

***FRG Series Laser Markers
User Manual***



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REQUIRED PRECAUTIONS

1. **This equipment must be operated by Class IV Laser trained and qualified personnel only.** Read and understand this manual before operating the equipment.
2. **Prior to operating this equipment, safety shielding must be supplied by the end user to enclose the lens aperture and marking area.** This shielding should meet the requirements of a Class I enclosure as defined by the Center for Devices and Radiological Health (CDRH). This shielding must be present on the machine, interlocked and activated to protect personnel from contacting direct or scattered invisible laser radiation. **DO NOT BYPASS** interlocks during operation at any time. Only authorized service personnel are to have access to any bypass interlocks.
3. **Always remove all electrical power prior to servicing or adjusting the system.** Do not remove the housing or aperture shield at any time. Any internal service to the FRG-20 marking heads must be completed by factory trained or certified personnel only to avoid injury and to maintain the factory warranty. All service internal to the marker head is to be performed by the factory.
4. **This equipment is designed to cycle automatically when activated.** Always keep hands, loose clothing, hair, etc. away from the lens aperture and all moving parts of the equipment during the operation of the machine.
5. The laser beam exits the laser housing bottom aperture opening. **Never look into or expose skin to the beam area at any time with power applied to the system.** Always remove AC power to the complete system before service or adjustment.
6. As with any machine, bodily harm may result from misuse, lack of training, maintenance or experience with the equipment, etc. **Always observe safety precautions both as stated within these guidelines as well as standard operational considerations for any Class IV Laser equipment and/or automated machinery.**
7. **Use caution if operating the system with flammable materials.** Some materials may burn or ignite when exposed to laser radiation. **Venting of the material vapors that result from laser etching is recommended in all applications and especially in those applications where burning of the intended materials produced any byproducts known to be a health hazard.**
See Section 7.3 in the ANSI Z136.1-1993 Standard for the Safe Use of Lasers, for exposure criteria in 29 CFR 1910 Subpart Z (from the US Government). Also, see the American Conference of Governmental Industrial Hygienists (ACGIH) for published Threshold Limit Values (TLVs). It may also be necessary to consult with your local government agencies regarding restrictions on the venting of vapors.
8. This product emits invisible laser radiation. **Do not allow any part of your body (including skin, hair, eyes, etc.) to come into contact with the radiation emitted from this product, whether direct or scattered.** **Protective eyewear** must be worn when operating and servicing this unit.

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Note: The information presented within this document is provided as a guide to the operation and function of this equipment as well as related safety warnings and precautions. Although every effort was made to provide this documentation as complete, the possibility exists that some portion of information may not be included within this manual. Only those trained, qualified and familiar with the operation and servicing of Class IV automated laser equipment should operate this system. Should any questions exist regarding the safe operation of this equipment, contact *Automated Laser Corp.*, Fort Wayne, IN prior to operation or service. For additional related Class IV laser guidelines and regulations, see ANSI Z136.1-1993 Standard for Safe Use of Lasers, or contact the Center for Devices and Radiological Health, Div. Of FDA, 2098 Gaither Road, Rockville, Maryland 20850.

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GENERAL SAFETY

- Read and understand this manual completely before operating this machine. The machine can cycle automatically and must be operated by qualified personnel only.
- This equipment is supplied as a Class IV Laser Product. All applications must consider use and operator safety requirements at all times. Industry standards are set as outlined in ANSI standard Z136.1, CDRH regulations and as published by ANSI/OSHA requirements.
- See Appendix B included with this manual for additional safety information.
- Note all warning signs and labels attached to the equipment.

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

FCC COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Note: Any changes or modifications made to this piece of equipment not expressly approved by Automated Laser Corp. could void the user's authority to operate the equipment.

FRG Series Laser Marker Description

SYSTEM DESCRIPTION

The FRG Series Laser Marker is a high-speed industrial permanent marking system. The system comes complete with everything needed to run, including the marker head, controller, and software. (Note: Optional Monitor, keyboard, and mouse may be purchased from Automated Laser or provided by the end-user).

A detailed description of each component follows:

Marker Head

The marker head contains the beam delivery optics and the laser, which is a sealed, industrial Diode Laser unit. The FRG-20 series marker head provides a 4" X 4" marking window at a maximum of 20 watts of optical power. Other marking window sizes and laser power options are available upon request.

Controller

The control system is enclosed inside the control housing and performs all of the necessary system control. Also contained in the Control Housing are the supporting electronics and galvo head controller.

Autolase Software

The Autolase weldMARK Software comes installed on the system controller. This software provides the functionality for all of the marking parameters.

Cables

The FRG-20 requires a standard molded AC power cable.

Depending on the desired level of automation, an I/O cable may need to be constructed by the user. This cable attaches to the marker head and provides supplemental I/O, including trigger, safety interlocks, and a *Mark In Progress* bit. This would be connected to the pluggable screw-terminal block on the back of the marker head.

If a host computer will be used to send the FRG-20 marking information, then a standard RS-232C Null Modem cable will be required. See Appendix B for details.

UNPACKING THE SYSTEM

The FRG series markers are carefully packaged prior to shipment. Be sure to save the cartons and packing material in case you need to ship the system.

Note: ***If your FRG Series marker needs to be returned to the factory for any reason, the warranty will be voided if the system is not returned to Automated Laser Corporation in its original packaging.*** An approved shipping container can be ordered by contacting Automated Laser Corporation.

Marking System

Open the shipping container and remove the packing material. Lift the marker head and control housing out of the container (this may require two people) and place on a bench. Be careful not to stress or sharply bend the fiber optic cable connecting the two units.

Accessories

Included in the shipping carton should be accessories, such as this manual, a power cable, I/O connector, and a USB security dongle.

Once all of the components are unpacked, place them on a bench. You are now ready to make the system connections.

SYSTEM CONNECTIONS

Automated Laser, Inc. recommends using a multiple outlet strip with surge protection to supply power to the Autolase System. This will not only protect the system from power surges, but will be a convenient way of turning the system on and off.

Interface

The monitor is a standard 15-pin SVGA cable that plugs into the back of the control housing.

Plug in a USB keyboard and mouse on the back of the marker head.

Connect the DB25 cable to the Control Housing and Remote Head.

Connect the circular connector cable from the control housing to the remote head and screw the connector securely in place.

Caution: Do not connect or disconnect this circular connector with the power to the control housing switched on.

Power Cable

After verifying that the power switch is in the OFF position, plug in the molded 120-VAC cordset into the Control Housing, and Monitor. Finally plug the other ends of all the power cables into the outlet strip.

Interlocks

The FRG Series marking heads have a series of interlocks to provide an advanced level of safety while operating the unit. Whenever an interlock is opened, the laser energy will be defeated and no emissions will be produced.

Key Switch

The key switch on the front panel of the control housing interrupts the power to the laser. While the key is in the ON position, it cannot be removed.

Remote Interlock

The Remote Interlock connections must be tied together for operation of the laser. These can be found on Pins 9 and 10 of the User I/O connector on the back panel of the Control Housing. These positions are shipped from the factory with a jumper installed. This is intended to be used with external safety equipment, PLCs, and lockout devices.

There is a LED on the front panel that is an interlock status indicator. If the interlock terminals are shorted and the Key switch is on, the LED will turn on.

Other Interlocks

There is an additional Laser Enable interlock on pins 7 and 8 of the User I/O connector that may be used to momentarily defeat the laser output. This interlock is intended to be used on a piece of guarding that has to be opened to allow a part to be changed as on a piece of automated equipment.

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While this interlock is open, the laser output is defeated by an internal mechanical shutter being placed in the beam path. Once these contacts are closed again, laser output is immediately restored.

INDICATORS

The FRG laser marker has two LED indicators to monitor status of the system.

Interlocks closed

The interlocks closed LED is on the front panel of the control housing. This LED will illuminate when all of the interlocks are made, and the key switch is in the *On* position. This indicator gives a quick indication of interlock status and is quite useful for troubleshooting.

Mark in Progress

The Mark in Progress (MIP) LED is located on the Front of the control housing and illuminates any time the internal safety shutter is opened. This gives a visual representation of when the laser output may be energized.

SYSTEM START-UP

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

- Once all of the connections are made, switch on the Control housing and Monitor.
- If you are using a multiple outlet strip, switch it ON to apply power to the system.

The computer will perform its boot tasks and start the Autolase weldMARK Software, showing the main screen.

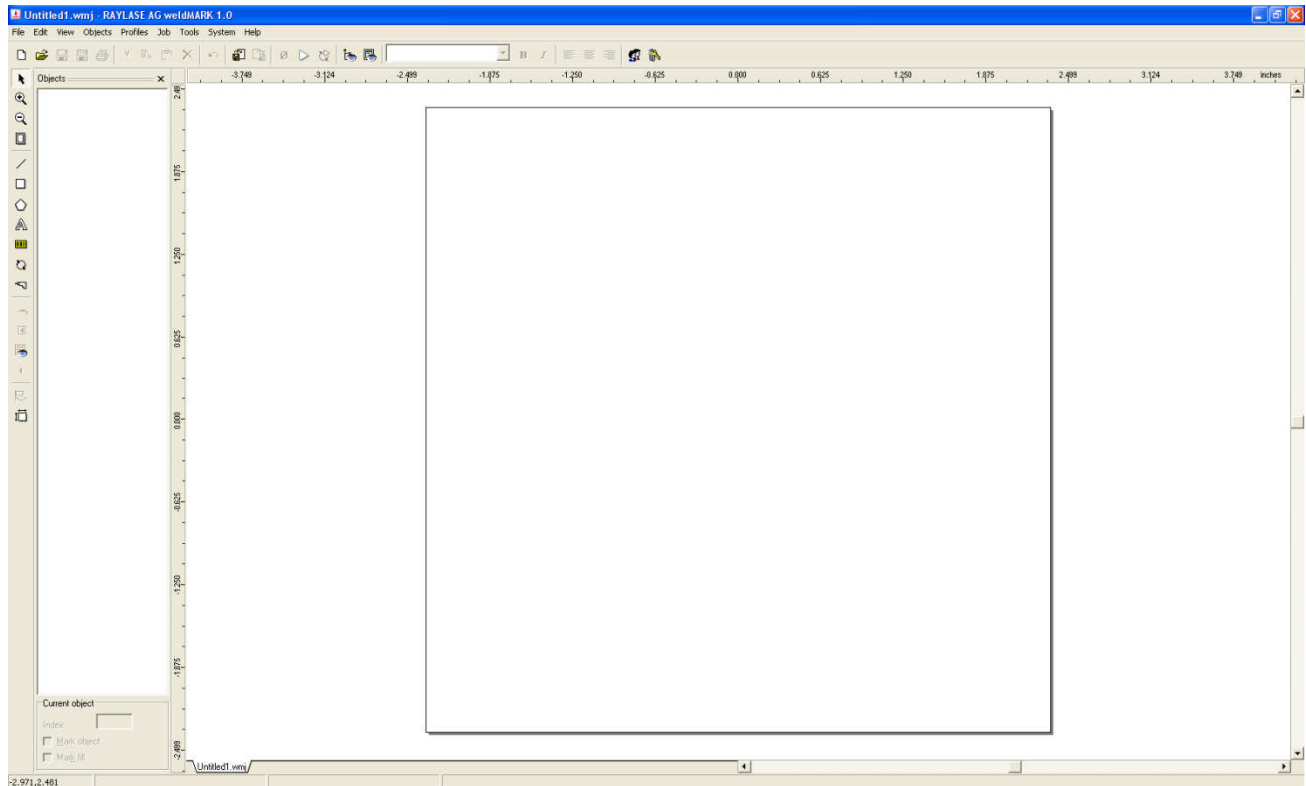


Figure 1: Autolase weldMARK Software Main Screen

OPERATION

General Settings

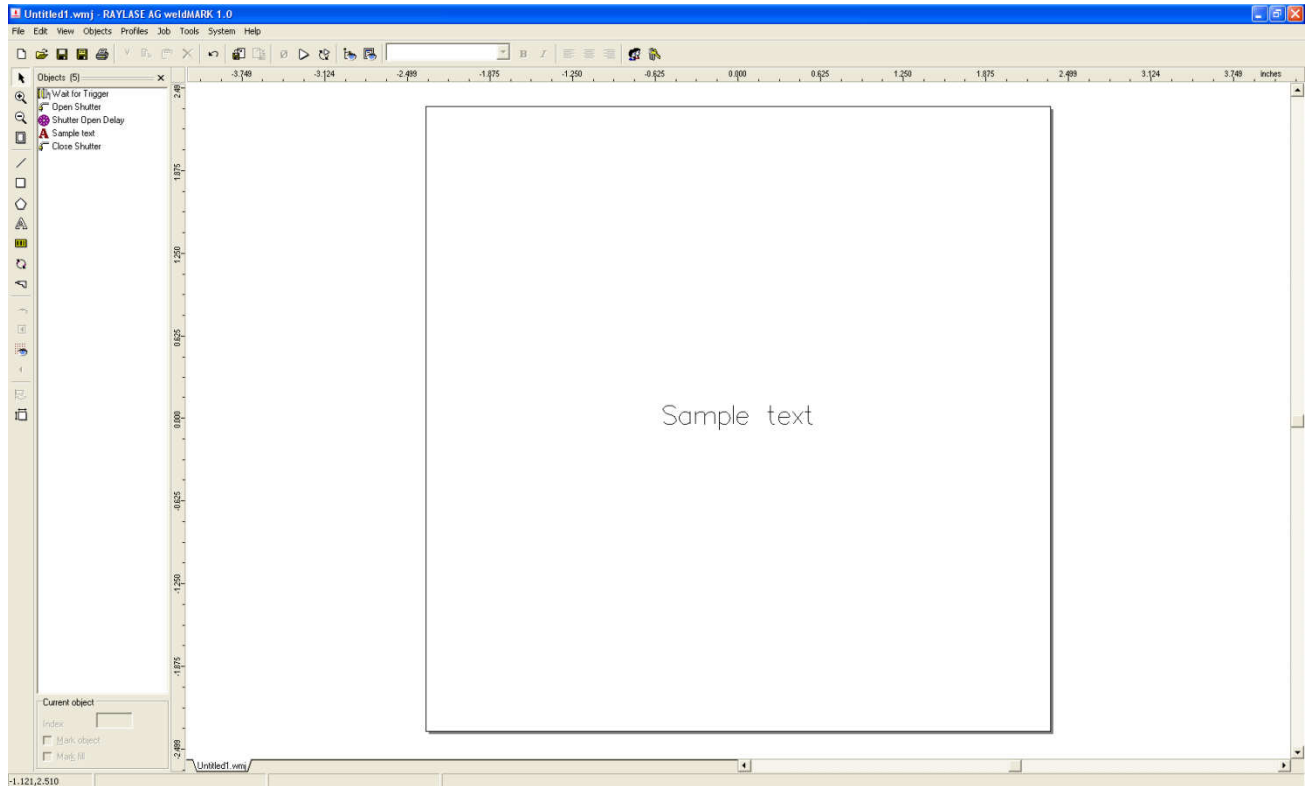


Figure 2: General Settings Screen

The opening screen of the marking software with a job already define will look very similar to the screen shown in Figure 2.

The large window on the right side of the screen represents the marking field of the laser. Objects to be marked can be placed in this window and will mark in the same relative location in the actual marking field of the laser.

The section to the left shows the Automation Objects associated with a complete marking profile. These objects are processed from top to bottom each time a mark is started.

The following section describes the function of each of the automation objects used in the standard marking profile.

Automation Objects

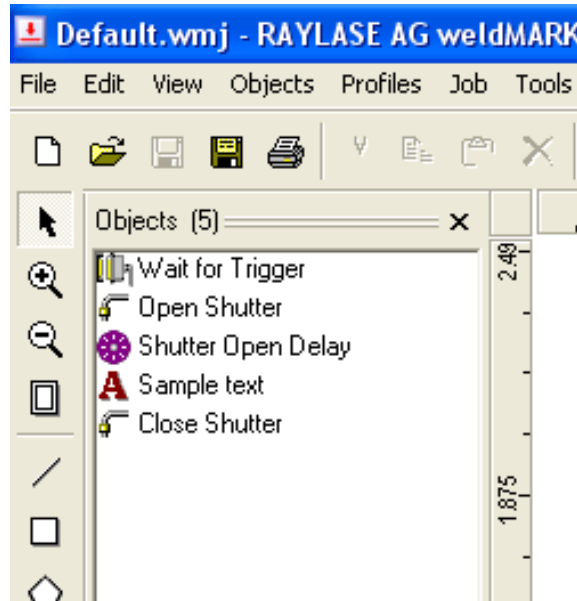


Figure 3: Automation Objects

Automation objects control the flow of the marking profile and process from top to bottom when the mark job is started. In the example shown above, once the job is started, it will wait for an external trigger before progressing any further. Once the conditions in the Wait for Trigger object are met the sequence will step to the next object.

Clicking on any of these objects then pressing F2 will open that object's properties window where the parameters for that object may be modified.

Objects may be added by selecting Objects > Add >Automation from the menu bar.

The following list will appear to display the different type of objects that may be inserted.

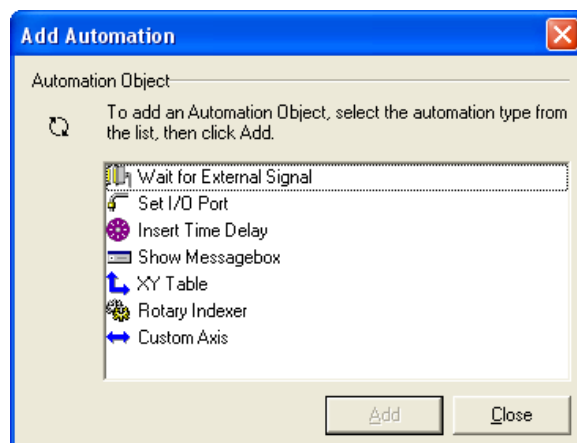


Figure 4: Automation Object List

Wait for External Signal

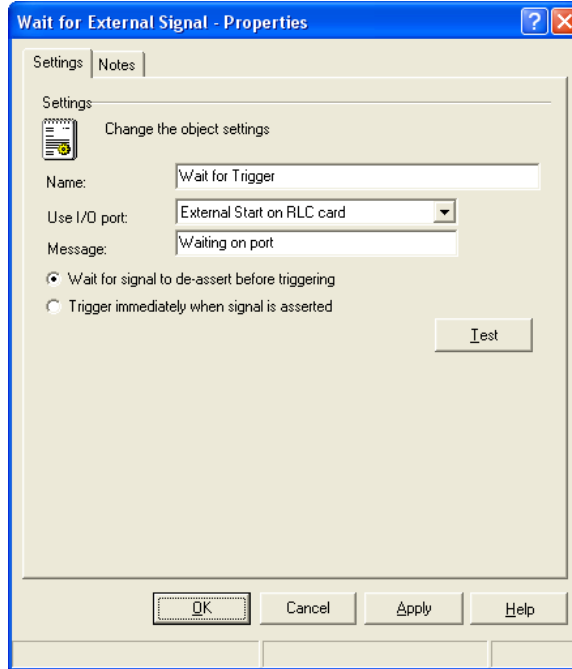


Figure 5: Wait for External Signal object

The Wait for External Signal object causes the sequence of processing objects to pause until the defined conditions are met. The object may be renamed here to give it a more descriptive name. This name will appear in the Objects list in the main window. The 'Use I/O port' field allows you to define which port to receive the input from.

Open Shutter

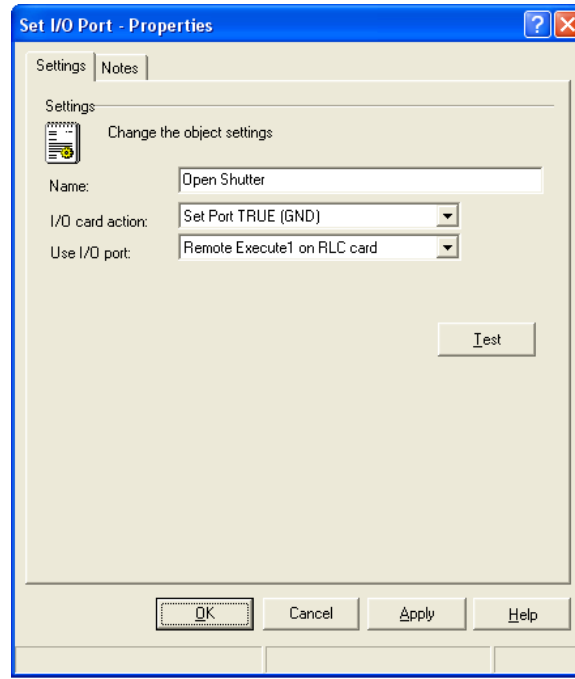


Figure 5: Open Shutter object

The Open Shutter object is actually a 'Set I/O Port' object that has been renamed to reflect its function more clearly on the main screen. To open the shutter, the specified port is set to True.

Shutter Open Delay

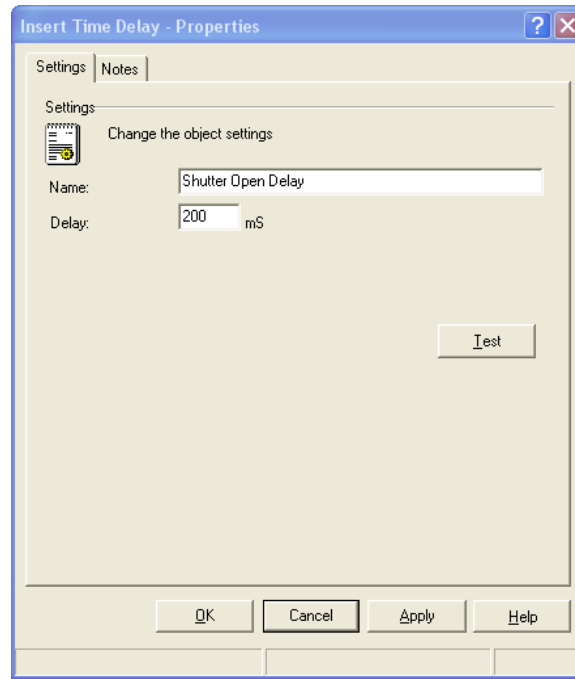


Figure 6: Open Shutter Delay object

The Open Shutter Delay object is actually an 'Insert Time Delay' object renamed to reflect its function more clearly on the main screen.

This delay is inserted to allow the mechanical shutter time to open before firing the laser. Without this, the mark would likely be missing a small portion of the beginning of the mark due to the shutter opening slower than the laser fire signal takes to start the mark.

Marking Object

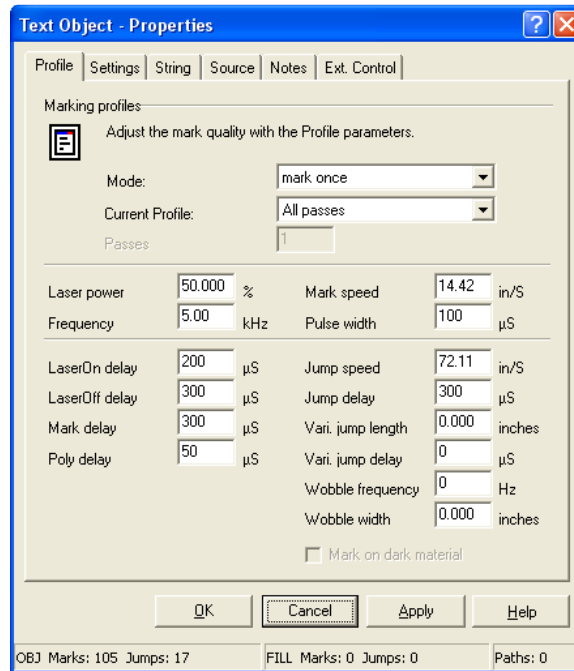


Figure 7: Text Parameters

The Text Object properties defines the speed and power for the characters to be marked. Each object to be marked may have different power and speed settings. This is particularly useful when marking text and graphics together. Each may be independently controlled to provide the best mark.

Other parameters in the lower section of this window may be used to fine tune how characters are drawn. The default settings are generally adequate for most marking needs, but the Autolase weldMARK software gives us the flexibility to further tweak the marks for special needs.

Close Shutter

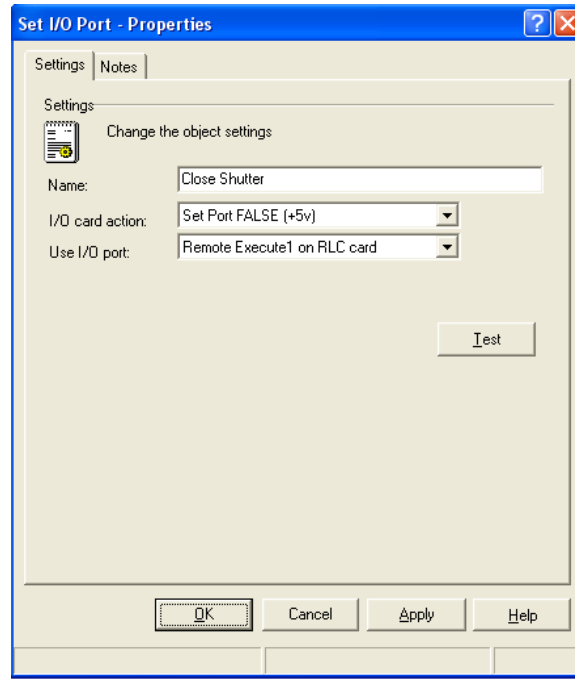


Figure 8: Close Shutter object

The Open Shutter object is actually a 'Set I/O Port' object that has been renamed to reflect its function more clearly on the main screen. To close the shutter, the specified port is set to False.

For further details on using Automation Objects, refer to the online help in the software, or the software manual "Manual_weldMARK_en.pdf" located in the Program Files directory, typically:

"C:\Program Files\RAYLASE\weldMARK\Documentation\manual_weldMARK_en.pdf".

Marking your job



To begin marking, simply click on the Run Process Icon located on the top toolbar.

This will start the job marking by working down the list of Automation Objects.

Depending on how the software is configured, it may be necessary to click on this icon each time you want to mark. Typically in an automated system the software would be configured to receive this Run command serially to enable the job each cycle.

Power Adjustment

The laser output power is adjusted via the marking object's properties window. Each object may have its own power level setting, allowing ultimate flexibility in marking clarity between objects.

Because of the wide range of materials capable of utilizing laser marking, experimentation will be needed to determine the optimum laser power and beam velocity settings. In some cases poor marking output may be attributed to incorrect power or speed settings. If assistance is required in determining the best range for these settings, please contact the factory.

NOTE: Automated Laser strongly recommends leaving the Key Switch on the Rear Panel in the OFF position until you are ready to mark. Once marking is completed, turn the switch to the OFF position.

NOTE: In order for the Laser Marker to work, all interlocks must be closed. This means that the Key Switch on the back panel must be ON, and the Remote Interlock terminals on the User IO connector must be connected together.

SHUTTING DOWN

- Wait for any active job to complete marking.
- Close the Automated Laser weldMARK software, saving any changes you have made when prompted.
- Exit Windows
- Switch off laser power.

AUTOMATIC MODE

The FRG Series markers can be run in an Automatic mode where the system goes to the Marking Screen, waiting for a trigger upon startup.

To have the system start in automatic mode, there must be a job selected in the System Preferences dialog box.

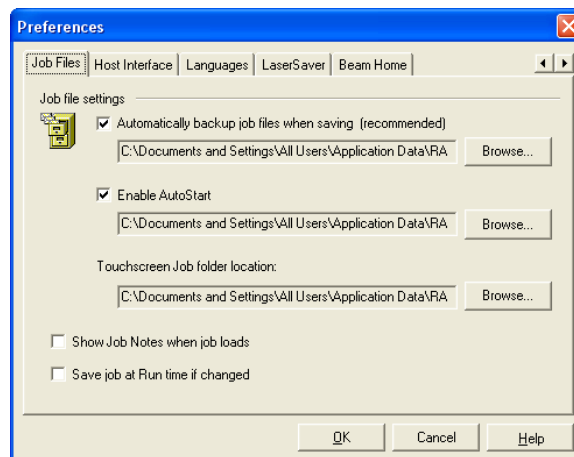


Fig. 9 System Preferences

Select Enable AutoStart and Browse to the job file you want to have started automatically.

This will load the selected job, but will not enable the job for marking. To do this you will need to either select the 'Run Process' icon from the menu bar, or enable the job via serial commands in Host mode.

Host mode starts the laser in a "listening" mode with no job active. The following describes how to enable Host mode, and the commands are used to load a job and enable it for marking.

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Select System > Preferences from the menu bar. In the Host Interface tab, select the host connection type, port, and speed parameters and check the 'Enter Run from Host mode' box to enable the program to receive serial data on startup.

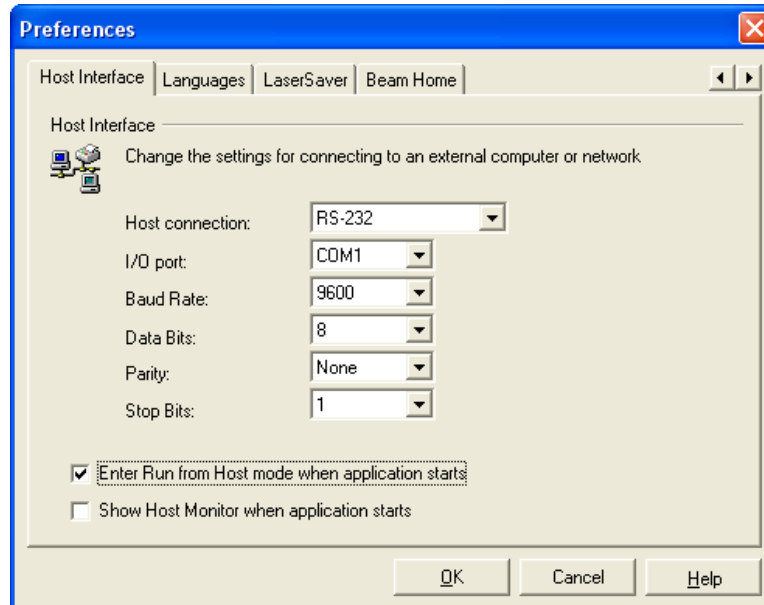


Fig. 10

In Host mode the following commands may be sent to the laser to initialize a job file.

Autolase weldMARK serial commands

Command	Action
OPEN,file,C:\Default.wmj	Loads the specified job for marking. Full path with extension is required.
MODIFY,field,04,*****	Inserts the data "*****" to be marked into our field.
RUN	Laser is now waiting for trigger input.
After marking....	
MODIFY,field,04,*****	Inserts new data "*****" to be marked into our field. (Optional)
RUN	Laser is now waiting for trigger input.
At end of run....	
SET,control,local	Returns control of program to the keyboard so user can access menu options or shut down the marker.

MOUNTING THE MARKER HEAD

The FRG Series marker heads are designed with a focal length of approximately 8 inches from the baseplate of the laser. This distance is critical for high-quality laser marking. Failure to position the marking part within tolerance will cause blurring of the mark or even eliminate marks at any power or speed setting. The marker head may be mounted utilizing the four (4) 1/4-20 threaded holes on the bottom of the unit. To minimize the effects of vibration, mount the marker head to solid surface. This will prevent the mechanical motion of the marker from agitating the work piece.

INTERFACING TO OTHER SYSTEMS

Several features of the FRG Series Markers make it easy to interface to external control systems. As stated in the Triggers Section, a trigger may be assigned to a function key or a programmable input. All of the external I/O connections can be found on the pluggable screw-terminal connector on the back of the marker head.

Pin	Description	Comment
1	Start (Trigger)	Dry Contact closure to start marking
2	Ground	
3		
4		
5	MIP	Contact closure output, on when safety shutter is open
6	MIP	
7	Laser Enable	Close to enable laser, open ckt. Defeats safety shutter disabling laser output.
8	Laser Enable	
9	Interlock	Close to enable laser, open ckt. Disables laser.
10	Interlock	

Remote Interlock

The Remote Interlock can be found on Pins 9 and 10 of the User I/O connector. This is a safety device that is normally wired through a safety circuit such as an Emergency Stop. These two terminals need to be connected together in order for the laser to work. Dry contacts are recommended for this input.

Laser Enable

The Laser Enable input allows the user to disable the command signal to the laser, the Interlock Inputs for safety considerations.

Trigger

The Trigger Input is activating by shorting pins 1 and 2 on the I/O connector together. Dry contact PLC outputs, or a relay contact are recommended for these inputs.

NOTES ABOUT MARKING

Fume Extraction

Due to the variety of materials that the FRG Series Markers can mark, **Automated Laser strongly recommends that you provide a method of fume extraction around the marker head.** The reason for this is two-fold:

1. Different materials respond differently to laser marking. Most materials release an unpleasant odor when marked, possibly causing operator discomfort. Some of these odors may be not only unpleasant, but hazardous to breathe for extended periods of time. Certain materials can produce noxious, toxic, or even fatal contaminants in the air when processed with a laser. The vapors, fumes, and/or particles that result from laser marking should be thoroughly evaluated, and the adequacy of the provisions for fume extraction, filtering, and venting should be carefully considered.

See Section 7.3 in the ANSI Z136.1-1993 Standard for the Safe Use of Lasers, for exposure criteria in 29 CFR 1910 Subpart Z (from the US Government). Also, see the American Conference of Governmental Industrial Hygienists (ACGIH) for published Threshold Limit Values (TLVs). It may also be necessary to consult with your local government agencies regarding restrictions on the venting of vapors.

2. While every attempt has been made to provide a virtually maintenance-free system, the release of by-products in the air while marking can accumulate on the exit aperture. This is a very delicate lens that focuses the beam to a very small point. If a means of fume extraction is not provided, this lens will need to be cleaned regularly.

Screen Savers

Because the FRG Markers are real-time marking systems and need to perform real-time calculations on the fly, the Autolase weldMARK Software demands dedication of the computer's processor to the marking task. Installing additional applications, utilities, and networking can cause unpredictable results with the laser marker. It is best to consider the FRG computer as a dedicated controller, to be used only for laser marking.

GENERAL MAINTENANCE

Cleaning the Air Filters

If the marker system is heavily used, the air filters should be cleaned on a weekly interval. Clean only the foam-style filters, paper filters must be replaced.

1. Remove power from the Marking System.
2. Snap the filter guard off of the fan housings.
3. Remove the foam filter. Wash clean using warm water. A very mild, diluted detergent may be used.
4. Allow filter to dry completely before re-installing.

The filter may be cleaned less frequently if the marking system is used under a lighter duty.

Inspecting and Cleaning the Exit Aperture

The exit aperture is the final optic that the beam passes through prior to marking. This can be found on the bottom side of the laser marker. The lens should appear clean, free of dust and fingerprints. If this is not the case, perform the following steps for cleaning:

1. Remove all power from the marking system.
2. Turn off the key switch and remove the key.
3. Remove light dust and debris with an air duster.
4. Using rubbing alcohol and a cotton swab, clean the lens using *very light pressure* in a circular motion. Do not use excessive force. The lens is easily scratched and can be damaged from trying to clean it.
5. Allow to air-dry.

The accumulation of dirt on the exit aperture can cause the lens to over-heat and break. A dirty lens will also reduce the net output power of the laser.

Replacing the fuse

A 7-Amp fuse protects the AC input to the marker head (FRG-20). If the cooling fans do not turn when power is applied, the input fuse may need replacing.

1. Remove the power cord from the input module.
2. Using a small screwdriver, open the hinged cover to the power entry module.
3. Lift up on the red insert with the screwdriver. Note the orientation of the text "115V" on the red insert.
4. Remove the fuse from the insert. Check for continuity to make sure it is blown.

5. If blown, replace with an equivalent 7A ¼" X 1-¼" fuse. Use Buss number AGC-7 or equivalent.
6. Replace the fuse into the insert.
7. Replace the insert into the input module, noting the correct orientation.
8. Snap the hinged cover closed on the input module. *NOTE: Be certain that the "115 V" text is displayed in the window on the input module.* If not, reverse the red insert.

Additional inspections

1. Ensure that the "LASER ON" Indicator properly functions during marking. Perform a test mark. The indicator should turn on after activating the marking trigger and turn off once the mark is complete.
2. Inspect the housing, making sure there are no gaps or holes that could allow laser energy to exit the marking head assembly.

Caution: There is no need to remove the marker housing for standard maintenance procedures. Laser radiation levels inside the housing can be as high as 30 W.

WARRANTY AND LIMITATION OF LIABILITY

Automated Laser Corporation, Fort Wayne, IN warrants to the original end user purchaser (the “purchaser”) of the equipment supplied by Automated Laser Corporation (“equipment”) that such equipment will be free from manufacturing defects in materials and workmanship use for a period of one year from the date of shipment to the purchaser from the factory or authorized distributor. This warranty only applies if the product is received by the purchaser as new, in the original factory sealed shipping carton and is used under normal service and for the intended equipment purpose.

Automated Laser Corporation’s obligation under this warranty shall be strictly and exclusively limited to the repairing or replacing any such equipment that is found to be defective in material or workmanship under normal use and service provided the equipment is returned to the factory within one (1) year from the date of the original shipment to the purchaser. This warranty does not apply to any product that has been tampered with, altered or modified in any way or improperly installed, misused or damaged.

THIS STATED WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF AUTOMATED LASER CORPORATION. IN ADDITION, NO OTHER PERSON OR ORGANIZATION IS AUTHORIZED TO ASSUME OR EXTEND FOR AUTOMATED LASER CORPORATION ANY OTHER LIABILITY WITH RESPECT TO EQUIPMENT MANUFACTURED OR SUPPLIED BY AUTOMATED LASER CORPORATION. AUTOMATED LASER CORPORATION SHALL HAVE NO LIABILITY WHATSOEVER IN ANY EVENT FOR PAYMENT OF ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, DAMAGES FOR INJURY TO ANY PERSON OR PROPERTY, OR LOSS OF SERVICE OR PRODUCTION, AND COSTS INCLUDING ATTORNEY FEES.

Equipment subject to this stated warranty must be authorized by the factory to be returned for evaluation, repair or replacement prior to shipment from the purchaser to Automated Laser Corporation complete and returned complete in the original shipping packaging. Unless pre-approved in writing, Automated Laser Corporation shall not be responsible for any freight or transportation charges incurred for any shipments.

IN NO EVENT WILL AUTOMATED LASER CORPORATION BE LIABLE FOR ANY DAMAGES (INCLUDING ATTORNEY’S FEES) ARISING OUT OF THE SALE OF EQUIPMENT, SOFTWARE, PROGRAMMING OR ANY SERVICES, INCLUDING LOSS OF USE OF EQUIPMENT, LOSS OF PROFIT, LOSS OF DATA, INCIDENTAL, CONSEQUENTIAL OR INDIRECT DAMAGES OR ANY OTHER LOSSES, WHETHER SUCH LIABILITY IS BASED ON WARRANTY, NEGLIGENCE, CONTRACT, STRICT LIABILITY IN TORT OR OTHERWISE. THE PURCHASER REMAINS RESPONSIBLE TO APPROVE THE OPERATION, SAFETY AND ACCURACY OF RESULTS FOR ALL APPLICATIONS AND ACKNOWLEDGES THIS RISK AS AN AGREEMENT OF PURCHASE.

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ELECTRICAL SPECIFICATIONS

Component	Electrical Specification	FRG-20
Marker head	Voltage	115 vac
	Current	7 amps
	Frequency	60 hz
Laser module	Laser power output	20 watts
	Laser Wavelength	1064 nM

I/O

Output	User I/O pins	Comments
MIP	5 - 6	5A @ 30 vdc
Input		
Trigger	1 - 2	Dry contact closure
Laser Enable	7 - 8	Dry contact closure
Interlock	9 - 10	Typically through MCR or Safety relay.

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Sample connections

The following diagram is a representation of a typical interface. This is not intended to be all-inclusive.

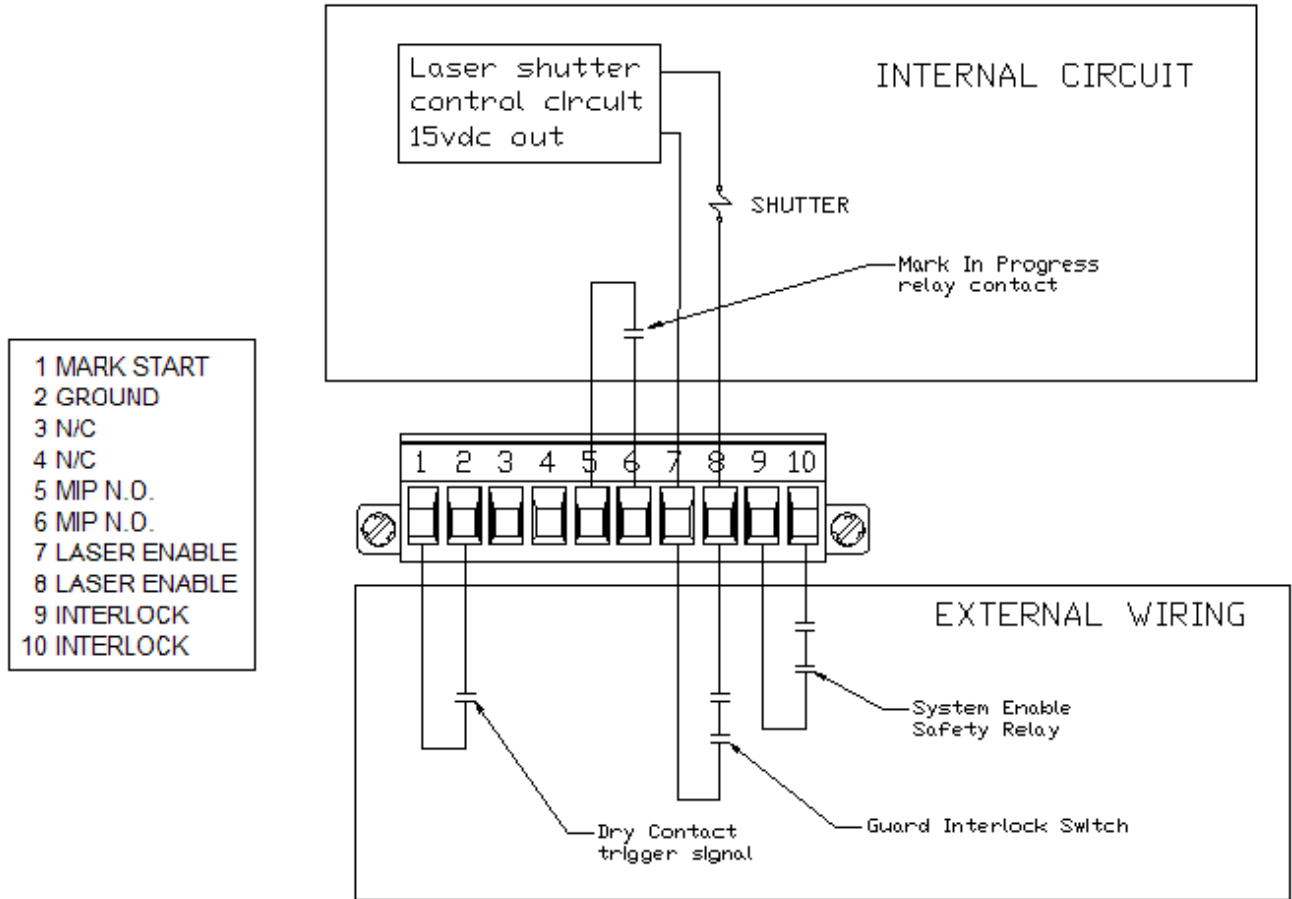


Figure 11: Typical User Connections

MECHANICAL SPECIFICATIONS - FRG-20

All Dimensions in inches

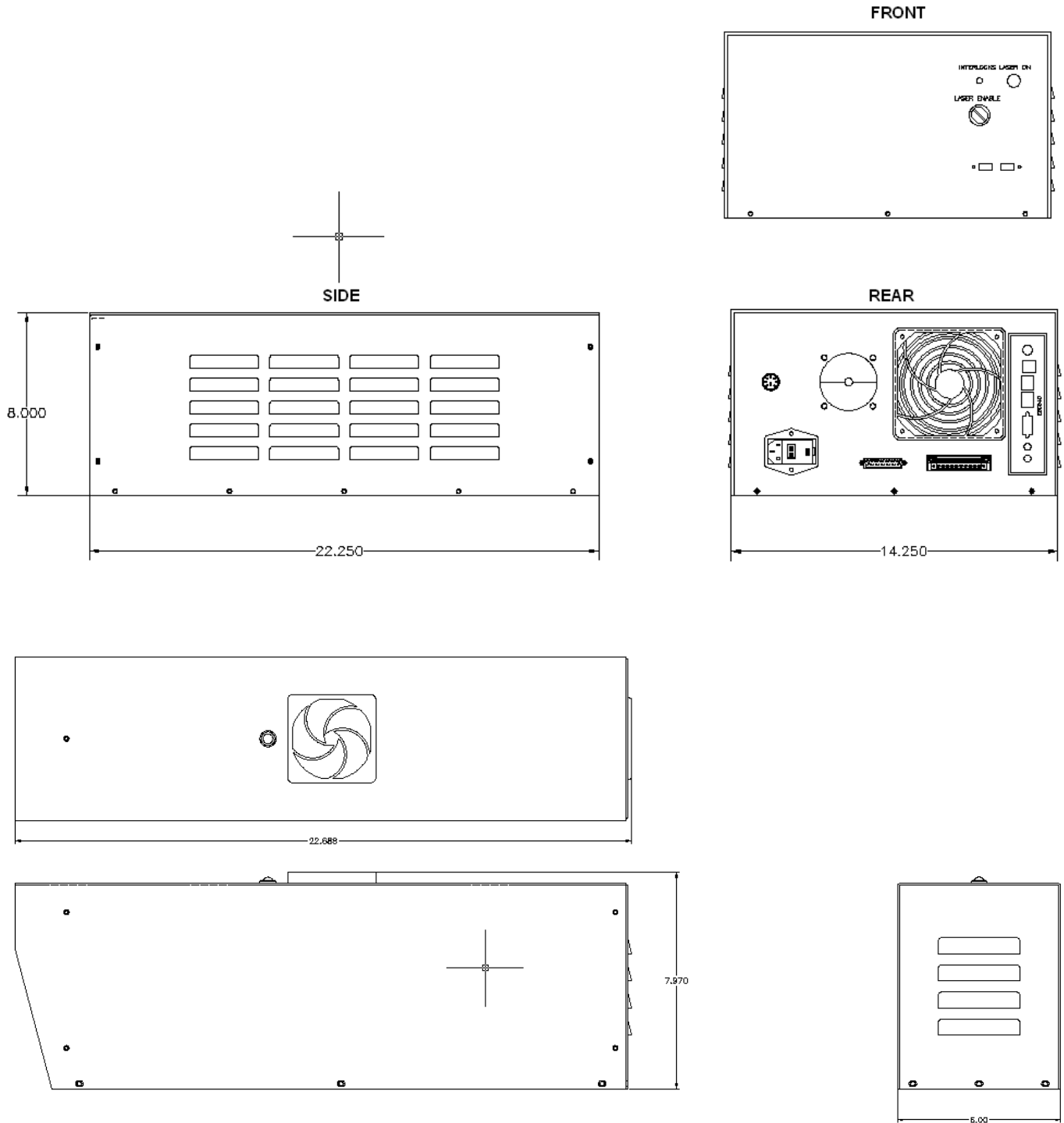


Figure 12: Control Housing & Remote Head Dimensions

Automated Laser Corporation

FRG Series Markers User Guide

MARKER HEAD

FRG-20

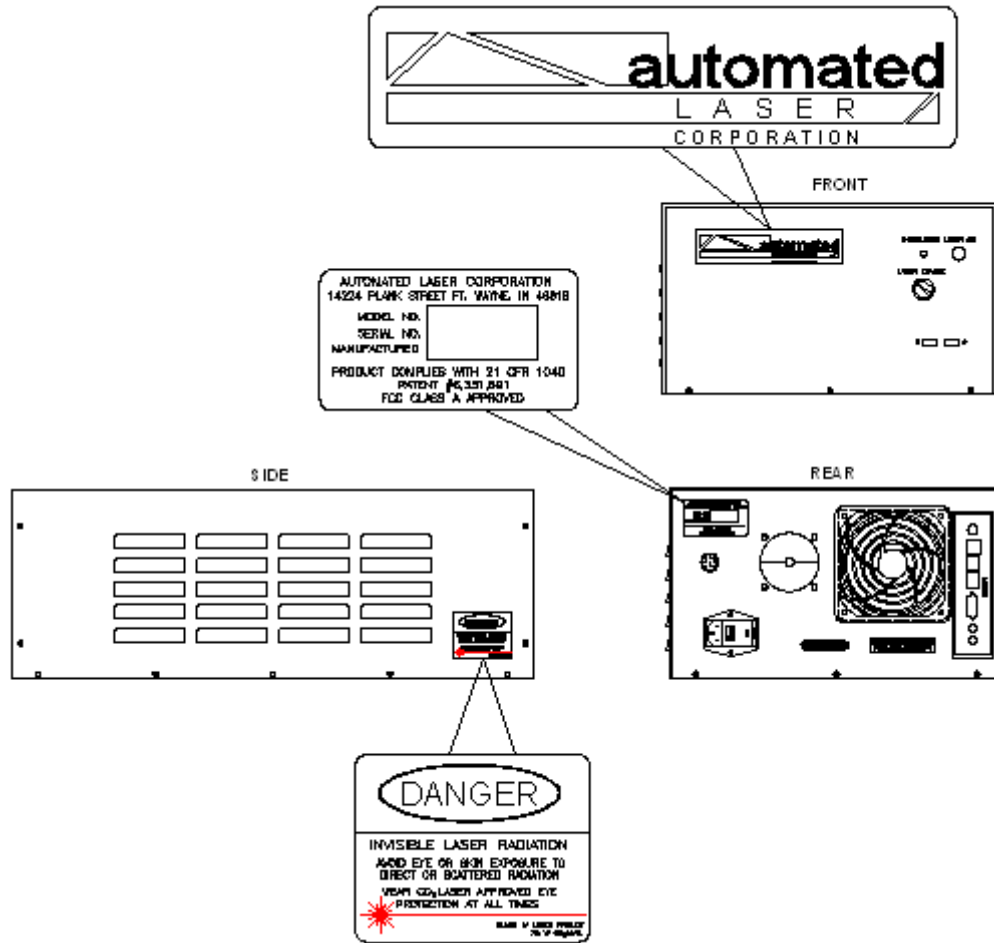


Figure 13: Control Housing Layout & Label Locations

APPENDIX A: LASER SAFETY

Safety Standards

The most predominating set of standards for laser safety can be found in the American National Standards Institute's (ANSI) publication Z136.1 – Standard for the Safe Use of Lasers. This document is referenced by Federal and state authorities, as well as OSHA, and can be obtained from ANSI or the Laser Institute of America (LIA), at 407-380-1553. Additionally, your state may have regulations for laser safety.

The type of laser in the FRG Series Marking Head is a 1064nm Class 4 Diode Laser system. A Class 4 laser or laser system is any that exceeds the output limits (Accessible Emission Limits, AEL's) of a Class 3 device and are considered to be an acute hazard to the skin and eyes from scattered or direct radiation. As would be expected, these lasers may be either a fire or skin hazard or a diffuse reflection hazard. Very stringent control measures are required for a Class 4 laser or laser system. The end use applications must take standard industry precautions into account for the safe use of this product.

Laser Beam Hazards

The FRG Series Laser Marker produces an intense beam of coherent (same wavelength) light. This light is in the mid-infrared region and is not visible by the human eye. By nature, when light falls upon an object, it will be partially absorbed by that object. This is especially true with laser light, which when directed upon an object (whether directly or indirectly) will be at least partially absorbed. When an object absorbs energy such as an intense beam of light, the temperature is raised of the object, which is how the laser performs its function. The laser focuses an intense beam of coherent light onto a very small surface area, causing such results as melting, burning, or deformation.

This same intense coherent light when exposed to the human body can result in tissue damage, with the eye being the most vulnerable part of the body. The FRG Series Markers emit a wavelength between 1064 nm. The part of the eye that absorbs most of this wavelength is the cornea. **This is why it is important to wear certified protective laser eyewear at all times when using the FRG Series Laser Markers.** Protective eyewear must be worn when the emitted beam is not completely enclosed with an external housing to create a Class I Enclosure.

The skin is also vulnerable to laser radiation. Care must be taken to prevent skin exposure to the laser beam, whether direct or scattered. This is why it is important to enclose the beam path whenever possible.

Additional Hazards

There are also hazards related to the use of lasers that are not associated directly with the beam. These non-beam hazards include electrocution, fire, and asphyxiation – all of which can result in severe injury or death.

Electrocution: If the system needs to be serviced, disconnect all AC power prior to opening the cover. Lethal voltages exist inside the Laser Marker housing, and the cover must not be removed unless absolutely required and with power off.

Fire: Due to the wide range of products that can be marked with the laser, use extreme caution when marking on new materials. The ablation process with a high-energy beam can result in an unintended fire.

Asphyxiation: Because the FRG Series Laser Markers typically ablate the material being marked, the resulting smoke and fumes could be a hazard and ventilation is often necessary. Know and understand the materials being processed prior to use.

The Laser Safety Officer

The ANSI Z136.1 standard specifies that a Laser Safety Officer (LSO) be designated to oversee safety for all operational, maintenance, and servicing situations for any facility using Class 3b or Class 4 lasers or laser systems.

The LSO should monitor and enforce the control of laser hazards. This person is also responsible for the evaluation of laser hazards, the establishment of appropriate control measures, training personnel on laser safety, maintenance procedures and schedules, and procurement of laser safety equipment. See ANSI Z136.1 for more information regarding the LSO.

For additional related Class IV laser guidelines and regulations contact the Center for Devices and Radiological Health, Div. Of FDA, 2098 Gaither Road, Rockville, Maryland 20850.

APPENDIX B: USING THE SERIAL PORT TO TRANSFER LINE DATA TO THE FRG-SERIES MARKERS

Description

The FRG Series markers have the capability to retrieve the marking text through the serial port on the controller. This can allow real-time data to be marked, which can come from a variety of sources such as PLCs, other PCs, test equipment, and other processors.

Setup

Communication Port

The primary COM port on the FRG Marker is the 9-Pin D-Sub male connector found on the back housing. The host controller will need to be configured with the same settings as the FRG Controller, shown below:

Baud Rate	9600
Parity	None
Data bits	8
Stop bits	1
Soft Handshaking	XOn / XOff
Hard Handshaking	(off)

The XOn/XOff handshaking protocol prevents the COM port from being overrun. A maximum buffer size has been set to 1024 bytes (1 byte is approximately 1 character). When the FRG serial buffer has reached this limit, the XOff character will be sent to the host computer, informing the host to suspend data transfer until an XOn character is sent by the FRG Controller. Once the Marker's serial buffer has begun to be emptied, the XOn character will be sent to the host, allowing additional data to be sent.

If your host controller does not support the XOn/XOff protocol, special care must be taken in order not to overrun the FRG buffer of 1024 bytes. The buffer is cleared every time a valid trigger is received.

Cabling

Three signals are needed to support data transfers from a host to the FRG Marker. These are the Transmit (Tx), Receive (Rx), and Ground (Gnd). Facing the rear of the marker head, the pin-outs can be found on the 9-pin connector by the diagram below.

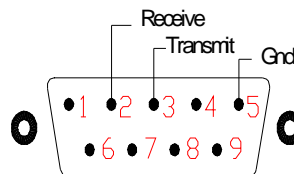


Figure 3: 9-Pin D-Sub Male Serial Connector

In order for RS-232 communications to work properly, these minimum signals need to be connected properly. The *Receive* of one port needs to connect to the *Transmit* of the other. Similarly, the *Transmit* of one port needs to connect to the *Receive* of the other. Finally, the *Ground* pins from each port must be connected.

The connection method to the host can vary depending on the type of host system. Several options are shown below.

