage the laser tube. Damage caused by condensation is not covered under warranty.

Freeze/Burst Protection

The recommended coolant mixture does not provide freeze protection; therefore the coolant temperature must be maintained above the freezing point of water. Since lower temperatures may occur during shipment and storage, the META Platform should never be stored or transported unless the coolant has been completely removed by using a compressed air supply to blow out all coolant passages.

Control Air System

The cutting head purge, pneumatic table locks and front and rear doors (Control Air) require clean, dry air (CDA) set to between 4.41-5.52 bar (60-80 PSI). Failure to maintain pressure can cause damage to the cutting head and beam path optics, the LMT doors to remain open and job parameter errors to occur. Purity of this gas should be 99.95% clean, dry (dew point below 4.44°C (40°F), oil

free and filtered to 5µm. The CDA connection to the LMT is a ¼" flexible tube.

Tubing for the Control Air inputs on the lower rear of the LMT system is provided.

Purge Gas

The pressure of CDA used to purge the beam path must be 135 lpm .

Door and Pallet Clamps

The pressure of CDA used to operate the pneumatic doors and pallet clamps must be 60 SCFH.

Nitrogen Assist Gas System

The LMT requires nitrogen to protect the cutting lens and assist in the cutting process. The assist gas connection to the LMT is a 3/8" flexible tube. The pressure set point of the assist gas must be 5.52 bar (80 PSI) and must not be allowed to drop below 4.14 bar (60 PSI) or exceed 20.68 bar (300 PSI). Purity of this gas should be 99.95% clean, dry, oil free.

The above defined pressures are where the system will work. Cutting pressures required may vary according to the thicknesses and types of the materials involved. Consult Coherent applications white papers for your particular materials.

Assist Gas Option System

There is another assist gas input for the customer to use other assist gases besides nitrogen, such as CDA or oxygen. The assist gas connection to the LMT is a 3/8" flexible tube. The pressure must be regulated between 0.00 MPa (0 PSI) and 2.07 MPa (300 PSI) for CDA and between 0.00 MPa (0 PSI) and 1.38 MPa (200 PSI) for oxygen.

NOTICE!

The system does not have lockout capability for the Process Cooling Water, Compressed Dry Air and Assist Gas. The facility needs to provide the necessary lockouts for these energy sources. The lockouts need to be readily accessible, within line of sight of the operator and lockable.

Oxygen can be used as an assist gas for metal cutting, but should not be used for non-metal materials in most cases.

WARNING!
The use of nitrogen, argon and other gases could potentially create an asphyxiating environment. This situation should not arise in normal circumstances, as long as the exhaust system is not blocked and proper airflow is maintained within the LMT system.

The flow rate for assist gas will depend on the application and machine setup.

NOTICE!
All gases supplied to the LMT must be dry and oil-free. Moisture in the system can damage the LMT system's optics. If oil is introduced into the system, there is a risk of explosion if the laser is later used with oxygen.

Human Machine Interface (HMI) and Networking

All LMT systems include the Human Machine Interface (HMI), which consists of a computer, a touch-screen monitor, BeamHMI machine control software and a keyboard. All LMT systems are shipped with HMI software installed on the computer.

LaserLink™ is Coherent CAD/CAM software. LaserLink is used to import CAD files (DXF, DWG, Gerber), raster files (BMP, JPG, PNG, GIF), edit geometry, assign machine settings from a user-editable database of settings and create process files to run jobs.

Training

Basic operator and applications training is provided at the time of installation. For more comprehensive applications and operation training, please contact Coherent. Classes are held at the Coherent facility once a month.

Receive, Unpack and Inspect

The LMT packaging has been designed for robust shipment.

Upon receiving the system, inspect the outside of all containers immediately to ensure no damage occurred in transit. If there appears to be visible damage (holes in the containers, fluid damage, crushing etc.), immediately notify Coherent and a representative of the carrier. Request that a representative of the freight company be present when unpacking the contents.

The containers might appear in good condition, but the contents may be damaged. Make sure to inspect major components as they are unpacked. Unpacking instructions are found in the Installation Procedure found later in this section.

To unpack the LMT system, at least two people and the following tools will be required:

- Scissors or a package cutting knife
- Impact gun with 9/16” or 5/8” sockets
- Forklift with 145 mm (5.71 in) wide x 70 mm (2.76 in) thick forks, able to lift at least 1043 kg (2300 lbs.).

NOTICE!
While in transit, shipping containers and contents may be exposed to cold temperatures. To prevent condensation from developing on and within the LMT system, move the crate(s) to a location near the installation area and allow to acclimate before opening and unpacking.

Moving/Placing the META Platform

Make sure to provide a clear path from the receiving area to the installation site. Use the fork tubes provided to avoid damaging the LMT during transportation to the installation site.

Special Installation Requirements

NOTICE!
Please ensure that Coherent is aware of any and all special environmental requirements prior to installation.

Schedule the Installation

Contact Coherent to schedule your META Platform installation. Ensure that all pre-installation needs have been addressed prior to Coherent installation engineer arrival on-site. Be prepared to provide signed pre-installation checklist electronically prior to scheduling installation.

Pre-installation Checklist

GENERAL REQUIREMENTS	CUSTOMER RESPONSIBILITY: CHECK IF COMPLETE
Space: Review this manual for footprint dimensions and service clearance and exclusion zones around the machine and related accessories. Adequate space around system and accessories that conforms to drawing of service clearance and exclusion zones around the machine. See "Floor and Space Requirements" on page 3-2 of Pre-installation Manual.	[ ] Floor must be free from vibrations [ ] Floor must be flat up to slope of ± 12.7 mm (0.5 in.) over the installation area, including PA table area if purchased [ ] Left side minimum clearance = 610 mm (24.00 in.) [ ] Right side clearance = 914 mm (36.00 in.), expandable to 1524 mm (60 in.) for laser service [ ] Rear clearance = 1219 mm (48.00 in.) [ ] Front clearance = 1524 mm (60.00 in.)
Electrical: Review this manual for electrical requirements for the laser machine tool and related accessories. The electrical wiring should be connected to the machine by a licensed electrician prior to the arrival of the installation technician. (Optional) external circuit breakers must be rated to >32A. See "Electrical Utilities" on page 3-6 of Pre-installation Manual.	[ ] Laser machine tool electrical requirement: 380-420VAC 3PH +N +PE, 32A [ ] Main disconnect switch electrical torque specs: L1, L2, L3, N = 25in-lb PE = 30in.-lb
Exhaust: Review this manual for specification of exhaust fan system requirement. The exhaust system should be installed and functional before arrival of installation technician. See "Exhaust Blower and/or Fume Extractor" on page 3-8 of Pre-installation Manual.	[ ] Volume/Flow: 17 m^3/min (600 cfm)

GENERAL REQUIREMENTS	CUSTOMER RESPONSIBILITY: CHECK IF COMPLETE
Cooling: An external, re-circulating water cooling system is required for the LMT system. Review this manual for LMT system cooling requirements. The external cooling system should be connected to electrical, turned on and tested into a closed loop or bypass. Then it can be connected to the LMT system prior to the arrival of the installation technician. There are ¾ FNPT fittings on the META Platform. See "Liquid Cooling System" on page 3-9 of Pre-installation Manual.	[ ] 20 kW (68 kBTU/h) cooling capacity [ ] Water and 10% corrosion inhibitor coolant composition [ ] Capable of 24.6 lpm (6.5 gpm) with a 344.7 kPa (50 psi) pressure differential
Clean, Dry Air (CDA): CDA is used to purge the cutting head optics and control the pneumatic table locks and front and rear pallet doors. Review this manual for CDA requirements. These must be available and connected to the LMT system prior to arrival of the installation technician. There is a ¼ FNPT push-lock compression fitting on the META Platform. See "Control Air System" on page 3-10 of Pre-installation Manual.	[ ] Standard compressed air [ ] 0.4 - 0.7 MPa (60 - 100 PSI) pressure at the input of the LMT system [ ] Purity of this gas should be 99.995% clean, dry, oil free.
Nitrogen: Nitrogen is used as an assist gas for some cutting applications. Review this manual for nitrogen specifications. Regulated nitrogen must be available prior to arrival of installation technician. There is a 3/8 FNPT fitting on the META Platform. See "Nitrogen Assist Gas System" on page 3-11 of Pre-installation Manual.	[ ] Pressure: 0.55 - 2.0 MPa (80 - 300 psi) [ ] Nitrogen purity of 99.95% clean, dry, oil free.
Alternative Assist Gas: The system allows for input of optional cutting assist gas other than nitrogen. This is usually CDA or oxygen. The requirements for this optional assist gas are described in this manual. There is a 3/8 FNPT fitting on the META Platform system. See "Assist Gas Option System" on page 3-11 of Pre-installation Manual.	[ ] Pressure; CDA: 0.0 - 2.0 MPa (0 - 300 psi) [ ] Pressure; Oxygen: 0.0 - 1.0 MPa (0 - 140 psi) [ ] Purity of this gas should be 99.95% clean, dry, oil free.

Customer Signature _____ Customer Name _____ Date _____

SECTION THREE: OPERATION

Overview

This section describes the META 10C Laser Machine Tool (LMT) system controls and indicators and common operating procedures. Operating instructions are given that assume the user/operator has previously created a job file (process instructions) for the META 10C to perform a specific cutting/engraving operation.

Job Files (cutting instructions for the META 10C) are created using LaserLink™ software.

Operation of the META 10C is done using Beam Human Machine Interface (HMI) software. Refer to the instructions given in "Section Five: System Software" for using the BeamHMI controls.

Controls and Indicators

System Power (Main Disconnect Switch)

The Main Disconnect Switch, found on the left rear corner of the machine (See Figure 4-1), switches the three-phase input power. After the Main Disconnect Switch, there is a contactor that closes only when the Emergency Stop button is disengaged and safety interlocked panels are in place.

Key Switch / Start Button

With the system power on, turn the key switch to the ON position then press the Start button. This will activate the 48 VDC for the laser.

The control supply (24V), the 60 VDC motor supply and the HMI are individually protected by separate circuit breakers located inside the LMT system. A fault on these breakers indicates a serious problem and you should contact Coherent service before attempting to reset any of these breakers.

Emergency Stop Button

The Emergency Stop Button is located on the HMI Panel. Pressing the Emergency Stop Button shuts off three-phase AC power to the machine, de-energizing the laser and motion systems (the system computer will remain on as it is controlled by a separate circuit

Figure 4-1. Main Disconnect Switch

breaker). To release the Emergency Stop button, turn it clockwise to release. The button must be released to operate the META 10C.

DANGER!
Do not remove any panels for maintenance or service without turning off the main circuit breaker. The machine still has lethal voltages inside the service bays even after an Emergency Stop button has been pressed.

HMI Panel

The HMI Panel (See Figure 4-2) contains the key switch and emergency stop button. This panel also includes a light tree that gives status and warning information about the LMT system.

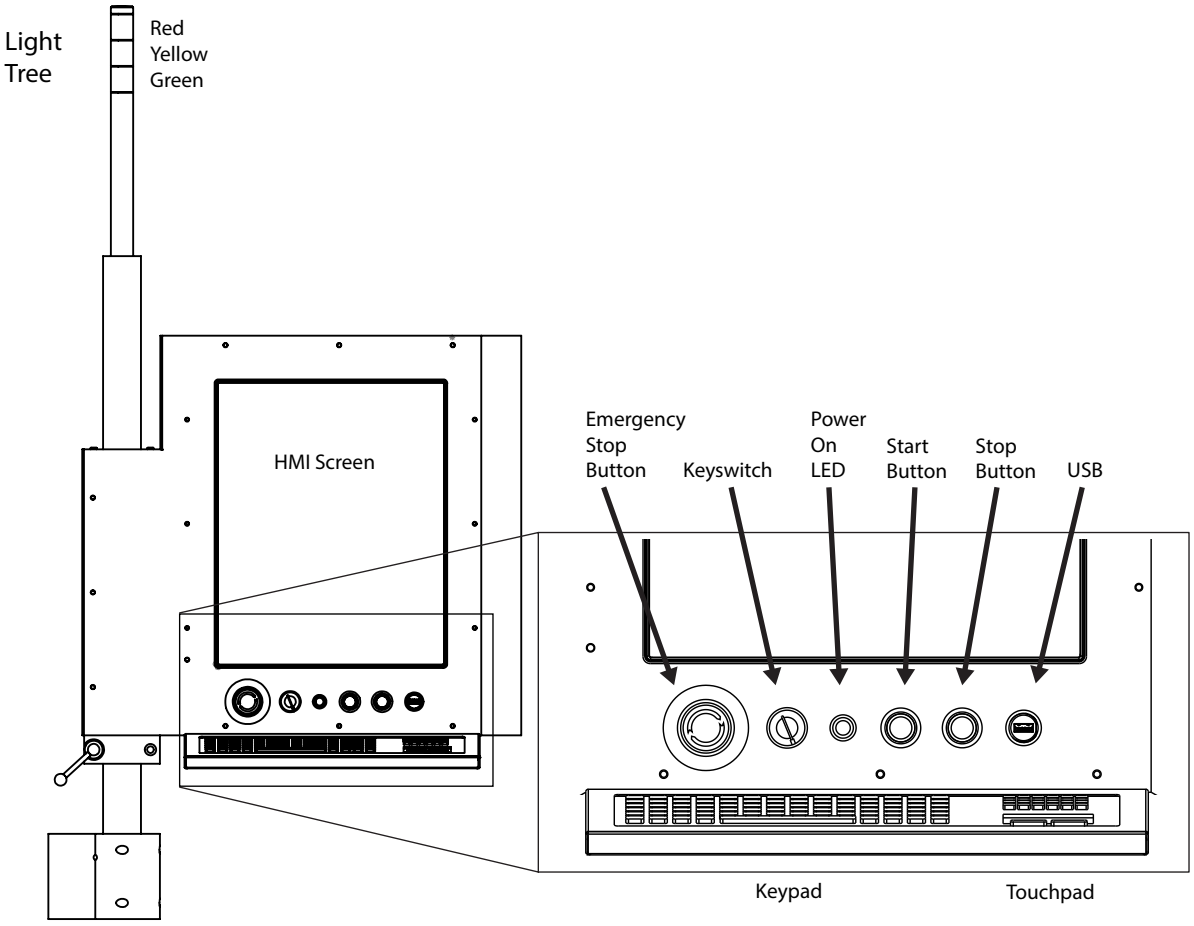


Figure 4-2. HMI Panel

LIGHT TREE

- **GREEN** - Indicates the LMT system is running, in motion or processing a production job.
- **YELLOW** - Indicates the LMT system is idle.
- **RED** - Indicates a fault or an error state.

Operating Procedures

Pre-operation Checklist

[ ] Material is compatible for laser cutting or engraving – refer to the manufacturer's Material Safety Data Sheet (MSDS).

- Before cutting anything on the META 10C, make sure you know the suitability of your material for laser cutting and the adequacy of you exhaust system. Check with the material manufacturer for each material you plan to cut. They can usually supply you with advice on laser cutting their material or will at least supply an MSDS. Specifically review the MSDS regarding how the material reacts to heat or fire.
- In addition, the material to be cut must be:
  - Consistent Thickness - variations in thickness across a single sheet may cause incorrect focus, problems with the auto focus system and inconsistent cutting;
  - Less than 1" Thick - hard materials such as metal must be even thinner.

[ ] Liquid-cooling system/Chiller is on.

[ ] Exhaust (ventilation) system is on.

[ ] Assist Gas is on.

[ ] Compressed Air system is on.

[ ] Facility electrical disconnects are on.

[ ] Nothing is physically blocking the motion of the Gantry.

[ ] Cutting Pallet is inside the META 10C in the locked cutting position.

[ ] Top cover(s) and front and rear doors are closed.

[ ] All Emergency Stop Buttons are released.

[ ] Key Switch is in the "OFF" position.

System Power-on

1. Complete all items on the Pre-operation Checklist.
2. Turn the Main Disconnect Switch to "ON" position.
3. Verify the System Computer is on and log in to Windows.

- Double-click the BeamHMI icon to start the HMI control software.

4. Turn the Key Switch to the “ON” position (key switch located on the HMI Panel).
5. Press the Start button (located on the HMI Panel).
6. The HMI will display a start-up screen while it connects to the META 10C system (See Figure 4-3).

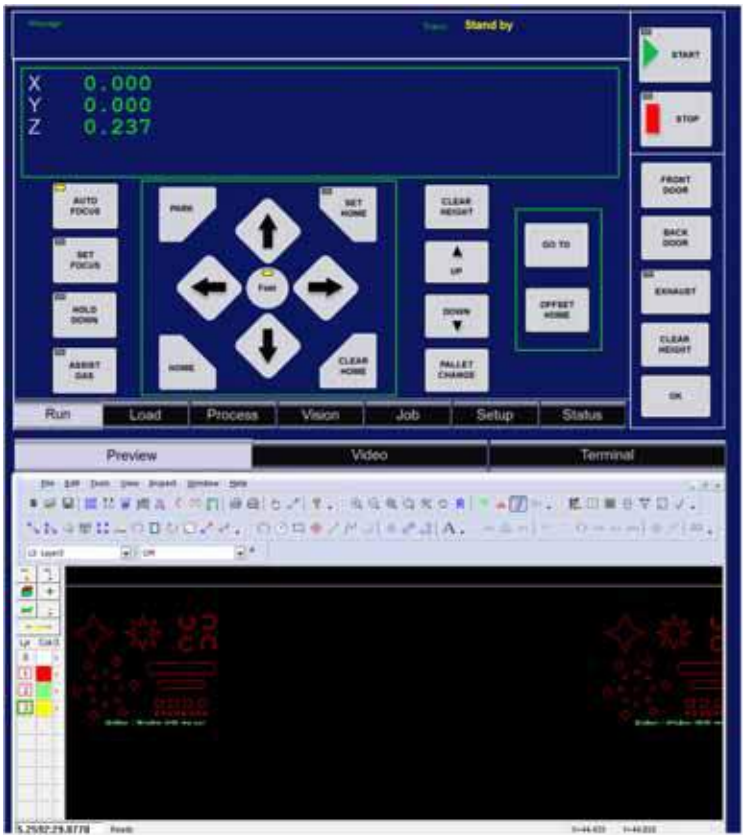


Figure 4-3. HMI Connecting and Loading Parameters

7. The HMI will display the Run Tab and load Parameters.
8. The HMI will then prompt the user to Home the machine.

Check Material

Before cutting anything on the META 10C, make sure the suitability of the material for laser cutting and the adequacy of the exhaust system are known. Check with the material's manufacturer for each material to be cut. The manufacturer in most cases can provide advice on laser cutting their material and/or supply a Material Safety Data Sheet (MSDS). Specifically review this document regarding how the material reacts to heat or fire or if it produces toxic fumes, as well as the reflection rate for infra-red (IR) radiation. General material guidelines are available in Section Seven: Applications.

In addition, the material to be cut must be:

- Less than 1 inch thick - hard materials must be even thinner.
- Smaller than the Cutting Pallet - The META 10C cuts up to 1.25 m x 1.25 m (49 in. x 49 in.) and the pallet can handle sheets up to one inch larger (some pallets may vary). The sheet to be cut must fit inside the pallet's top frame (not sit on top of the frame).

Prepare Pallet and Load Material (Internal Pallet Load)

In the base system, the pallet is typically loaded from the LMT system front side (the HMI Panel end). The pallet may be loaded from the rear.

1. Press the Park button to move the Gantry out of the way. This position is user programmable from the configuration menu on the control panel.
2. Press the Load button after the arm has stopped moving, open the Top Cover and lower the Front Door. The Pallet can now be pulled out to the Loading Position. The Pallet will lock in place in both the Cutting Position and Loading Position. The load position is user programmable from the configuration menu on the control panel.

CAUTION!
The Cutting Pallet is heavy. Do not pull it past the Loading Position without assistance or unless an optional external Pallet Loading Table is in position.

3. Inspect the pallet and verify it is clear of previously processed parts and scrap. Remove any existing parts and scrap.
4. If the material to be cut/engraved is smaller than 1.25 m x 1.25 m (49 in. x 49 in.), cover the pallet with a sheet of paper or other part mask.

5. Carefully slide the material onto the pallet. Some materials may be heavy or require assistance in loading. Push the front left corner of the material flush with the front left top frame of the Pallet.
6. Be sure that all blocking material lies flat and will not interfere with the cutting nozzle.
7. Push the Pallet back into the machine until it locks into the Cutting Position. If the Pallet does not slide easily, check that the V-wheel rollers are properly aligned.
8. With the Pallet in place, press the Hold Down button to turn on the assist fan and check that the material is being held flat. The vacuum will also automatically come on when a file is started.

   If the remote cable is used, the Exhaust button will turn on the fan. The Hold Down button will open and close the damper.
9. Close the Top Cover and Front Door. The material is now ready to be processed.

Prepare Pallet and Load Material (External Pallet Load)

See the appropriate appendix for instructions on loading and operating the optional external pallet load systems.

Nozzle Adjustment

The height of the nozzle can be independently adjusted. This variable depends on the gas assist requirements of particular materials. Some materials benefit from a high gas flow during cutting or a particular gas type to reduce oxidation of the edges during cutting. Metal cutting always requires careful adjustment of nozzle height and gas flow. Oxygen is often used for steel cutting to increase feed rates.

The nozzle height is adjusted by rotating the large adjusting knob above the nozzle. The height gauge will give you a relative setting so the same gap can be repeated on future runs.

Setting the nozzle too low may cause the cutting head to crash. For many applications, the nozzle height can be set large to avoid crashes.

The following are recommended nozzle height adjustments:

- For materials such as acrylic, where you want little gas assist to maximize flame polishing, the gap between the nozzle and the top of the material should be greater and pressure set low.

Never set the pressure to 0 psi as the final optic can be damaged if no cover gas is provided.

- For materials that require gas assist, the gap between the nozzle and the top of the material should be around 0.02" - 0.04" in.

NOTICE!
Do not set the nozzle height at or below the top of focused material. This can cause the nozzle to crash and can damage the machine.

Capacitive Height Sensor (CHS)

Precise control of the distance between the assist gas nozzle and the workpiece is necessary for high edge quality when cutting metals. The Capacitive Height Sensor (CHS) is utilized to maintain a nozzle standoff distance in order to attain high quality cutting results. The CHS is designed for the operator to manually set the gap between the nozzle and the workpiece using the procedure found below.

At the start of a job, the machine uses the CHS to move to the gap set by the operator. The machine controller uses the measurements taken by the CHS to adjust the bed height in order to maintain the nozzle gap set by the operator.

The CHS is enabled by enabling the Metal Option entry for the desired layer in the .LMC file in LaserLink™ (See the LaserLink™ Help file / software manual for more instructions).

Setting Nozzle Gap and Focus Offset

1. Go to the Setup Tab of the HMI.
2. Under Settings, select Nozzle Gap and press or click the Set Value button.
3. Using the onscreen keypad, enter the desired Nozzle Gap.

   The Nozzle Gap is the desired distance between the nozzle and the top of the workpiece.

For the Focus Offset (distance between the top of the workpiece and the Focal Point of the laser beam), the LMT system will use the Focus Offset specified in the Process Table of the LaserLink job file.

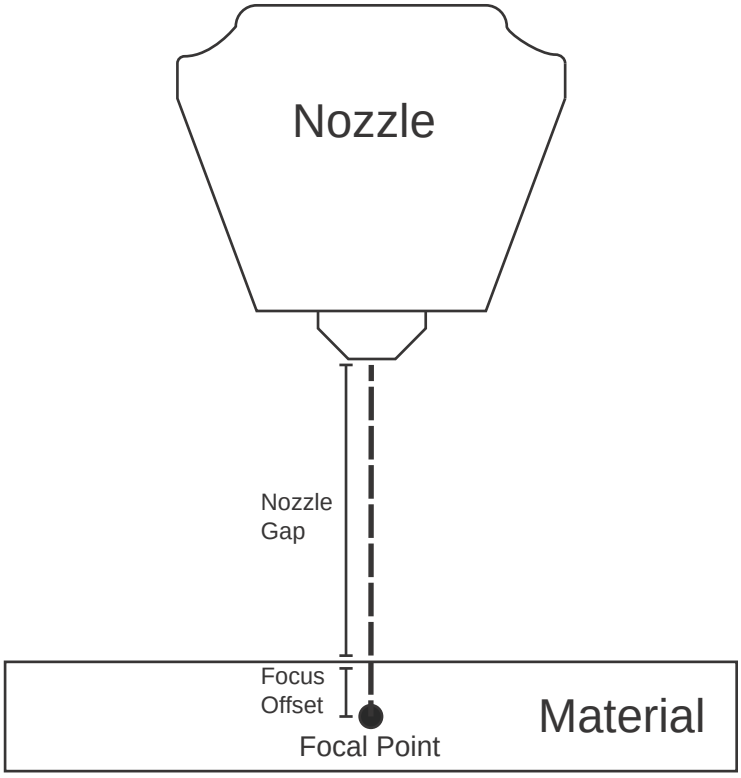


Figure 4-4. Nozzle Gap / Focus Offset

NOTICE!
The Focus Offset in the Process Tab and the Setup Tab MUST match for all layers when using the Capacitive Height Sensor (CHS) to cut metal.

4. The machine will auto focus on the material and the bed will then move down.

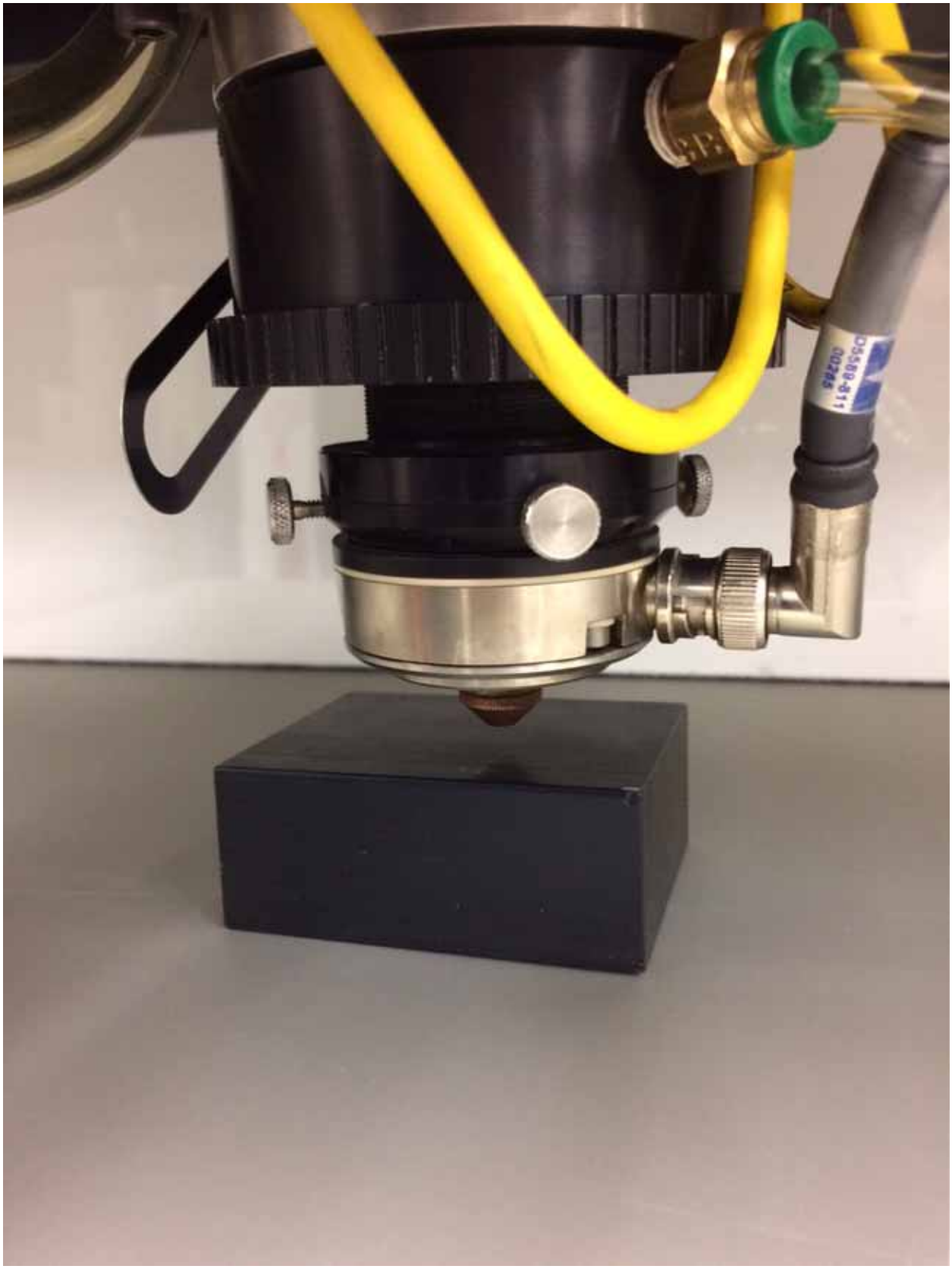


Figure 4-5. Setting the CHS Nozzle Offset

5. When the bed comes to rest, open the cover and slide the leveling block tool under the nozzle. To raise the nozzle, turn the adjustment knob counter-clockwise. To lower the nozzle, turn the adjustment knob clockwise. Raise or lower the nozzle until it starts to touch the leveling block (See Figure 4-5). Set the final height of the nozzle when adjusting it away from the cutting bed. Backlash in the threads combined with air pressure in the cutting head will lower the position of the nozzle if the adjustment is stopped when adjusting toward the cutting bed.
6. Remove the leveling block. The block should easily slide out.
7. Perform the "Nozzle Centering" procedure found in Section 6: "Maintenance & Troubleshooting" on page 6-21.

Using CHS with Anodized or Finished Metals

The Capacitive Height Sensor requires the workpiece to be grounded. All materials with non-conductive finishing will require the following procedure to ground the workpiece.

1. Remove the finish from a small section of material.
2. Attach a clip lead to the section of the material with the finish removed and attach the other clip lead to one of the pallet strips (See Figure 4-6).

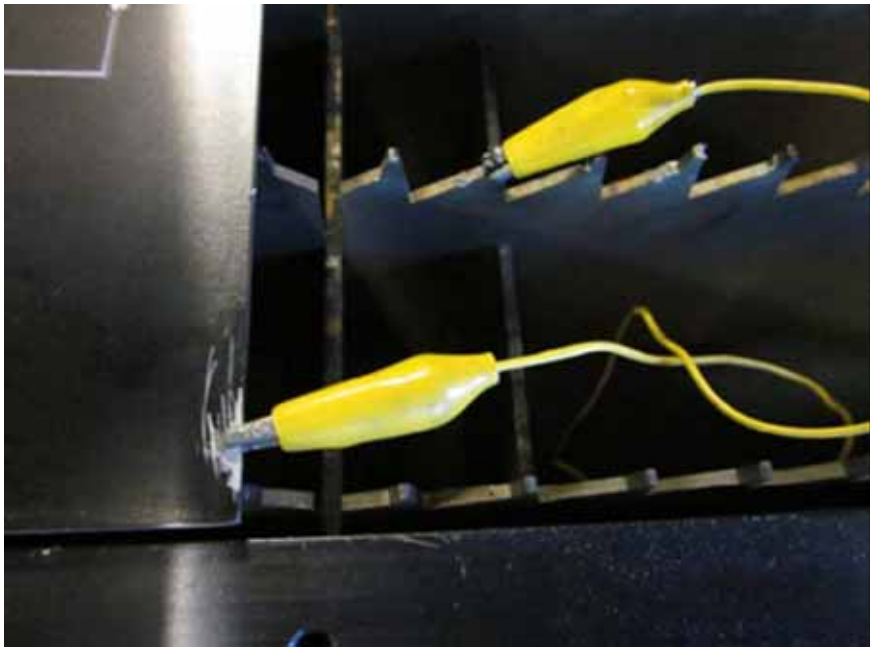


Figure 4-6. Clip Leads Attached to Anodized Material and Pallet

Nozzle Removal

To remove the Nozzle, loosen the lock nut and unscrew the nozzle. The standard nozzle supplied has an orifice of 1.50 mm (0.06 in.).This can be drilled out to any size. Replacement nozzles are available from Coherent Product Support.

Hold Down and Part Masks

The Hold Down button allows the user to manually open the pneumatic damper, which can assist in holding down material. This is generally not necessary when cutting metal parts.

Adding a part mask cutout makes the hold down suction and exhaust work more efficiently (See Figure 4-7).

Figure 4-7. Part Mask

NOTICE!

Always cover the open area of the cutting bed with paper of other suitable material to maximize the effectiveness of the hold down and improve ventilation performance. Most of the cutting debris and fumes should pass through the cut and be evacuated through the hold down fan. Although all of the sensitive optics and mechanisms isolated from the cutting area, if there is excessive build up of fumes on the top of the cut they can find their way into sensitive areas in the machine.

Exhaust

The Exhaust button turns on the external exhaust fan (if the fan is connected to the optional switch closure connector (relay) on the I/O Panel). The Exhaust fan will also automatically come on when the user starts a file and remains on for a programmable time after the file has completed.

If the optional switch closure connector is not used as the means of controlling an exhaust system, the Exhaust button will not function. It will still illuminate automatically when the user starts a file.

The LMT system uses a pressure sensor to sense if the fan is on. This sensor **does not** confirm proper ventilation is being provided. Providing and maintaining the ventilation system is the responsibility of the user. If a filtration system is being used the filters must be cleaned often to maintain sufficient flow. Smoke or smelly fumes that do not evacuate quickly are a sign that the ventilation system needs service.

Assist Gas

The Assist Gas also automatically comes on when the user starts a file and can be adjusted manually via the HMI. The user can test the airflow or adjust the pressure by pressing the Assist Gas button and adjusting the assist gas process setting on the HMI Process tab.

CAUTION!
Compressed gasses can cause gas embolisms. Do not place fingers near or under the gas nozzle when assist gas is on.

Select a Job file

1. Go to the Load Tab of the HMI and navigate the file tree to the location of the desired Job file (See Figure 4-8).

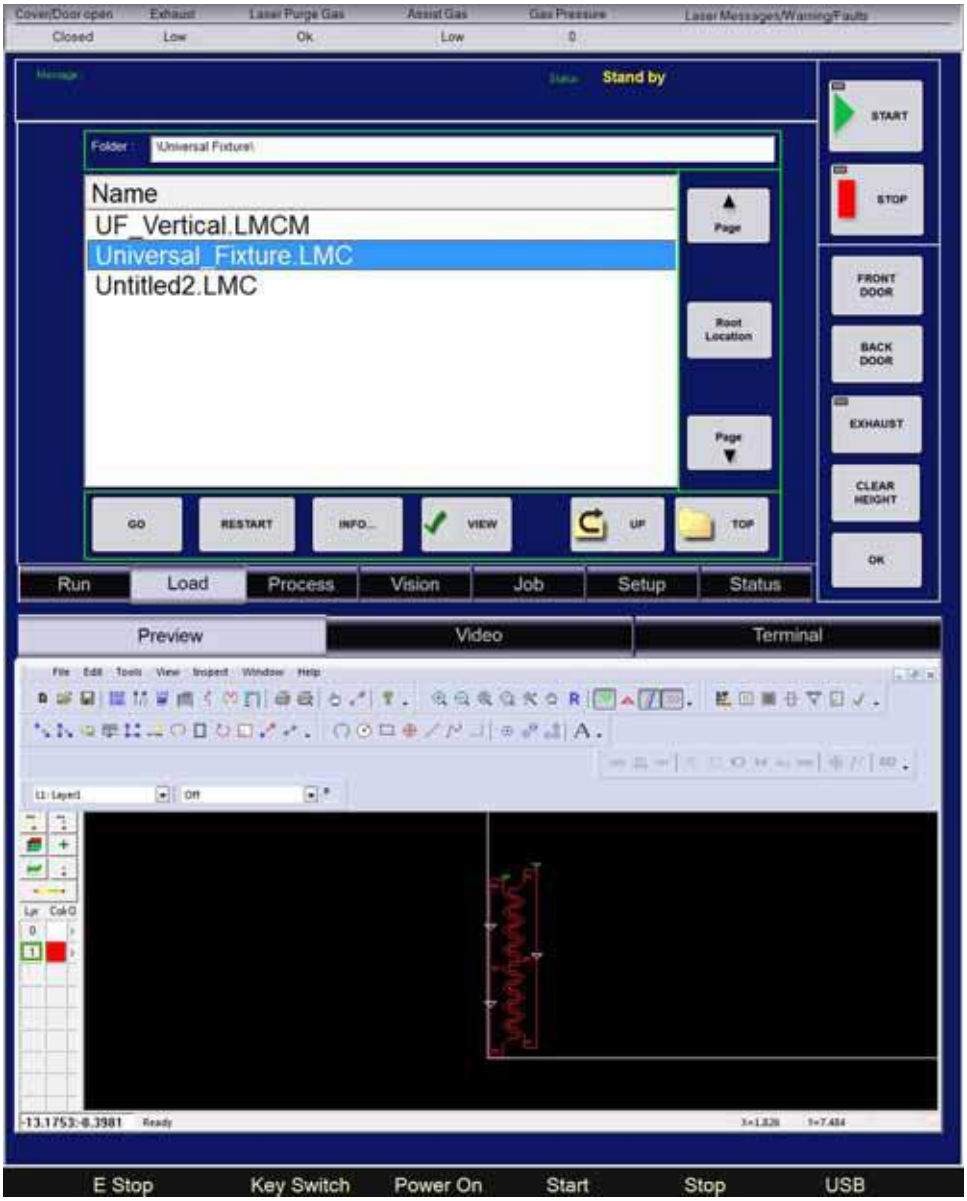


Figure 4-8. HMI Load Tab with Job file selected

2. Click the desired Job file to select it.
3. Click the GO button to load the Job file.

Run the Job file

1. Go to the Run Tab of the HMI. The Status bar will display the name of the loaded job file.

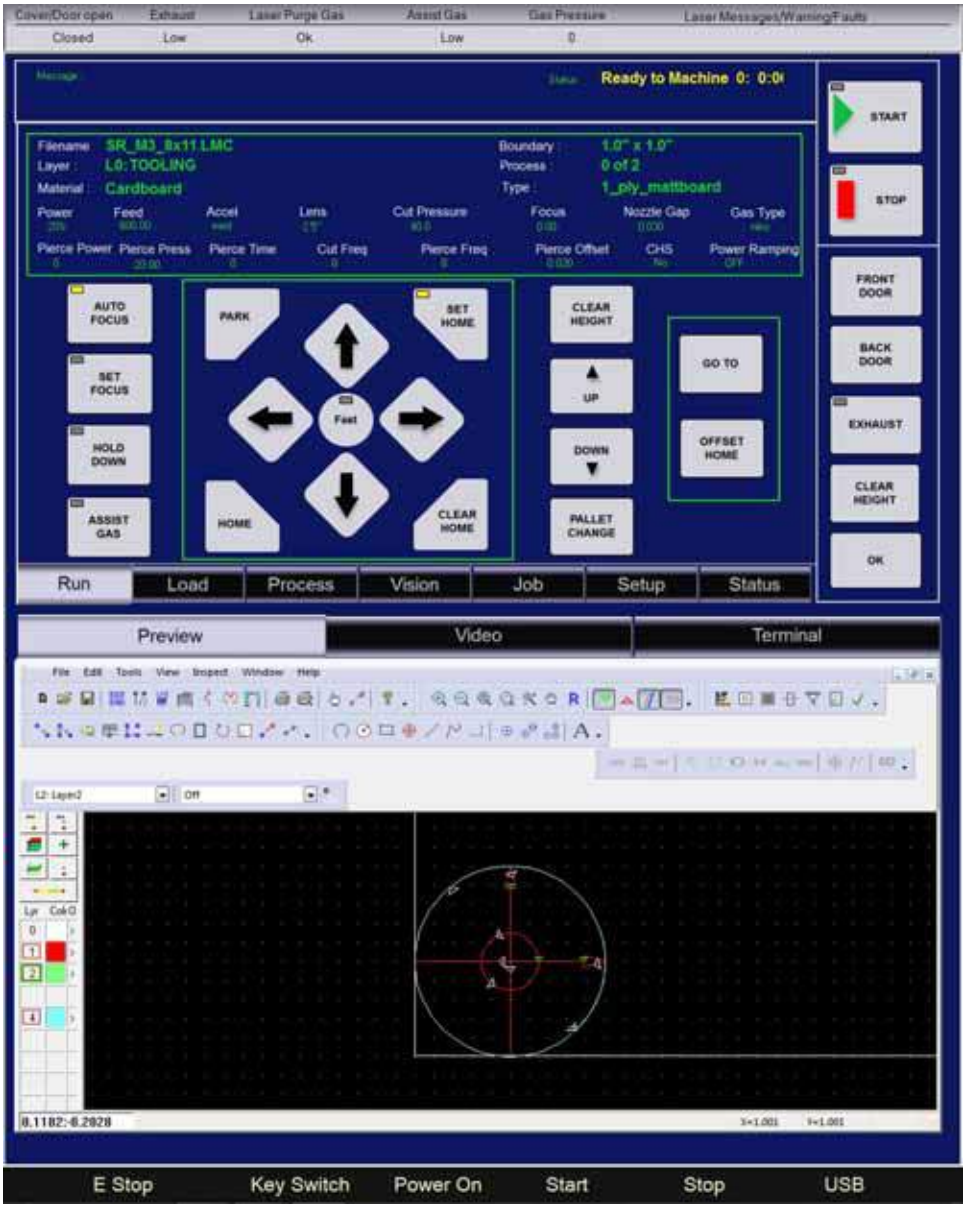


Figure 4-9. HMI Run Tab with Job file loaded

2. Click Start to run the loaded Job file.

Unload Parts/Clear Scrap

After completing a cutting job, remove the cut parts and uncut waste. When using a “points” pallet, the cut parts will fall through and can be retrieved from the parts drawer at the bottom front of the machine.

Step and Repeat

Refer to the Software Manual for full instructions on creating a Step and Repeat-capable job file in LaserLink™.

To run a Step and Repeat job on the LMC, follow the above procedure to select and load a job file.

Next, on the Job tab enter the desired quantity of repeated parts to be cut. If the number is less than the amount specified in the sheet of the job file (in LaserLink™), only the amount specified will be cut. It is also possible to specifically choose not to cut specified parts in a step and repeat job. By clicking on boxes, a red X appears, representing the deselected cuts (See Figure 4-10). This can be used to resume a step and repeat job if the job is interrupted before the job finishes: simply deselect the previous cuts and change the quantity to reflect the remaining cuts. ,

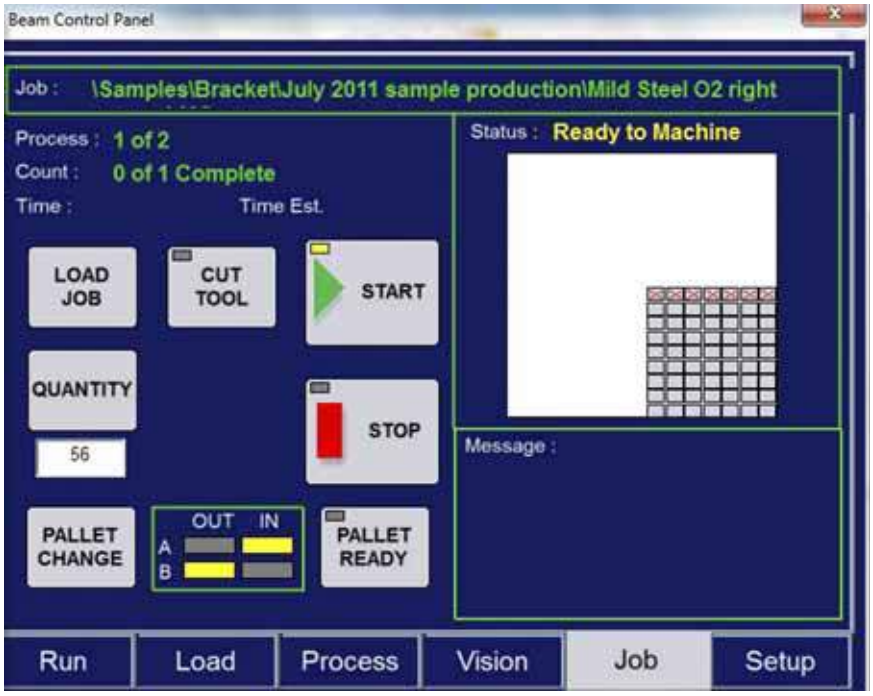


Figure 4-10. Job Tab with Step and Repeat Job Loaded and Steps De-Selected

Normal Shut-down (System Power-off)

1. When the system is parked or homed, turn the power key to the OFF position.
2. Close the HMI window and other programs running on PC.
3. Turn off main power switch.
4. Lock out utilities using facility lockout systems.

Emergency Shut-down

Press the Emergency Stop button to immediately shut down the machine.

NOTICE

The Emergency Stop button renders the normal operator access areas of the machine safe. It does NOT remove dangerous voltages from inside the cabinets. The Emergency Stop is NOT a substitute for Lockout / Tagout.

SECTION FIVE: SYSTEM SOFTWARE

Human Machine Interface (HMI)

The HMI is a Windows application that allows the user to control the functions of the META 10C via a touchscreen interface on the PC attached to the system. The HMI application is used to control the standard operations of the META 10C, the optional Vision system and the optional manual and automatic pallet exchange table.

Figure 5-1. BeamHMI Icon

Double-click the BeamHMI icon (See Figure 5-1)to open the HMI program. A window will appear indicating the communication status of the META 10C with the Internet. The Run Tab of the HMI follows.

Run Tab

The Run Tab (See Figure 5-2) is the primary control center of the META 10C. There are four sections of the Run Tab:

1. The Status Panel (See Figure 5-3) displays information about the status of the machine and lists all of the cutting parameters of the current cutting file. During the machining job, it updates the process and layer being machined.
2. The Control Panel contains all of the control buttons and settings to operate the META 10C.
3. The Tabs Panel allows access to the other windows of the HMI.

Status Panel

The first row of the **Status Panel** displays:

- **Filename** of job file currently loaded;
- **Process** number and total number of process steps;

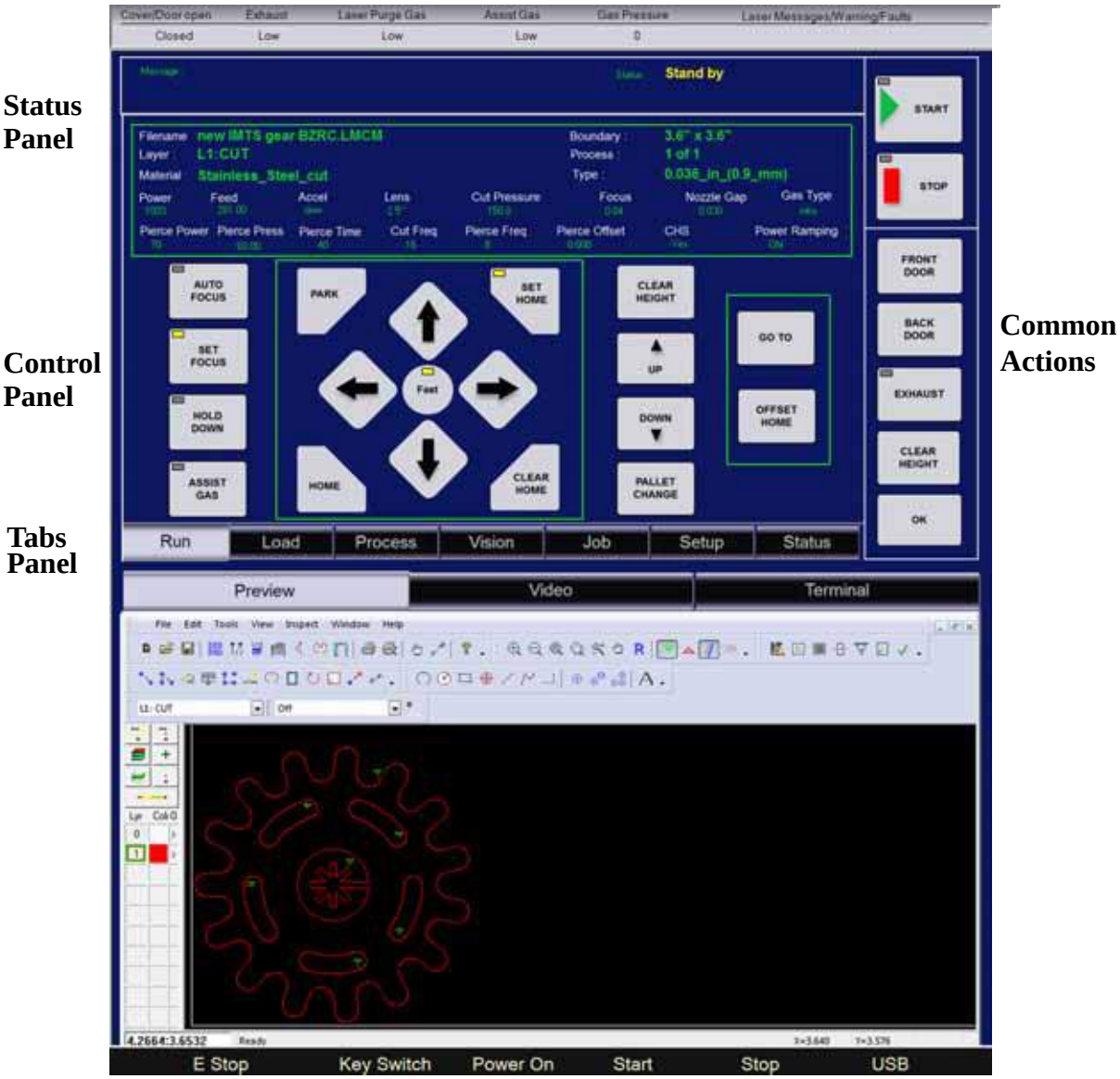


Figure 5-2. Run Tab of HMI

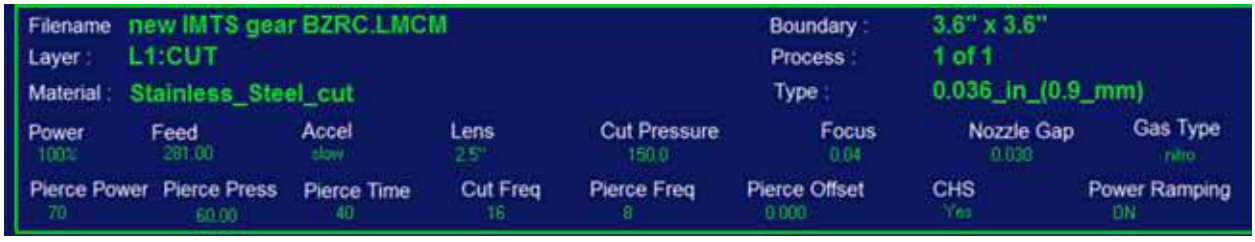


Figure 5-3. Status Panel of Run Tab

- **Status** of the machine. Possible statuses include Standby, Ready to Machine, Machining, Pause, Stopped and other error

codes if an interlock is tripped during machining. The Status field flashes during operation of the machine.

The second row of the Status Panel displays:

- **Layer** name the processed entities are on.
- **Material** field from the process table.
- **Type** field from the process table.
- Maximum **boundary** size of the file.

The third and fourth rows display:

- **Power** (laser power in %)
- **Feed** (in/min)
- **Pierce**
  - Time in milliseconds (left value). If this time is zero there will be no pierce.
  - Power (in %)
- **Focus offset** in inches (from nominal material thickness).
- **Acceleration** (slow, medium and fast)
- Assist gas **pressure** (psi)

Control Panel

The buttons of the Control Panel and the other tabs of the HMI fall into three categories:

1. **Toggle buttons** - Tap once to enable. Tap again to disable. These are identified by a rectangle indicator “light” in the upper-left corner of the buttons. It will turn yellow to indicate enabled and gray to indicate disabled.
2. **Action buttons** - Tap button to execute the associated action.
3. **Movement buttons** - Hold down to move in the indicated direction.
4. **Parameter buttons** - Tap button to allow the input of a value to the parameter associated with the button (See **Process Tab** for detailed instructions). The value of the parameter must be within a specific range.

The buttons are:

- **AUTO FOCUS** (toggle) - Activates the focus sensor. Enabling this for all processes is recommended, and it is enabled by default when the system is turned on. At the beginning of a job process, the sensor flag is lowered prior to the plenum rising on the Z-axis. The sensor flag contacts the job material and retracts, causing the plenum to stop and setting the focus height.
- **SET FOCUS** (toggle) - Manually sets the focus height of the META 10C for the next process. Raise or Lower the plenum on the Z-axis to the desired cutting height and press the button. The indicator light will stay on.

NOTICE!

Set Focus does NOT override Auto Focus. Auto Focus must be

NOTICE!
Avoid crashing the nozzle into the plenum when using Manual Focus. Damage to the META 10C may result.

It is recommended that the META 10C be run in Auto Focus mode until a high level of familiarity with the META 10C is achieved.

- **HOLD DOWN** (toggle) - Opens the pneumatic damper which allows the exhaust fan to draw air through the plenum. This applies suction to the process material to hold it down to the plenum.
- **ASSIST GAS** (toggle) - Activates the cutting assist gas, which is directed onto the job material via a nozzle on the cutting head. Different types of gas at different pressure settings are employed to improve the processing of a wide variety of materials.
- **PARK** (action) - Moves the cutting head to a predetermined Park location at top speed. The Park location ideally places the cutting head out of the operator's way when loading and unloading process material.
- **HOME** (action) - Moves the cutting head to the predetermined Home location at top speed. At system power up, this button is used to find the Home location for the X,Y and Z axes.

- **SET HOME** (action) - Reset the Home location to the current laser cutting head location for the X and Y axes only. The indicator light is yellow when the Home position is not at the default (0,0).
- **CLEAR HOME** (action) - Sets the Home location to the default (0,0) position for the X and Y axes only.
- **DIRECTION ARROWS** (action) - Moves the cutting head in the indicated direction (Left, Right, Forward and Backward).
- **FAST** (toggle) - Toggles between Fast and Slow speeds for the Direction Arrow buttons. At Fast speed (indicator light is yellow), a single press of a Direction Arrow button moves the cutting head 0.025 mm (0.001 in.). Holding down the Direction Arrow button moves the cutting head at speed.

NOTICE!
When setting the Clearance Height, be sure to consider the maximum thickness of the material or fixture in use. Setting a Clearance Height that is too high can cause the plenum to crash into the cutting nozzle and possibly damage the system.

- **UP ARROW** (action) - Moves the plenum up (positive) on the Z-axis.
- **DOWN ARROW** (action) - Moves the plenum down (negative) on the Z-axis.

The Up and Down Arrow buttons behave the same as the Direction Arrow buttons. However, use caution when raising the plenum as the process material or plenum itself can crash into the cutting nozzle. Due to the crash sensor, this will stop the system, but may still cause damage.

NOTICE!
When raising the plenum, it is possible for the plenum or process material to crash into the cutting nozzle. This may cause damage to the system and/or process material.

- **PALLET CHANGE** (action) - This function is only available with the optional Automatic Exchange Table. The action of this button is configured in the SETUP tab, under PALLET TRANSFER - TRANSFER MODE.

Common Actions

The Common Actions are actions that may generally be performed on any tab of the HMI.

- **START** (toggle) - Initiates the current process. When this button is pressed, it will change into a PAUSE button. If the PAUSE button is pressed before the process completes, the META 10C will enter Pause Mode, and button's indicator light will flash yellow once. The Status Panel will indicate Pause Mode and the Pause Mode Timer. Pressing the PAUSE button will resume the process.

NOTICE!
After pressing Pause, do NOT open the cover until all motion stops. The laser shutter will close when the cover is opened and the cut will not be complete when the process is restarted.

While in Pause Mode, the gantry may be safely moved, allowing for adjustments or examinations of the process materials. The linear encoders of the META 10C allow the gantry to return exactly to the previous process point, even when moved.

Opening the Top Cover, Front Door or Rear Door during a process will either pause or stop the META 10C, depending on a parameter setting. The motion of the gantry will stop in the same way as pressing the PAUSE button, however the META 10C will not complete its current vector because the shutter will close, disabling the laser, before the vector completes. When the cover is closed, the META 10C will restart the process automatically without pressing the START button if the parameter is set to pause. If the parameter is set to stop, the job will not resume.

It is recommended that the PAUSE button is used to interrupt a process instead of opening the cover. This will ensure that the entire process is completed properly.

While in Pause Mode, the PAUSE and START button will be ignored if the cover is open.

The operator can press the STOP button to end the process completely.

- **STOP** (action) - Terminates the current process.
- **FRONT DOOR** (toggle) - Toggles the front door of the LMT system open or closed.
- **BACK DOOR** (toggle) - Toggles the back door of the LMT system open or closed.

- **EXHAUST** (toggle) - Turns the exhaust fan on or off if the exhaust system is connected to the optional switch closure connector (relay) or tied into the customer's exhaust system. Otherwise, this button illuminates when a job file is loaded but will have no other function.
- **CLEAR HEIGHT** (action) - This button toggles the cutting bed between the Clearance Height and Load Height settings from the Setup Tab (See "Setup Tab" on page 5-19.
- **OK** (toggle) - Used to calibrate the Vision system.

Load Tab

The Load Tab (See Figure 5-4) is used to find and load .LMCM process files. There are four sections of the Load Tab:

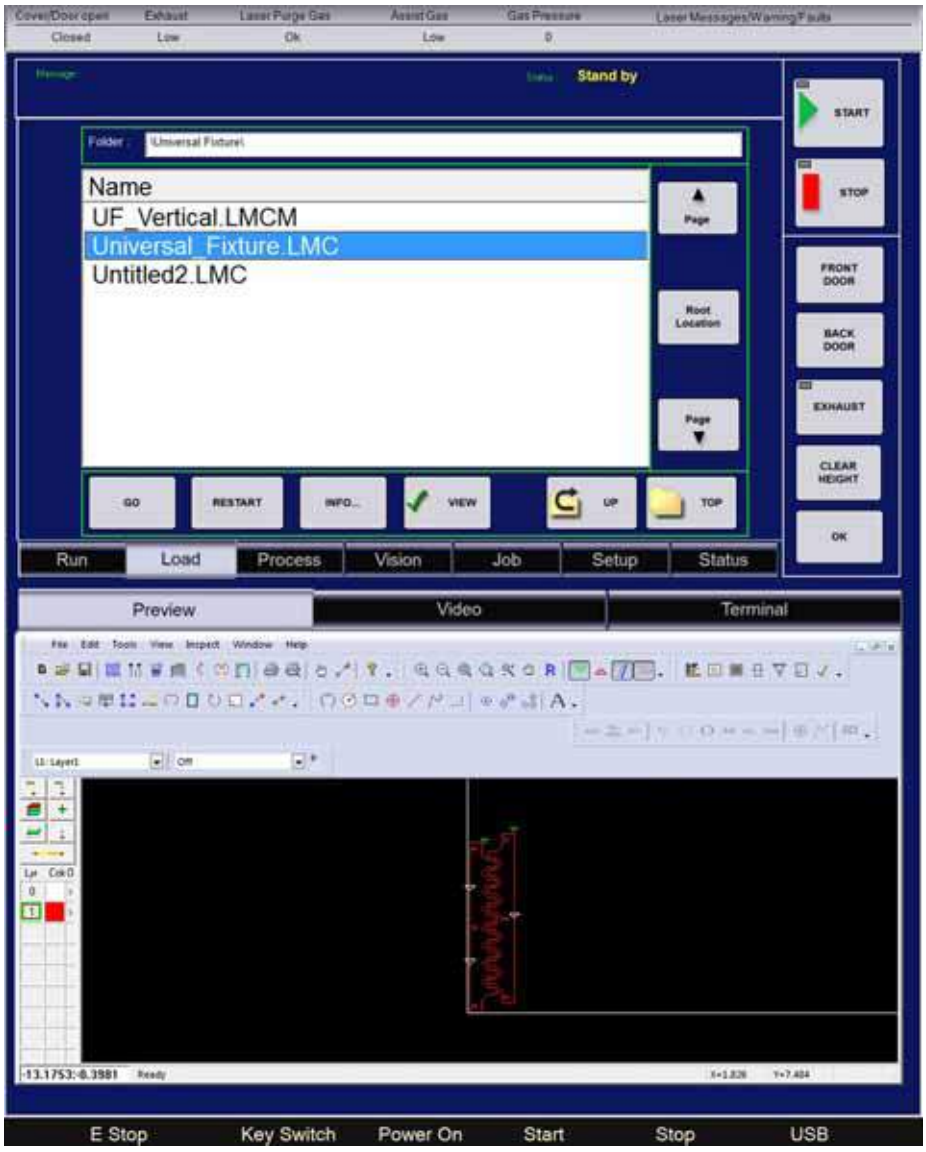


Figure 5-4. Load Tab of HMI

1. The Folder Panel indicates the current directory. The root directory is identified in the Setup Tab via the Network Path option of the Network menu.

2. The Folder Structure is a scrolling window that displays the sub folders and job files under the path of the Folder Panel. Tapping or clicking on a sub folder opens that sub folder. Tapping or clicking on a job file selects and highlights the file, which can then be loaded by pressing the **GO** button.

3. The Navigation Buttons consist of action buttons that interact with the Folder Structure and job files.

4. The Preview Tab displays the loaded part in LaserLink™.

Folder Panel

- **Page** ∧ (action) - Scrolls the File Structure list up.
- **Page** ∨ (action) - Scrolls the File Structure list down.
- **GO** (action) - Loads the highlighted job file.
- **RESTART** (action) - Allows the job to be restarted at any point without re-cutting areas.
- **INFO...** (action) - Displays details about the highlighted job file.
- **UP** (action) - Opens the parent directory of folder currently displayed in the File Structure.
- **TOP** (action) - Opens the root directory in the File Structure.

After a job file is loaded by pressing GO, the Status Panel of the Run Tab window (See Figure 5-5) displays information relating to the job file and the process settings it specifies.

Figure 5-5. Status Panel of Run Tab with Job File Loaded

Process Tab

The Process Tab (See Figure 5-6) allows the process parameters of the loaded job file to be manipulated. The Process Tab is divided into three sections:

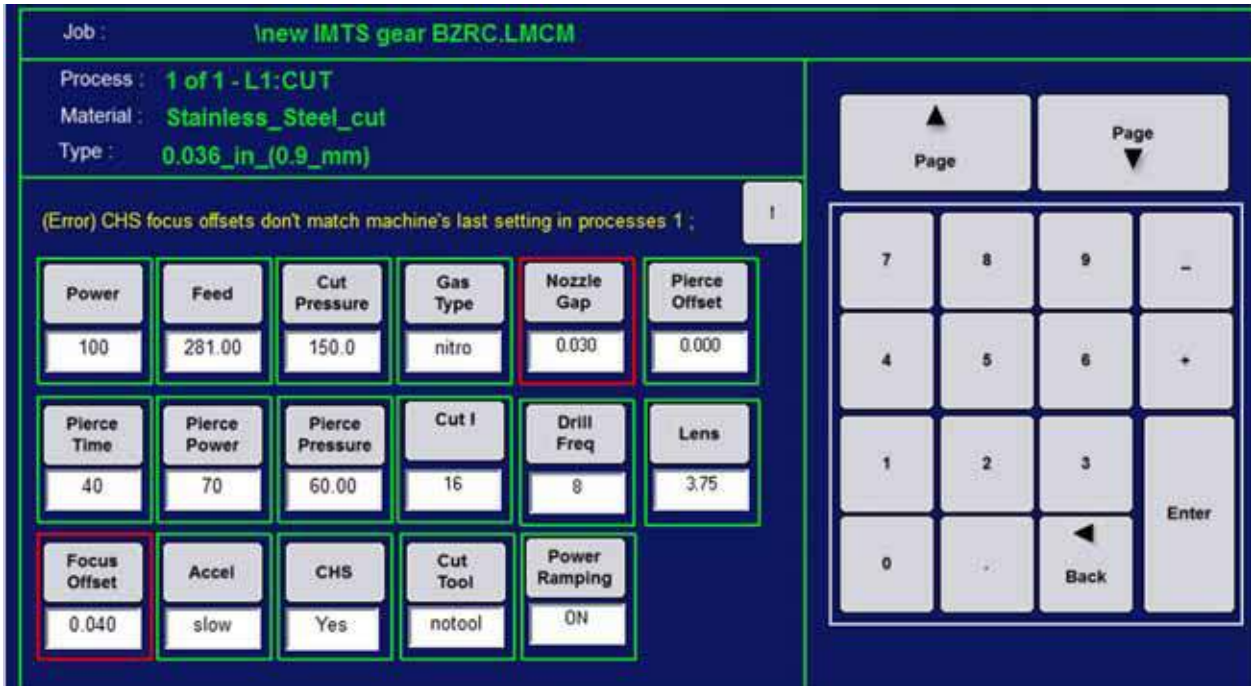


Figure 5-6. Process Tab of HMI

1. **Job Info** - Displays the selected **Process** layer of the loaded Job file, the **Material** setting from the material processing database and the layer **Type**.
2. **Adjustable Process Parameters** - Stores and displays parameters for the process layers of the loaded job file. These parameters can be adjusted via the keypad.
3. **Keypad** - Standard keys used to enter in values for parameter buttons.

The buttons of the Process Tab are as follows:

- **POWER** (parameter: 0-100%) - Controls the set point for the laser power controller. This parameter represents the average laser power output when the META 10C is processing at the full Feed Rate. The laser power controller varies the power of the laser during acceleration and deceleration to maintain a consistent cut quality.
- **FEED** (parameter: 1-2,000 in/min) - Controls the feed rate of cutting operations. Movements between cuts, called "slews," are not influenced by the feed rate. The feed rate may vary

during a cut due to decisions made by the profiler in the META 10C controller during tool path optimization routines.

- **CUT PRESSURE** (parameter: 2-289 psi) - Controls the pressure of the (cutting) assist gas (See “Nitrogen Assist Gas System” and “Assist Gas Option System” on page 13 of Section 3: System Requirements.) during the cutting operation.
- **PIERCE TIME** (parameter: 0-10000 ms) - Controls the dwell time, in which the META 10C is stationary, during the pierce operation.
- **PIERCE POWER** (parameter: 0-100%) - Controls the laser power during the pierce operation.
- **PIERCE PRESSURE** (parameter: 2-289 psi) - Controls the (cutting) assist gas pressure used during the pierce operation.
- **FOCUS OFFSET** (parameter: +0.2 to -10 in.) - Controls the offset for the focus from the nominal focal point set by the Autofocus system. A negative number moves the focus head away from the cutting material. Use this setting to widen the laser spot for an increased line width during scoring, or to narrow the focus for increased power during cutting operations.
- **ACCEL** (parameter: Slow, Medium or Fast) - Controls the acceleration of the META 10C during cutting operations. The Fast setting minimizes run time and works well for most parts. Some small parts or complex geometries may show improved cut quality with slower acceleration.
- **PAGE** ∧ (action) - Scrolls up through the processes and/or layers in the process table for the loaded job file.
- **PAGE** ∨ (action) - Scrolls down through the processes and/or layers in the process table for the loaded job file.

To change a process parameter:

1. Tap the parameter button to be changed.
2. Use the keypad buttons to enter the value. Use the **Back** < button as necessary.
3. Tap the Enter button when done.

NOTICE!
The data value for each parameter must be entered using the on-screen keypad. Do NOT use the keyboard keypad.

Vision Tab & Video Tab

The Vision Tab (See Figure 5-7) is used to calibrate the Vision system and is used in conjunction with the Video Tab.

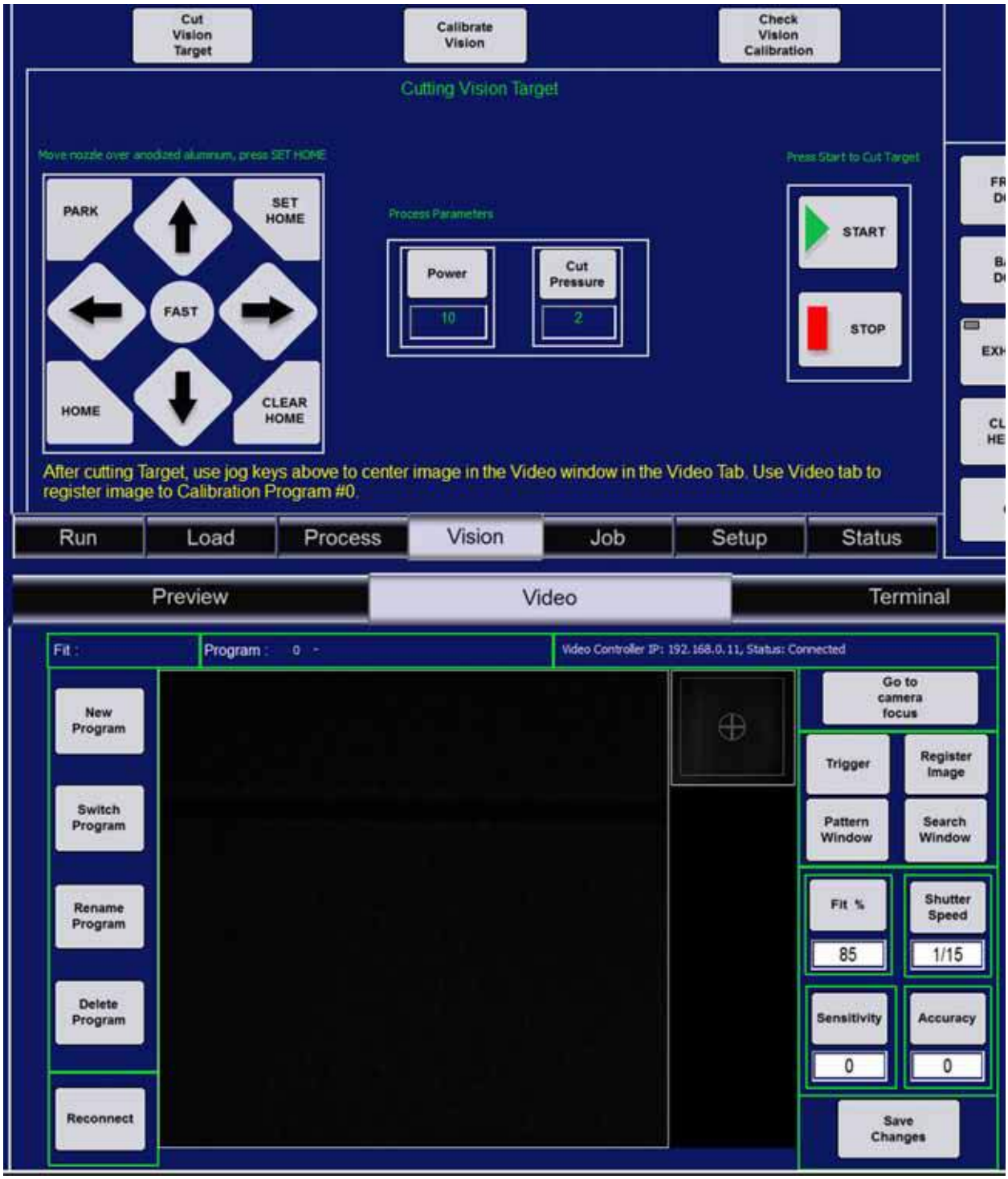


Figure 5-7. Vision Tab & Video Tab of HMI

4.

The buttons of the Vision Tab are as follows:

- **Cut Vision Target** (action) - Loads the standard Vision target .LMC file and runs the file using the Process Parameters specified on the Vision Tab.

  This action is performed in the factory to register the target mark with the Vision system; once registration is performed, the Vision system will recognize the registration mark and can adjust for rotation and scaling if enough registration marks are included in the .LMC file.

  As specified in the text above the keypad on the Vision Tab, it is recommended to use black anodized aluminum when cutting the Vision target, calibrating the Vision system and checking the Vision calibration due to the high contrast between the black anodized surface and the white marking created when etching aluminum with nitrogen assist gas. Other materials can be used, but you may need to adjust the camera settings using the Video Tab in order to ensure the Vision system recognizes the mark.

- **Calibrate Vision** (action) - Loads the standard Vision target .LMC file and runs the file using the Process Parameters specified on the Vision Tab.

  This action is performed in the factory to calibrate the Vision system camera to the motion controller of the LMT system. First, the standard Vision target is marked into the surface. The Vision system then acquires the mark and compares the target mark position and rotation to the expected position and rotation and calculates adjustments to the X-Offset and Y-Offset parameters. Next, the Vision system compares the scale of the target mark to the expected scale and calculates adjustment to the Scale parameter. Finally, the LMT system then marks “ticks” that bisect the target mark along the X and Y axes. After calibration, these “ticks” should be precisely between the quadrants of the target mark.

- **Check Calibration** (action) - Loads the standard Vision target .LMC file, runs the file using the Process Parameters specified on the Vision Tab and marks "ticks" to display the current calibration of the Vision system to the LMT system motion controller.

  Perform this action if you suspect the LMT system is not accurately accounting for rotation or scaling when using the appropriate Vision registration marks. If the "tick" marks are not exactly between the quadrants of the Vision target, perform the Calibrate Vision action.

- **PARK** - See Run Tab above.
- **HOME** - See Run Tab above.
- **SET HOME** - See Run Tab above.
- **CLEAR HOME** - See Run Tab above.
- **DIRECTION ARROWS** - See Run Tab above.
- **FAST** - See Run Tab above.
- **Power** - See Process Tab above. Only enough power to make a distinguishable mark is needed.
- **Cut Pressure** - See Process Tab above.
- **START** - See Run Tab above.
- **STOP** - See Run Tab above.

The features of the Video Tab are as follows:

1. Status bar - Displays statuses relevant to the registration mark and Vision system video controller.
2. Program buttons - Allow the operator to create new registration marks and manage existing registration marks.
3. Vision system buttons - Allow the operator to perform various functions.
4. Video window - Displays a live feed from the Vision system camera.
5. Program preview window - Displays an image preview of a stored registration mark.

The status bar of the Video Tab is composed of:

- **Fit** - Displays the fit of a detected registration mark to a stored registration mark in percent (%).
- **Program** - Displays the storage number and name (if specified) of a registration mark.

- **Video Controller IP** - Displays the IP address of the Vision system video controller board.
- **Video Controller Status** - Displays the connection status between the LMT system and the Vision system video controller; either “Connected” or “Disconnected”.

The Program buttons are as follows:

- **New Program** - Creates a new registration mark entry.
- **Switch Program** - Changes the registration mark that the Vision system will recognize and allows the operator to edit its parameters.
- **Rename Program** - Allows the operator to change the name of a registration mark.
- **Delete Program** - Deletes the current registration mark.

The Vision system buttons are:

- **Go to camera focus** (action) - Select the focus position by jogging the cutting head over the location. Use the pointing diode as a guide. Tap this button to:
  - automatically move the camera directly over the focus position
  - automatically adjust the Z-axis to camera focus height
- **Trigger** - Pressing the Trigger button scans the registration mark and returns a match (Fit) in percent (%).
- **Register Image** - Assigns the captured image as a registration mark for the current program.
- **Pattern Window** - Allows the user to specify the specific area that contains the registration mark. All features within the Pattern Window are considered elements of the registration mark.
- **Search Window** - Allows the user to specify the area in which the Vision system searches for a registration mark.
- **Fit %** - Allows the operator to adjust the required Fit percent (%) for the Vision system to recognize a registration mark.
- **Shutter Speed** - Allows the operator to adjust the exposure of the Vision system camera (in fractions of seconds). A longer exposure gathers more light and may increase the Fit % for a particularly dark registration mark.
- **Sensitivity** - Do not adjust unless instructed by Coherent Product Support.

- **Accuracy** - Do not adjust unless instructed by Coherent Product Support.

To change a Vision parameter:

1. Tap the parameter button to be changed.
2. Use the keypad buttons to enter the value. Use the **Back <** button as necessary.
3. Tap the Enter button when done.

NOTICE!
The data value for each Vision parameter must be entered using the on-screen keypad. Do NOT use the keyboard keypad.

Job Tab

The Job Tab (See Figure 5-8) is used to configure step and repeat job files (See “Step and Repeat” on page 16 of Section 4: Operation) and to control the optional automatic pallet exchange system.The buttons of the Job Tab are as follows:

- **LOAD JOB** (action) - Opens the Load Tab.
- **CUT TOOL** (action) - Performs a Cut for the tooling defined in the tooling layer in the currently loaded .LMCM file.
- **START** (toggle) - Initiates the current process. When this button is pressed, it will change into a PAUSE button. If the PAUSE button is pressed before the process completes, the META 10C will enter Pause Mode, and button’s indicator light will flash yellow once. The Status Panel will indicate Pause Mode and the Pause Mode Timer. Pressing the PAUSE button will resume the process.
- **STOP** (action) - Terminates the current job.
- **QUANTITY** (parameter) - Stores the total number of parts to be cut in a Step and Repeat job.
- **PALLET CHANGE** (action) - This function is only available with the optional Automatic Exchange Table. The action of this button is configured in the SETUP tab, under PALLET TRANSFER - TRANSFER MODE.
- **Status** - Displays a representation of the loaded step and repeat job as a grid. Identifies the part being cut as well as the parts that have already been cut in the current process. The operator can also “cross out” the parts by clicking on the grid. Parts with red cross marks will not be cut.
- **Message** - Displays error messages and prompts for the operator.

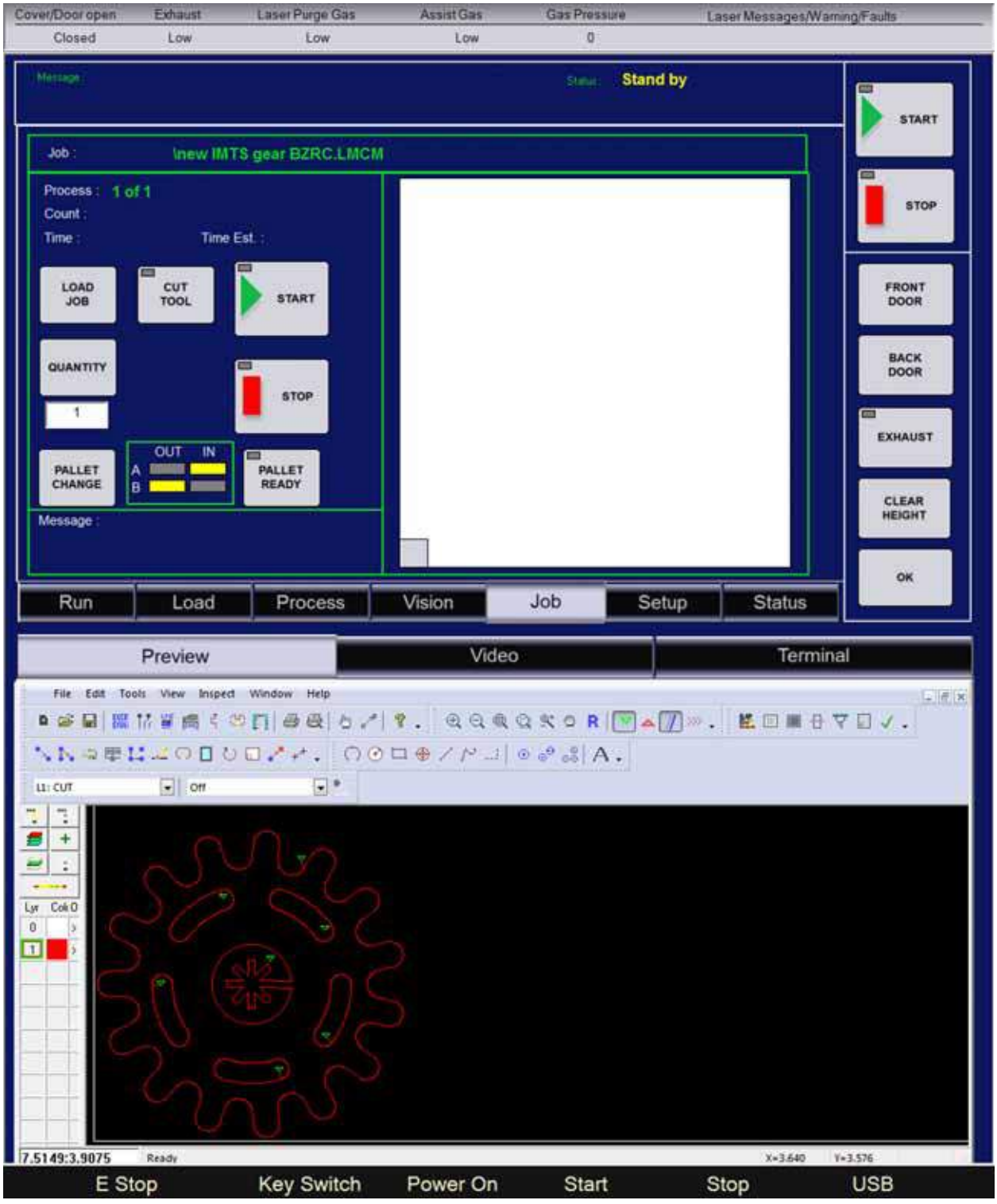


Figure 5-8. Job Tab of HMI

Setup Tab

The Setup Tab is used to configure the META 10C and to setup communications between the META 10C and the network.

The Setup Tab is divided into five sub-tabs:

1. **Laser/Nozzle** - Contains parameters related to the laser power, cutting rate, focus and assist gas pressure.
2. **Pallet/Z** - Allows the operator to set the Clearance Height and Load Height. Z Lift settings for Slew, SR or Array and Z Cal are also located in this Tab (see page 5-21).
3. **Home/Park** - Allows the operator to change the home and park positions (see page 5-22.
4. **CHS/Vision** - Allows the operator to calibrate and adjust the Capacitive Height Sensor (CHS) and the optional Vision system (see page 5-23).
5. **Logging/Gases** - Displays LMT system statistics and provides options for data logging and assist gas selection (see page 5-24).

The Laser/Nozzle tab contains the following parameters:

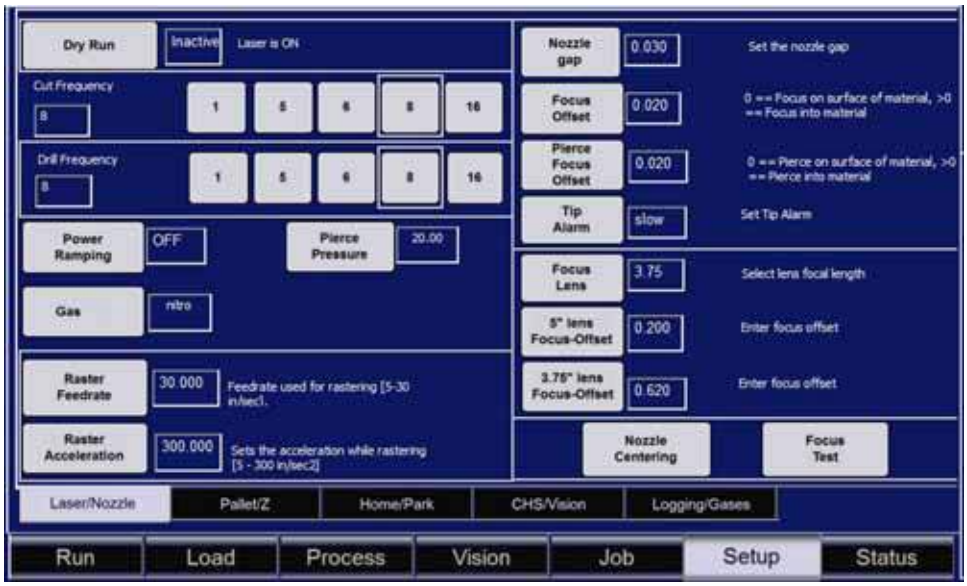


Figure 5-9. Laser/Nozzle Tab of Setup Tab

- **Dry Run** (Active or Inactive) - Allows the cutting head to run through the loaded job without the laser firing. Active - Laser will fire. Inactive - Laser will not fire.
- **Cut Frequency** - Sets the laser frequency to 1, 5, 6, 8, 16 kHz during a cut operation.

- **Drill Frequency** - Sets the laser frequency to 1, 5, 6, 8, 16 kHz during a pierce operation.
- **Power Ramping** - Allows the operator to toggle power ramping.
- **Gas** - Allows the operator to select the desired assist gas.
- **Pierce Pressure** (2-289 psi) - Sets the gas pressure to be used during a pierce operation.
- **Raster Feedrate** (5-30 in/sec) - Feedrate used for rastering.
- **Raster Acceleration** (5-300 in/sec^2) - Sets the acceleration when rastering.
- **Nozzle Gap** (in.) - Sets the distance between the nozzle and the workpiece.
- **Focus Offset** (in.) - Sets the location of the focus of the laser beam during a cut operation. When set to 0, the beam is focused on the surface of the workpiece. When set above 0, the focus is within the workpiece.
- **Pierce Focus Offset** (in.) - Sets the location of the focus of the laser beam during a pierce operation. When set to 0, the beam is focused on the surface of the workpiece. When set above 0, the focus is within the workpiece.

NOTICE!
Pierce Offset value cannot be greater than Focus Offset.

- **Tip Alarm** (slow or fast) - Sets the tip alarm response time.
- **Focus Lens** (3.75" or 5") - Indicates what focal lens is used.
- **5" Lens Focus-Offset** - Indicates the focus offset of the 5" focus lens.
- **3.75" lens Focus-Offset** - Indicates the focus offset of the 3.75" focus lens.
- **Nozzle Centering** - Fires the laser at a low setting to allow the operator to determine whether the laser beam is centered in the nozzle.
- **Focus Test** - Runs the focus test .LMC file to allow the operator to determine whether the laser beam is in focus on a test material.

The Pallet/Z tab contains the following parameters:

Figure 5-10. Pallet/Z Tab of the Setup Tab

- Z-Axis
  - **Clearance Height** (-1 to -8.5 in.) - Sets the cutting bed ClearHeight position. This is the position from which the Auto Focus routine begins.
  - **Load Height** (-1 to -7 in.) - Sets the height that the cutting bed moves to once a job is completed.
  - **Z lift for slew moves** - Distance the Z-Axis moves to for MA commands.
  - **Z lift for Array Steps** - Distance the Z-Axis moves down for array steps.
  - **Z lift for SR moves** - Distance the Z-Axis moves for ERT commands for the SR.
- **Pallet** - Only available for LMT systems with optional PA table or 8-foot pallet.
- **8 Ft. Clearance Ht.** - Clearance height for optional 8 foot pallet.
- **Pallet Transfer Mode** - Changes the transfer mode of the PA table.
- **Enable/Disable Pallet Drives** - Allows the operator to toggle the drive motors of the PA table.

The Home/Park tab contains the following parameters:

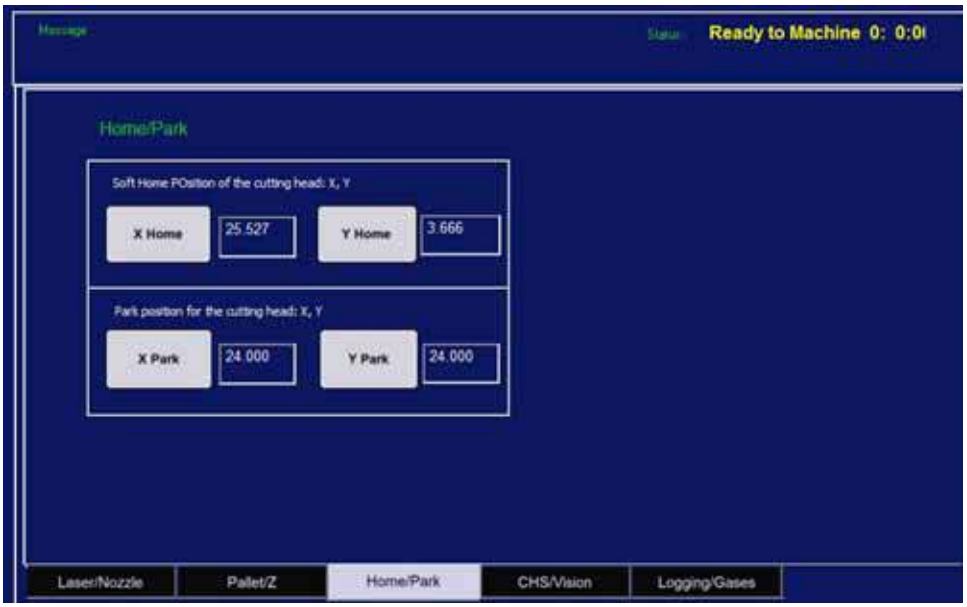


Figure 5-11. Home/Park Tab of the Setup Tab

- **X Home Position** (0 - 48 in.) - Sets the soft home position in the X-axis.
- **Y Home Position** (0 - 48 in.) - Sets the soft home position in the Y-axis.
- **X Park Position** (0 - 48 in.) - Sets the park position in the X-axis.
- **Y Park Position** (0 - 48 in.) - Sets the park position in the Y-axis.

The CHS/Vision Tab contains the following parameters:

Figure 5-12. CHS/Vision Tab of the Setup Tab

- CHS Calibration/Testing
  - **CalibrateCHS** - Performs the calibration procedure for the CHS system.
  - **Check Graph-Cap** - Performs a validation procedure for the CHS system.
  - **CHS Status** - Displays the status of the CHS system when calibrating or validating.
- Vision Delta Offsets
  - **Program Number** - Selects the stored registration mark.
  - **Delta(X)** - Allows the operator to specify the offset for the X-axis.
  - **Delta(Y)** - Allows the operator to specify the offset for the Y-axis.

The Logging/Gases Tab contains the following parameters:

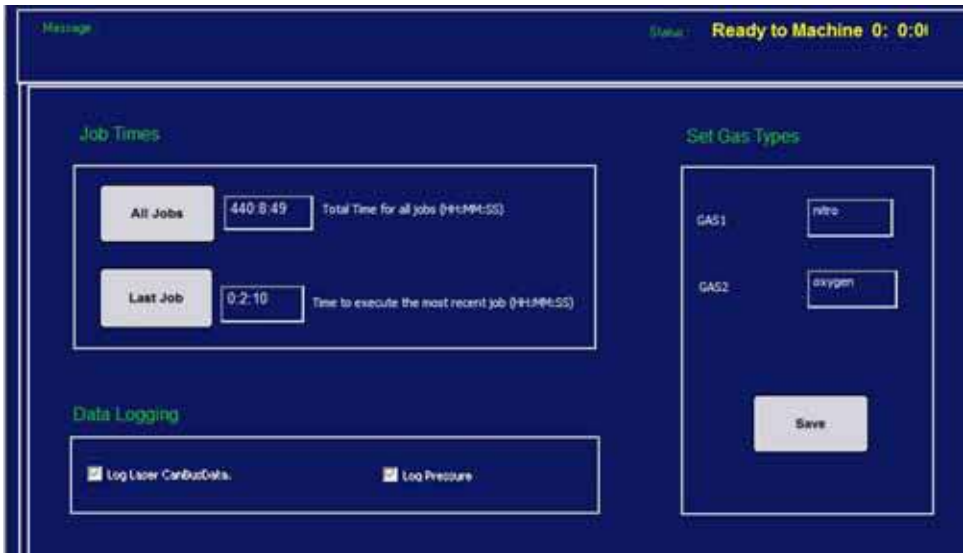


Figure 5-13. Logging/Gases Tab of the Setup Tab

- Job Times
  - All Jobs - Displays the total time spent performing jobs.
  - Displays the time took to execute the most recent job.
- Data Logging
  - Log Laser CanBusData. - Outputs the Laser CanBusData to the log file.
  - Log Pressure - Outputs the assist gas pressure to the log file.
- Set Gas Types
  - GAS1 - Allows the operator to set the type of assist gas in the GAS1 position.
  - GAS2 - Allows the operator to set the type of assist gas in the GAS 2 position.
  - Save - Saves the gas types.

Status Tab

The Status Tabdisplays a running data log that is useful for diagnostics.

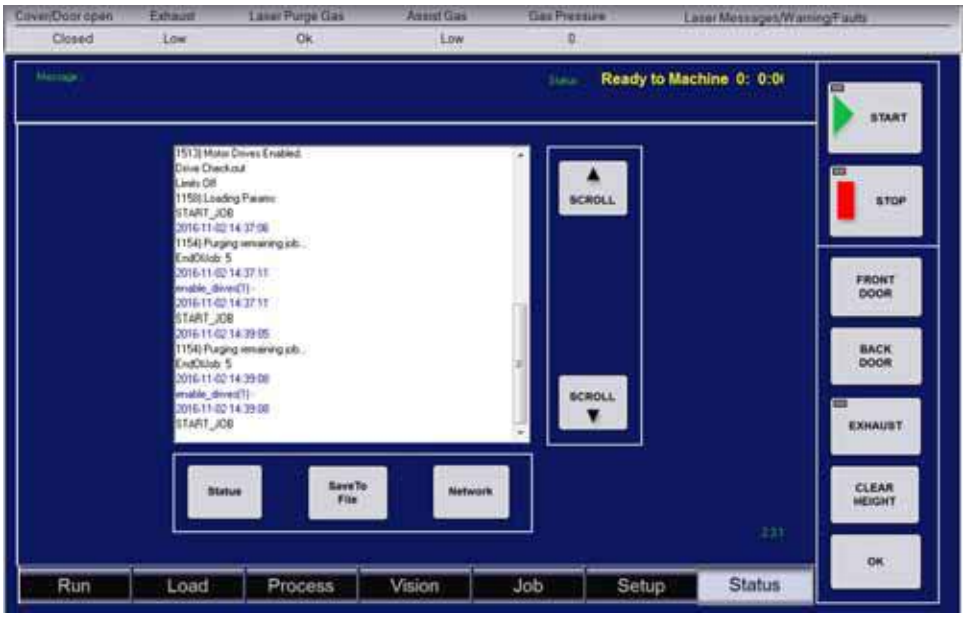


Figure 5-14. Status Tab

The features of the Status Tab are as follows:

- Status - Displays the current status of the data log.
- Save to file - Saves the data log to a file on the LMT system computer.
- Network - Opens the network connection settings.

Terminal Tab

The Terminal Tab is a command line interface that allows the operator to interact with the individual control systems of the LMT system, perform diagnostics and issue commands to controller programs.

The Terminal Tab should not be used unless explicitly directed as part of a procedure in this Operator's Manual or instructed by Coherent Product Support.

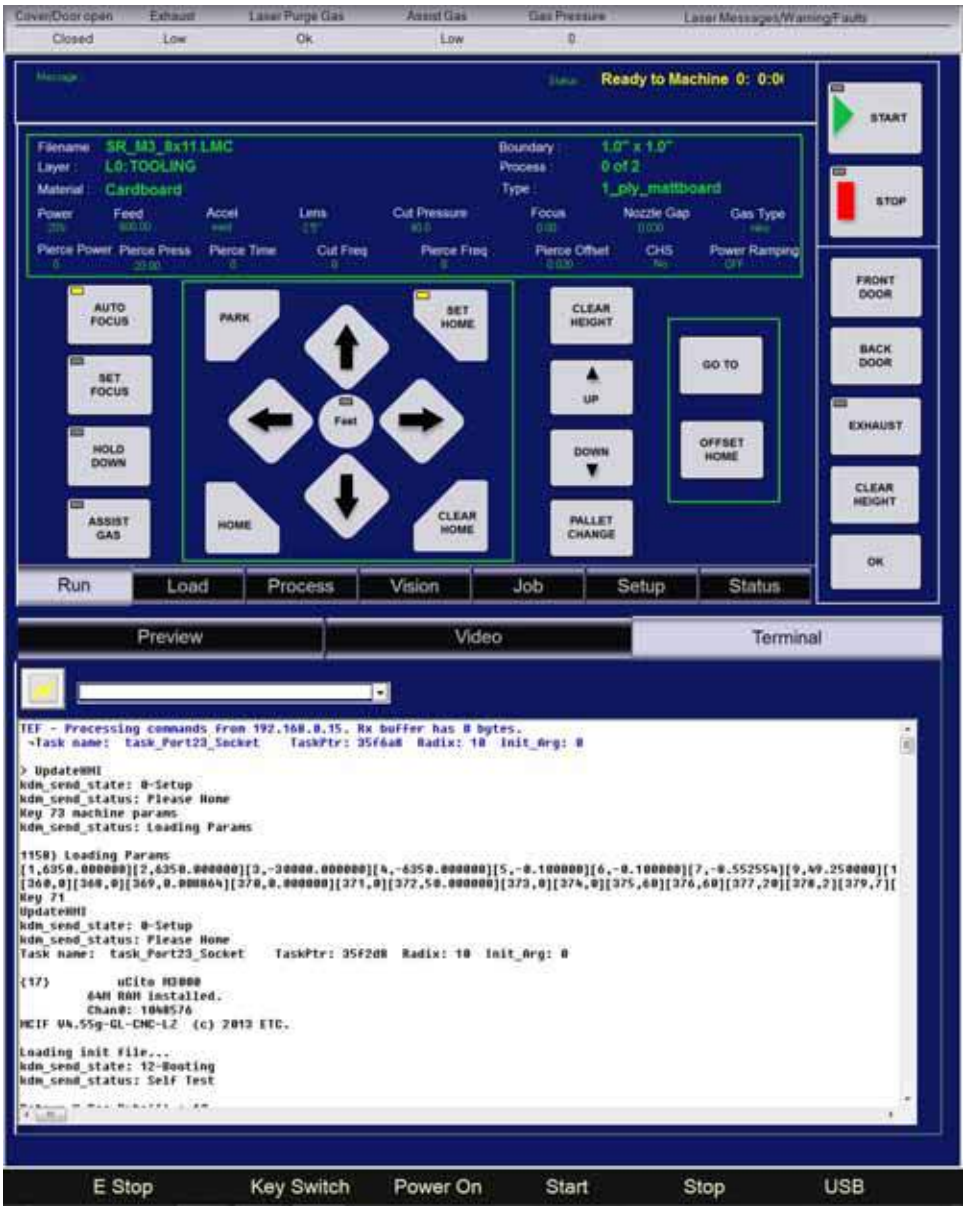


Figure 5-15. Terminal Tab

SECTION SIX: MAINTENANCE AND TROUBLESHOOTING

Maintenance Overview

In order to maximize the lifetime of the META 10C system a routine maintenance schedule must be followed. This section covers the specifics of which components require maintenance, how often each component must be inspected or replaced, and the proper procedures for replacement.

Remember that the META 10C system contains a Class 4 laser system with inherent hazards. Serious injury, blindness or death can result if general safety and common sense are ignored. The systems Main Circuit Breaker must be off before attempting any of the maintenance procedures in this section.

NOTICE!
Only those technicians and operators familiar with the system operation should perform any of the following maintenance procedures outlined in this section.

Review the Safety Section and fully understand the hazards associated with this product before attempting any work.

Maintenance Procedures

Following are maintenance procedures that should be performed regularly by the user as specified in Table 6-1.

Table 6-1. Recommended Frequency of Maintenance Procedures

SYSTEM FEATURE	PROCEDURE	FREQUENCY
Copper Nozzle	Clean (replace as necessary)	Daily
Focus Lens	Clean	Weekly (or more)
M4 Mirror	Inspect and clean if necessary	Weekly
Vision Camera Lens	Inspect and clean if necessary	6 Months
Vision Camera LEDs	Inspect	6 Months
Door Struts	Check	6 Months

Table 6-1. Recommended Frequency of Maintenance Procedures

SYSTEM FEATURE	PROCEDURE	FREQUENCY
Plenum and Pallet	Clean	Daily
Pallets	Check grip tape	6 Months
X-Belt	Check	6 Months
Water and Gas Hoses	Check for leakage	6 Months
Exhaust Duct and Hoses	Check	6 Months
Coolant Water	Perform coolant water service	6 Months
Z-Axis and Ball Screws	Grease	6 Months
Focus Sensor	Clean	Monthly

General Maintenance

Coolant Water Service

Clean Cooling Water

1. Turn off the LMT system.
2. Turn off the chiller.
3. Drain the chiller.
4. Add new water to the chiller.
5. Turn on the chiller.
6. Turn on the LMT system.

Optishield®: First Time Use

1. Flush cooling circuit with distilled water.
2. Calculate system capacity/volume in gallons. Fill chiller with a 5% solution of Optishield® and distilled water (example: 1 gallon of Optishield® to 19 gallons of water).
3. Turn on the chiller and let this solution circulate for approximately 30 minutes.
4. Drain the fluid. Do NOT rinse the system.
5. Fill chiller with a 10% solution of Optishield® and distilled water (example: 1 gallon of Optishield® to 9 gallons of water).

6. System is ready for use. Change fluid every 6 months. Store Optishield® at room temperature, above 60°F. Keep container closed when not in use.

Optishield®: After First Time Use

1. Drain used fluid from system. Dispose of according to local, state and federal regulations.
2. Fill chiller with a 10% solution of Optishield® and distilled water (example: 1 gallon of Optishield® to 9 gallons of water).
3. System is ready for use. Change fluid every 6 months. Store Optishield® at room temperature, above 60°F. Keep container closed when not in use.

Notes

If system has known corrosion problems, the system should first be treated and flushed with a mild cleanser. Contact OPTI TEMP for more details.

If system has algae problems, flush the system with a strong solution of hydrogen peroxide to kill the algae. OPTI TEMP also sells a product “Optishield Plus” that contains an algicide. Not available in Europe.

Pointing Diode Inspection

1. Turn on the LMT system.
2. Jog the cutting head over a flat sheet of material, such as cardboard.
3. Open the cover and look for the red dot of the pointing diode laser.
4. If the beam is faint or not visible, contact a Coherent service engineer.

Ball Screw Greasing

1. Raise the Z-axis pallet to the maximum in order to expose the ball screws (See Figure 6-2).
2. Inspect the ball screws for dust, dirt and debris.
3. Wipe the ball screws if necessary.
4. Add anti-fling, high-speed grease to each ball screw.

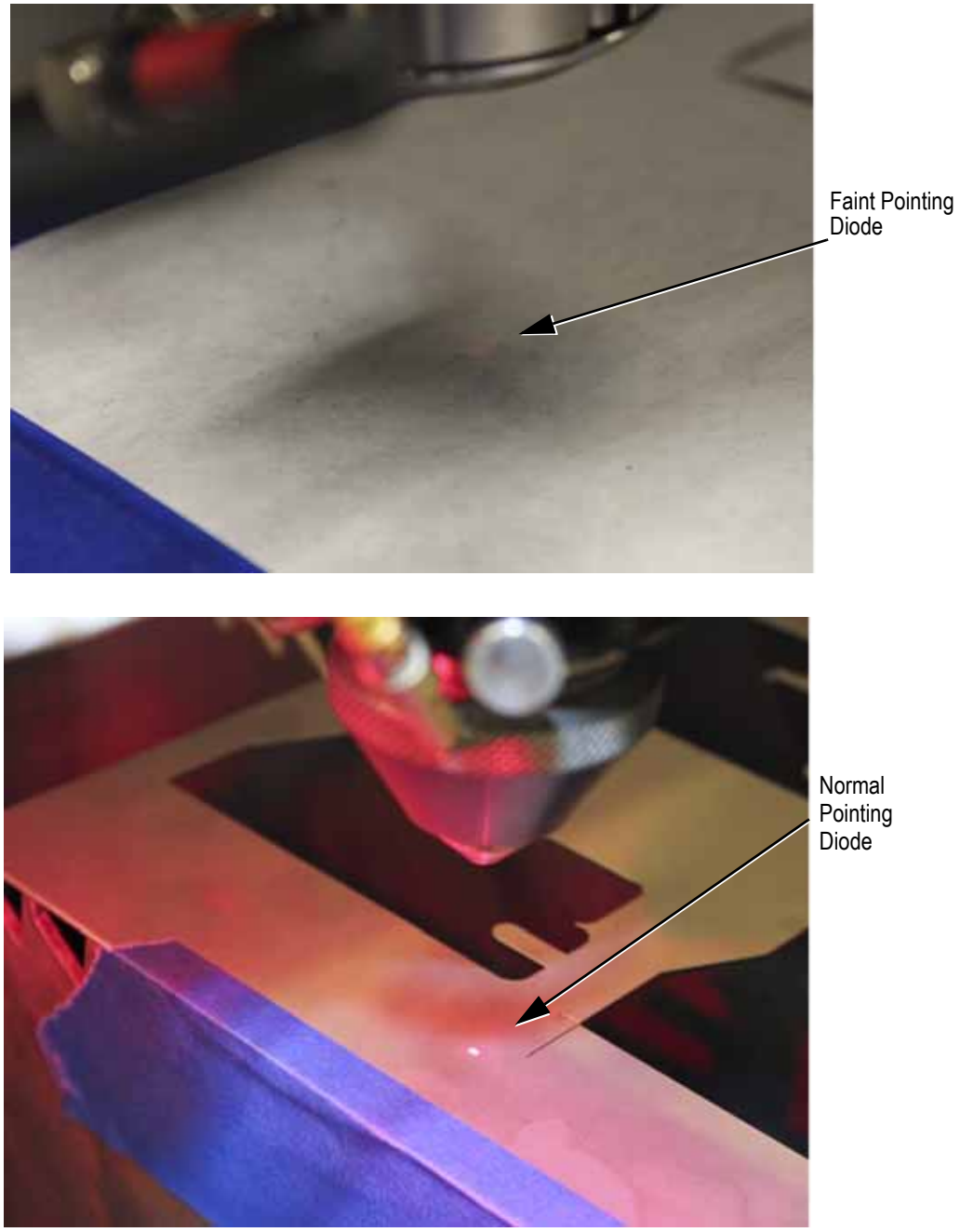


Figure 6-1. Pointing Diode (Faint Compared to Normal)

Figure 6-2. Ball Screw

Optics / Alignment & Focus

Focus Test and Adjustment Procedure

This test should be performed weekly to check the focus of the machine, and every time a focus lens is changed or cleaned.

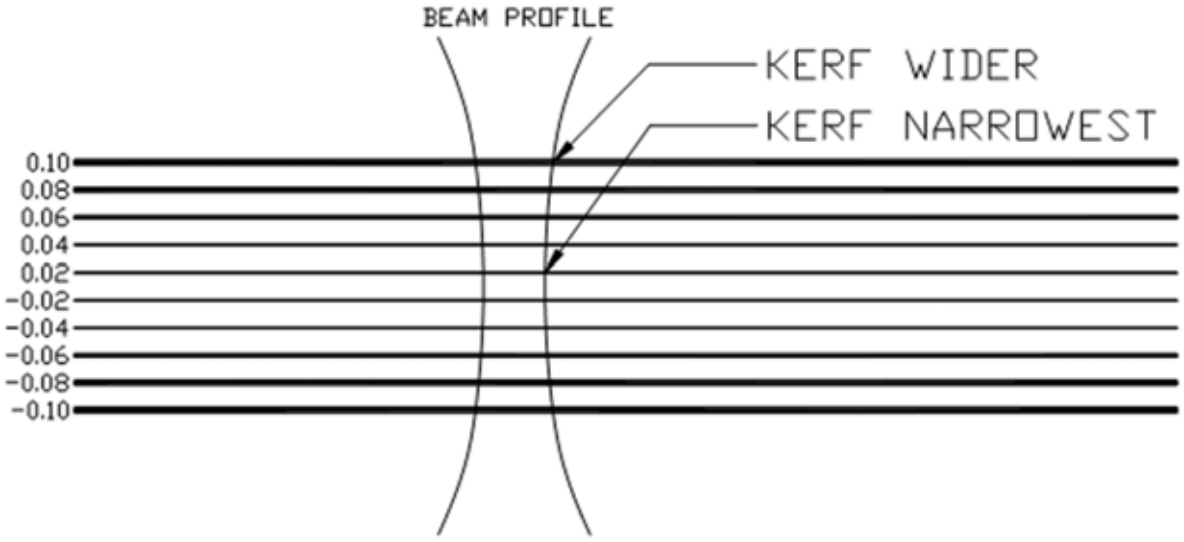
Introduction

The focus of the LMT is a very important parameter to maintain for consistent process results. As the focus changes the beam diameter will increase reducing the energy density therefore reducing the power. The focus profile is shaped like an hourglass. Small changes in focus have little effect however as the focus reaches +/- 0.06" the beam diameter will start to change quickly. (See figure below.) The objective for adjusting the focus is to give your process the biggest latitude. This is done by setting the middle of the hourglass at zero focus. This will allow for the largest variation in height change during a given cut. The focus test procedure can be performed every day if it is performed before running the first job of the day if process-critical applications are being used. Otherwise the process can be run at any appropriate interval depending on the process.

Focus Test

NOTICE!
Remove the copper nozzle before running this file to avoid a head crash.

1. From the service directory, run **focus_pwr10.lmc** on a piece of 1/4" plywood or MDF (Micro Density Fiberboard). 10 lines will be scored in the material at 10 different focus offsets (See Figure 6-3). Each resulting line corresponds to a different offset value, ranging from -0.10" which is the highest, to 0.10" which is the lowest.
2. Notice that the line thicknesses are paired and moving from the center out. A properly set focus height will result in each of these pairs having the same thickness. 0.20" should have the same thickness as -0.20". As the offsets become greater the pairs will have greater widths. If these pairs are not matched the focus offset must be adjusted. When inspecting line pair thicknesses, look to the left of the lines, as the material may be warped and the LMT system focuses to the left of the lines.



Dimensions in inches.

Figure 6-3. Beam Profile

3. In the control panel menu under Configuration/Focus Offset, select the appropriate lens setting and make the adjustment to the offset for that lens based on the focus test. Change the value in 0.02” increments and rerun the focus test.

   - If the thinnest lines are offset towards the bottom, the offset must be bigger. The offset is the distance between the end of the focus sensor and the optimal focus.
   - If the lines are offset towards the top the offset must be smaller.

4. Repeat this operation until a satisfactory result is achieved.

   - Once the beam is in focus and the Z-axis is calibrated, the Focus Height option of the Settings Tab of the HMI can be used to focus the beam for materials of different thicknesses.

- The Focus Offset parameter of the LaserLink™ Process Table can also be used to focus the beam for materials of different thicknesses. Make sure to set the Focus Height number to zero in the Settings Tab of the HMI when using Focus offset in LaserLink™.
- A combination of Focus Height in the Settings Tab of the HMI and Focus Offset in LaserLink™ can also be used to adapt to temporary fixtures.

Final Optic (Focus Lens)

The final optic must be inspected each day. If it is fogged or dirty it must be cleaned before using the Coherent Laser Machining Center. A special spanner wrench is supplied to remove the optic. The cleaning procedure will demonstrate apron installation and detailed instructions are available for future operators not trained during initial installation.

Cleaning the Final Optic

NOTICE!
Never handle optics with bare hands. Oils from human skin can cause optics to burn or deteriorate. Always use gloves or finger cots.

NOTICE!
Do NOT use suction devices for loading or unloading optics. These devices can scratch the optics.

NOTICE!
Never touch the coated surfaces of optics. Doing so may damage the coating and the optic. Always hold optics at the edge.

NOTICE!
Place optics on a clean, dry surface when inspecting and cleaning. Use layers of clean sheets of lens tissue over layers of clean paper towels or wipes to support the optics.

NOTICE!
Avoid speaking over optics and keep all food, beverages and other potentially contaminating materials away from the work area.

NOTICE!
Failure to maintain this optic can lead to serious failure of other optical components. If the LMT appears to be losing power and is not cutting as previously experienced stop using the LMT and inspect this optic.

1. Align the optic nut wrench pins with the two holes in the optic nut and press together. Take great care to not scratch the optic window with the wrench. If you scratch the window, you will need to replace it (See Figure 6-4).

Figure 6-4. Optic Nut Removal

2. Once the wrench has been completely inserted, the nut can be removed by twisting the tool counter-clockwise. Once the nut has been removed, leave it on the wrench and set it aside.

3. Place a new, clean piece of the lint free lens paper on a flat stable work surface. Allow the optic window to drop onto the lens paper by turning the nozzle assembly upside down. If the optic window doesn't drop onto the paper easily, it may be sticking to the rubber O-ring that seals it. In this case lightly tap the assembly on the paper until the window drops out. The optic window is now ready for cleaning.

4. If not on already, put on a pair of powder-free gloves. The optic window must not be handled with bare fingers. The most important point to remember is that the optic window has a very delicate coating that must be protected. If the coating is damaged the window will not transmit the laser beam efficiently and system performance will degrade. You should always handle the optic window with gloves and hold it by the edges.Inspect the window visually at this point to determine how dirty the lens actually is (See Figure 6-5).

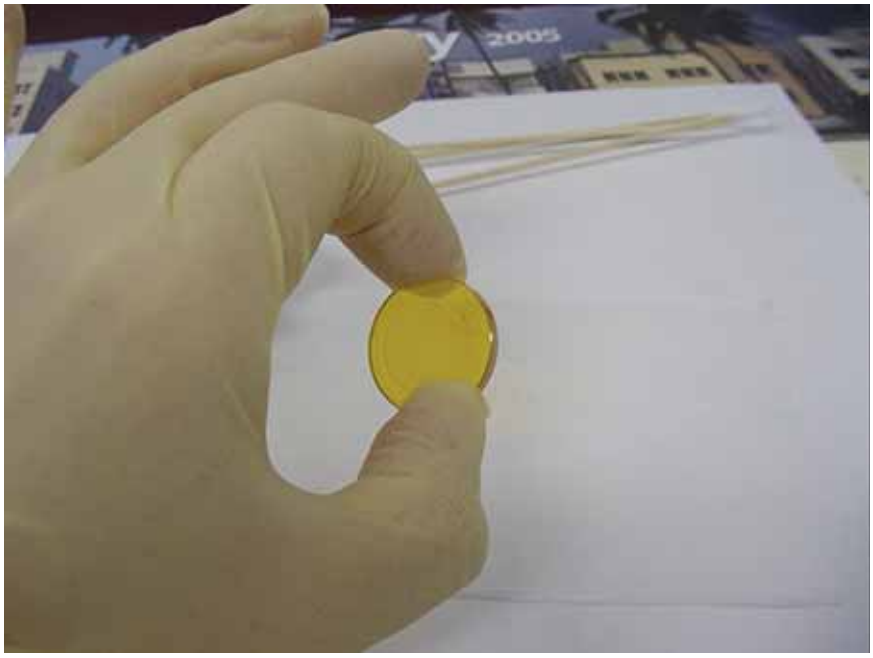


Figure 6-5. Optic Handling

5. Lay the optic window on your clean piece of lint paper and puddle alcohol on it. Let the alcohol soak the window for a few seconds, just don't let the window dry out. It's important to

keep the optic window wet during the cleaning process (See Figure 6-6).

Figure 6-6. Optic Window Cleaning with Alcohol

6. Bunch or fold up a clean piece of lens paper and lightly swirl or stroke the puddle of alcohol with minimal pressure. Wash the puddle of alcohol and debris away with more alcohol. It may be necessary to repeat this process several times to clean the window.

   Note: The optic nut will leave a black or dark ring on the lens where it contacts it. Most of the ring will come off when you clean the window, but do not scrub the window to get it all off or you risk damaging the coating. Make sure you clean both sides of the window (See Figure 6-7).

7. Sometimes the stains on the window will require the use of a cotton swab to clean it. Using a cotton swab from the very end of the stick and using very gentle pressure, stroke the window from side to side. You may also use acetone to clean the window, but always try alcohol first. Acetone flashes off very quickly and may cause spots on the window (See Figure 6-8).

8. Once the optic window is clean, blow off all the remaining alcohol with canned air. You will most likely need to pick it up with your gloved hand to completely blow off all the alcohol. Once the optic window is dry, inspect it by holding it up to the

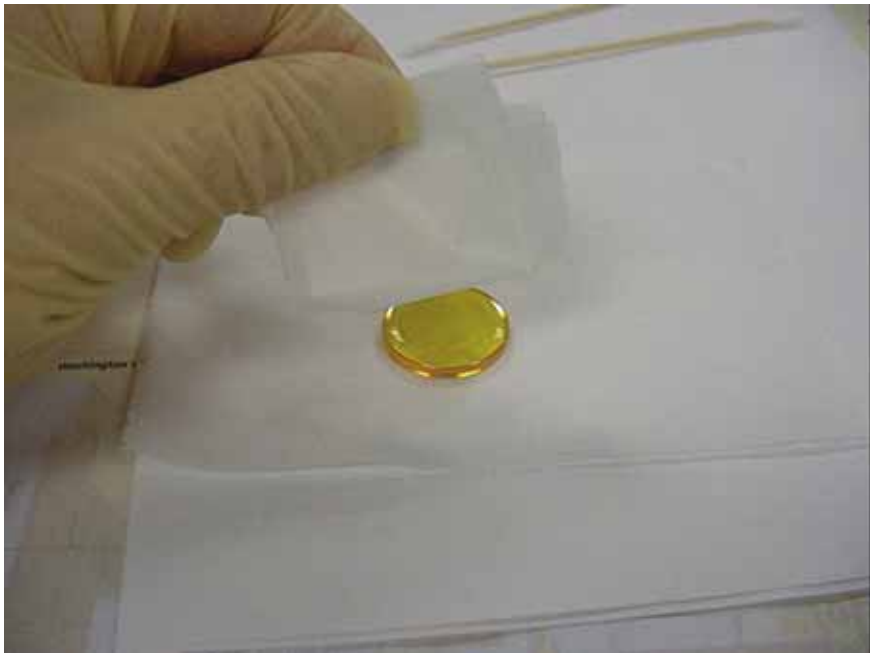


Figure 6-7. Optic Window Cleaning with Lens Paper

Figure 6-8. Optic Window Cleaning with Swab

light to make sure the window is clean, scratch free, and there are no alcohol stains left behind. The window must be as clean and transparent as possible (See Figure 6-9).

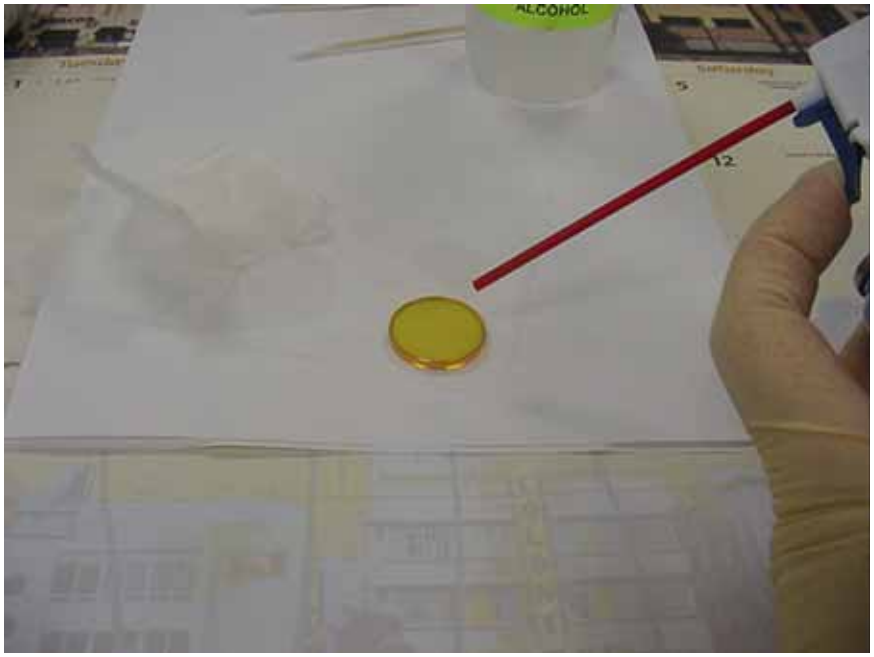


Figure 6-9. Optic Window Cleaning with Canned Air

9. Place the clean, dry, and scratch free lens using your gloved hand into the top of the nozzle assembly with the etched arrow pointing upwards away from the nozzle assembly (See Figure 6-10). Remember to handle the window by the edges.

10. Replace the optic window nut with the wrench using a clock-wise turning motion. Twist it finger tight. Do not over tighten or you risk damaging or breaking the optic window.

Figure 6-10. Installing the Optic Window

Y-Square Test

The squareness of the system requires testing every 6 months and when the LMT system is re-leveled. To test the squareness of the LMT system you will need to cut a square part and measure it. To measure the part, start with a simple carpenter's square. If additional accuracy is required, the diagonals of the part can be measured. If the diagonals are equal the part is square. The adjustment is done by changing the Y-axis offsets in software. This is the additional distance the LMT moves from the home switches following the Y-axis homing routine. By adding an offset to one side of the gantry or the other, the gantry can be made square to the Y-axis using software only.

1. Cut a square part from a piece of thin, > 1/8”, material using the sq_15x15.LMC program found in the service directory. A circle will be cut in the lower left corner so you can keep track of the X and Y sides.

2. Use the carpenter's square to measure the part (See Figure 6-11). Place the cut Y side against the square. Observe the X-axis cut on the other edge of the square. As you slide the part along the Y-axis, keeping the Y edge tight to the square, one side or the other will touch the other side of the square first. If there is a gap between the edges of the material and the edge of the carpenter’s square, the Y-offset will need to be adjusted.

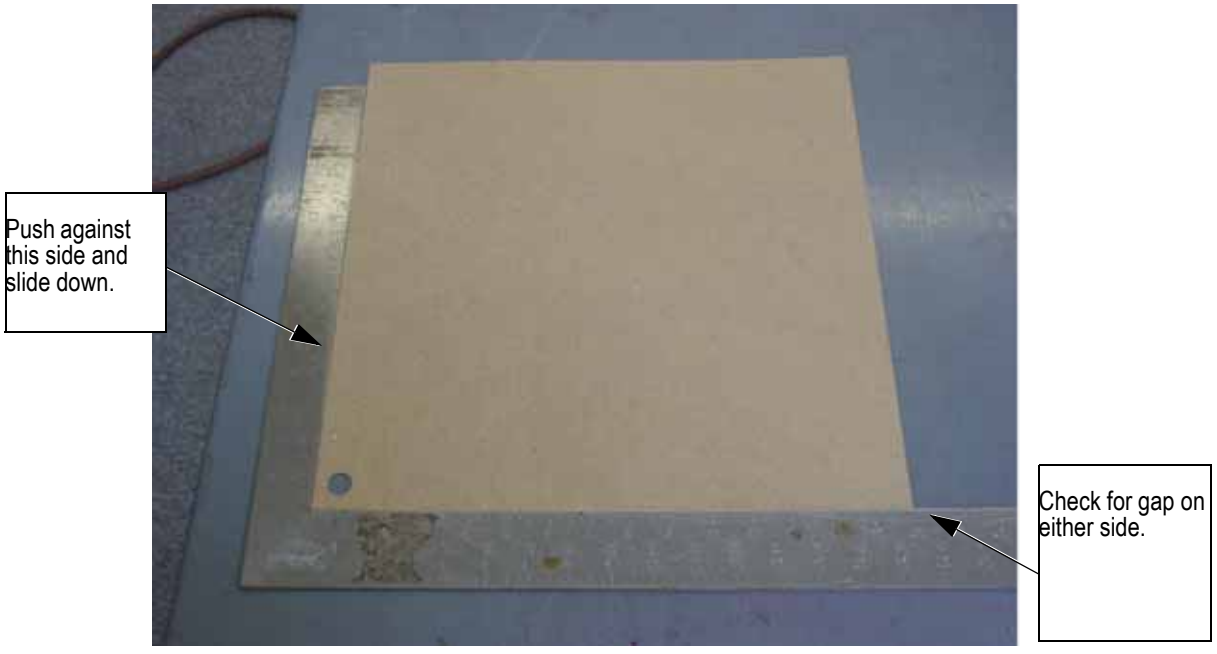


Figure 6-11. Squareness Check

3. Go to the Setup tab and find the Y Square menu item. To change the values use the raise and lower buttons. You will then be prompted to home the machine.
4. When the LMT has completed the homing routine, cut a new square and measure it.
5. Repeat these steps until you have achieved the desired squareness accuracy.

Top Cover & Doors

The Top Cover should be regularly cleaned, inside and outside. DO NOT use abrasive cleaners, such as Windex on the transparent plastic (Polycarbonate). This can scratch or cloud the material.

If available, we recommend using Brillianize® brand plastic cleaner and polish. For a distributor, call: (800) 445-9344. If the plastic panel is damaged, it can be replaced.

NOTICE!
Do NOT use abrasive cleaners such as Windex on the transparent plastic (Polycarbonate) of the Top Covers. This can scratch or cloud the material.

Gas Strut Replacement

The gas struts that assist in opening the cover may need to be periodically replaced. These are easily installed and can be ordered from Coherent (see Parts List).

1. Raise the top covers and ensure that the struts are assisting the lifting process. You should be able to open the covers a few inches and let go - the struts will open the covers the rest of the way.
2. Once opened, make sure that the covers stay open (See Figure 6-12). Failed struts will cause the covers to immediately close due to gravity.
3. Close the covers and make sure they stay closed. Failed struts will result in the covers staying open.

If the covers fail to stay open and stay closed, replacing the gas struts is necessary.

Inspection

Inspect the door stop for the absorptive material and the door stop itself for damage (See Figure 6-13).

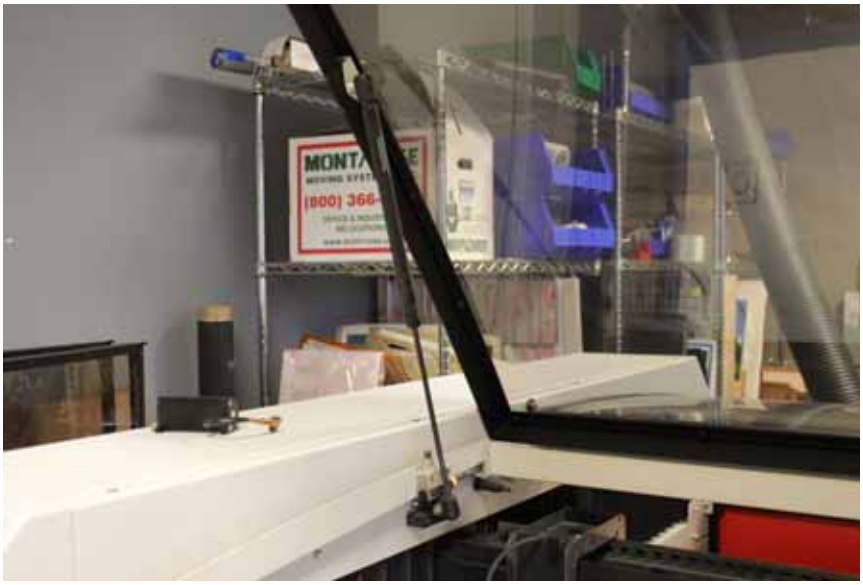


Figure 6-12. Top Cover Strut

Figure 6-13. Door Stop Inspection

Cutting Bed

Cleaning

The Cutting Bed and exhaust plenum should be cleaned daily.

1. Dirt and dust inside the Cutting Bed should be wiped.

WARNING!
Failure to regularly clean the cutting bed and exhaust plenum may result in a fire hazard.

2. Check the V-wheel rollers that the Pallet slides on. Make sure they are clean and turn freely. Wheels on the left side also should "float" sideways at least 1/16. If necessary, lubricate the V-wheels with a light machine oil.

Level

The cutting bed must be parallel with the cutting plane of the LMT. The cutting plane is defined by a plane that is traced by the imaginary zero focus point of the laser. The end of the nozzle can be used to trace this plane If the bed is not parallel then the beam will go out of focus during the cut. The bed can easily be checked for level by the following the procedure:

1. Power on the LMT system if not on already.
2. Jog the carriage head assembly to X, Y position (0, 0) using the arrow buttons of the HMI.

   To save time, use the X Park Position and Y Park Position (or X Home Position and Y Home Position) parameters in the Setup tab of the HMI to change the coordinates to which the Park (or Home) button moves the carriage head assembly (See Table 6-2).

Table 6-2. Corner (X, Y) Coordinates

	LEFT	RIGHT
REAR	(0, 48)	(48, 48)
FRONT	(0, 0)	(48, 0)

3. Open the top cover of the LMT system.

4. Place a flat, level piece of solid material (such a stainless steel) on the corner of the cutting bed.
5. Place the leveling block on the material so that a wide face is oriented upwards towards the nozzle and its outside edges are flush with the outside edges of the cutting pallet (See Figure 6-14).
6. Close the top cover of the LMT system.
7. Using the Up and Down arrow buttons on the HMI, adjust the height of the cutting bed so that the nozzle touches the leveling block but does not prevent the leveling block from moving once force is applied (See Figure 6-14).

Figure 6-14. Leveling Block

NOTICE!
The top covers and doors of the LMT system must be closed while adjusting the position of the carriage head assembly and cutting bed.

8. Record this Z-axis height.

9. Repeat steps 2-8 for the remaining three corners.
10. Compare the recorded Z-axis heights. The heights must all be within a range of 0.005".
11. Determine which corners must be adjusted. It is preferable to adjust the fewest corners possible.
12. Move the cutting bed so that the plenum is exposed in the first corner to be adjusted.
13. Use a 5/32" Allen wrench to adjust the height of the corner by adjusting the vertical screw accessible through a hole in the plenum (See Figure 6-15). Turn clockwise to move the corner down; turn counter-clockwise to move the corner up.

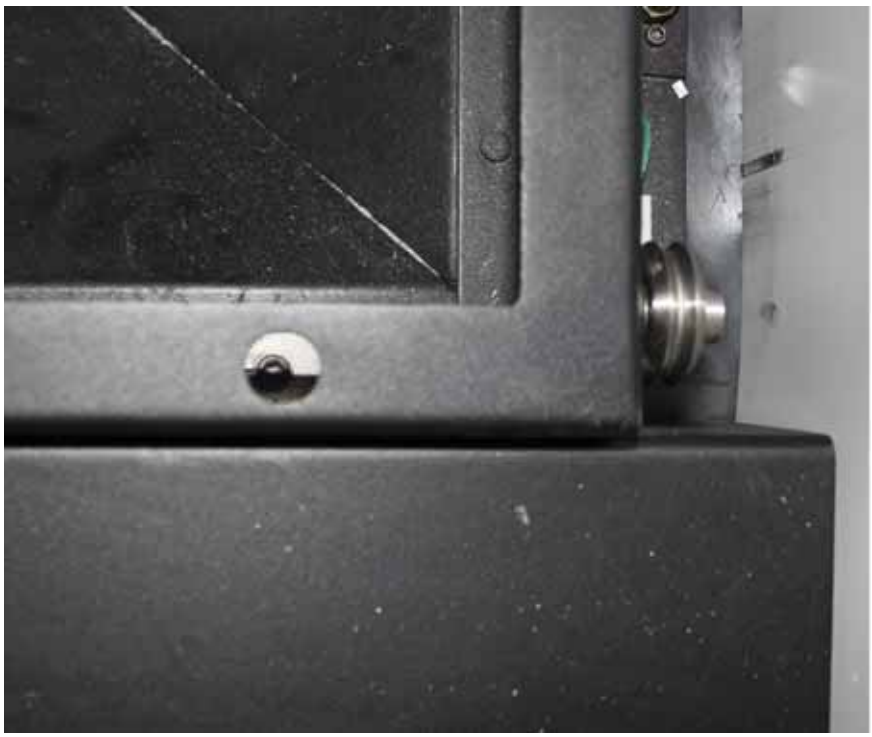


Figure 6-15. Cutting Bed Corner Adjustment Screw

For older machines, the adjustment screw may need to be unlocked using an open-ended 1/2" wrench prior to adjustment with either a 5/32" Allen wrench or flathead screwdriver.

NOTICE!
The cutting bed adjustment screws do NOT need to be turned far to make adjustments.

14. Re-check the corner with the leveling block and nozzle according to steps 2-8 and record the Z-axis height.
15. Repeat steps 12-14 for the remaining corners requiring adjustment.

Nozzle

Nozzle Cleaning and Replacement

The Cutting Nozzle assembly should be routinely removed and cleaned. The nozzle assembly is designed to “break away” by tilting it to the side. After pulling the nozzle away, disconnect the airline pushing the green ring towards the nozzle and gently pulling on the hose.

To remove the nozzle, loosen the lock nut and unscrew the nozzle. See “Nozzle Adjustment” on page 7 of Section 4: Operation for instructions on resetting the nozzle height when it is reinstalled.

NOTICE!
Be sure to set the nozzle height correctly when reinstalling it. Setting it too low can cause the nozzle to crash and may damage the machine.

Wipe all residue from inside and outside of the nozzle. If necessary, soak the nozzle in alcohol or acetone to remove excess residue.

Check the inside of the nozzle chamber and window for dust or cutting residue. If necessary, clean the window with alcohol and gently wipe it with soft lens cleaning tissue.

If the nozzle is damaged or warped, causing the gas flow to be uneven or the beam to be clipped, unscrew it and replace with a new nozzle.

Nozzle Centering

It is important for the beam to pass through the nozzle without being impinged, otherwise power and cut quality may be negatively affected.

The following procedure centers the beam in the nozzle.

1. Load the drill_anywhere.LMC file from the service directory of the Load Tab of the HMI and press GO.
2. Apply some clear, glossy tape to the end of the nozzle (See Figure 6-16).

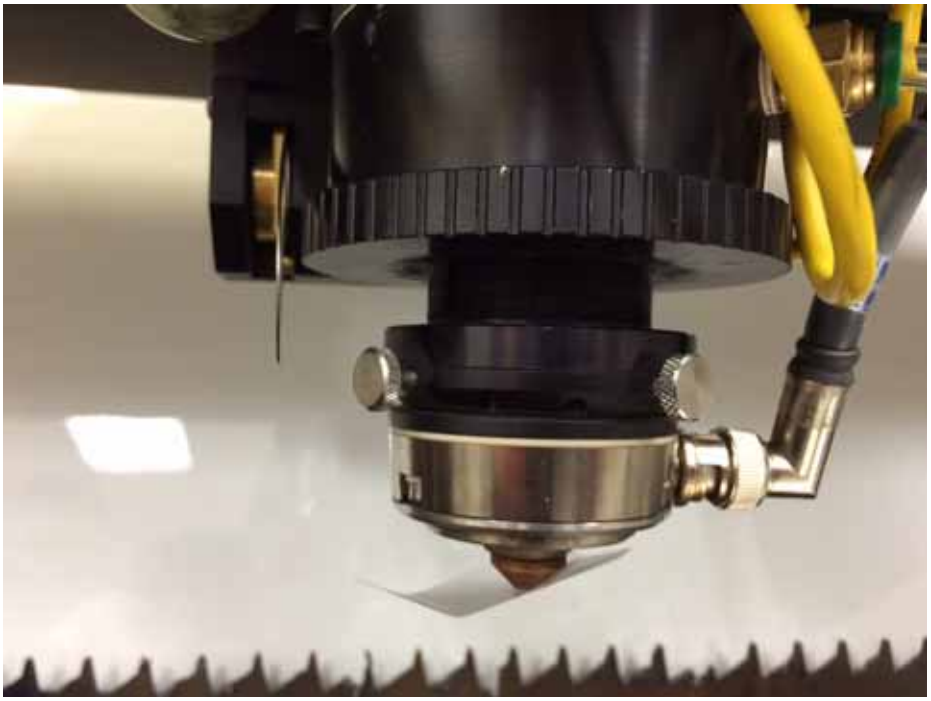


Figure 6-16. Nozzle With Tape

3. Set the auto focus off by pressing the Auto Focus button once.
4. Move the Z-Axis about 5 inches away from the nozzle and then press the Set Focus button.
5. Press Start to fire one shot into the tape. If you do not see the sparks from the laser piercing the tape, increase the power.
6. Carefully remove the tape from the nozzle and inspect the hole position in relation to the center of the nozzle and the adjusting screws (See Figure 6-17). If clipping is suspected, as evidenced by an elongated beam hole or a missing hole, check the aiming beam brightness. If it is dim, the beam is most likely clipping.
7. Adjust the corresponding screws to move the location of the beam in relation to the center of the nozzle (See Figure 6-18).Adjust the seating of the M4 mirror block.

Figure 6-17. Outline of Nozzle with Centered Beam

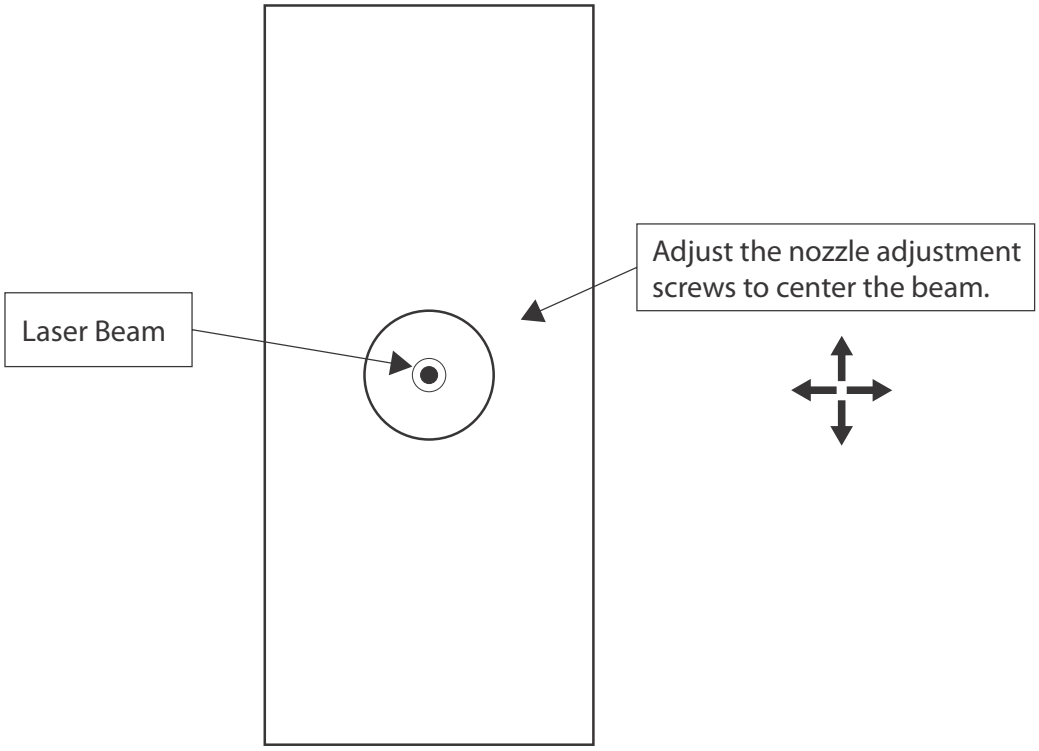


Figure 6-18. Centering the Beam in the Nozzle

8. Repeat steps until the beam is centered in the nozzle.

Capacitive Height Sensor (CHS)

Calibration

The CHS is calibrated at the factory and will only require recalibrating if one of the components has been replaced.

1. Place a flat, rigid (no flexing) metal material of thickness greater than 0.070 inches underneath the cutting head. Make sure the pallet is grounded. Make sure the nozzle is clean. Calibration will work best when both nozzle and plate are burnished with an abrasive cleaning pad and cleaned with alcohol.
2. In the Setup Tab of the HMI, navigate to Config>Pallet Height>Clearance Height. Make a note of the current setting and then set the Clearance height to -9.0.
3. Go to the Terminal tab.
4. Press F9 to enable the cursor. Type "graph_cap" and watch the voltage column as the gap is changed in 0.02 inch increments. After the fifth gap change, make sure that the voltage stays within 10-13 on average, with some instances of 8, 9, 14-16 being acceptable.
5. If the graph_cap results are not acceptable, type "calibrate_lasermaic". The META 10C will auto focus on the metal material and perform the calibration routine.
6. For metal jobs, the nozzle gap (CHS Nozzle Offset) between the tip of the nozzle and the top of the material surface will be read from a table, not set during the first Auto Focus.

   This table is automatically created after a successful calibration. To view the created table, type "show_vbase_table".
7. Set the CHS Nozzle Offset (See "Setting Nozzle Gap and Focus Offset" on page 9 of Section 3: Operation).
8. CHS is now ready for operation.

Maintenance Parts

Parts commonly replaced during preventive maintenance are listed throughout "Appendix A: Parts, Tools and Accessories".

For 3rd-party accessories used in conjunction with system (e.g. chiller), refer to the manufacturer's product literature for safety information, maintenance recommendations and procedures.

Emergency Stop Switch Test

The EMERGENCY STOP Switches must be periodically tested to determine that it functions properly.

1. Turn system on.
2. Press the EMERGENCY STOP button on the front of the system control unit and check that the system shuts down properly. Make sure button locks into place.
3. Repeat for all other switches.

Troubleshooting

Follow these processes to troubleshoot the LMT system and its performance.

Applications Troubleshooting

Laser is not cutting through the material:

- Try to cut at slower speed.
- Check the cutting frequency.
- If cutting metal, check the nozzle gap.
- Check that the focal lens is not dirty.
- Make sure the beam is centered in the nozzle, as it may be clipping the nozzle.
- Run the focus test.
- Check the assist gas pressure, as it may be low.
- Check that the mirrors are not contaminated.

Laser is not firing:

- Make sure the Dry Run setting in the Setup tab is set to 0.
- Check the warning LEDs on the front panel:
  - Assist Gas
  - Cooling Water
  - Exhaust System

Dross on bottom of cut material:

- Partial dross (not on all of the edges):
  - Check the nozzle centering.
- Check the nozzle gap and focus offset.

- Check the cutting frequency.
- Check that the lens and the mirrors are clean.
- Run the focus test.
- Try higher assist gas pressure.
- Try faster / slower cutting speed.
- Check that the CHS follows the sheet surface – if needed, use alligator clip to ensure the grounding of your material.

Cut edge of acrylic isn't flame-polished:

- The cutting speed is too fast.
- The cutting frequency is too low (16 kHz gives the best result).
- The copper tip hasn't been removed from the nozzle and the assist gas flow is too intense (causing hazy cutting edge).
- The honeycomb below the sheet is causing tick marks:
  - Add spacing blocks to make about 1" gap between the honeycomb and the acrylic.

Cut edges of plastics are discolored:

- Lower the power.
- Use nitrogen as the assist gas instead of compressed air.
- Try both low and high assist gas pressures (15 psi – 60 psi).
- If lower pressure gives better results, try cutting without the copper tip.
- Make sure the exhaust system is working properly.
- Cover the whole cutting bed using material such as paper sheets to maximize the vacuum below the material.
- Use masking on the material.

APPENDIX A: PARTS, TOOLS AND ACCESSORIES

Replacement and Spare Parts

The following parts can be ordered by contacting our Product Support Hotline at (800) 367-7890 or (408) 764-4557 outside the USA; or through e-mail at **Product.Support@Coherent.com**; or your local Coherent service representative.

When communicating with our Product Support Department by telephone or e-mail, the model and serial number of your laser system is required by the Support Engineer responding to your request.

Table A-1. Accessory Kit

ITEM	QTY	PART NUMBER	TITLE	REFERENCE
1	1	01-0504-101	Optic Nut Wrench	
2	1	01-0644-101	Cutting Bed Leveling Gauge	
3	1	02-0124-101	Water Filter Kit	
4	1	02-0358-101	Lens Cleaning Assembly	
5	2	11-0000	Thermal Paper	Testing paper
6	1	11-0030-001	Beam Alignment Targets	Nozzle
7	2	11-0030-002	Beam Alignment Targets	M4 Target
8	1	12-0135	Read-head Spacer	
9	1	12-0136	Renishaw Gauge	
10	1	13-0004-008	Brass Male Connectors	Control Air
11	1	13-0004-009	Brass Male Connectors	Assist Gas
12	180	13-0007-014	Polyurethane Tubing	Control Air
13	24	13-0007-187	Polyurethane Tubing	Exhaust Sensor
14	180	13-0009-375	Nylon Tubing	Assist Gas Line
15	2	13-0029-001	Reducing Bushing	
16	300	13-0030-500	Polyethylene Tubing	
17	2	13-0081-001	Brass Male Connector	Chiller
18	15	14-0043-001	8-32 Truss Head Phillips Screw	Extra

Table A-1. Accessory Kit (Continued)

ITEM	QTY	PART NUMBER	TITLE	REFERENCE
19	3	14-0043-003	8-32 Truss Head Phillips Screw	Extra
20	3	14-0044-001	Nylon Washer	Extra
21	3	14-0045-002	Acorn Nuts Zinc Plated Steel	Extra
21	1	26-0014	Cat-5 Patch Cord	
23	1	30-0080-101	External Exhaust Relay Cable Assembly	Remote Switch

Air Filter Dryer Unit

A pre-assembled air filter dryer unit (see Figure A-1) is available for those needing to filter compressed air. This unit is available from Coherent.

Coherent Part Numbers:

Air Purge Filter Assembly 1166836

WARRANTY

Warranty Overview

Following are Coherent’s standard warranty terms. However, the warranty terms for your systems may vary. Please refer to the signed Sales Quotation for actual warranty for your system.

Coherent warrants items manufactured by it to be free from defects in materials and workmanship for a period of one year (12 months). This warranty applies only to the original Buyer, for equipment installed at the original location. Major sub-systems manufactured by other companies (e.g. the motion controller, chiller) are covered only by their original manufacturers' warranty and Coherent does not make any warranty in respect to such items.

Conditions of Warranty

Coherent’s liability under valid warranty claims is limited to repair or replacement at a Coherent facility or Buyer's location at the discretion of Coherent. Buyers are responsible for any shipping charges, insurance, and travel expenses incurred by Coherent while providing warranty service. Coherent does not provide on-site service outside of the domestic United States.

Warranty claims must be made within thirty (30) days of occurrence of the circumstances giving rise thereto. Such claims must be in writing and must fully disclose all related circumstances giving rise to the claim. Before any products are returned for warranty service, written authorization and written shipping instructions must be obtained from Coherent. The Buyer shall be responsible for all shipment and related costs, as well as any damage due to improper packing or handling of products being returned for warranty service. Coherent reserves the right to reject any warranty claim for products that have been damaged in shipment or shipped by a non-acceptable means of transportation.

If it is found that products have been returned without cause, the Buyer will be responsible for all return shipping charges and may, at Coherent’s sole discretion, incur charges for testing and examination.

Responsibilities of the Buyer

The Buyer is responsible for providing the specified utilities and an operating environment as outlined in the product literature. Damage to the LMT system caused by failure of Buyer's utilities or failure to maintain an appropriate operating environment, is solely the responsibility of the Buyer and is specifically excluded from any warranty, warranty extension, or service agreement.

The Buyer is responsible for prompt notification to Coherent of any claims made under warranty. In no event will Coherent be responsible for warranty claims made later than seven (7) days after the expiration of warranty.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from any of the following:

- Components and accessories manufactured by companies, other than Coherent, which have separate warranties,
- Improper site preparation or installation by the Buyer,
- Buyer-supplied interfacing,
- Operation outside the environmental specifications of the product,
- Operating with improper or inadequate cooling, exhaust or purge,
- Improper or inadequate maintenance,
- Unauthorized modification or misuse,
- Opening the laser head housing, or
- Service or repair of product by unauthorized personnel.

Coherent assumes no responsibility for customer-supplied material.

Coherent considers hoses and cables that are frequently flexed or bent to be consumable parts. As such, these parts are not covered under the warranty.

The obligations of Coherent are limited to repairing or replacing, without charge, equipment which proves to be defective during the warranty period. Replacement sub-assemblies may contain reconditioned parts. Repaired or replaced parts are warranted for the duration of the original warranty period only. The warranty on parts purchased after expiration of system warranty is ninety (90) days. Coherent's warranty does not cover damage due to misuse, negligence or accidents, or damage due to installations, repairs or adjustments not specifically authorized by Coherent.

This warranty applies only to the original purchaser at the initial installation point in the country of purchase, unless otherwise specified in the sales contract. Warranty is transferable to another location or to another customer only by special agreement which will include additional inspection or installation at the new site. Coherent disclaims any responsibility to provide product warranty, technical or service support to a customer that acquires products from someone other than Coherent or an authorized representative.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, AND DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL LOSS. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

GLOSSARY

°C	Degrees Celsius
°F	Degrees Fahrenheit
µ	Micro(s) = (10^{-6})
µs	Microsecond(s) = (10^{-6} seconds)
A or Amp	Amperes
AC	Alternating current
accessible radiation	Radiation to which it is possible for the human eye or skin to be exposed in normal usage
Amp	Amperes
average power	The total energy imparted during exposure divided by the exposure duration
Assist gas	A gas or gas mixture used to clear debris from the beam path during a cut, minimize Heat Affected Zones (HAZ), shield the material processing area from contamination and protect the LMT system optics from debris, smoke and particles during the machining process. The gas or gas mixture used, as well as the pressure, will change depending upon the material used, process characteristics and the desired results.
CDRH	Center for Devices and Radiological Health
CHS	Capacitive Height Sensor; maintains a consistent distance between the nozzle tip and the workpiece
circuit breaker	An automatically operated electrical switch that protects an electrical circuit from damage caused by overload or short circuit. Can be manually reset or turned off and on.
cm	Centimeter(s)
controlled area	An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards
CPU	Central processing unit
cutting head	A mechanical assembly suspended from the gantry that moves along the X-axis of the LMT system and includes the nozzle, CHS, Vision camera (optional), focus sensor and assist gas delivery.
cutting pallet	Flat platform that provides a surface for placing job materials. Moves vertically on the Z-axis.
cutting speed	The speed of the cutting nozzle as it passes over the workpiece.
DC	Direct current
dross	A mass of solid impurities formed from molten metals that are recast on the workpiece, usually on the bottom edge.
dwell	See *pierce*

edge quality	Smoothness and cleanliness of the material's processed edge.
ejecta	Material expelled from the kerf by the assist gas.
Emergency Stop	A button or buttons, usually red, that interrupts power to the LMT system in case of an emergency or hazardous situation.
energy	The capacity for doing work; energy content is commonly used to characterize the output from pulsed lasers, and is generally expressed in joules (J)
ESD	Electro-static discharge
feed rate	See *cutting speed*
ft.	foot (feet)
focal length	The distance from the secondary nodal point of a lens to the primary focal point; in a thin lens, the focal length is the distance between the lens and the focal point
focal point	The point toward which radiation converges or from which radiation diverges or appears to diverge
focus offset	Distance between the top of the workpiece and the focal point of the laser beam, with positive distances resulting in the focal point being below the surface of the workpiece. This is advantageous for certain cutting applications.
focus sensor	A swing-arm sensor that allows the LMT system to determine the height of the cutting nozzle above the material and set the focal point and focus offset.
gantry	A mechanical assembly providing overhead beam delivery via the X-axis carriage / cutting head. The gantry spans the X-axis of the LMT system and moves on the Y-axis.
gpm	Gallons per minute
HAZ	Heat Affected Zone
Heat Affected Zone	The area of the process material that has had its properties altered by heat from the cutting process.
HMI	Human Machine Interface
hold down	A function of the LMT system during which the exhaust is activated, causing the process material to be forced down on the cutting pallet, reducing the chance for errors in the job; see *part mask*
Human Machine Interface	Touch-panel display that allows interfacing with the LMT system.
Hz	Hertz or cycles per second (frequency) (= 1/pulse period)
I/O	Input/Output
ID	Inside diameter
in.	inch (inches)
installation	Making the LMT system ready for operation; includes vital procedures that ensure the system is functioning to the same specification as when it left the factory.
IR	Infrared (wavelength); electromagnetic radiation with wavelengths which lie within the range 0.7 µm to 1 mm

job	Also: process. The action of performing a material processing application using the LMT system, in which the system follows a set of instructions specified in a .LMC file.
job file	A .LMC file used by the LMT system to perform a job.
kerf	The width of the resulting cut from laser processing.
kg	Kilogram(s) = 10^3 grams
kHz	Kilohertz = 10^3 Hertz (1000 Hertz)
kV	Kilovolt(s) = 10^3 volts
LASER	A device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels; an acronym for Light Amplification by Stimulated Emission of Radiation
Laser Safety Officer	One who has authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards
laser system	An assembly of electrical, mechanical, and optical components which includes a laser
LCD	Liquid Crystal Display
LED	Light Emitting Diode
limiting exposure duration	An exposure duration which is specifically limited by the design or intended use(s)
.LMC	The file extension for job files used by the LMT system.
LMT	Laser Machining Tool
lpm	Liters per minute
LSO	Laser safety officer; see *laser safety officer*
maximum permissible exposure	MPE; the level of laser radiation to which a person may be exposed without hazardous effects of adverse biological changes in the eye or skin
m	Meter(s)
mA	Milliamperes = 10^{-3} Amperes
mask	See *part mask*
max.	maximum
min.	minimum
mm	Millimeter(s)
MPE	Maximum permissible exposure; see *maximum permissible exposure*
ms	Millisecond(s)
mV	Millivolt(s)
NHZ	Nominal hazard zone; see *nominal hazard zone*
nm	Nanometers = 10^{-9} m (wavelength)
nominal hazard zone	NHZ; the space within which the level of the direct, reflected or scattered radiation during normal operation exceeds the applicable MPE; exposure levels beyond the boundary of the NHZ are below the appropriate MPE level
nozzle gap	See *nozzle offset*

nozzle offset	Distance between the cutting nozzle and the workpiece.
NPT	National pipe thread
OD	Outside diameter, or Optical density; see *optical density*
OEM	Original equipment manufacturer
optical density	Logarithm to the base ten of the reciprocal of the transmittance
pallet	See *cutting pallet*
part mask	Material, such as tape, paper or plastic, used to cover areas of the cutting pallet not used in a particular job. This maximizes the hold down pressure.
pierce	Extra power and time required at the starting location of the cut to assist in the initial penetration of the material when cutting thick materials, usually metals, starting from locations other than the edges. The pierce time is often called dwell time, as it specifies the amount of time required for the cutting head to dwell at that particular location.
power	The rate at which energy is emitted, transferred, or received in units of watts (joules per second)
RH	Relative humidity
RMA	Return material authorization
rms	Root mean square
SP	Static Pressure
step and repeat	A method of job automation in which a part or parts are repeated in a configurable grid.
top cover	Two transparent covers that magnetically seal to the front and rear doors and protect the operator from laser radiation, gas and mechanical hazards.
typ.	typical
Upper Control Panel	Panel on the front of the machine that contains the Emergency Stop Button, key switch, and indicator LEDs and assist gas pressure gauge.
V	Volt(s)
VAC	Volts, alternating current
VDC	Volts, direct current
visible radiation	Light; electromagnetic radiation which can be detected by the human eye; this term is commonly used to describe visible wavelengths which lie in the range of 0.4 µm to 0.7 µm
W	Watt(s)
watt (W)	The unit of power or radiant flux. 1W = 1 joule per second
wavelength	The distance between two successive points on a periodic wave which have the same phase
X-axis	

carriage	See *cutting head*
Z-axis platform	See *cutting pallet*

INDEX

Coherent META 10C™ Operator's Manual

Part No. 1309888 Rev. AA

META 10C™ Operator's Manual
© Coherent Inc., December 2016 (RoHS), printed in the USA
Part No. 1309888 Rev. AA

Hyperchill Plus

Industrial Water Chillers
for Precision Cooling

Short description

Extremely compact and easy to use, Hyperchill Plus is designed for safe and reliable operation in the most varied working conditions, providing a precise and accurate control of the process fluid temperature. The availability of a wide range of accessories and options makes Hyperchill Plus a very flexible solution that fits the needs of all industrial applications.

Thanks to a non-ferrous hydraulic circuit, Hyperchill Plus ensures stable working conditions with maximum quality and cleanliness of the cooling fluid (water, water-glycol mixture, low viscosity fluids), improving the efficiency and productivity of the process and greatly reducing maintenance costs and plant downtime.

Each individual Hyperchill Plus unit is extensively tested to guarantee efficient operation and reliability in all working conditions.

Process cooling applications:

- Coating Systems
- Chemical & Pharmaceutical Processes
- Plastics Processing
- Thermoform Machines
- Plasma Coating
- Medical Imaging Systems
- Food & Beverage Industry
- Injection Moulding
- Machine Tools
- Electroplating Baths
- Biogas & Natural Gas Treatment
- Compressed Air Treatment
- Laser Technology
- Extruders
- Surface Processing
- Welding Engineering
- Blow Mould Machines
- Flexographic Printing Systems

Parker Hiross

ENGINEERING YOUR SUCCESS.

Product Specification

Hyperchill Plus Water Range

Customer Benefits

- **A differential pressure switch ensures a system shut down in the case that the circuit runs dry. Therefore the customers investment is protected.**
- **Because of its compact design the Hyperchill Plus provides a space saving and easy to install solution.**
- **Condenser filters reduce dirt, thereby preventing system downtime.**
- **Reliable operation even in extreme ambient conditions. The standard units allow maximum ambient temperatures up to 48 °C. The tropicalized units up to 53 °C.**
- **The non-ferrous hydraulic circuit maintains the quality of the coolant ensuring stable working conditions, improving productivity and decreasing maintenance costs.**

Product Features

Complete solution, easy to install and manage

- **Non ferrous hydraulic circuit:** non-ferrous water tank (stainless steel from ICEP005), stainless steel plate evaporator, non-ferrous pump with bypass prevent water from becoming corrosive.
- **Pump and tank installed inside the chiller** provides a compact and easy to install solution; without pump and/or without tank solution available.
- **Electronic controllers with proprietary software** provide access to all the parameters of the units and allow special management for any specific need, with remote monitoring available.
- **Completely configurable** with many options and kits to fit the needs of industrial applications.
- **Condenser filters** reduce dirt, thereby preventing system downtime.
- As standard installed **differential pressure switch** that makes sure that the systems shuts down in the case that the circuit runs dry. Therefore the investment is protected.
- **Designed with eyebolts** (till ICEP014) for easy handling.
- **IP54 standard** from ICEP007 for outdoor installations.
- **Independent condensing plenum** enables routine and special maintenance to be performed without stopping the system.
- Unit structure and design guarantee **full internal access** for easy maintenance.
- ICEP020 and ICEP024 designed with **fan step control** in order to work in low ambient temperatures down to -10 °C.
- **RS485 card** available on all models (standard from ICEP007).
- **Water and refrigerant manometers** permit full control of the working conditions.
- **Water pump: (standard 3bar) different head-pressures** available to meet the requirements of specific applications.
- **Visual level Indicator:** designed for open circuit models ICEP002, ICEP003, ICEP005.

High reliability & Low energy consumption

- **Large built-in water tank** that provides a large thermal mass / storage capacity thus reducing the number of refrigerant compressor stop/starts and short cycling thereby increasing the compressor and chiller lifetime and reducing the energy consumption.
- **Maximum ambient temperature up to 48 °C** on standard units, **Tropicalization up to 53 °C** and Low ambient options ensure reliable operation in extreme ambient conditions.
- **Oversized condensers and evaporators** guarantee high performing heat exchange increasing COP (Coefficient Of Performance).
- **PID software developed and tested** to give the highest temperature consistency even at variable loads.
- Use of **compliant scroll compressors** (from ICEP007) designed specifically for high efficiency and long life in industrial applications.
- **Low ambient speed-control** (optional) on fan-motor ensures constant performances at different temperatures, long lifetime of the fans and a reduction in absorbed power when ambient temperature is low.

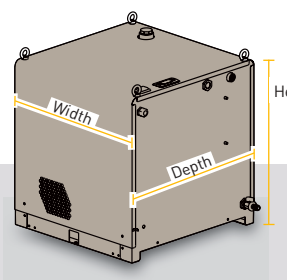
Product Specification

Hyperchill Plus Water Range

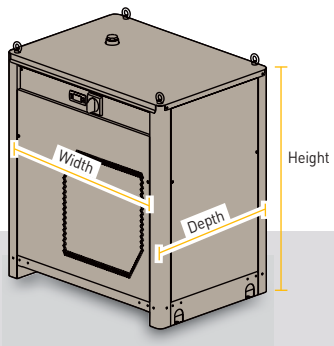
Hyperchill Plus Water Range

Model ICEP		002-W	003-W	005-W	007-W	010-W	014-W	020-W	024-W
Cooling capacity[1]	kW	1,7	3,3	5,2	7,8	10,8	14,6	20,3	23,6
Compressor abs. power[1]	kW	0,7	1,3	1,4	1,7	2,5	3,2	4,4	5,4
Cooling capacity[2]	kW	1,3	2,3	3,7	5,8	7,9	10,6	14,6	17,2
Compressor abs. power[2]	kW	0,7	1,2	1,3	1,8	2,7	2,8	4,3	5,8
Power supply	V/ph/Hz	230/1/50			400/3/50				
Protection index		33			54				
Refrigerant		R407c							
Compressor									
Type		hermetic pistons			scroll				
Compressors / circuit		1 / 1							
Max.abs. power[1] compressor	kW	0,7	1,3	1,5	2,4	3,8	4,4	5,7	6,6
Axial fans									
Quantity	n.°	1	1	1	1	1	1	2	2
Max. abs. power[1] fan	kW	0,07	0,12	0,12	0,3	0,3	0,4	0,4	0,4
Air flow	m³/h	430	1295	1295	3437	3437	4337	6878	6159
Water cooled version									
Condenser water flow	m³/h	N.A.					1,5	2,1	2,5
Condenser connections	in	N.A.					3/4"	3/4"	3/4"
Pump P30									
Max.abs.power	kW	0,4	0,4	0,4	0,9	0,9	1,0	1,3	1,3
Water flow (nom. / max)[1]	m³/h	0,3 / 1,9	0,6 / 1,9	0,9 / 1,9	1,3 / 4,8	1,8 / 4,8	2,5 / 6	3,4 / 9,6	4,9 / 9,6
Head pressure (nom. / max)[1]	m H_2O	35/5	33/5	26 / 5	30 / 12,8	29 / 12,8	29 / 21	29 / 17,3	28 / 17,3
Water flow (nom. / max)[2]	m³/h	0,2 / 1,9	0,4 / 1,9	0,8 / 1,9	1,0 / 4,8	1,3 / 4,8	1,8 / 6	2,5 / 9,6	2,9 / 9,6
Head pressure (nom. / max)[2]	m H_2O	36 / 5	32 / 5	27 / 5	32 / 12,8	30 / 12,8	31 / 21	30 / 17,3	29 / 17,3
Dimension and weight									
Width	mm	520	755	755	756	756	756	756	756
Depth	mm	500	535	535	806	806	806	1206	1206
Height	mm	550	801	801	1405	1405	1405	1405	1405
Connections in/out	in	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"
Tank capacity	l	15	15	22,5	65	65	65	100	100
Weight (axial)	kg	40	80	85	160	165	175	220	230
Weight (water cooled)	kg	n/a	n/a	n/a	n/a	n/a	175	220	230
Noise level									
Sound pressure (axial)[3]	dB(A)	52	52	52	53	53	50	50	50

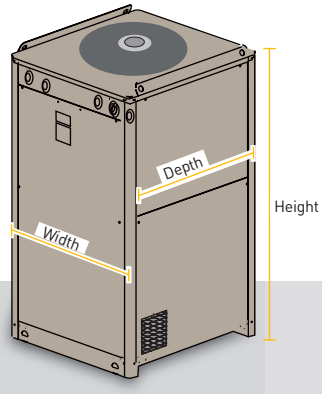
1) at water in/out temperature 20/15 °C, glycol 0 %, either 25 °C ambient temperature (air-cooled models) or 25 °C condenser water inlet temperature with 35 °C condensing temperature (water-cooled models)
2) at water in/out temperature 12/7 °C, glycol 0 %, 32 °C ambient temperature (air-cooled models)
3) referred to axial fan version in free field conditions at a distance of 10 m from until, measured on condenser side, 1 m from ground



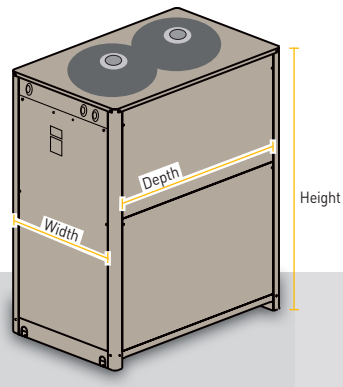
ICEP 002



ICEP 003-005



ICEP 007-010-014



ICEP 020-024

Product Specification

Hyperchill Plus Water Range

Correction factors

A) Ambient temperature	°C	5	10	15	20	25	30	35	40	45
correction factor (f1)		1,05	1,05	1,05	1,05	1	0,94	0,89	0,84	0,80
B) Water outlet temperature	°C	5	10		15		20		25	
correction factor (f2)		0,76	0,87		1		1,04		1,04	
C) Glycol (by weight)	%	0	10		20		30		40	
correction factor (f3)		1	0,99		0,98		0,97		0,96	
D) Condenser Water inlet temp.	°C	20	25		30		35		40	
correction factor (f4)		1,05	1		0,95		0,9		0,85	

To obtain the required cooling capacity, multiply the value at nominal conditions by the above correction factors (i.e. cooling capacity = Pxf1xf2xf3xf4, where P is the cooling capacity at the water outlet temperature of 15 °C). Hyperchill Plus, in its standard configuration, can operate up to ambient temperatures of max. 48 °C and min. 5 °C and water temperatures of max. 30 °C inlet and min. 0 °C outlet. The above correction factors are approximative: for a precise selection, always refer to the software selection programme.

Options

	ICEP002-W	ICEP003-W	ICEP005-W	ICEP007-W	ICEP010-W	ICEP014-W	ICEP020-W	ICEP024-W
No Tank	✓	✓	✓	✓	✓	✓	✓	✓
No Tank & NO Pump	✓	✓	✓	✓	✓	✓	✓	✓
No Pump	✓	✓	✓	✓	✓	✓	✓	✓
P50	✓	✓	✓	✓	✓	✓	✓	✓
P15				✓	✓	✓	✓	✓
Harting Plug	✓	✓	✓	✓	✓	✓	✓	✓
Close Control (+/-0,5 °C)		✓	✓	✓	✓	✓	✓	✓
Low Water				✓	✓	✓	✓	✓
Fan Speed Control				✓	✓	✓	✓	✓
Low Ambient -20 °C				✓	✓	✓	✓	✓
Anti-Freeze Heating				✓	✓	✓	✓	✓
BioEnergy				✓	✓	✓	✓	✓
Differential Dynamic Set Point				✓	✓	✓	✓	✓
Tropicalization (53 °C, without ambient fill kit)						✓	✓	✓
Siemens Electrical Components (no control)	on request							

Versions

Open Circuit (with ambient fill tank)	✓	✓	✓					
Closed Circuit			✓	✓	✓	✓	✓	✓
Water cooled (plate condenser)						✓	✓	✓

Accessories

Water fill kits: non-ferrous pressurized, automatic or ambient manual kits, for water filling in any installation.
Remote control kits: base version for remote ON/OFF and general alarm monitoring. Advanced version for complete remote unit monitoring.
Wheels (ICEP002 - ICEP014): for ease of transport.
Water filters: for circuit cleanliness and machinery protection.
Water by-pass: non-ferrous, externally adjustable allowing the correct flow through the system to be set.
Control panel cover: from ICEP007, can be supplied already installed.

EMEA Product Information Centre
Free phone: 00 800 27 27 5374
(from AT, BE, CH, CZ, DE, DK, EE, ES, FI, FR, IE, IL, IS, IT, LU, MT, NL, NO, PL, PT, RU, SE, SK, UK, ZA)

US Product Information Centre
Toll-free number: 1-800-27 27 537

www.parker.com/hzd

Your local authorized Parker distributor

Filtering Device
INRV 1600.2

Translation of the original manual in english language

Serial number	180386
Order number	1803036
Production date	16.04.2018
Filter equipment	INRFA01 + INRFA08
Color	RAL 5010
Options and accessories	XINR903
Manufacturer and address	Fuchs Umwelttechnik Produktions- und Vertriebs-GmbH Gassenäcker 35 - 39 D- 89195 Staig-Steinberg Tel.: +49 (0)7346 - 9614-0 Fax: +49 (0)7346 - 8422 E-Mail: Info@Fuchs-Umwelttechnik.com

Contents

1 User information

The filtering device is manufactured according to the state of the art and to recognised safety regulations.

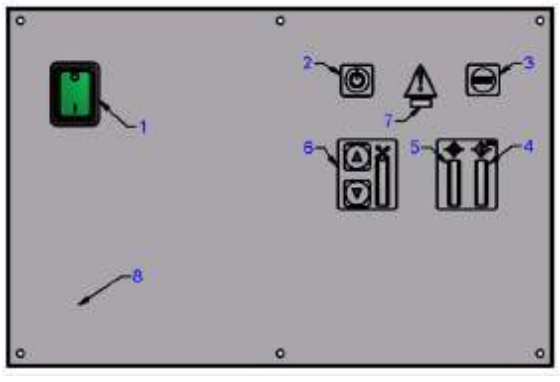
As a result of improper use and use contrary to the intended purpose danger to life and limb may arise.

These operating manual contains vital information for the safe operation of the filtering device.

1.1 Identification of the filtering device

The filtering device can be identified with the help of the name plate.

The name plate ist placed in the upright corner of the front plate with the control.
If the front plate is covered or assembeld in a door, the name plate is placed nearby on the housing.



1.2 Presentation of safety notes and warning messages

Danger!

Indicates a <u>imminent</u> dangerous situation, which
causes severe injury or death, in case of failure to observe the instructions.

- Measure - Listing of all measures to be done to avoid the consequences.

Warning!

Indicates a <u>possibly</u> dangerous situation, which
may causes severe injury or death, in case of failure to observe the instructions.

- Measure - Listing of all measures to be done to avoid the consequences.

Caution!

Indicates a <u>possibly</u> dangerous situation, which
may causes injury, in case of failure to observe the instructions.

- Measure - Listing of all measures to be done to avoid the consequences.

Notice!

Indicates a <u>possibly</u> dangerous situation, which only
may causes material damage, in case of failure to observe the instructions.

- Measure - Listing of all measures to be done to avoid the consequences.

1.3 Warning signs and mandatory signs

Warning signs and mandatory signs indicate dangerous situations, instructions and additional information.

			
Warning of a danger	Warning of suspended load	Warning of dangerous electrical voltage	Warning of tripping risk
			
Warning against hand injuries	Warning against health hazardous substances		
			
General mandatory sign	Wear respiratory protective	Wear protective gloves	Wear protective goggles
			
Before opening unplug power supply			

1.4 Text marking

Text is marked in the following ways:

Sort of text	Mark	Function
Instruction for handling 1. level	1.	Calls for a specific action.
Instruction for handling 2. level	a)	Marks a partial step in a sequence of actions.
Result in instruction for handling	✔	Marks the result.
List	●	Marks items of a list.
Action	➧	Marks actions to prevent accidents.
Reference	☞	Marks references to other points in the document.
Important information		Marks important information in the document.

1.5 Warranty and liability

Our "General Conditions for Sales and Delivery"shall apply in all cases. They will be supplied to the owner on conclusion of the sales contract at the latest. Warranty and liability claims for personal injury and damage to property are excepted if they are caused by one or several of the following reasons:

- Filtering device was not used in accordance with the manufacturers specifications for its intended use.
- The filtering device and the filters were installed, started up, operated, maintained or disposed improperly.
- Damaged filters or filters from other manufacturers were used.
- Unapproved design changes were made by the purchaser to the filtering device.
- The specified filter service lives were not complied with.

1.6 EC - Declaration of Conformity

in compliance with EC Machinery Directive 2006/42/EC, Appendix II A.

We hereby declare that the conception and design of the machine referred to below and the version brought by us into circulation comply with the provisions of the directive quoted above.

Moreover, we declare that the machine quoted below conforms with the provisions of the EU Directives "Electromagnetic Compatibility"2014/30/EU.

Type:	INRVA
Machine designation:	INRV 1600.2
Serial number:	180386
Production date:	16.04.2018
Filter equipment:	INRFA01 + INRFA08
Manufacturer and address:	**Fuchs Umwelttechnik Produktions- und Vertriebs-GmbH** Gassenäcker 35-39 D- 89195 Staig-Steinberg
Documentation authorized person:	Klose, Hans-Peter (Adress see manufacturer)

Applied harmonised standards, especially:

EN ISO 12100:2010-11 - Risk assessment and risk reduction
EN 60204-1/AC:2010-02 - Electrical equipment of machines
EN 61000-6-2/AC:2005-09 - Immunity for industrial environments
EN 61000-6-4/A1:2011-02 - Emission standard for industrial environments

Staig-Steinberg, 16.04.2018

Fuchs Umwelttechnik Produktions- und Vertriebs-GmbH

Hans Baumeister (Manager)

2 For your safety

Use the filtering device only in the proper way. Otherwise you may endanger yourself and others.

You endanger yourself and others if you handle the filtering in a wrong way or if you do not follow the safety and warning indications. Grave injures and massive damage of property can be the result.

2.1 Intended use

The filtering device may only be used for the extraction of the pollutants listed below.

Permitted extraction substances	INRFA01 + INRFA08	
For smoke, fine dusts and small amounts of gaseous pollutants and solvent fumes	4 x FIPAT055	Filter cartridge Cl. M
	1 x IF SF15V	Particulate air filter
	2 x IF AKVA12	Activated carbon filter

Use for any other purpose shall be regarded as improper use of the filtering device.

It is regarded as improper use if the filtering device is used to extract the following substances

- moist or liquid substances,
- processes with sparks or flammable materials without the implementation of additional precautions,
- explosible dust or gas atmospheres
- sticky substances.

2.2 Improper use

Warning!

Danger by improper use of the filtering device
The filtering device is designed to separate inert, non explosive dusts. Improper use of the filtering device leads to unsafe conditions as the danger of fire and explosion, for this cases the manufacturer takes no responsibility.

- Never smoke while working with the filtering device.
- Never use the filtering device for suctioning flammable liquids.
- Never use the filtering device in areas which contain flammable liquids.
- Always use original "Fuchs Umwelttechnik filter equipment", to avoid electrostatic discharge at the filter materials.
- Check the saturation degree of the filters daily.

Further preventive actions:

- Draft fire protection plans including information about message paths, extinguishing agents, etc. to achieve rapid response in fighting fires.
- Install a suitable extinguischer (CO_2 or powder) next to the filtering device.
- Take special note of the German BGI 888 "Safety regulations for the use of fire extinguishing systems within extinguishing gases".

2.3 Duties of the owner

The owner ensures that,

- these operating manual is kept within easy reach of the filtering device at all times.
- all instructions in the operating manual will be observed.
- all inspections and all maintenance work will be done.

The owner undertakes to allow only persons to work on the system who,

- have read and understood these operating manual,
- are qualified in basic work safety and accident prevention regulations,
- are instructed in the safe handling of the filtering device (instruction).

The knowledge about the safe handling of the filtering device is confirmed by a personal signature below:

Name	Date	Signature

2.4 Personal protecting equipment

The owner must provide every operating and maintenance person with the necessary personal protection equipment for the actions

- Changing filters,
- Disposing filters,
- Maintenance of the filtering device,
- Dismantling of the filtering device.

The minimal personal protection equipment consists of

- protective gloves: long, disposable polythene gloves
- respiratory protection: fine dust respirator conformant to Test Protection Class 3

2.5 Qualification of the personnel

Only trained and instructed personnel may work on the filtering device.

This affects all phases in the life time cycle of the filtering device such as transporting, installing, putting into service, operating, troubleshooting and disposal.

Maintenance and repair work may only be carried out by skilled workers trained for the particular task.

As a result of their training and professional activity, they must be capable (proven by documentary documentation) of recognising the specific dangers and risks the may arise or occur during maintenance and repair work.

The specific responsibilities of the personnel must always be clarified in every detail before the filtering device is put into service.

Personnel under training may only work on the filtering device under the supervision of an experienced person.

2.6 Handling dangerous substances safely

Machining materials with modern methods produces substances that are harmful to health.

Warning!

Danger from dust, condensates and adsorbates

Harmful to health when inhaling, swallowing or coming into contact wiht the skin. You may become sensitised to these substances if you inhale them of allow them to come into contact with your skin. There is a serious risk of injuring your health if you are exposed to these substances for longer periods of time.

- Never eat, drink or smoke while working with the filtering device.
- Wear disposable polyethylene gloves and a fine dust respirator as per Test Protection Class 3 before you open the filtering device.
- Never inhale escaping substances, fumes or gases.
- Remove and dispose of wast using safe methods.
- Ovserve the safety instructions in your local operation instructions and work instructions.

2.7 Controlling the danger of fire and explosion

Determine the safety parameters of your emissions in order to assess the fire and explosion risk.
Define suitable precautions accordingly.

Warning!

Danger by fire or explosion

Almost all insustrial dusts can be set on fire by sparks or hot, glowing parts. This may causes burns or grave injuries by explosions.

- Never allow burning or smouldering objects, materials or substances to the enter the filtering device.
- Never smoke while you are working.
- Use suitable preliminary separators if you are unabel to exclude the entrainment of hot, glowing or smouldering objects, materials or substances into the filtering device with sufficient certainty.
- Never leave the filtering device unattended when the power plug is plugged into the mains socket.
- Switch off the filtering device and unplug the power plug from the mains socket when the filtering device is not in use.

2.8 Firefighting

If despite all precautions smoke ist detectable on the device or at the air outlet, combat the fire using the following measures:

- Switch off the filtering device immediately and unplug the power plug from the mains socket.
- Douse the filter container or dust tank with a suitable extinguisher (CO_2 or powder). Spray extinguishing agent through the suction opening into the filtering device.

Danger!

Danger from toxic gases
Toxic gases and toxic vapours occur it there is a fire in the filter. Inhaling of toxic gases or toxic vapours may cause intoxication and health injuries.

- ➧ Never inhale escaping gases and fumes.
- ➧ Immediately ventilate the entire working environment after firefighting.

2.9 Running and operating

Danger!

Danger from electric shock
The filtering device operates with high voltage. Hight voltage can cause lethal effects.

- ➧ Only trained electricians are allowed to work at the electrical devices.

Danger from damaged parts of malfunctions
Only a properly and trouble free functioning filtering device offers you operational reliability.

- Make sure every time before you start up that the filtering device and its connection cables show no signs of damage.
- Have every damage of malfunction repaired by a skilled person trained for the job before you work on or with the filtering device.
- Send the filtering device to the manufacturer for inspection orf repair if:
  - the filtering device is not operating properly.
  - was dropped or damaged.
  - was left to stand outdoors or fell into water.

Preventing damage and malfunctions
Prevent damage and malfunctions by observing the following instructions:

- Only operate the filtering device in a dry industrial building.
- Never allow the filtering device to stand outdoors or on wet surfaces.
- Keep the power cord away from hot surfaces.
- Keep openings free from dust, lint, hair and anything that may restrict air flow.
- Never insert objects in the openings.
- Always switch the controller oof by the main switsch before you unplug the power plug from the mains socket.

Danger from making modifications at the filtering device
Prevent damage and malfunctions by observing the following instructions:

- Always use the original spare parts from the manufacturer.
- Only use accessories recommended by the manufacturer.
- Never change the filterung device, its original design, layout or equipment without obtaining an approval certificate from the manufacturer.

Otherwise this may lead to unforeseeable, unsafe operating situations for the impacts of which the manufacturer can assume no liability.

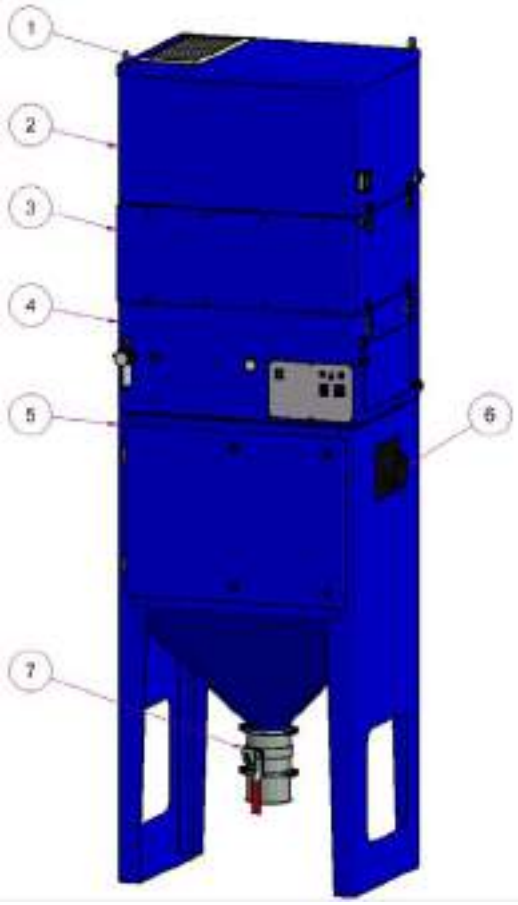
The filters are specially adapted to the prevailing conditions. With non approved filters, there is a risk of dangerous emissions due to insufficient filtration effect.

Always use original Fuchs Umwelttechnik filter equipment!

3 Product description

The filtering device is an industrial product that was designed and manufactured exclusively for industrial use.

3.1 Main components and function



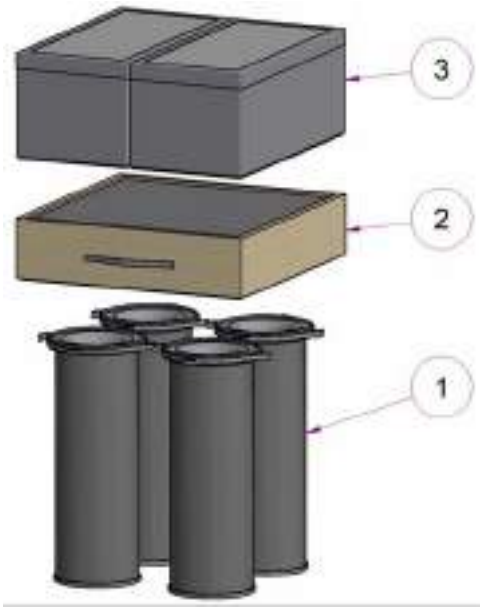
Pos.	Description
1	Outlet
2	Fan module
3	Filter module
4	Cleaning module
5	Pre-filter module
6	Suction nozzle
7	Dust container

Functional principle

- The raw gas is fed through the suction nozzles into the filtering device.
- The raw gas is purified of pollutants by the used filter combination in the filtering device.
- The filter cartridges are cleaned automatically with a shot of compressed air at regular intervals.
- The cleaned dust is collected in the dust collector provided.
- The cleande air emerges from the filtering device via a blow-out grille or a blow-out nozzle.

3.2 Filter combination used

The permitted extraction pollutants are mainly dependent on the filter combination used in the filtering device.



Pos.	Inserted	Designation and dimension	Order unit	Order no.
1	4 pc.	Filter cartridge Cl. M	1 pc.	FIPAT055
2	1 pc.	Particulate air filter	1 pc.	IF SF15V
3	2 pc.	Activated carbon filter	1 pc.	IF AKVA12

3.3 Filter system function

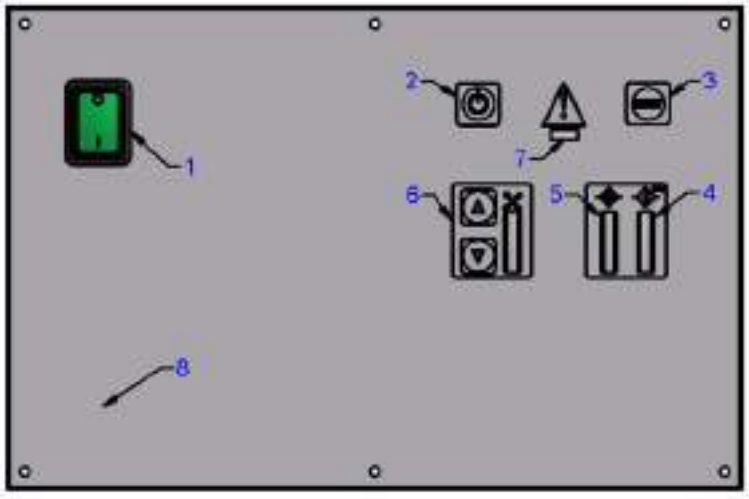
The extraction and filtering device operates with a multistage mechanical filter system. Various filter combinations are used depending on the pollutants to be extracted.

Pollutants to be extracted	Filters used	Remarks
• Coarse particles • Coarse dust	• Filter bags • Filter cubes • Metal filters • Filter cartridges • Pocket filters • Filter mats	Optional possibly with separate pre-separator
• Fine dust • Fumes	• Particulate air filter	BIA tested
• Gaseous pollutatns • Solvent • Adhesive vapours	• Activated carbon filter	
• Special waste (Aldehydes, amines, ammoniac usw.)	• Special filter	On request

Filter efficiency

- for particles up to 99.995 % according to DIN EN 1822 dependent on filter equipment.
- for gaseous substances dependent on the type, concentration and composition of the gases.

3.4 Controls



Pos.	Description	Function
1	Main switch	Switch to stand-by mode.
2	On/Off button	Start or stop extraction process.
3	Reset button	Acknowledge error messages.
4	Bargraph display „Filter saturation main filter“	Show saturation state of the main filter.
5	Bargraph display „Filter saturation pre-filter“	Show saturation state of the pre-filter.
6	UP/Down key, bargraph display „Extraction rate“	Set extraction rate.
7	Fault lamp red/yellow	Show system fault
8	Interface (option)	Connect extraction and filtering device to a central controller.

3.5 Controller interfaces

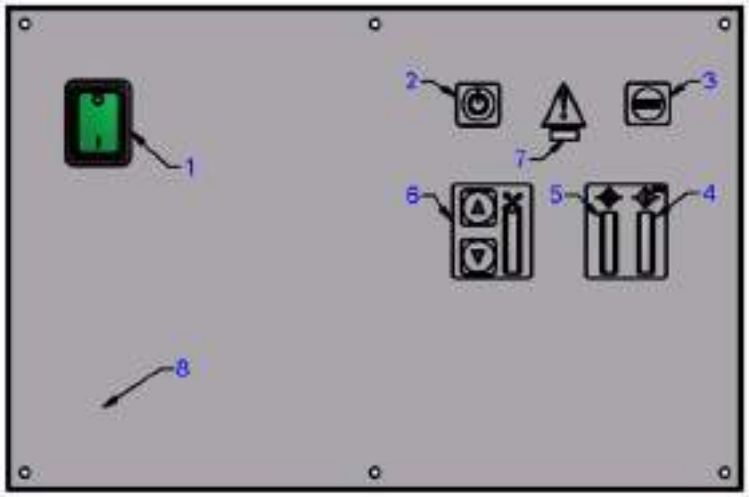
The interfaces available are always positioned below the controls.

Interface MKF SPS01

- The interface is wired at the factory to a 25-pin connector (Bulgin, Type Standard Buccaneer).
- The fan is started remotely by an external, potential-free contact at PIN 20 and PIN 24 (bridge between PIN 19 and PIN 23) or 24 V DC input via PIN 19 and GND via PIN 20.
- The status messages of the fan and the filter are output as single messages. The status messages require a voltage supply of 24 V DC input on PIN 15 and GND on PIN 16.
  - Main filter saturated: 24 V DC output signal on PIN 9
  - Filter pre-warning main filter saturated: 24 V DC output signal on PIN 13
  - Pre-filter saturated: 24 V DC output signal on PIN 11
  - Motor fault: 24 V DC output signal on PIN 14
  - Fault (main and pre-filter): 0 V DC output signal on PIN 7
  - Repeat filter check: 0 V DC output signal on PIN 12
- The speed can be controlled externally by an input signal of 0 - 10 V DC on PIN 3 and GND on PIN 4
- The status messages of the fan and the filters can also be output as a group message. PIN 9, PIN 11, PIN 13 and PIN 14 must be bridged for this. The status messages require a voltage supply of 24 V DC input on PIN 15 and GND on PIN 16.
  - Main filter saturated: 24 V DC output signal on PIN 9
  - Filter pre-warning main filter saturated: 24 V DC output signal on PIN 9
  - Pre-filter saturated: 24 V DC output signal on PIN 9
  - Motor fault: 24 V DC output signal on PIN 9
  - Fault (main and pre-filter): 0 V DC output signal on PIN 7
  - Repeat filter check: 0 V DC output signal on PIN 12

For further information about the interface, please see the interface circuit diagram (☞ see section 9.5).

3.6 Safety and monitoring equipment



The safety and monitoring devices detect errors or unsafe operating conditions.

In such a case

- the fault lamp (item 7) flashes red or yellow,
- the operating state or the error message is shown in the bargraph displays (item 4, 5 and 6).

The filtering device continues to operate without restriction when an error occurs and displays a fault message.

At the end of the operating process the saturated filters must be changed immediately or the filtering device must be maintained.

3.6.1 Monitoring of the used filters

In this filtering device the installed filters are monitored contantly with regard to their saturation level by differential pressure measurements. For this, the pressure before and after the respective filter is measured and the difference value compared with a set limit value.

Since these limit values are determined and saved at full suction capacity, an exact filter monitoring can only take place at full suction capacity.
For this reason the device always runs up to full suction capacity for about ten seconds first when switching on. During this time the filters are checked at optimum operating state and the determined values are compared with the saved limit values.
After these ten seconds the device is set automatically to the set value for the suction capacity.

Pre-filter message
If the system should display a pre-filter message, responsible may be:

- One of the filters monitored as a pre-filter is saturated.
- Suction nozzle or suction cross section is to narrow.
- Suction hose is kinked or blocked.
- Housing of the suction point is too tight.

As a pre-filter message the fault lamp (item 7) flashes red and the bargraph display „Filter saturation pre-filter“ (item 5) in alternation (☞ see section 3.6).

Filter pre-warning
If the extraction and filtering device shows a pre-warning:

- A monitored main filter is almost saturated.

As a filter pre-warning, the fault lamp (item 7) flashes yellow and the bargraph display „Filter saturation main filter“ (item 4) shows 6 LEDs green and 2 LEDs yellow (☞ see section 3.6).

Main filter message
If the system shows a main filter message, the following applies:

- one of the filters monitored as a main filter is saturated.

As a main filter message the fault lamp (item 7) flashes red and the bargraph display „Filter saturation main filter“ (item 4) in alternation (☞ see section 3.6).

3.6.2 Monitoring of the fan

The integrated motor current monitoring monitors the blower function.

When the blower fails

- the fault lamp (item 7) flashes red,
- alternately with the bargraph display „Suction power“ (item 6) the LEDs 1-5 and 6-10 (☞ see section 3.6).

3.7 Options and accessories

The delivered filtering device is equipped with the following options and accessories.

3.7.1 XINR903 - Connecting plate, 1 x NW160

With the option XINR903 the filtering device is equipped with a connecting plate with nozzle 1 x dia 160.

3.8 Technical Data

Device type	INRV 1600.2
Dimensions l x w x h [mm]	900 x 660 x 2790
Space requirements for filter change or maintenance l x w x h [mm]	1800 x 1300 x 4550
Weight without filter equipment ca. [kg]	350
Degree of protection [IP]	42
Suction capacity max. [m^3/h]	400-1600
Max. vacuum [Pa]	6800
Number of fans [$St.$]	1

Energy supply on the filtering device	INRV 1600.2
Voltage [V]	400
Frequency [Hz]	50/60
Power consumption [kW]	2,2
Rated current [A]	6,8
Fuse [A]	16
Compressed air supply [Bar]	5
Permissible ambient temperature [C]	+5 - +35
Permissible storage temperature [C]	+5 - +40
Power input Europe	Phase, neutral and protective ground
Power input USA	Centre tap two-phase system with PE
Housing material	Powder-coated steel sheet

Sound level at filtering device	INRV 1600.2
Continous sound pressure [$dB(A)$]	59
Acoustic power level to CE (DIN 45635-3) 1m [$dB(A)$]	67

Filter equipment	INRFA01 + INRFA08
Total filter surface area of the particulate filters ca. [m^2]	28,00
Total weight of the gasfilters ca. [kg]	29,80
Total weight of the filter equipment ca. [kg]	51,98

4 Transporting

The filtering device was carefully and safely packaged at the factory without damages.

Notice!

On receipt, check the filtering device immediately for transport damages.

- Check whether the packaging has signs of damage. This is an indication of transport damages to the filtering device.

Notice!

If the packaging of the filtering device has really sustained damage, then

- unpack the filtering device in the presence of the forwarding agent.
- have any damage confirmed by the forwarding agent.
- document the findings.
- report damages within 24 hours.
- leave the damaged packaging and damaged filtering device unchanged.
- do not use the damaged filtering device.
- report the damage to the shipping agent as described above.
- report the damage to the manufacturer.

5 Mounting

Warning!

If lifting accessories are breaking, the lifted module may fall down and causes severe injuries.

- Do not stand under suspended load.
- Do not use damaged lifting accessories.
- Use the provided ring loops to lift only one module at a time only.
- Notice that the ring loops are positioned in the load direction.

5.1 Unpacking the filtering device

Unpack the filtering device observing the following measures:

1. Lift the filtering device up carefully out of the packing.
2. Never pull the filtering device by the connecting cable.
3. Remove the transport locks which protect the filtering device from damage.
4. Set down the filtering device carefully.

✔ Filtering device is unpacked.

5.2 Choosing the mounting place

Choose the mounting place for the filtering device observing the following measures:

1. Select a dry and cool installation site as far as possible.
2. Never allow the filtering device to stand outdoors or on wet surfaces.
3. Do not place the filtering device directly next to heating elements.
4. Place the filtering device on a solid, flat surface.
5. Pay attention to the necessary space required for changing filters and for maintenance work.
6. Keep the power cord away from hot surfaces.

✔ Mounting place is choosen.

5.3 Moving the filtering device

Move the filtering device to the mounting place observing the following measures:

1. Use appropriate transport devices to move the filtering device.
2. Never pull the filtering device by its power cord.
3. Only lift one module at a time with the lifting loops.
4. Only move the filtering device on flat, smooth floors.
5. Do not move the filtering device over sharp corners or edges.
6. Never place the filtering device on its power cord.

✔ Filtering device has been moved to the mounting place.

5.4 Assembling the filtering device

Warning!

Hands can be jammed. This may causes severe hand injuries.

- Do not grab into the hazard area when assembling the modules.

Assemble the filtering device observing the following measures:

1. Set the modules on top of each other (☞ see chapter 3.1) and fix them with the fasteners.
2. Establish all connections between the modules of the filtering device.

✔ Filtering device is assembled.

5.5 Retaining the filtering device

Retain the filtering device observing the following measures:

1. Fix the filtering device to the floor by suitable measures (e.g. plug tight).
2. Protect the filtering device unit against external impacts and knocks.

✔ Filtering device is secured.

6 Installing

The following points must be checked prior to installation:

- Make sure that the filtering device is mounted correctly.
- Make sure that all the maintenance openings are sealed tightly.
- Check all the closures and fastening elements.

6.1 Connecting collection devices

Warning!

Almost all industrial dusts can be set on fire by sparks or hot, glowing parts. This may causes burns or grave injuries by explosions.

➧ Only use the filtering device to suction non explosive dusts and non explosive fumes in combination with the correct filter equipment.

1. Connect your collection device to the suction opening provided on the filtering device.

✔ Collection devices are connected.

Leaks result in power losses!
Therefore make sure that the connections between your collection devices and the filtering device are tight.

If you connect several connection devices,
these should be designed so that they cannot cause mutual interference.

6.2 Connecting interface

Danger!

The filtering device operates with high voltage. Hight voltage can cause lethal effects..

➧ Only trained electricians are allowed to work at the electrical devices.

Have the filtering device interface connected to your main controller by a trained electrician only.
(Wiring diagram ☞ see chapter 9.5)

6.3 Connecting the power supply

The filtering device is designed for operation at a specific power source (☞ see chapter 3.8). The filtering device is equipped at the factory with the suitable power cord and power plug for a specific power source.

Danger!

The filtering device operates with high voltage. High voltage can cause lethal effects.

➧ Only trained electricians are allowed to work at the electrical devices.

Caution!

Incorrect positioned power cords create tripping points. Downfalls can cause severe injuries.

➧ Position the power cord in a correct way. Avoid tripping points.

1. Plug on the filtering device with the prepared connection facility.

✔ Power supply is connected.

If the power plug must be changed for a different power source or different plug, then

- have any change work carried out by a qualified electrician only.
- always use the correct plug to fit the socket. Never use an adapter to make the connection.
- have the electrican confirm that the grounding conductor on the new plug is connected and functional.

6.4 Connecting the compressed air supply

Only feed dry, non-oily compressed air to the filtering device.

Make sure that the operating pressure is always constant.

Caution!

Damaged pneumatic hoses may spin around materials. These materials can cause injuries at the eyes.

- Check the pneumatic hoses weekly.
- Replace damaged pneumatic hoses immediately.
- Replace pneumatic hoses according to the maintenance plan.

1. Connect the compressed air supply to the connection facility provided.
2. Set the operating pressure specified on the filtering device.

✔Compressed air supply is connected.

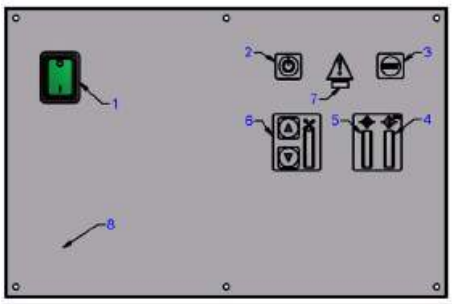
7 Using

Caution!

Incorrect positioned power cords create tripping points. Downfalls may cause severe injuries.

- Position the power cord in a correct way. Avoid tripping points.
- Have the power cord always in mind when using the filtering device.

7.1 Switching on the main switch

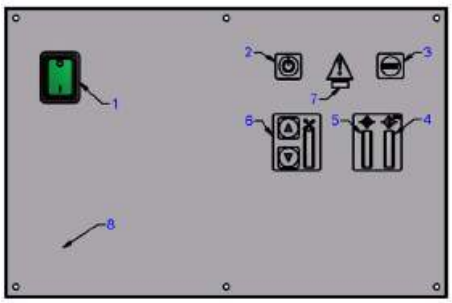


1. Switch on the main switch (item 1).

- The software conducts a self-test.

✔ Extraction and filtering unit is switched on.

7.2 Starting the suction process



1. Press the On/Off button (item 2).

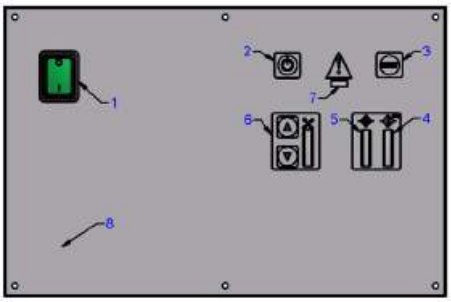
- The fan starts.
- The On/Off button (item 2) lights green.

✔ Extraction process is started.

For the safety test, the filtering device must be set to maximum extraction rate for approx. 10 seconds after it is switched on.
After the check, the filtering device returns automatically to the set extraction rate.

7.3 Set suction power

Please note that the fan must be running to set the suction power.



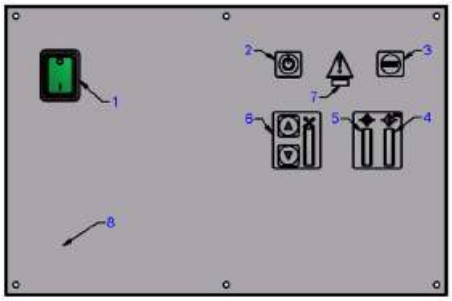
1. Start the extraction process.
   (☞ see section 7.2)
2. Press the UP key ▲ (item 6).
   - The suction power increases.
   - The current suction power is shown in the bargraph display.
3. Press the Down key ▼ (item 6).
   - The suction power is reduced.
   - The current suction power is shown in the bargraph display.

✔ Suction power set

For the safety test, the filtering device must be set to maximum extraction rate for approx. 10 seconds after it is switched on.
After the check, the filtering device returns automatically to the set extraction rate.

7.4 Filter saturation display

Please note that the fan must be running to display filter saturation.



1. Start the extraction process.
   (☞ see section 7.2)
2. On the bargraph display „Filter saturation main filter“ (item 4) the filter saturation of the main filter is displayed.

- The filter saturation is displayed by ten LEDs.
  - Filter state normal: 6 LEDs green.
  - Filter state 95% saturated: 6 LEDs green and 2 LEDs yelow.
  - Filter state 100% saturated: 6 LEDs green and 2 LEDs yellow and 2 LEDs red.

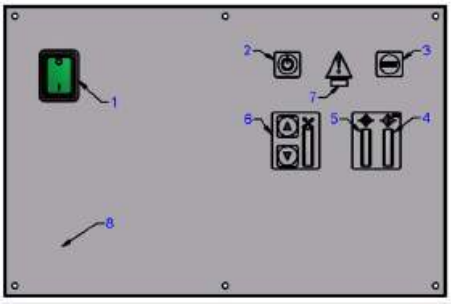
3. On the bargraph display „Filter saturation pre-filter“ (item 5) the filter saturation of the pre-filter is displayed.

- The filter saturation is displayed by ten LEDs.
  - Filter state normal: 6 LEDs green.
  - Filter state 95% saturated: 6 LEDs green and 2 LEDs yellow.
  - Filter state 100% saturated: 6 LEDs green and 2 LEDs yellow and 2 LEDs red.

4. Depending on the extraction system, the bargraph display „Filter saturation pre-filter“ (item 5) may also display a filter saturation with new filters.

✔ Filter saturation is queried.

7.5 Stop extraction process

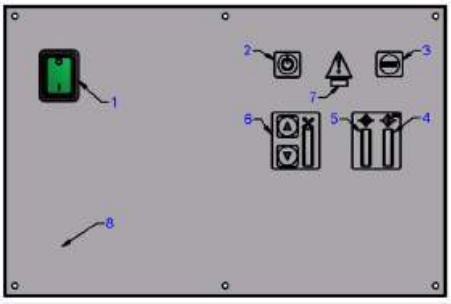


1. Press the On/Off button (item 2).

- The fan switches off after a short delay.
- The lamp in the On/Off button (item 2) goes off.

✔ Extraction process is stopped.

7.6 Taking the filtering device out of operation



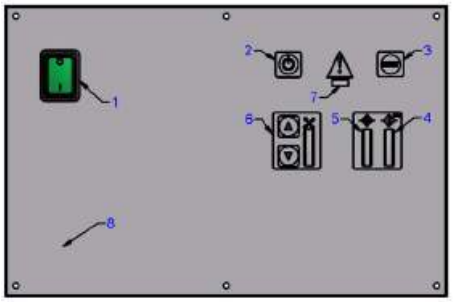
1. Stop the suction process.
   (☞ see chapter 7.5)
2. Switch off the main switch (Pos. 1).
3. Pull the power plug out of the main socket.
4. Disconnect the filtering device from the compressed air supply..

✔ Filtering device ist taken out of operation.

7.7 Faults

7.7.1 Recognising and rectifying faults

The filtering device outputs existing uncertain operating states or error messages:



- The fault lamp (item 7) flashes red or yellow.
- The bargraph display „Filter saturation pre-filter“ (item 5), „Filter saturation main filter“ (item 4) or the bargraph display „Suction power“ (item 6) flashes.
- The unsafe operating states or error messages are output via the interface to the controller of the customer.

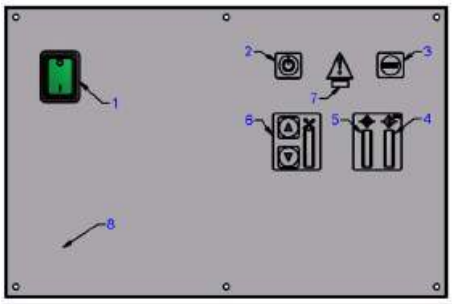
Display	Cause	Remedy
Bargraph display „Suction power“ (item 6) flashes (LEDs 1-5 and 6-10) and fault lamp (item 7) flashes red	Catches open.	Close all catches.
	Fan defective. Fan not connected correctly.	Replace fan. Connect fan correctly.
Bargraph display „Filter saturation pre-filter“ (item 5) flashes and fault lamp (item 7) flashes red	Pre-filter saturated.	Replace pre-filter.
	Foreign body in suction pipe. Suction nozzle cross section too small. Suction hose too long. Housing tight.	Remove foreign body (change hose if necessary). Increase suction area (lay bypass if necessary). Shorten suction hose. Create fresh air opening.

Display	Cause	Remedy
	Pressure hose blocked.	Replace silicone hose for pressure monitoring.
Bargraph display „Filter saturation main filter“ (item 4) flashes and fault lamp (item 7) flashes red	Main filter saturated.	Replace main filter.
	Pressure hose blocked.	Replace silicone hose for pressure monitoring.
	Pressure switch defective.	Change control board.
Fault lamp (item 7) flashes yellow	Main filter saturated 95%.	Do not change main filter until 100% saturation.
	Pressure hose blocked.	Replace silicone hose for pressure monitoring.

If an unknown fault occurs or the fault cannot be rectified by the steps described above the contact the manufacturer.

7.7.2 Acknowledging fault messages

To acknowlege a fault message observe the following measures:



1. In an uncertain operating state occurs, the filtering device emits the following alert messages:
   - The fault lamp (item 7) flashes red or yellow.
   - The bargraph display „Filter saturation pre-filter“ (item 5), „Filter saturation main filter“ (item 4) or the bargraph display „Suction power“ (item 6) flashes.
2. Switch off the filtering device.
3. Eliminate the displayed fault according to the procedure described in chapter 7.7.1.

- After switching back on the extraction and filtering unit, the display changes back to normal state after a short test time.

✔ Fault message is acknowledged.

8 Maintenance

Notice!

Only a properly and troublefree functioning filtering device offers you operational reliability.

➧ Carry out the maintenance work according to maintenance schedule and maintenance description.

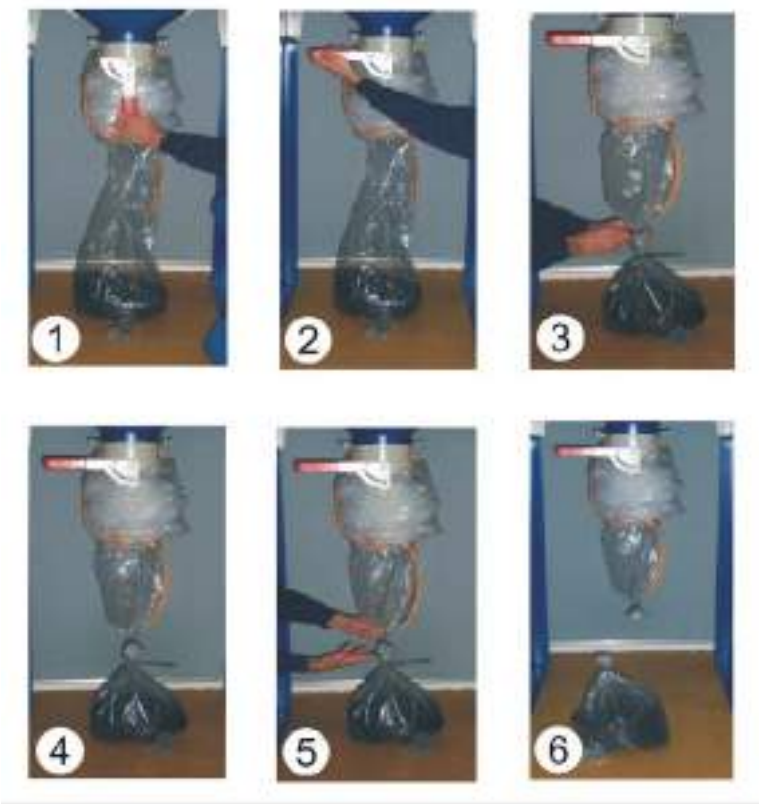
8.1 Checking at regular intervals

Checking interval	Checking action
Previous to every switching on	• Make sure that the filtering device and its connecting cables show no signs of damage.
Several times a day	• Observe the diisplay messages and error messages on the control panel. (☞ see chapter 3.6) Eliminate faults according to the instructions. (☞ see chapter 7.7.1).
Weekly	• Check the tight fit of the suction pipes, their connections and joints. • Check the firm seat of the module locks. • Check the seat of the seals on the housing and the filters. • Check all pneumatic hoses on damages. Replace damaged pneumatic hoses.
Every 2 years	• Replace all pneumatic hoses. • Overhaul the filtering device.

8.2 Empty dust container

Empty the dust container daily. The emptying intervals must be adapted if it is overfull.

Empty the dust container observing the following measures:



1. Loosen the locking screw and open the flap.

- The dust falls into the polyethylen bag.

2. Close the flap and tighten the locking screw.
3. Seal the polythene bag air-tight.
4. Seal the polythene hose air-tight at the lower end.
   Pay attention to the correct fit of the polythen hose.
5. Cut the polythene hose between the two sealing points.
6. Dispose the dust properly.

✔ Dust container is empty.

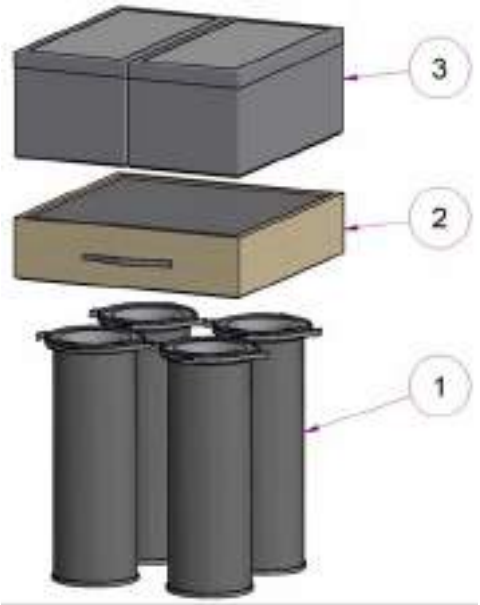
8.3 Changing filters

Warning!

While changing filters direct contact with the separated substances is possible. Direct contact with these substances may cause serious damage to health after prolonged exposure.

- Acoid direct contact with the separated substances.
- Wear long disposable ethylene gloves and a fine dust respirator (Test Protection Class 3).

The following filter equipment is located in your filtering device:



Pos.	Inserted	Designation and dimension	Order unit	Order no.
1	4 pc.	Filter cartridge Cl. M	1 pc.	FIPAT055
2	1 pc.	Particulate air filter	1 pc.	IF SF15V
3	2 pc.	Activated carbon filter	1 pc.	IF AKVA12

8.3.1 Preparing filter change

Take the filtering device out of operation (☞ see chapter 7.6).
Open the openings of the filtering device according to the following measures:

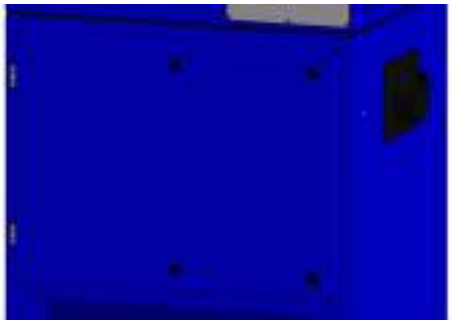
Remove filter maintenance plate from the filter module

1. Open all the nuts on the filter maintenance plate.
2. Lift off the filter maintenance plate carefully from the front.

- Reassemble in reverse order.

✔ Filters are now accessible.

Open the filter maintenance doors of the filter cartridges



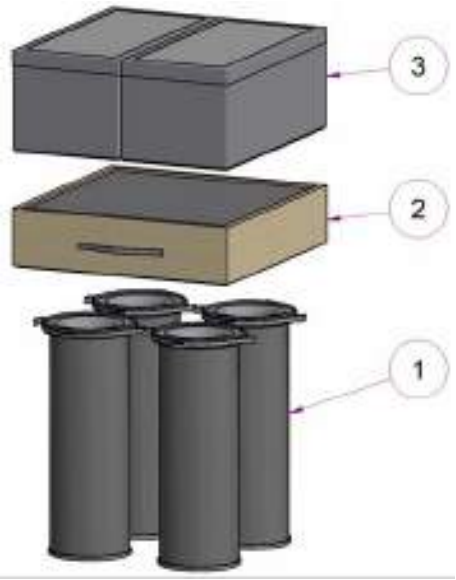
1. Open the filter maintenance doors with a suitable Allen key.
2. This key is enclosed with the extraction and filtering device.
3. Open the filter maintenance doors carefully.

- Reassemble in reverse order.

✔ The filter cartridges are now accessible.

8.3.2 Renewing the filter cartridges

The filter cartridge is monitored by the pre-filter control of the filtering unit.



1. Prepare an air-tight sealable polythene bag.
2. Loosen the four wing nuts at the flange of the filter cartridge.
3. Remove the filter cartridge carefully from the filtering device.
4. Pack the removed filter cartridge air-tight in the prepared polythene bag.
5. Dispose of the removed filter cartridge properly.
6. Insert the new filter cartridge carefully into the filtering device.
7. Pay attention to the seal of the new filter cartridge.
8. Retighten the four wing nuts at the flange of the filter cartridge.
9. Repeat this process with all installed filter cartridges.

✔ Filter cartriges are renewed.

Notice!

The surface of the filter cartridges gets damaged by touching. Unsufficient filtering action is the result.

➧ Do not touch the surface of the filter cartridges!

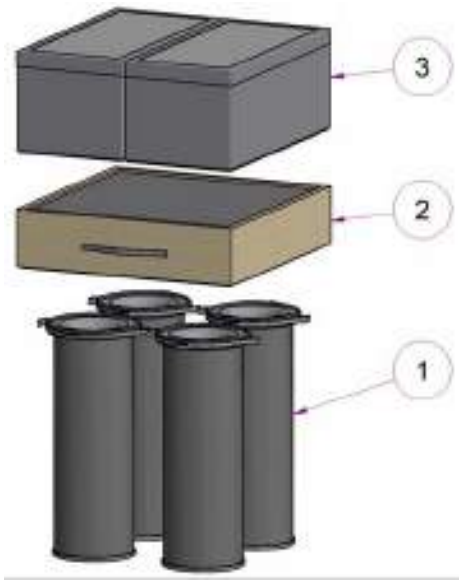
8.3.3 Cleaning the filter cartridges

The filter cartridges can be cleaned conditionally!

Type of soiling	Cleaning method	Safety note
Dry dust	• Clean carefully with a broom.	• Do not sweep in the immediate vicinity of unprotected persons.
Dry, non toxic dusts and fumes	• Suck off with a vacuum cleaner.	• The vacuum cleaner must have at least the same high separation factor as the filter cartridge of category „M“ so that the sucked off fine dusts cannot leave the vacuum cleaner unfiltered.
	• Blow out the filter cartridge from the inside to the outside with compressed air.	• Only blow out the filter cartridge in a suitable room. • On no account blow out the filter cartridge in the immediate vicinity of unprotected persons. • Only blow out the filter cartridge with a maximum pressure of 5 bar.
Sticky contamination	• Only wash out the cartridge with water, soap solution or a soft steam jet.	• Allow the filter cartridge to dry completely. • Check the seal for any damage.

8.3.4 Renewing particulate air filter

The particulate air filter is monitored by the main filter control of the filtering device.



1. Prepare an air-tight sealable polythene bag.
2. Open the filter clamping screws.
3. Pull out the particulate air filter carefully.
   (☞ see chapter 8.3.5)
4. Pack the removed filter air-tight in the prepared polythene bag.
5. Dispose the removed filter properly.
6. Pay attention to the air flow direction arrow on the wooden frame of the filter.
7. Insert the new filter carefully into the housing.
   (☞ see chapter 8.3.5)
8. Pay attention to the seal on the underside of the new air particulate filter.
9. Clamp the filter with the filter clamping screws.

✔ Particulate air filter is renewed.

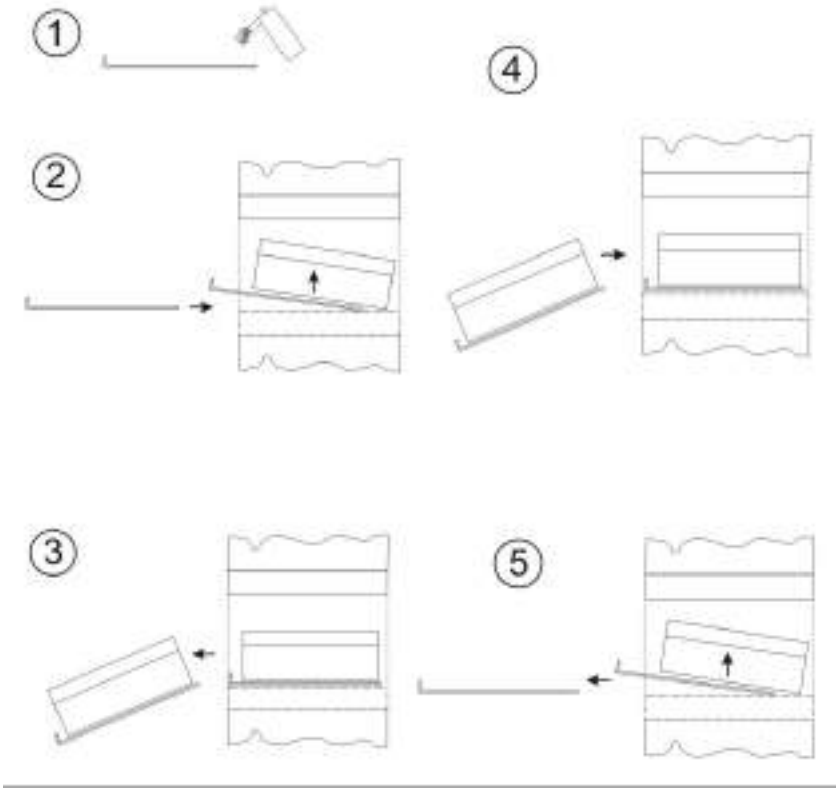
Notice!

The surface of the particulate air filter gets damaged by touching. Unsufficient filtering action is the result.

➧ Do not touch the surface of the particulate air filter!

8.3.5 Filter slide-in plate

A filter slide-in plate has been delivered with the filtering device. By using the slide-in plate for the filter changing procedure, damages at the sealing will be avoided

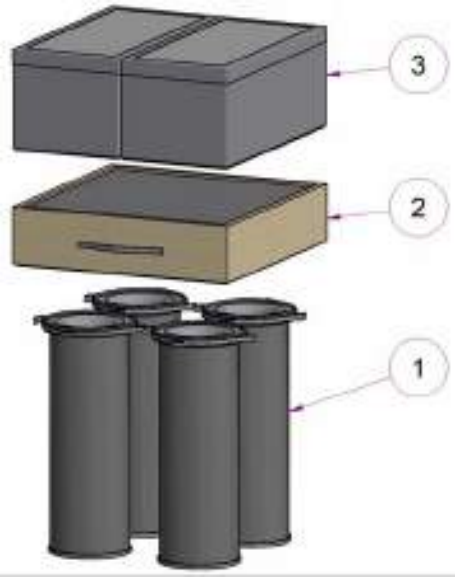


1. A filter slide-in plate is included with the extraction and filtering device.
2. The filter slide-in plate is designed for changing the filters so that the seal is not damaged.
3. Coat the filter slide-in plate with lubricant on the top (fig. 1).
4. Lift the filter and push the plate underneath (fig. 2).
5. Pull the filter carefully out of the housing by its strap (fig. 3).
6. Push the new filter with the slide-in plate into the device (fig. 4).
7. Lift the filter and pull out the slide-in plate carefully (fig. 5).

✔ Damages at the sealing have been avoided.

8.3.6 Checking saturation of the activated carbon filter

For technical reasons, it is not possible to indicate the saturation of the activated carbon filter by means of an LED.
Therefore observe the following instructions to check the saturation of the filter.



Saturation of the activated carbon filter is reached when one of the following has occurred.

- If the activated carbon filter is approx. 25 % heavier than its weight when new.

  The weight as new is specified on the rating plate of the activated carbon filter!

- If an increased unpleasant smell is detectable.

- If the activated carbon filter has been in operation for approximately 800 operating hours.

- If the activated carbon filter was installed in the filtering device more than a year ago.

If you detect saturation, renew the activated carbon filter.

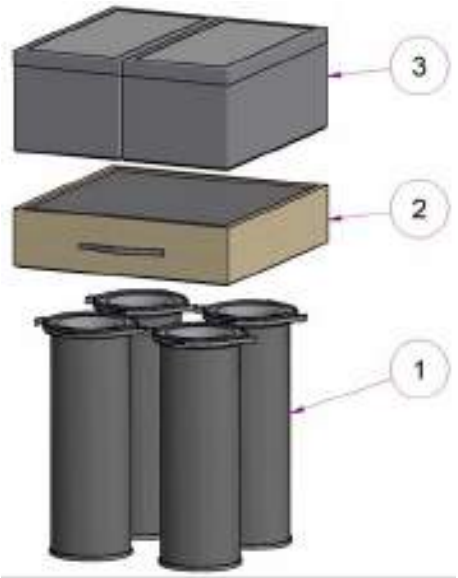
Observe the given measures for the changing of the carbon acticated filter (☞ see chapter 8.3.7).

8.3.7 Renewing activated carbon filter

Warning!

A saturated activated carbon filter dispenses pollutants to the environment! Direct contact with these substances may cause serious damage to health after prolonged exposure.

➧ Dispose saturated activated carbon filters immediately after extracting.



1. Prepare a sealable airtight polyethylene bag.
2. Lift the activated carbon filter carefully out of the housing by the handles.
3. Pack the removed activated carbon filter in the prepared airtight polyethylene bag.
4. Dispose of the removed activated carbon filter according to the regulations.
5. Observe the air flow direction arrow on the filter cassette.
6. Carefully insert the new activated carbon filter into the housing.
7. Pay attention to the seal on the underside of the activated carbon filter.
8. Make sure that the straps of the handles do not lie on the seal surface.

✔ Activated carbon filter is renewed.

8.4 Overhauling the filtering device

Notice!

Only a properly and troublefree functioning filtering device offers you operational reliability.

➧ Have your filtering device overhauled and repaired at the factory by the manufacturer,

- if the filtering device is not operating properly.
- if the filtering device was dropped or damaged.
- if the filtering device got wet.
- after approx. 1000 operating hours.
- after two years at the latest.

During a factory overhaul

- all safety related device components are inspected and changed, if necessary.
- all control parameters are checked and readjusted, if necessary.

The fan requires no maintenance

The service life of the used fans is between 3000 and 8000 operating hours. The service life is depending on the conditions of use.

9 Repairing

Warning!

While repairing the filtering device direct contact with the separated substances is possible. Direct contact with these substances may cause serious damage to health after prolonged exposure.

- Acoid direct contact with the separated substances.
- Wear long disposable ethylene gloves and a fine dust respirator (Test Protection Class 3).

Danger!

The filtering device operates with high voltage. High voltage can cause lethal effects.

- Only trained electricians are allowed to work at the electrical devices.

To repair the filtering device observe the following measures:

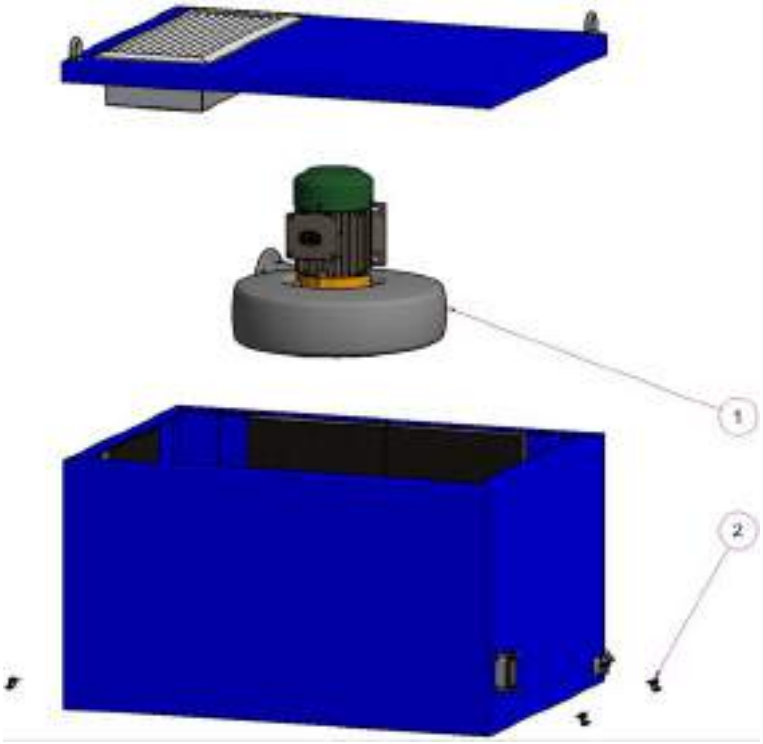
1. Take the filtering device out of operation (☞ see chapter 7.6).
2. Have the damage parts replaced by a trained person.
3. Check the seat of all the seals after the assembling of the filtering device.
4. Install the filtering device. (☞ see chapter 6.3).

✔ Filtering device is repaired.

9.1 Spare parts list – filter module

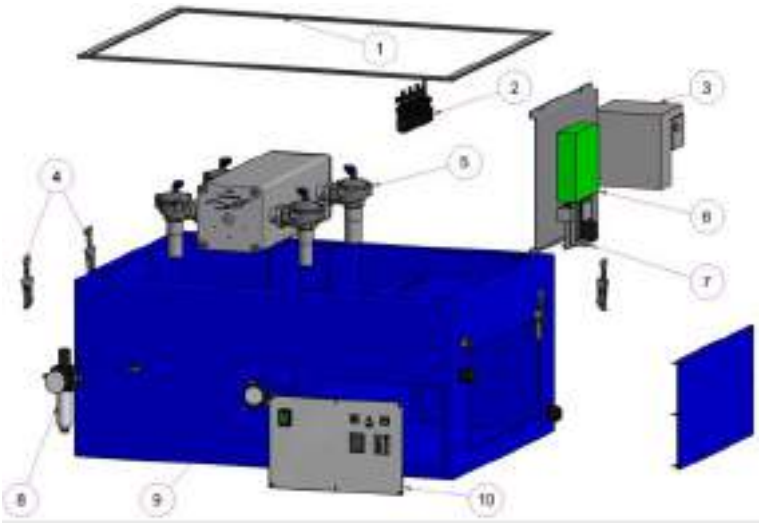
Pos.	Inserted	Designation and dimension	Order unit	Order no.
1	3,2 pc.	Sealing profile	1 pc.	DIKD 008
2	4 pc.	Fastener	1 pc.	BSTVS105
3	4 pc.	Closing hooks (galvanized)	1 pc.	BSTSH105
4	2,0 pc.	Sealing profile	1 pc.	DIPR2

9.2 Spare parts list – fan module



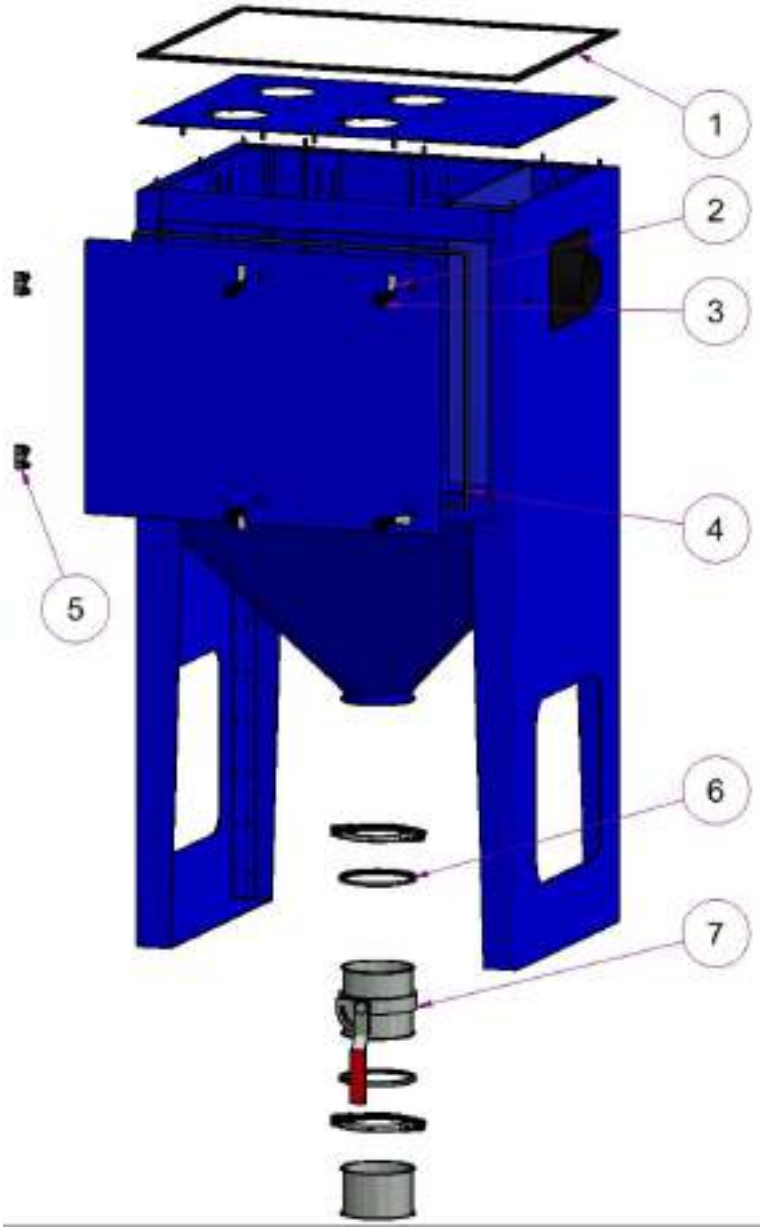
Pos.	Inserted	Designation and dimension	Order unit	Order no.
1	1 pc.	Medium-pressure ventilator	1 pc.	VTGR100
2	2 pc.	Closing hooks (perforated, galvanized)	1 pc.	BSTSH103

9.3 Spare parts list – cleaning module



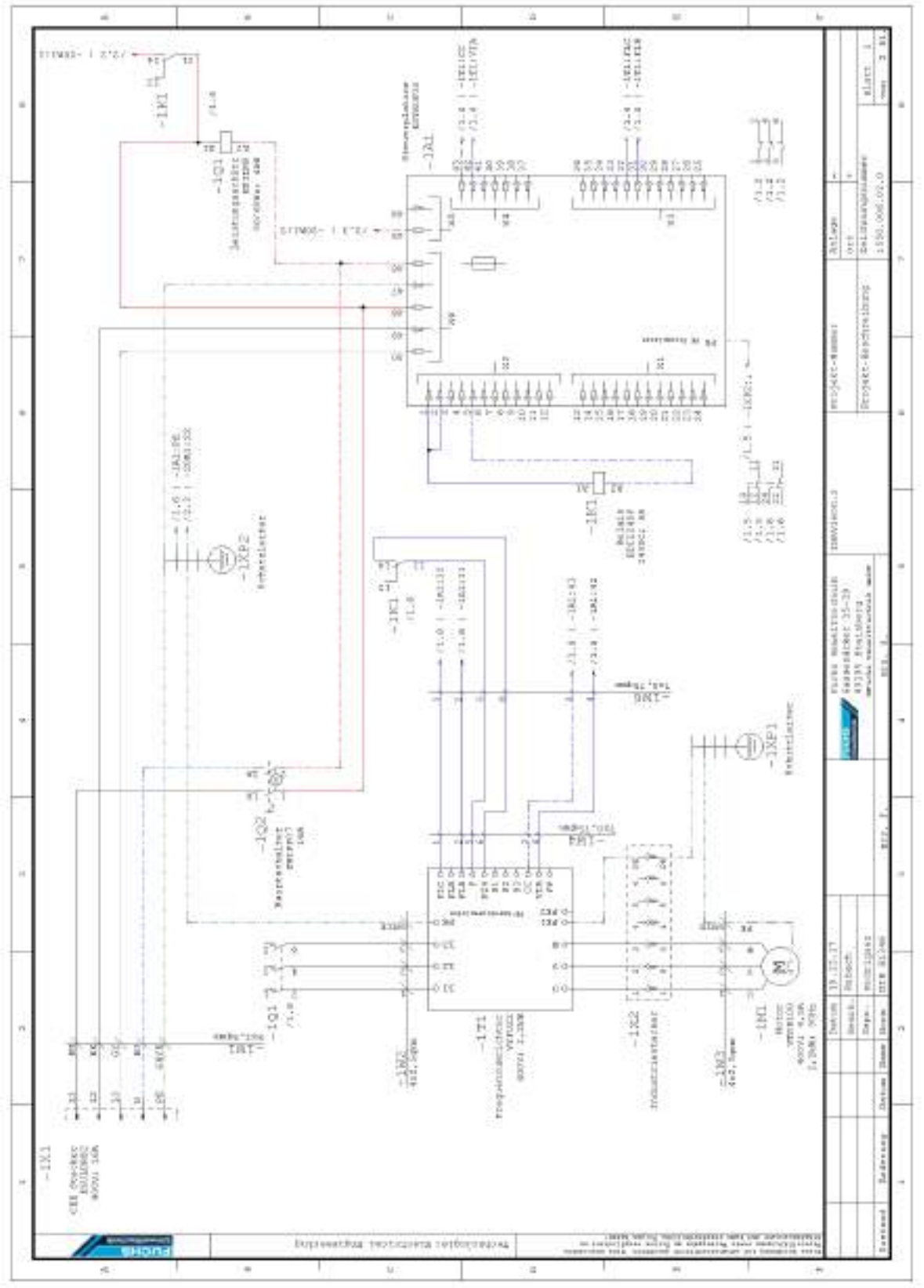
Item	Inserted	Designation and dimension	Order unit	Order no.
1	3,2 pcs.	Sealing profile	1 pcs.	DIKD 008
2	4 pcs.	Valve 230V/50Hz	1 pcs.	PN04.12
3	1 pcs.	Frequency converter 2,2 kW	1 pcs.	VTFU22
4	4 pcs.	Fastener	1 pcs.	BSTVS105
5	1 pcs.	Pressure box	1 pcs.	XDRUex01
6	1 pcs.	Valve control 230V	1 pcs.	EESTEU05
8	1 pcs.	Filter regular valve LFR-1/4”-5M-B	1 pcs.	PN05.03
9	1 pcs.	Integrated manometer 0-16 bar	1 pcs.	PN05.12
10	1 pcs.	Control board with front plate	1 pcs.	ESTEUP30

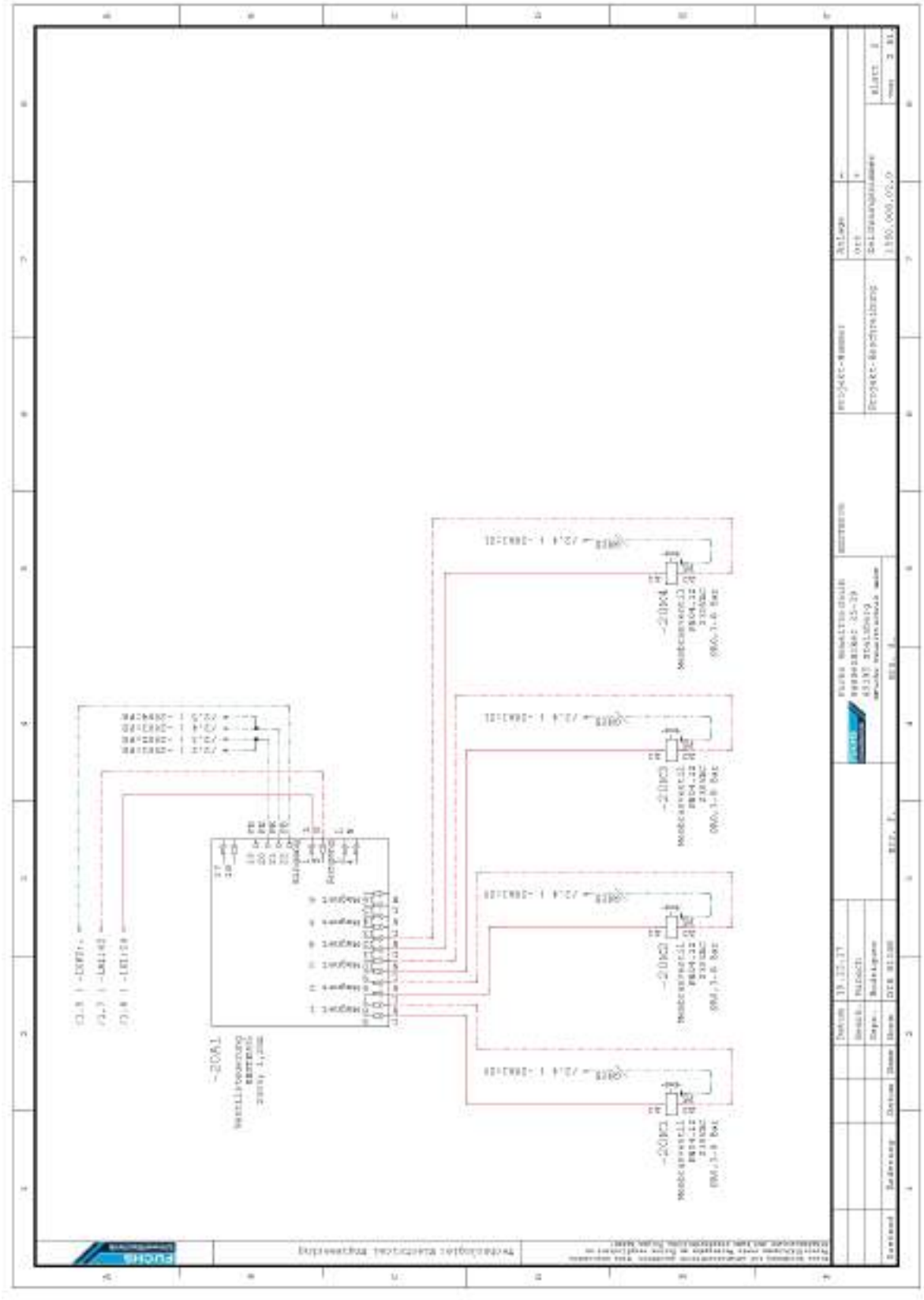
9.4 Spare parts list – pre-filter module

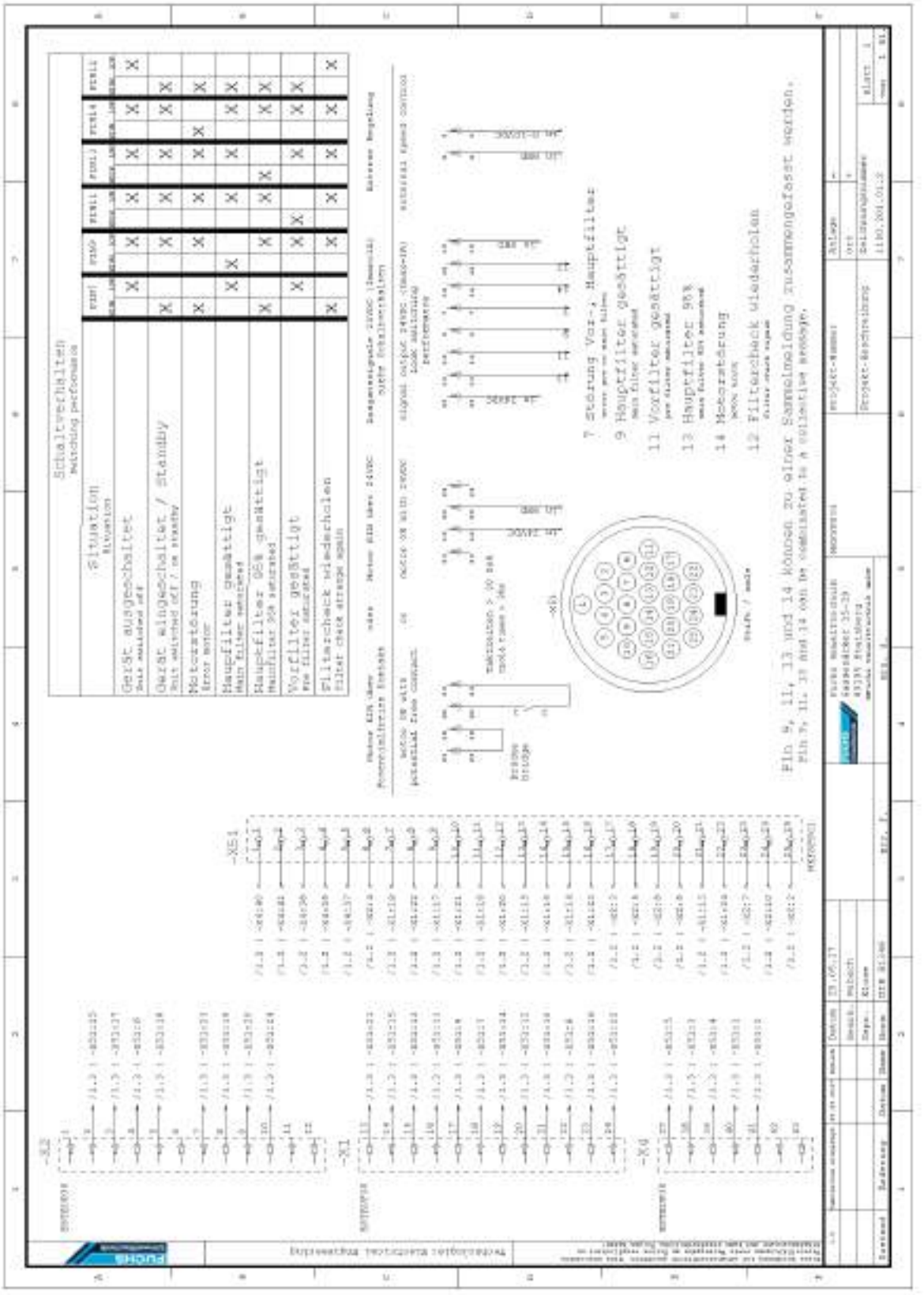


Pos.	Inserted	Designation and dimensions	Order unit	Order No.
1	1 pcs.	Seal for INRVA	1 pcs.	DIEPF10
2	4 pcs.	Tongue for toggle	1 pcs.	BSTKNEZ1
3	4 pcs.	Toggle with 8 mm square	1 pcs.	BSTVKV
5	2 pcs.	Hinge	1 pcs.	BSTSCH06
6	1 pcs.	Beading seal DN 150	1 pcs.	DIBÖR1501
7	1 pcs.	Shut-off valve NW 150	1 pcs.	ABSPH150

9.5 Wiring diagrams







10 Dismantling

Warning!

While dismantling the filtering device direct contact with the separated substances is possible. Direct contact with these substances may cause serious damage to health after prolonged exposure.

- Acoid direct contact with the separated substances.
- Wear long disposable ethylene gloves and a fine dust respirator (Test Protection Class 3).

Warning!

The pressure container is on pressure. When dismantling the filtering device the pressure can exhaust and may injure the eyes.

- Empty the pressure container before dismantling the filtering device.

Dismantling the filtering device

1. Remove all filter elements from the filtering device
   (☞ see chapter 3.2).
2. Remove and collect absolutely all the dust and foreign bodies from the equipment parts of the filtering device.
3. Empty the dust particles in the collection tank provided as described in your operation or work instructions.
4. Have the filtering device dismantled into its component parts by skilled workers trained to do the job.

✔ Filtering device is dismantled.

11 Storing

Notice!

By unproper storage the filtering device can be damaged.

- Store the filtering device only in dry and closed industrial buildings.
- Store the filtering device only at temperatures from +5 to +40 Degree Celsius.

Activated carbon filters have to be replaced after a storage durance of more than twelve months!

12 Disposal

Notice!

Particle filters and carbon filters are subject of special waste regulations.

- Dispose particle filters and carbon filters according to the pollutant load.
- Comply with the local regulations regarding waste disposal.

Safe disposal of component parts

The component parts of the filtering device have to:

- be recycled,
- be disposed according to the local regulations regarding waste disposal,
- returned to the manufacturer.

Never dispose electronic components in domestic waste. Only dispose electronic waste in the collection containers specially provided.