LASER Sentry

Instruction Manual

May 31, 2006

Hydraulic Press Brake Guarding

METAL TECH

1-800.516.5516 Fax 1-888.761.8725

4331 Saint Croix Court~ Punta Gorda FL 33950

US. Department of Labor

Occupational Safety and Health Administration
Washington, DC. 20210

DEP/GIE/WFR

Reply to the Attention of:

FEB 11 2004

Glen F. Koedding, CEO
Metal Tech Controls Corporation
P O Box 512113
Punta Gorda, FL 33951-2113

Dear Mr. Koedding:

Thank you for your letter to the Occupational Safety and Health Administration's (OSHA's) Directorate of Enforcement Programs (DEP). This letter constitutes OSI-IA' s interpretation only of the requirements discussed and may not be applicable to any questions not delineated within your original correspondence. You had concerns regarding Meta1 Tech's Laser Sentry guard systems installed on hydraulic powered press brakes being used in the United States and its territories.

In your letter dated April 28, 2003, you attached our March 10 memorandum, *Request for Guidance regarding Metal Tech Controls Corporation* 's *Laser Sentry guarding system that is installed on hydraulic press brakes.* We have reviewed your recent letter and its attachments very carefully. As you may know, OSHA has always embraced newer technology that enhances workplace safety. However, OSHA does not formally test, evaluate, certify, or approve products. Likewise, we are prohibited from endorsing private sector products, services, consultants, studies, or test results.

After the March 10 memorandum was issued, you had numerous conversations regarding this issue with Willie Robinson of my staff, which led to a site visit at Columbus, Ohio. Mr. Robinson, James Washam, Region V, Machine Guarding Specialist, Cincinnati OSHA Area Office, Cincinnati, OH, and Bruce Bigham, Columbus OSHA Area Office, Columbus, OH observed your operation, and, thereafter, OSHA reviewed additional product information regarding laser guarding systems.

OSHA's requirement for safeguarding mechanical and hydraulic power press brakes is addressed at 29 CFR 1910.212, *General Requirements for All Machines.* 29 CFR 191 0.212(a)(l) states, "One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are **barrier** guards, two-hand tripping devices, **electronic safety devices**, etc." Emphasis added. Further, 1910.212(a)(3) requires a guarding device to be **"so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle."**

In accordance with the above requirements, coupled with the additional information, that was provided to the Agency, and. the close observation of the operation during the site visit, 051-IA is rescinding its March 10 memorandum to the extent that the memorandum concludes that laser guarding devices are inherently prohibited pursuant to 29 CFR 1910.212 or pursuant to consensus standards. That is, a laser guarding device may be considered an electronic safety device, pursuant to 1910.212(a)(1), and would not be in violation of 1910.212(a)(3), if it effectively and reliably prevents worker injury by controlling the zone of danger described.

Please be aware that the Agency's opinion is limited to the use of a. laser guarding system in conjunction with hydraulic press brakes. While OSHA has not formally considered the application of laser guarding systems on other pieces of equipment (e.g., unitized dies, mechanical power presses, and resistance welders), the Agency

has significant concerns about the effectiveness of using laser guarding systems on other types of equipment to protect employees from pout of operation hazards and other equipment-related hazards.

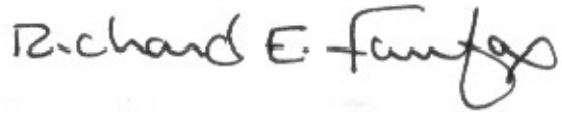
While the Agency has determined that the laser guarding device may be considered an acceptable form of guarding under 29 CFR 1910.212, OSHA cautions employers that guarding systems generally are appropriate only if they are designed, installed, used, and inspected in a manner that will effectively and reliably prevent injury. Thus, OSHA wi1l consider carefully individual laser guarding systems installed in conjunction with hydraulic press brakes to determine whether they effectively and reliably protect employees from point of operation hazards and other equipment-related hazards. While the Agency will provide its inspectors with more specific guidance in the near future, inspectors currently will, consider the laser guarding device in isolation, as well as in conjunction with the specific press on which it is installed, to ascertain whether it provides effective and reliable protection under the conditions in which the laser guarding. device and the press brake are used at a specific worksite. Employers who are using laser guarding devices in a manner such that they do not work in conjunction with a hydraulic press brake to provide effective and reliable protection are subject to citation under 29 CFR 1910.212.

In. addition, please be advised, that OSHA is not sanctioning the use of the Laser Sentry guarding system, and the Agency has not determined (and is not authorized to determine) whether or not the Laser Sentry guarding system, as presently designed, is capable of providing effective and reliable employee protection..

Furthermore, the electrical components of the equipment must be approved by a Nationally Recognized Testing Laboratory (NRTL) in accordance with the enclosed standard, 29 CFR 1910.303(a). The employer must examine, install, and use equipment in accordance with the instructions provided by the NRTL and included in the listing or labeling, as required by 29 CFR 1.910.303.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA requirements are set by statute, standards, and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at www.osha.gov. If you have any further questions, please feel free to contact the Office of General Industry Enforcement at (202) *693-1850.*

Sincerely,



Richard I. Fairfax, Director
Directorate of Enforcement Programs

CONTENTS

WARNING!

The *Laser Sentry* can only be installed and used on hydraulic press brakes that have the ability to stop and reverse direction in less than 1/4 of an inch of travel.

Most hydraulic press brakes can reverse well within 1/4 inch if they are properly maintained, especially up-acting machines.

If you install the *Laser Sentry* on machines <u>not capable</u> of this performance you are in violation of national safety standards. Doing so could result in serious injury to personnel. You assume all responsibility for the safety of the machine in question if it is not capable of this performance and or not maintained to continuously stop and or reverse within 1/4 inch.

If you do not have the means of determining the reverse time, consult the machines manual or consult the machine manufacturer. (Also see below).

The *Laser Sentry* performs reverse time safety checks. When you install the *Laser Sentry* perform a reverse time check by selecting this function from the setup menu. If the reverse time is inadequate the *Laser Sentry* will reject the machine and will not run.

The *Laser Sentry* has safe guarding limitatations. These limitations should be obvious to the end user. Do NOT use or expect the *Laser Sentry* to protect personnel outside these limits. If you are unable to foresee these limitations then you need professional advise and training and you should contact Metal Tech Controls Corp. to have a qualified traning professional come to your facility to train the operators who will be using the *Laser Sentry.*

CONTROL RELIABILITY

The *Laser Sentry* is manufactured to UL and CSA standards and is designed and built to the highest safety standards defined for machinery safety, EN954-1 Category 4 and meets the control reliability requirements of ANSI B11.19 and OSHA 1910.217. The *Laser Sentry* is also designed to meet CSA and EC (European Community) standards.

The laser Sentry is designed and manufactured in the USA. All components are at least UL and CSA listed, some carry a CE mark. All components except some board level parts are manufactured in the USA.

Laser transmitters:
Class II modulated visible laser diode emitter.
Beam width of 5.5 mm. at 5' 4 mm, 10' 5.5 mm, 20' 8.5 mm, and 50' 18 mm.
Environmental Rating - NEMA 6P; IEC IP67
Laser Classification - US Safety Standards 21 CFR 1040.10 and 1040.11; European Standards EN 60825 and IEC 60825.

Laser Receiver:
Contains a special lenses which provides detection of objects as small as .067.

The controller has two microprocessors, each programmed by different individuals. The processors jointly control and monitor the *Laser Sentry* functions, cross check each other and monitor the linear position transducer and laser transmitter and receiver for failure.

Two safety relays control the machines' ram closing hydraulic valve. These relays have force-guided contacts and are checked for welded of stuck contacts before being energized.

A separate relay is provided for reversing the ram.

An additional relay is provided for parallel connection to the machines' slow speed circuit. If the machine does not put the machine in to slow speed before 1/2 inch of the surface of the material, the *Laser Sentry* will force the machine into slow speed.

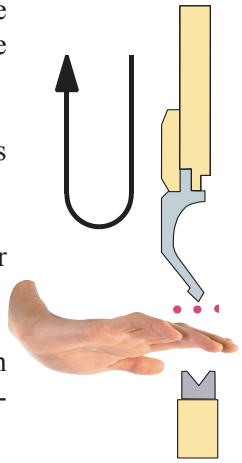
The *Laser Sentry* obtains the rams' position from a magnetostrictive transducer, which produces an absolute digital position to within .0025 of an inch. The transducer is monitored for position change when the Laser Sentry receives a ram movement signal. Should there be no change within a predetermined time the machine is immediately disabled. Should the connecting cables be disengaged the machine will be disabled within 1.5 mS.

The stop time of the machine is monitored each time the machine is stopped and then reversed. The time is checked against a predetermined time and should it exceed the preset time the machine is disabled.

The control is password protected to three levels, Operator, Supervisor and a Master. The passwords can be changed at the Supervisors or Master's discretion. Attempts to guess passwords are prevented by allowing only 3 attempts before locking out.

HOW *LASER SENTRY* PROVIDES SAFETY

The ***Laser Sentry*** provides press brake safety by eliminating the hazard in a similar manner as do elevator and subway doors eliminate the hazard of the doors closing and crushing someone. In the event the doors are blocked, the doors retract automatically thus eliminating the hazard! They use pressure sensitive switches to detect the presence of an object. When the sensor is activated the doors retract.



The ***Laser Sentry*** uses the interruption of lasers beam to sense objects, if any object breaks any of the three beams, human or otherwise the ram is instantly retracted.

To permit the bending process the ***Laser Sentry*** determines when it is safe for the laser beam to be broken. That is, when the hazard is less than 1/4 inch.

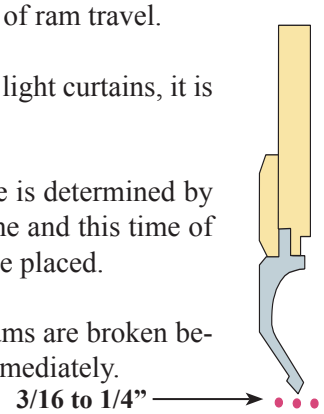
To determine just exactly where that "safe" point is, a precision digital absolute position transducer is used. The transducer provides the rams position within .0025 inches of repeatability.

The operator "teaches" the ***Laser Sentry*** the exact position of the surface part to be formed when it is resting on the lower die. This position is used by the ***Laser Sentry*** to determine the safe area of ram travel.

However the laser is **not** "muted" at 1/4 inch above the material as with the use of light curtains, it is muted .100 above the surface of the part being formed!

The beam is scanned between 3/16 and 1/4 of an inch under the die. This distance is determined by the reversing capabilities of the machine. The ***Laser Sentry*** tests the reversing time and this time of ram travel distance is used to determine just how far below the die the beam can be placed.

As the ram travels down or up in the case of an up-acting press and any of the beams are broken before the die reaches to within .100 of the part to be formed, the ram will retract immediately.



The machine's slow speed function is used to reduce the risk of pinching even further. As the ram approaches to within a minimum of 1/2 inch above the part, the ***Laser Sentry*** forces the machine into slow speed. In slow speed the reaction time of stopping and reversing the machine is reduced drastically, thus allowing a greater margin of safety as the die closes.

To provide as near fail-safe operation as possible, the laser beam is pulsed at very high speed, a separate microprocessor monitors the laser pulse and will detect any malfunction in the laser transmitter or receiver and shut down the machine.

Two safety relays that are crosschecked by both processors are provided to control the ram motion valves.

An input from the machines' control circuit that signals the ram to move is monitored so that when activated the ***Laser Sentry*** knows that ram motion is to begin and be maintained until the signal is de-activated. The ***Laser Sentry*** uses this information to monitor the output of the position transducer. Should it fail, the system will be shut down immediately.

Control reliability is provided by two microprocessors to maintain the transducer and the control the ***Laser Sentry***'s operation while crosses checking each other for proper operation.

SAFETY NOTICE

Please read this message first!

The ***Laser Sentry*** is a control that reverses the machines' ram motion in the event the laser beam is interrupted during the hazardous portion of the stroke. Whenever the operator's safety is dependent on the machine's ability to stop and reverse quickly enough to prevent an injury, it is absolutely imperative that the safe stopping/reversing time of the machine be known and that the laser beam be set to the proper distance from the leading edge of the upper tool.

The ***Laser Sentry*** provides the reversing time of the machine in milliseconds when the machine is emergency reversed in any position and checks the time against a predetermined time that has been deemed safe. The reverse time is also displayed on the screen.

The ***Laser Sentry*** can and should be used to monitor the reversing time. Proper setting of the reverse time set point in the ***Laser Sentry*** is the sole responsibility of the employer, purchaser and final owner of the equipment.

If the machine is incapable of reversing within 1/4 inch, the machine is unsafe and the hydraulic valve system should be repaired or replaced. DO NOT ATTEMPT TO OPERATE THE MACHINE IN THIS CONDITION! This requirement is the sole responsibility of the employer and or machine owner.

The proper application, installation, maintenance and operation of the ***Laser Sentry***, and the machine itself are the sole responsibility of the purchaser and or employer.

It is the purchaser and or employer's responsibility to inspect the ***Laser Sentry***, the laser transmitter and receiver, and any other pertinent equipment daily for proper operation. It is also the purchaser and or employer's responsibility to know that the stop/reverse time monitoring set points and the mute set points are proper and safe for the operator.

The purchaser and or employer are also responsible for the selection and training of the personnel necessary to properly install, operate and maintain the machine and its safeguarding systems. For example, the ***Laser Sentry*** should only be installed, checked out and maintained by a *qualified* person, as "*a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work." (ANSI B30.2-1983)*

The user is the person(s) identified and designated by the employer as being appropriately trained and qualified to perform a specific procedure. Often the user is the installer, die setter, electrician, maintenance personnel, supervisor, foreman, etc. who is involved with the setup, daily test and checkout of the machine and the safety devices.

The ***Laser Sentry*** should never be accessed by anyone other than properly trained personnel so designated by the purchaser and or employer. If the machine operator is not properly trained to set up the machine or the ***Laser Sentry*** then a setup person so designated should perform the setup.

The machine operator must receive specific proper training on exactly which machinery is protected by the ***Laser Sentry***, the machine's operating controls, warning signs and safety instructions. The machine operator must thoroughly understand and follow the company's safety rules and always use the safeguards and proper hand tools provided by the employer. The machine operator must immediately notify management if the machine, tooling or safety devices are not operating properly.

Never use the machine if it or the safety equipment is not in proper working order.

The ***Laser Sentry*** is provided with password protection. The purpose is to prevent untrained and unauthorized personnel from entering or modifying programs or from changing set points programmed for machine stop/reverse time monitoring and lost motion detection. It is the purchaser and or employer's responsibility to ensure that only trained and authorized personnel have access to these passwords and functions. The passwords can be changed at will by a supervisor.

The following are additional requirements the purchaser and or employer must meet before using the *Laser Sentry*.

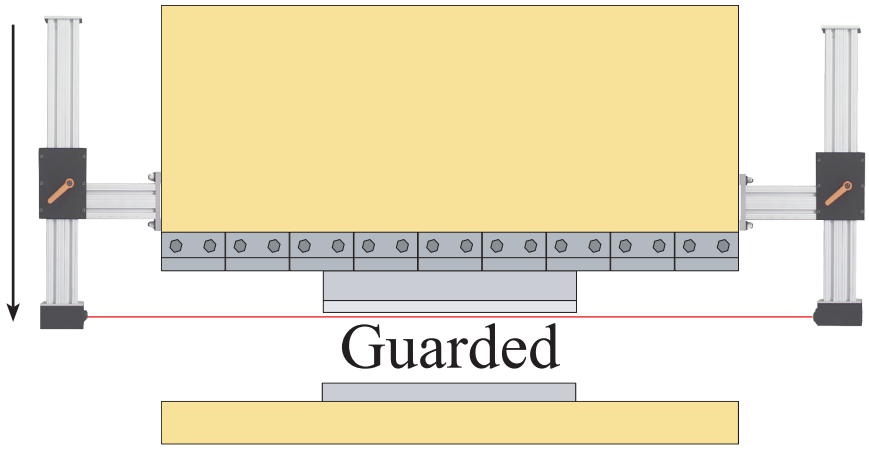
The machine on which the ***Laser Sentry*** is to be installed **MUST** be capable of stopping and reversing motion anywhere in the stroke or cycle in a safe time and within 1/4 inch of ram travel.

Do not use the ***Laser Sentry*** on any hydraulic press brake with inconsistent reversing time or inadequate control devices or mechanisms.

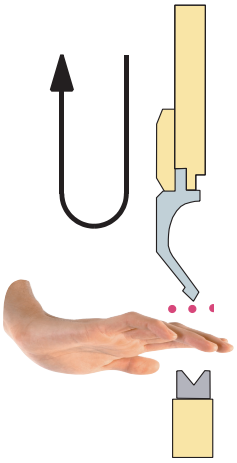
When the ***Laser Sentry*** is used to protect a machine operator from a hazard, the purchaser and or employer has the responsibility to ensure that all applicable federal, state and local Occupational Safety and Health Act (OSHA) requirements and any such rules, codes and regulations which may apply are satisfied.

All Safety related machine control circuit elements; including pneumatic, electric or hydraulic and their respective controls must be control reliable.

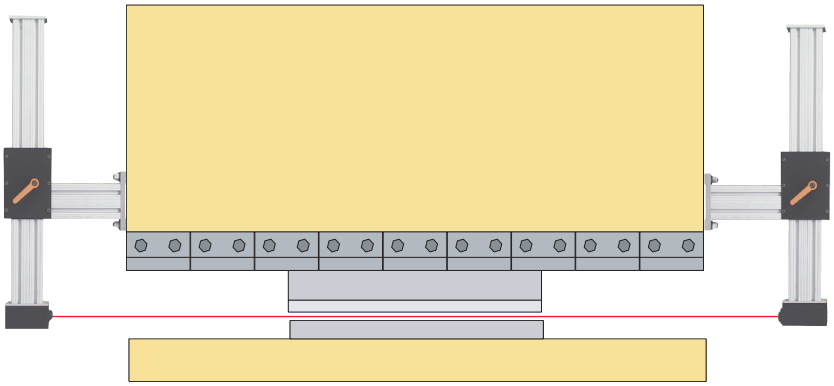
PRINCIPLE OF OPERATION



The laser beams (see BOX BENDING mode) are active when the ram is descending, should the beam be broken before it reaches within .100 of the part being formed the machine will be immediately reversed.



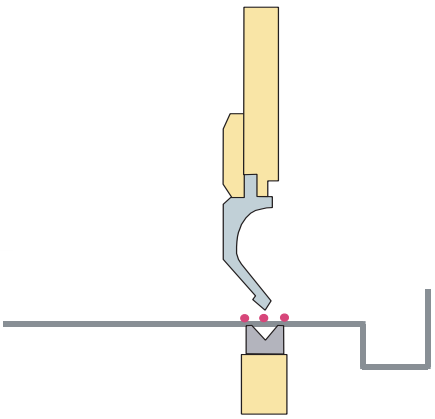
Reverses Ram



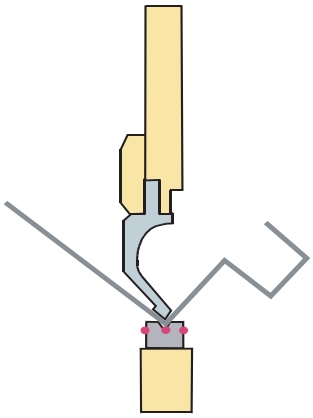
When the ram is descending, the machine is guarded by the ***Laser Sentry***. At 1/2 inch or greater above the part being formed, the ***Laser Sentry*** shifts the machine's ram into slow speed. (down acting machines).

If the laser beams are not be interrupted by the part resting on the lower die, the ram will immediately reverse.

When the laser beam/beams (see BOX BENDING mode) reaches the surface of the part being formed the ***Laser Sentry*** allows the ram to continue through the forming portion of the machine cycle allowing the part to be formed in the same manner as thought there where no guarding laser beam.



Laser beam detects part and allows the machine to continue forming.

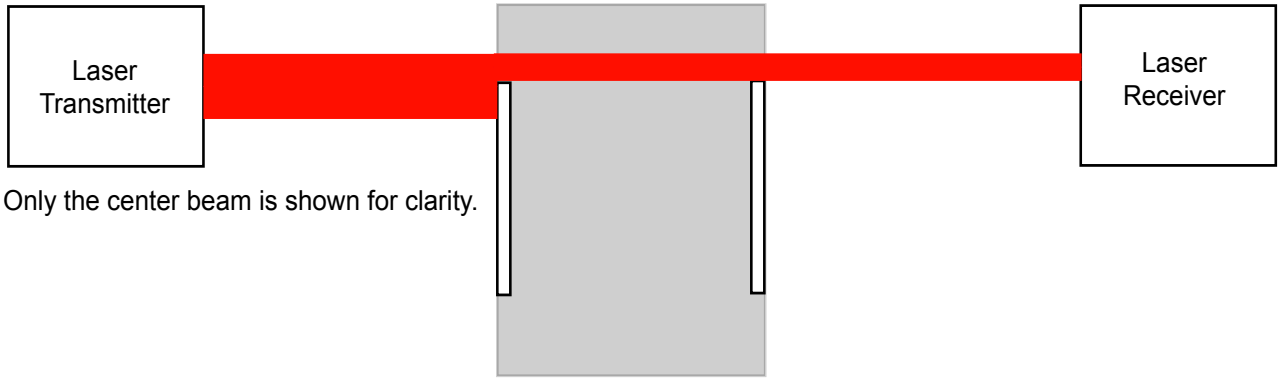


Part is formed and the ram returns home.

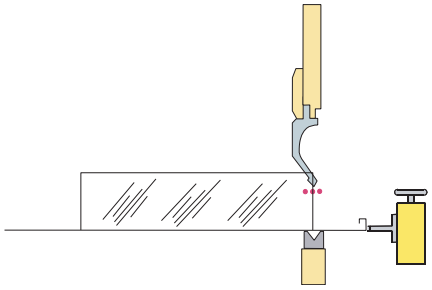
BOX BENDING MODE

Box or tray shapes are formed by selecting the BOX FORMING MODE. When in the Box Mode the ***Laser Sentry*** mutes the fromt laser beam (ignores it). As the ram descends the center laser beam is only partially blocked by the box flange, the portion of laser beam that passes beyound the box flange is enough to satisfy the laser reciever sensor.

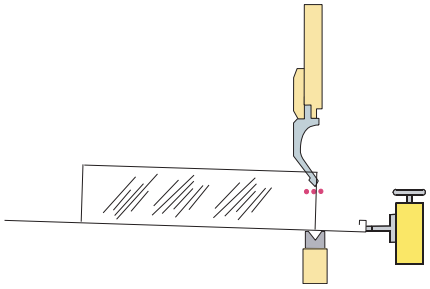
Exaggerated center beam partially blocked by box with flanges being formed.
As long as the recievng sensor can "see" even a partial laser beam it will not cause a fault.



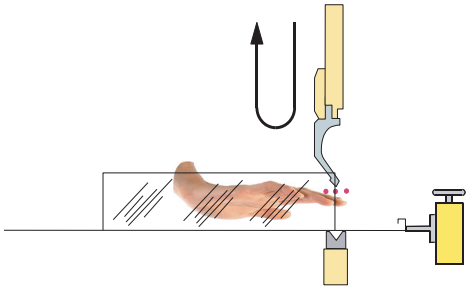
Looking down - Sky view



In Box Mode the front laser beam is muted. As long as the box flange is held against the back stop and the vertical flange is only partially blocking the center beam the box or tray can be formed.

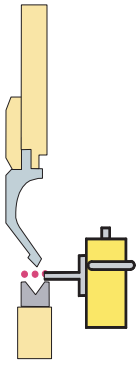


This is an example of the part's vertical flange that is tilted into the center beam, completely blocking the beam and causing the ram to reverse.The part must be vertically parallel to the rams travel so that the laser beam is only partially blocked.



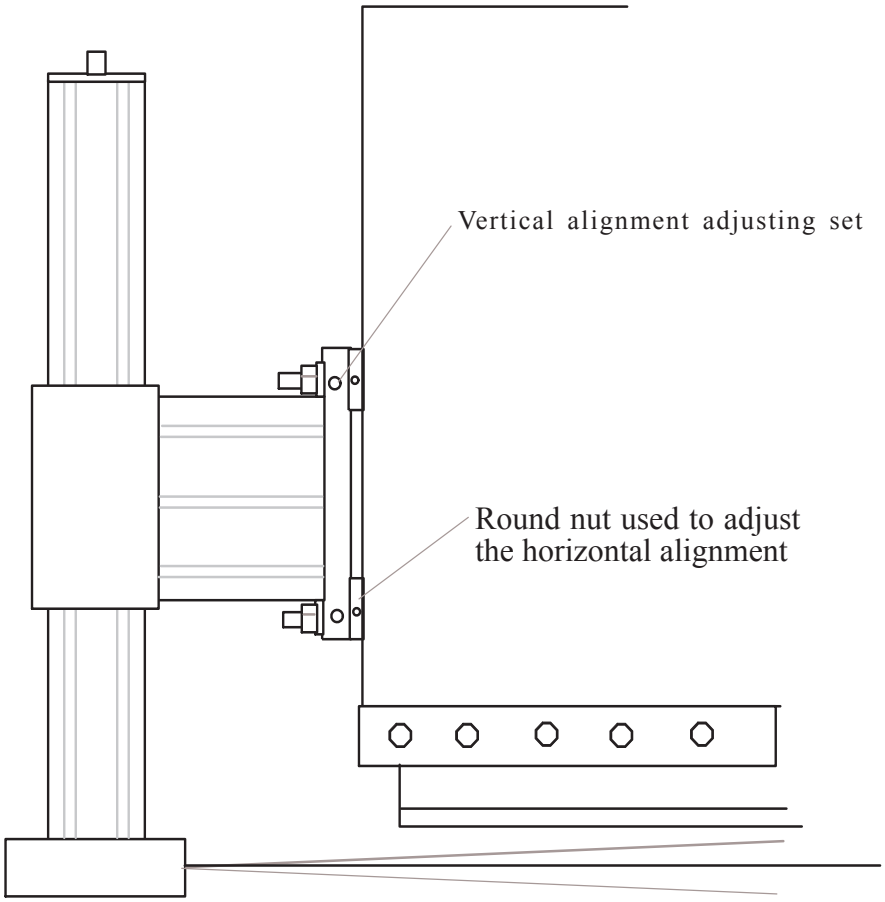
The operator is protected even if his/her hand is placed between the two vertical flanges.

BACK BEAM BLOCKED



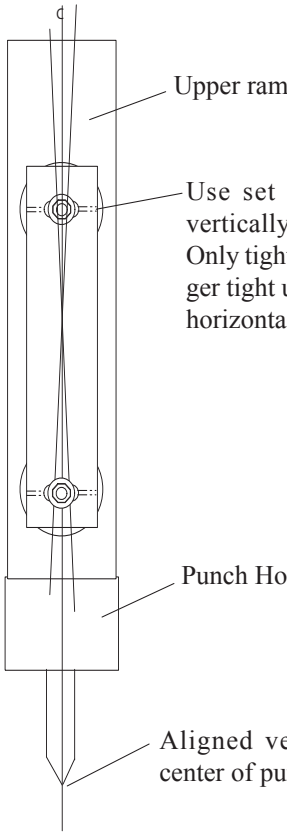
In the event something blocks the back laser beam, such as a back guage finger, the back beam can be muted. (see programming instructions)

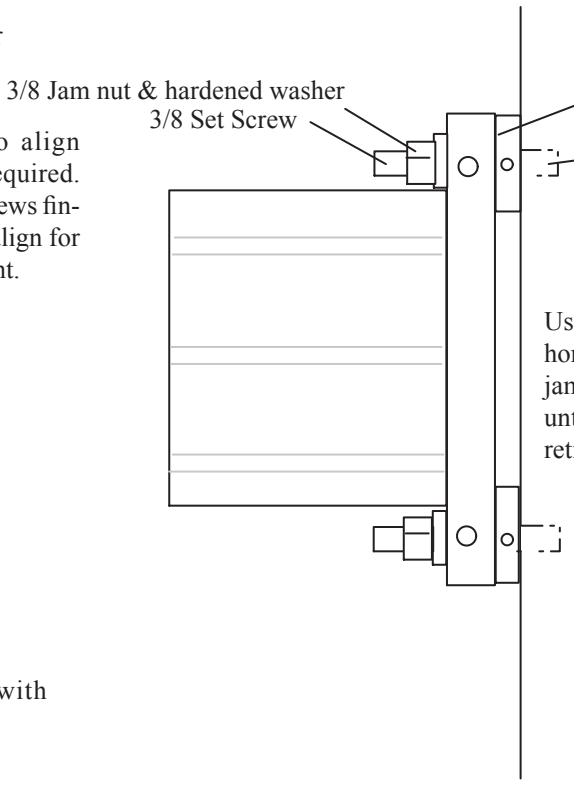
MACHINE END MOUNTING BRACKET



Laser beams must be horizontally aligned perfectly parallel to the upper tool holder.

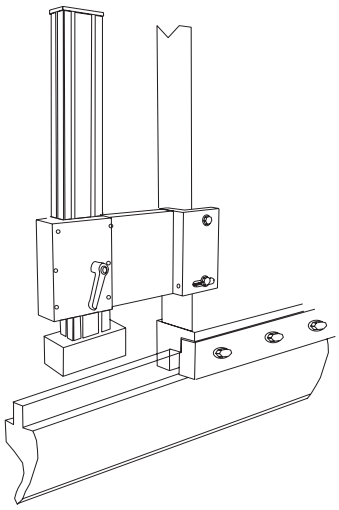
The center beam must be aligned with the center of the punch leading edge.





Use the round nuts to adjust for horizontal alignment. Loosen the jam nut and rotate the round nut until you achieve alignment, the retighten the jam nut.

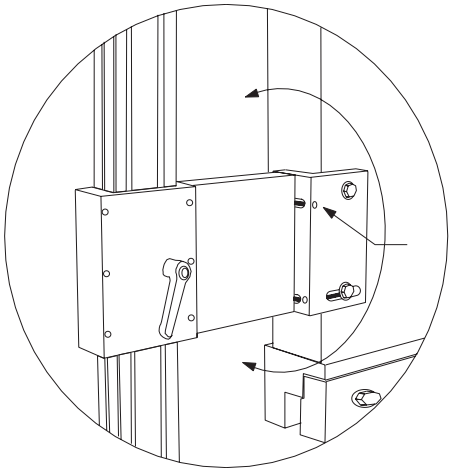
INSTALLING THE *LASER SENTRY*



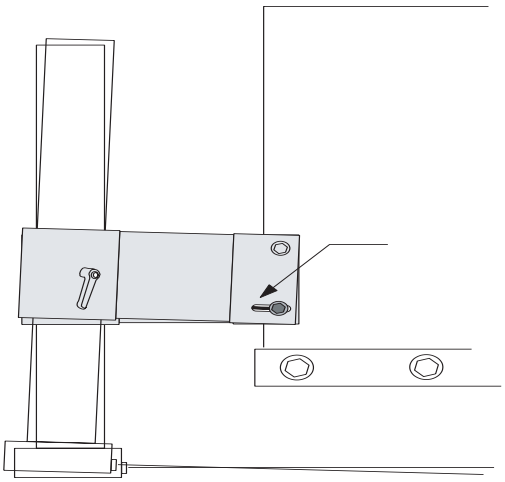
NOTE:
On machines 14' and longer it may not be possible to align the three laser beams. If this occurs, first determine if there is a mask on the receiver (it will have a slot over the center beam) call the factory on how to remove it. If this does not improve alignment then you should align the center beam. Then turn off the beam or beams that do not align. See REAR BEAM BLANKING and BOX FORMING on page 22 on how to blank these beams.

Mount the brackets so that when it is raised, the die can be safely removed.

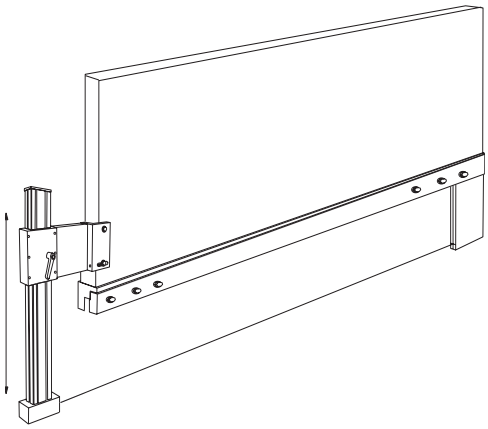
The mounting brackets have four points of alignment.



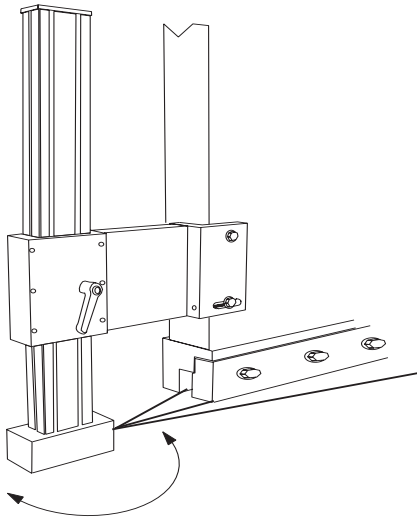
This one adjusts for vertical center and perpendicularity to the ram's die holder.



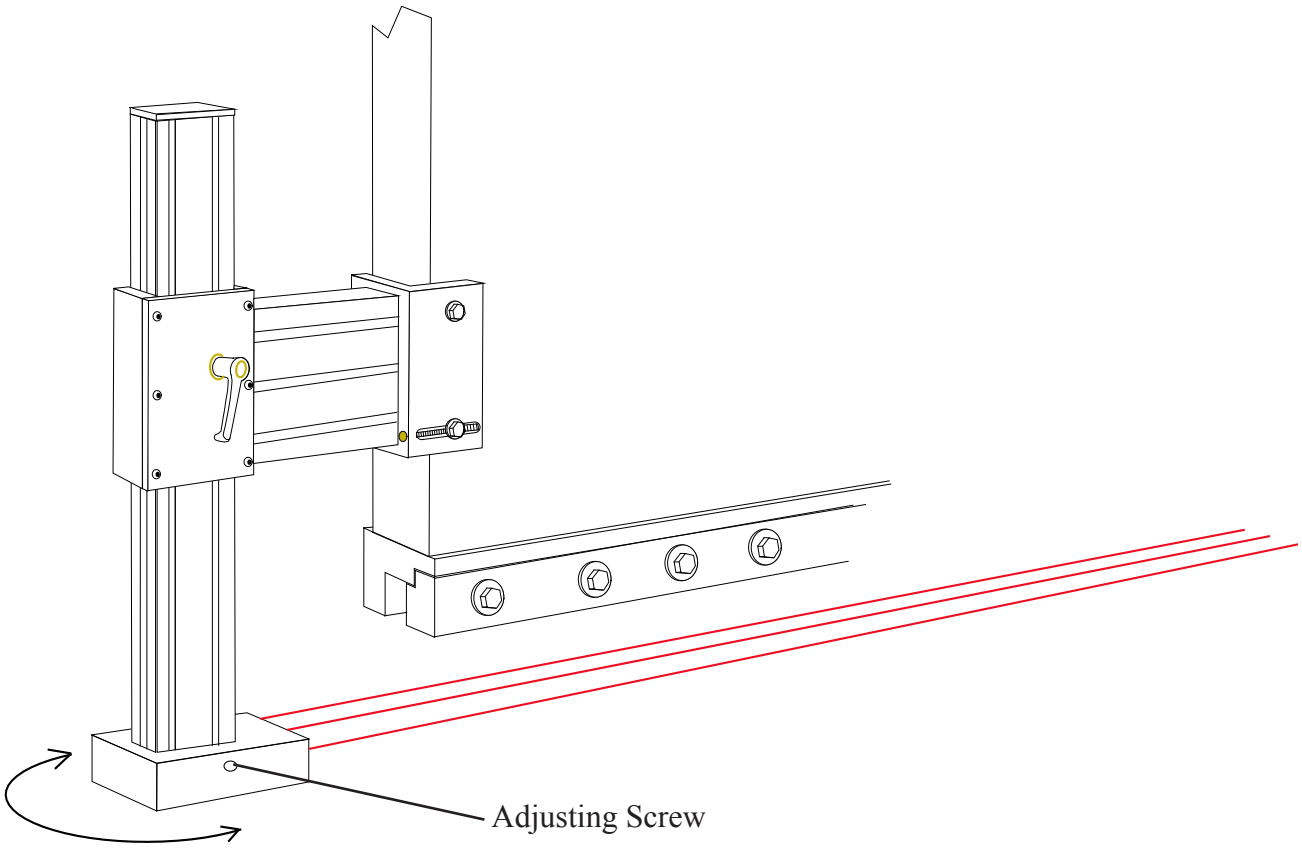
Adjustment for parallelism. See next view for details.

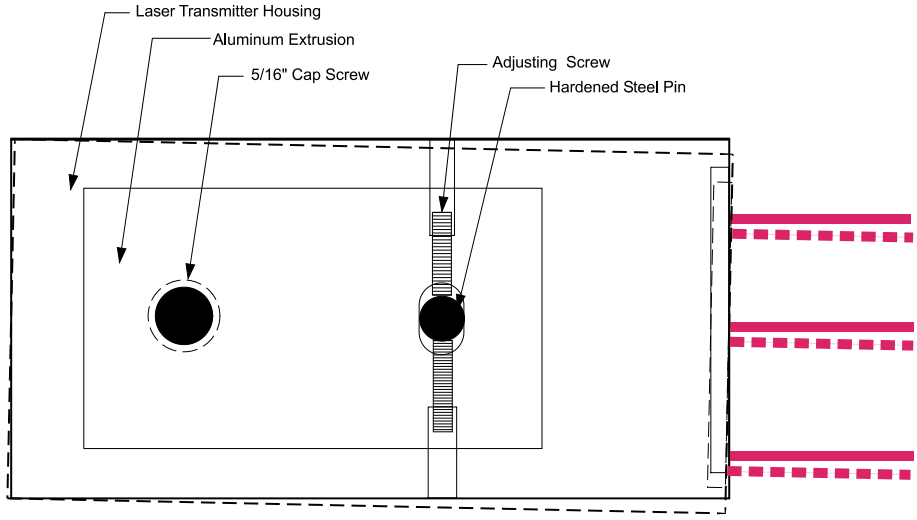


Adjustment for parallelism with the tool holder.



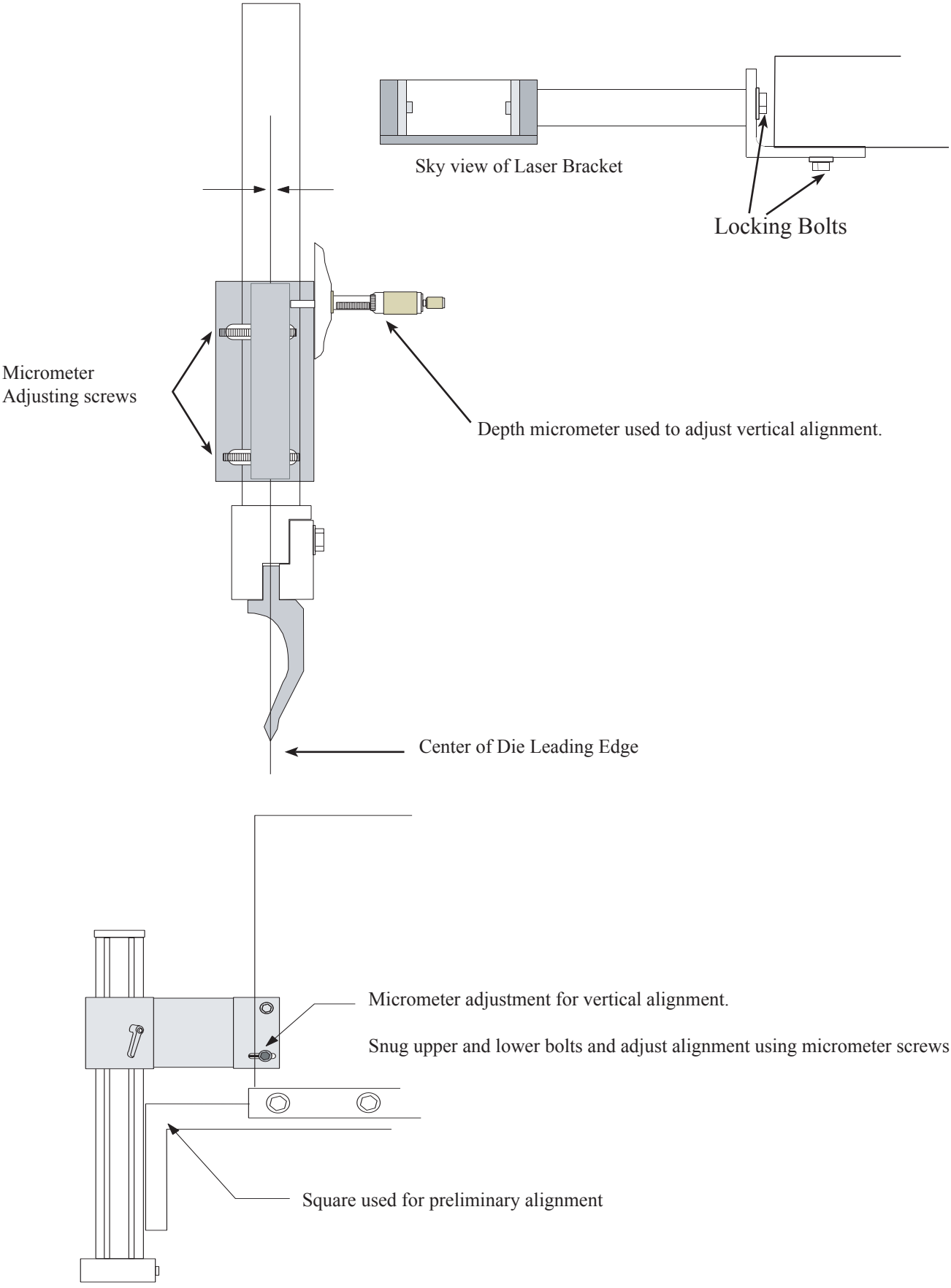
Beam angle adjustment. See detail drawing for making this adjustment.



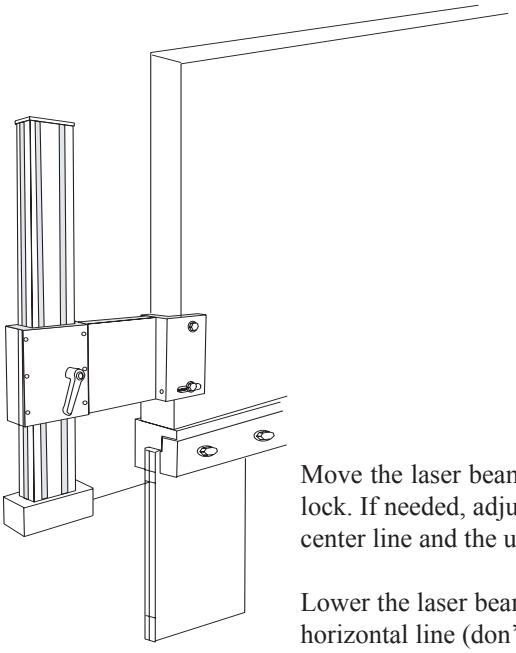


This drawing shows the Laser Transmitter head as though you were looking down through the aluminum extrusion. By loosening the 5/16” cap screw slightly you can micro-adjust the skew of the beams. Insert an allen wrench through the openings on the side, loosen the screw in the direction you want to move the head and tighten the opposite screw until reaching correct alignment. Tighten the opposing screw and recheck alignment. Micro-adjust the screws until you have perfect alignment and both screws are tight against the hardened steel pin.

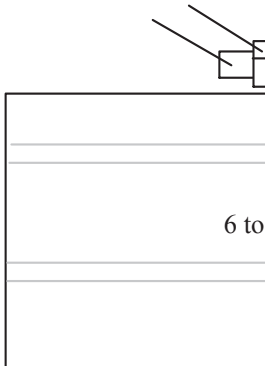
MOUNTING AND ADJUSTING THE BRACKETS



PRECISION ALIGNMENT
OF THE LASER TRANSMITTER



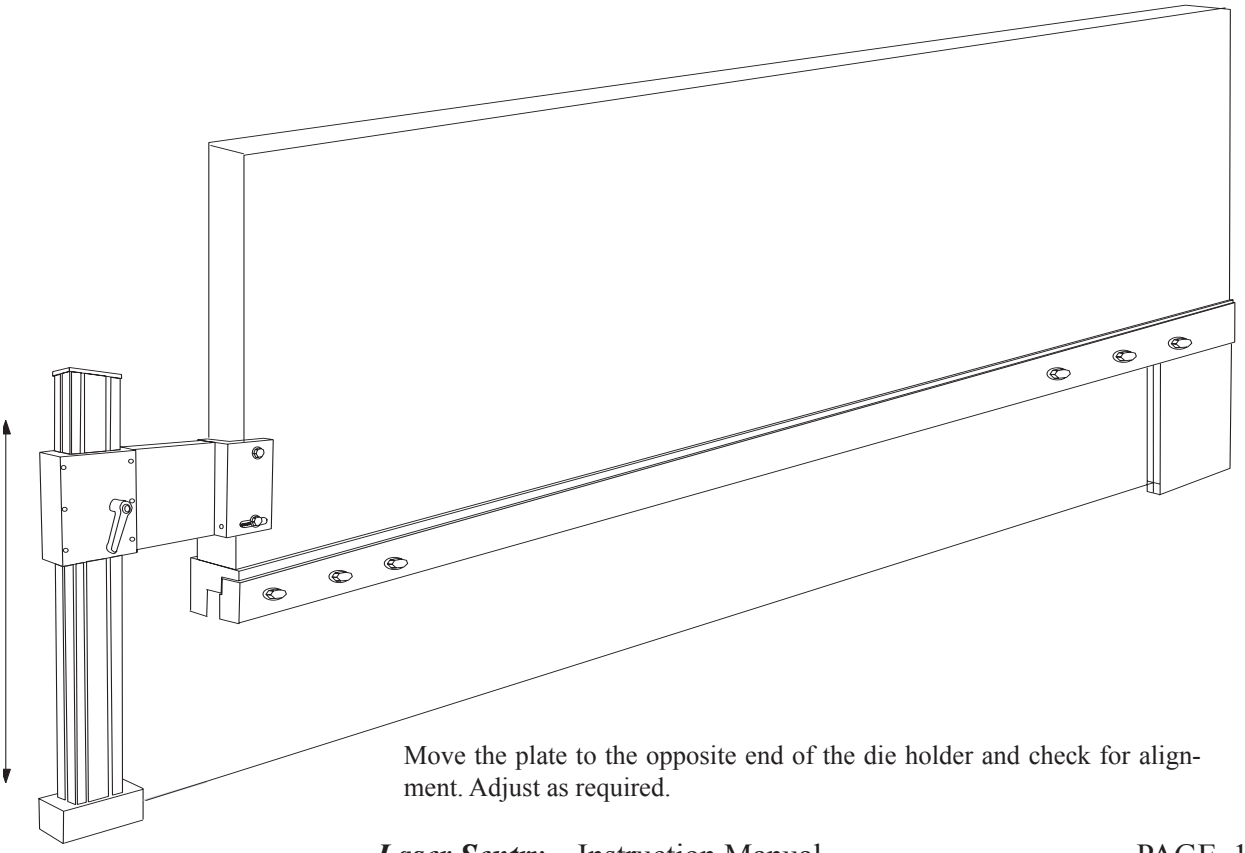
Laser Alignment Plate



Steel or aluminium plate (thickness to match die clamp) Edge scribed with center vertical line, one horizontal line 1” below the heel of die clamp. The other horizontal line, 6 to 8 inches down.

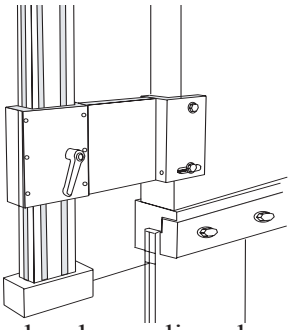
Move the laser beam up to the upper horizontal line and tighten the slide lock. If needed, adjust the bracket so that the beam is dead center with the center line and the upper horizontal line.

Lower the laser beam until it is aligned with the center line and the lower horizontal line (don’t forget to tighten the slide lock). Adjust as required.



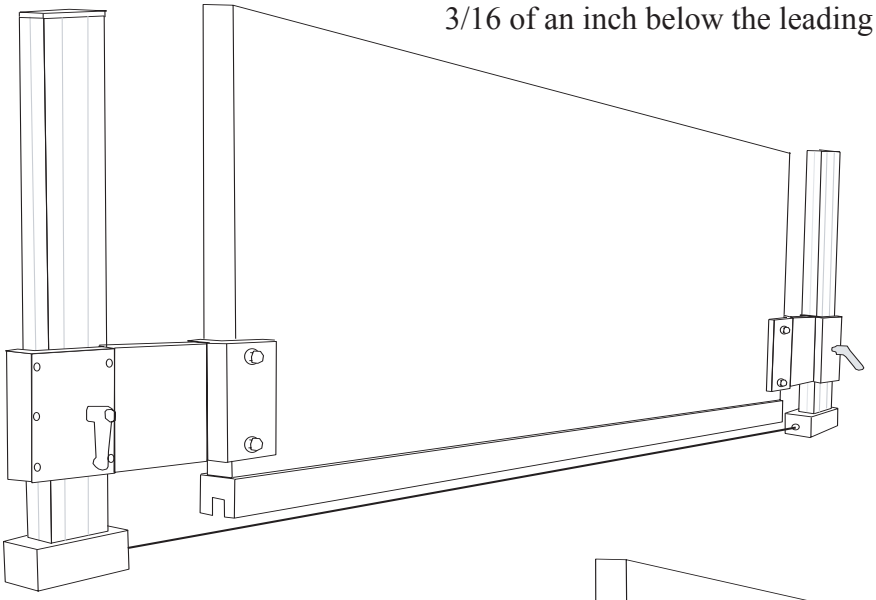
Move the plate to the opposite end of the die holder and check for alignment. Adjust as required.

ALIGNING THE LASER RECEIVER



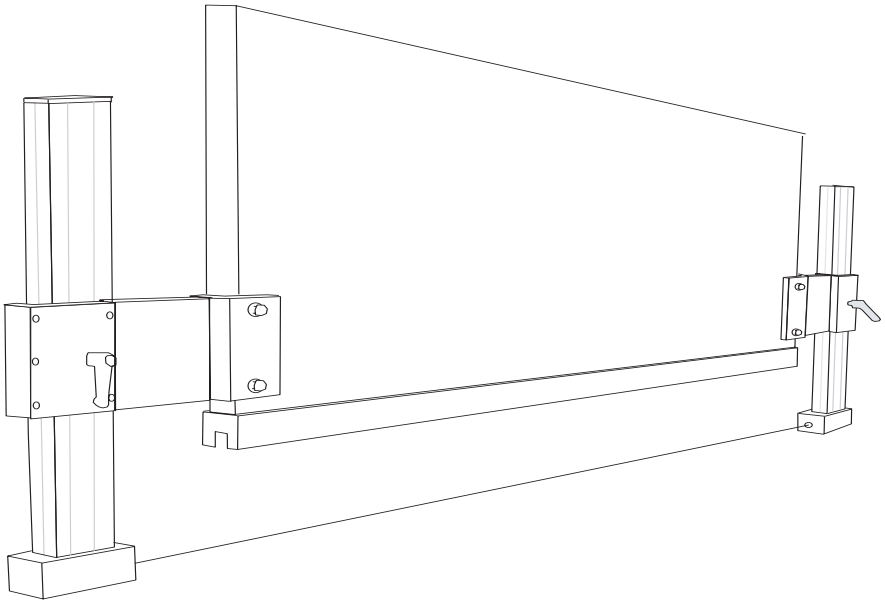
Once the laser transmitter has been aligned, move it so that the beam is aligned with the heel of the die clamp (top Scribed line on the alignment plate).

Loosen the scale's locking bolt and move the scale to read 0 +3/16". Align the receiver up with the laser beam and lock its' scale to match. By setting the scale like this, whenever you adjust the laser beam to the length of the die, the beam will always be 3/16 of an inch below the leading die edge.



Align the receiver bracket using the same method as shown in (MOUNTING AND ADJUSTING THE BRACKETS).

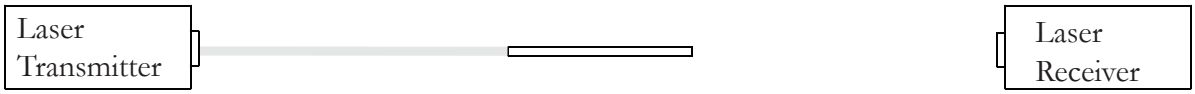
Once the laser receiver is adjusted for vertical and horizontal alignment move the laser transmitter up as shown. Make adjustments as required to align the laser beam exactly center in the lens of the receiver.



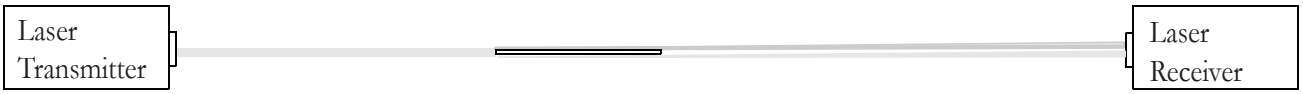
Lower the laser transmitter bracket 6 to 8 inches on the scale, then lower the receiver bracket the same distance. Check for alignment. The laser beam should be dead center in the receiver lens. Adjust the brackets as required and set the scale to match the one on the transmitter.

ABOUT DETECTING OBJECTS

The Laser Sentry is capable of detecting objects as small as 1 MM. (.029), at a transmitter/receiver distance of 4 feet. As the distance increases the detecting size increases. At 10 feet an object as small as 2 MM. (.058) will be detected. The size detection sensitivity is not important for protecting personnel because body part size is much larger than 2 MM., but for part detection, size could be important.



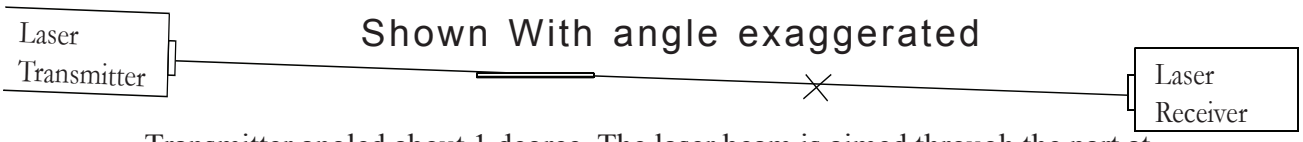
Part detection: Part blocks enough of the beam to prevent the laser beam from reaching the receiver.



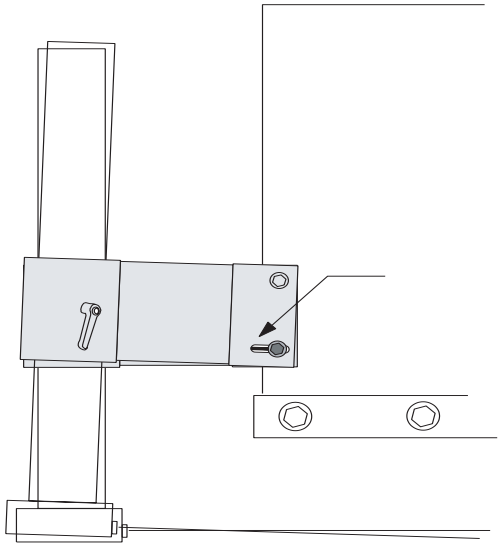
Increase the distance between the transmitter/receiver and the part will not be detected. This will cause a PART NOT DETECTED Fault.

If you are forming small thin parts, always teach the Laser Sentry the part surface with the part in the same place where you are going to form the part. Example: If you teach the control where the surface of the part is close to the transmitter, the beam will be smaller there, then if you try to form the part in the center of the machine, the beam is wider there and the part will not be detected.

If you are often forming thin small parts and you are getting PART NOT DETECTED errors it may be necessary to tilt the transmitter down so the beam is aimed at a cross section of the part, making the target thick enough for the laser to be blocked. (see below)



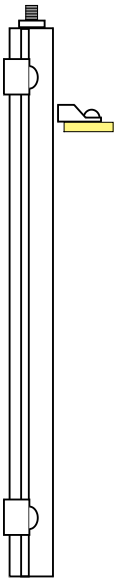
Transmitter angled about 1 degree. The laser beam is aimed through the part at an angle, effectively increasing the size of the target. The degree the transmitter is tilted is determined by the length of the machine. Use the smallest possible angle.



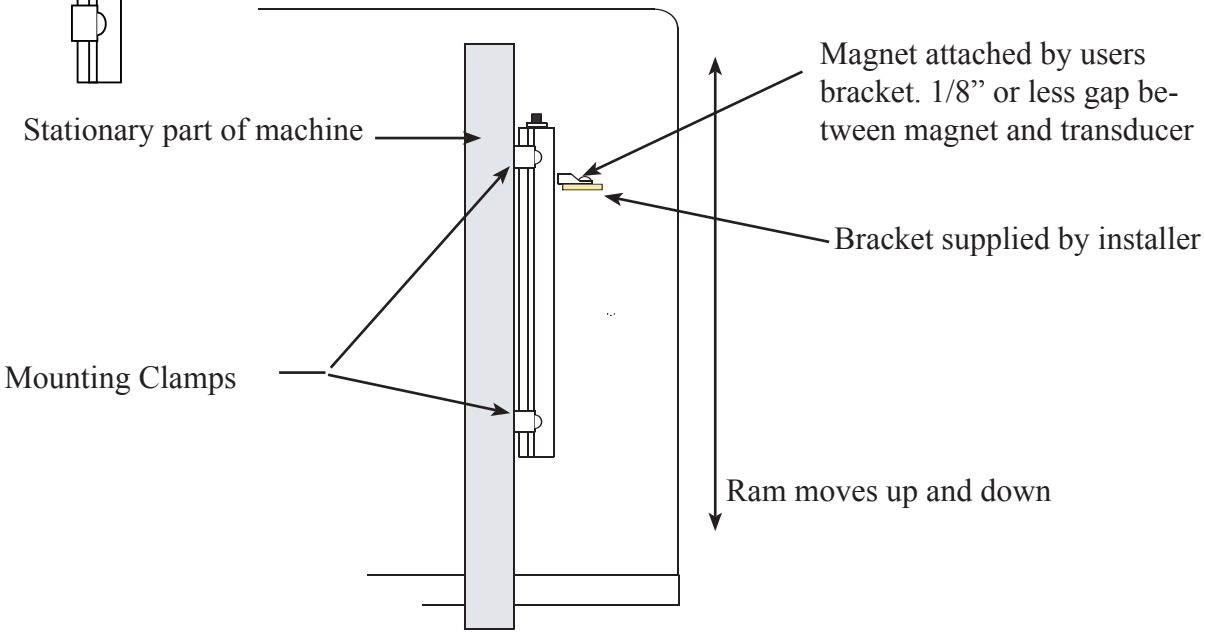
Tilt the transmitter by loosening the holding bolts slightly. Place a target at the very end of the press bed. Adjust the transmitter angle.

Align the receiver with the beam and adjust the receiver scale so that it reads the same as the transmitter's scale.

MOUNTING THE RAM POSITION TRANSDUCER

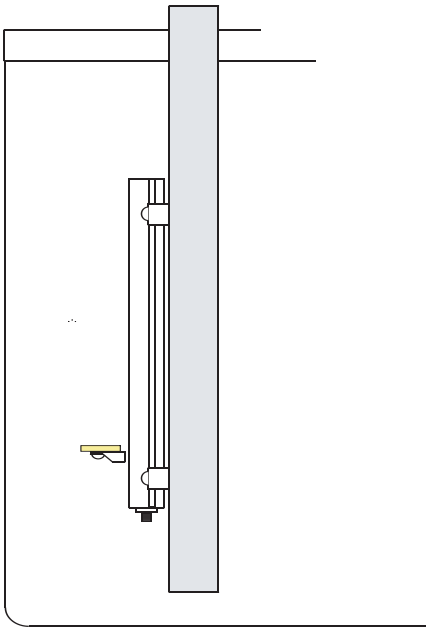


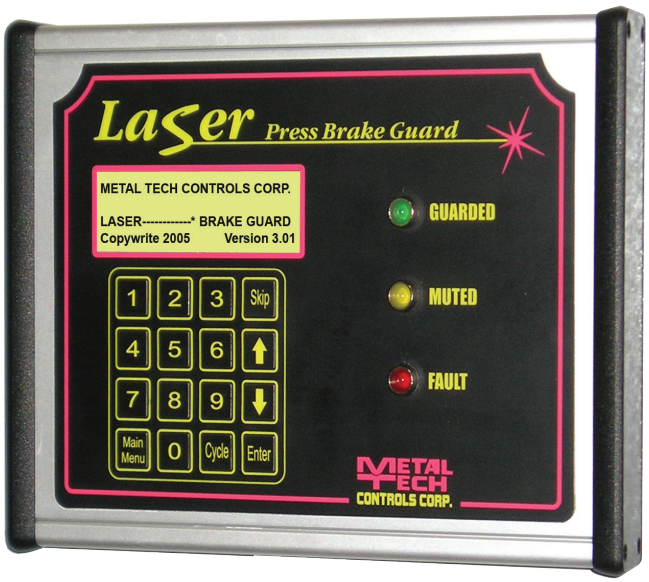
The ***Laser Sentry*** uses a linear transducer to monitor the ram's movement and position. Position is accurate to .0025 inches. The housing is mounted to the stationary part of the machine and the (magnet) slide is connected to the moving ram.



UP-ACTING MACHINES

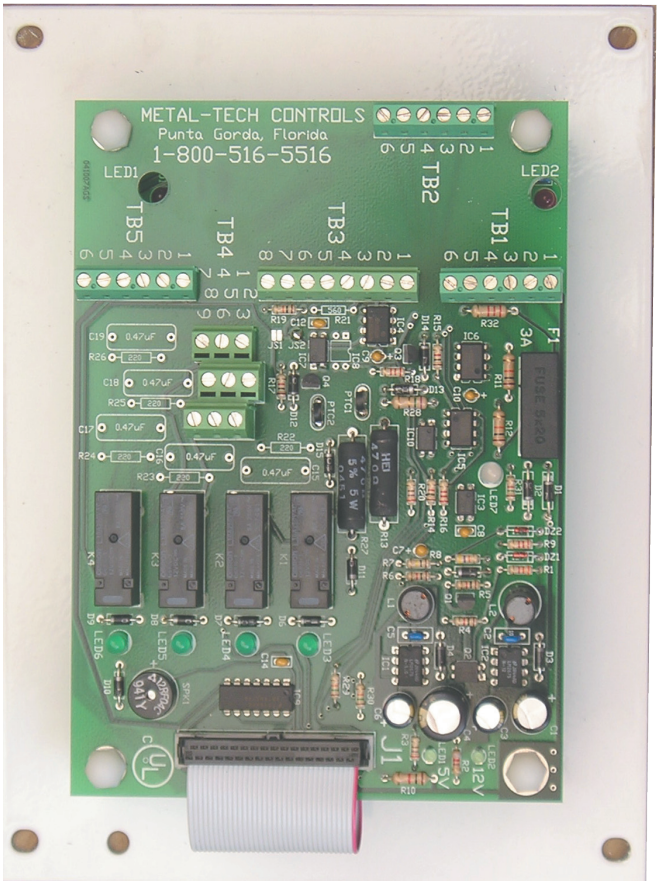
Mount the transducer in this direction in the same manner as shown above.





Laser Sentry HMI

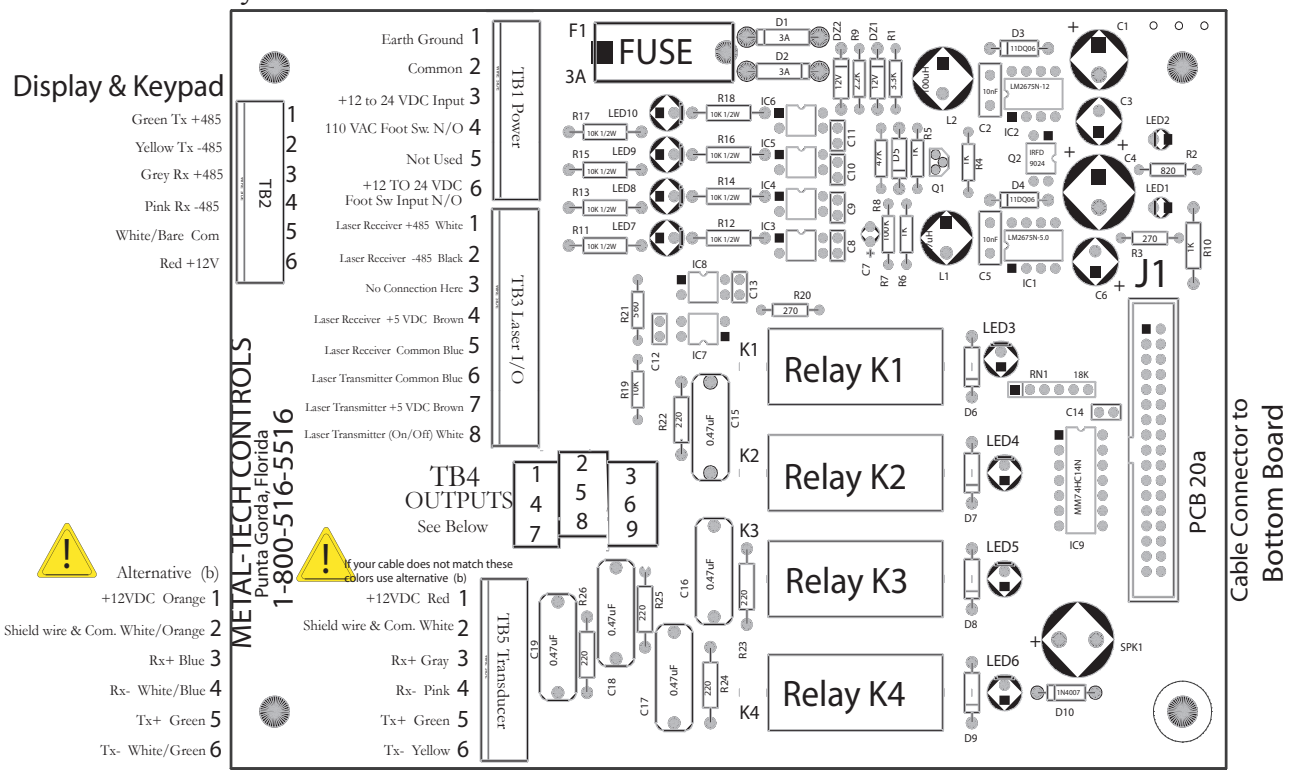
The Laser Sentry HMI (Human Machine Interface) has two powerful strip magnets on its' back so it can be mounted any where convenient. CAUTION! Do not place it where it could be damaged by material being formed, etc. Support the cable with the 3M wire management stick-ons.



The controller board rack should be mounted in a Nema 4 enclosure so that it is not subject to moisture or oil. Do not mount the controller stack near any high power switching devices. Route all cables to it away from any high power switches devices or cables. Secure connection cables to the sub panel to insure that they do not vibrate or move the prevent the connections from breaking.

ELECTRICAL INSTALLATION

Terminal 2 & 3
12 to 24 VDC Only



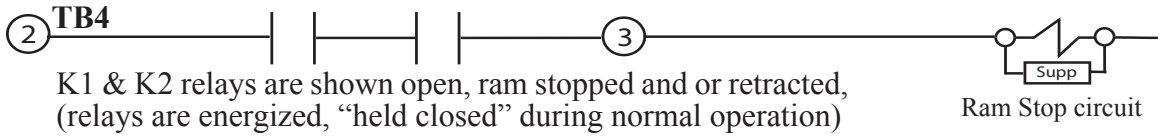
TB4 Outputs

Not Used (1)	K1 Out (2)	K2 In (3)
K3 N/O (4)	K3 Com (5)	K3 N/C (6)
K4 N/O (7)	K4 Com (8)	K4 N/C (9)

Surge Suppression

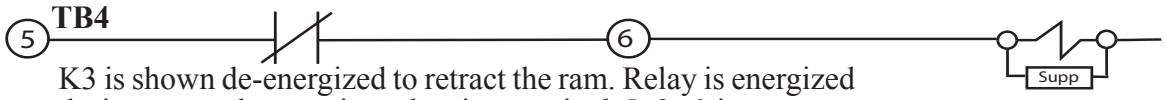
For DC circuits use diodes rated 250 v - 3 amp
For AC 110 volt circuits use MOVs rated 130 vac
For AC 24 volt circuits use MOVs rated 30 vac

Failure to suppress all driven circuits will void the warranty!

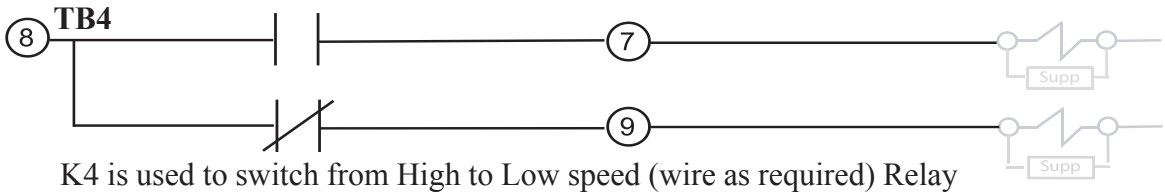


K1 & K2 relays are shown open, ram stopped and or retracted, (relays are energized, "held closed" during normal operation)

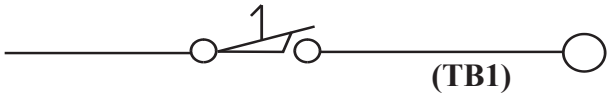
Ram Stop circuit



K3 is shown de-energized to retract the ram. Relay is energized during normal operation, that is, terminal 5 & 6 is an open



K4 is used to switch from High to Low speed (wire as required) Relay



Machine run signal - Input from foot switch circuit or ram closure valve circuit. (TB1) Terminal #4 if using 110 vac or Terminal #6 is using 12 to 24 vdc.

TB1 POWER SUPPLY

TB1 is the DC power supply terminal. The ***Laser Sentry*** can except a DC power supply between 12 and 24 VDC. If you do not have DC power available the a power supply can be purchased for most electrical supplier or from us. Part No. 400-MKS4012. Terminal 1 should be connected to EARTH ground. Both common and a machine ground must be connected to TB1 as shown.

TB1 FOOT SWITH INPUT

The ***Laser Sentry*** requires a N/O machine (run) input from the circuit that closes the ram i.e. the foot switch circuit or down valve closure circuit. This input may be 12 to 120 volts DC or AC. Terminal #4 is used if your require 110 vac, terminal #6 is used when 12 to 24 vdc is required.

When using the Wavy Material Function, the ram is retracted when the laser beam is interrupted by the wavy material (on anything else). The ram retracts until the laser beam is no longer broken and the ram is stopped. The ***Laser Sentry*** requires that the machine (run) input goes low, (foot switch is released), before allowing the ram to try to close again. It may be necessary to use a foot switch with two micro-switches in it. One switch controls the machine the other provides the 'go' signal to the ***Laser Sentry***. By adjusting the switch sequence you can set the foot switch up so that by releasing it halfway the 'go' signal to the ***Laser Sentry*** signal goes off but the switch serving the machine remains on causing the ram to remain stopped. See the Relay sequence table below.

TB2 (FUTURE HMI)

TB3 LASER I/O

These are inputs and outputs for the laser transmitter and receiver. Wire them as shown in previous page drawings.

TB4 - OUTPUTS

The ***Laser Sentry*** provides a pair of force guided contact safety relays, K1 and K2. These relays have normally open contacts which are held closed by the ***Laser Sentry***. The relay contacts are monitored for contact weld and failure to open or close. Should one fail the ***Laser Sentry*** will immediately shut down the press and issue the message, "RELAY FAILURE".

K1 and K2 are used to control the ram closure valve. When K1 and K2 de-engerizes the machine's ram should reverse or stop. (stop is required for use of the Wavy Material Function).

K3 relay is switched at the same time as K1 and K2. K3 has Common, N/O and N/C contacts to be used as required. K3 should be wired so that when it is de-energized the ram retracts. (If K1 and K2 stops the machine then K3 should be used to reverse the ram).

	OP=F/S Released CL=F/S Pressed X=Relay Energized O=Relay De-Energized					
		Foot Switch	K1	K2	K3	K4
A	RAM CLOSING AT HIGH SPEED	CL	X	X	X	X
B	RAM CLOSING AT SLOW SPEED	CL	X	X	X	O
C	RAM RETRACTING NORMAL	CL	X	X	X	X
D	RAM RETRACT BEAM BROKEN	CL	O	O	O	X
	WAVY MATERIAL					
1	RAM CLOSING BEFORE SLOW SPEED	CL	X	X	X	X
2	RAM CLOSING AT SLOW SPEED	CL	X	X	X	O
3	BEAM BROKEN (Ram Retracting)	CL	O	O	O	X
4	RAM STOPPED (Beam Cleared)	CL	O	O	X	X
5	RAM STOPPED (Now In Low Speed)	OP	O	O	X	O
6	RAM CLOSING (Repeat of 3 - 6 for 2 times)	CL	X	X	X	O
	REPEATS 3 thru 6					

NOTE: See additional information on next page.

K4 relay is the high/low speed control relay. It is to be connected into the machine's high/low speed change valve. Many up-acting machines do not have this type valve because the operator controls the speed by how much he/she presses the treadle down. On these machines K4 is not used. Even if the machine has its' own high/low circuit K4 should be installed into that circuit. It is designed to force the machine into slow speed even if the machine's slow speed is set lower than 1/2 inch or turned off.

TB5 LASER I/O

The wiring of the transducer is crucial. Wire exactly as shown. The bare shield **MUST** be connected to terminal #2 along with the white wire!

WAVY MATERIAL ELECTRICAL CONCEPTS

The requirements for using the Wavy Material Function need further clarification. In normal operation the ***Laser Sentry*** simply reverses the ram direction at high speed. This means (depending on the machines control circuit) de-energizing the down valve and energizing or de-energizing the up valve again, (depending on the machines control circuit).

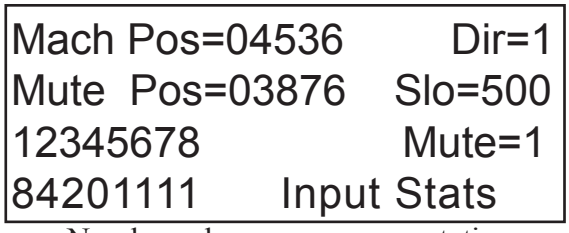
When using the Wavy Material Function the following occurs; beam is broken before reaching the programmed material mute point; ram retracts until the beam is no longer broken and stops, the ***Laser Sentry*** waits for the 'Go Signal" or foot switch input to go away (input TB2 #3), it then waits for the 'Go Signal" to come back 'ON' before allowing the ram to close. It will do this 3 times if the obstruction remains. After the third time the ram will be allowed to close.

This requirement may cause the machine's circuit to do strange things. If it does, a means must be found to overcome this. One way to do it is to isolate the ***Laser Sentry's*** input TB2 #3 from the machine's control inputs. This can be done by using a foot switch with two micro switches. The switches can be adjusted so that when fully pressed both micro switches "switch" and if the foot switch is only half released only one micro switch will "switch". Use this switch to supply the "Go Signal" to input TB2 #3.

DIAGNOSTICS

From the MACHINE SETUP menu select (6) for diagnostics. The machine will be placed in diagnostic mode. You can move the ram up and down but the laser beam will always be in the guarded mode. Interrupt the beam and the machine will reverse.

The display will show.



Numbers shown are representative

Mach Pos= is the transducer's reading of ram position.
Dir= is the direction the ram is moving 1=down 0=up.
Mute Pos= the programmed MUTE psoition recorded when QUICK tool was used.
Slo=05630 is the transducer position where slow speed is started
Mute=1 will change to =0 when the ram has reached the slow speed position programmed into the ***Laser Sentry***.

INPUTS, the 12345678 represents inputs 1 through 8 as follows.

1-Laser Status Front Beam
2-Laser Status Center Beam
3-Laser Status Rear Beam
4-Machine Go Input (foot Switch)
5-PIC RUN Status
6-PIC Dog Status
7-Pos Ready Status
8-K1 & K2 Test Status

In most cases you will be instructed by Metal-Tech technical support as to what the status of the inputs are and what they mean.

MACHINE SETUP

Run Menu

```
LASER---* BRAKE GUARD
  BOX=OFF     REAR=ON
WAVY PART is OFF
Ram Stop Time  065
```

When in this Menu press the MENU key to access the Main Menu.

```
Enter Your Password

PASSWORD
```

Entry into the Machine Setup Menu requires a password. Enter 4321. (Once you have entered the Machine Setup Menu, change your password following the directions (4).

Main Menu

```
1=QUICK MENU  2=SLOW
3=WAVY PART-OFF
4=BOX-OFF  5=REAR=ON
6=DISABLE   7=SETUP
```

Press '7' to gain access to the Machine Setup Menu.

```
   *** SETUP MENU  ***
1=SET SLOW POSITION
2=LOST MOTION
 Press Down Fo More
```

Use the UP/DOWN arrow keys to move through the menus. Select the item to edit and follow the instructions given bellow.

```
                MACHINE SETUP MENU

1=SET SLOW POSITION          5=DIR HYSTERESIS
2=SET LOST MOTION            6=DIAGNOSTICS
3=RAM STOP TIME          7=PART DETECTION
4=CHANGE PASSWORD            8=RAM REVERSE
                             9=BYPASS LASER
```

These are you menu choices. As you scroll through the menu you will have access to each function.

Slow Speed:
Ram slow down speed control is provide by the K4 relay. This is a safety related requirement. The default speed change is .500 above the programmed material setting. You cannot set it lower than this. You can set it higher if desired. Select (1) from the menu and enter the new setting.

Lost Motion:
This is a time in milliseconds. It is used to detect if the position transducer is working properly. When ram motion is called for by press the foot switch a timer begins ticking. As the ram positions change and the transducer is sending the proper position this timer is reset to zero. If there is a transducer fault the timer will not be set to zero and a MOTION FAULT will be generated, stopping and reversing the machine. Each machine is different, set this time as low as possible. Start at 50 mS and work your way up until no errors occur. DO NOT SET HIGHER THAN ABSOLUTELY NECESSARY! Serious injury could occur if this setting is set to high!

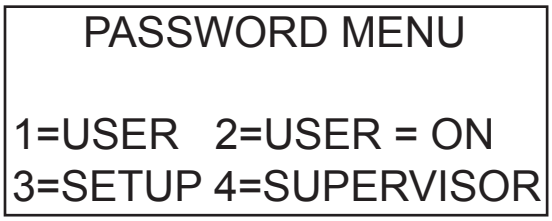
Ram Stop Time:
Each time the ram is reversed the time it takes to retract is timed. If the reverse time exceeds the pro-

grammed reverse time check number a fault occurs preventing the machine from further operation until the problem is corrected. The determine the best reverse time setting, install the heaviest die you have in the ram tool holder. Select a stroke of about 4 inches. Place a block of wood so that the laser beam will be interrupted about one inch from the bottom. Cycle the machine and each time it reverses record the displayed reverse time. Do this about ten time and take an average by dividing the total times by the number of times. Enter this number plus 10 percent.

Password Menu:
There are three levels of password protection provided. Setup person, Supervisor and 10 Users. The setup person is anyone authorized to make changes to everything but the Supervisor's password, this includes changing the 10 Users passwords. The Supervisor can make changes to anything, including changing everyone elses password. All passwords must be greater than 1000 and less than 65535. 65535 is the limit of a integer word in machine memory.

Factory Preset Codes:

User	1234
Setup	4321
Supervisor	5678



All passwords should be kept secure.

Selection (2) allows you to require a USER's password to be entered anytime the machine is powered up. As many as 10 Users can have individual passwords. You can change and or view these passwords by selecting (1) and using the Up and Down arrow keys to scroll through the 10 passwords.

The machine can be disabled by selecting disable from the Main Menu. You must enter a password to re-enable the machine.

Hysteresis:
This should only be changed on authorizatiom from the factory.

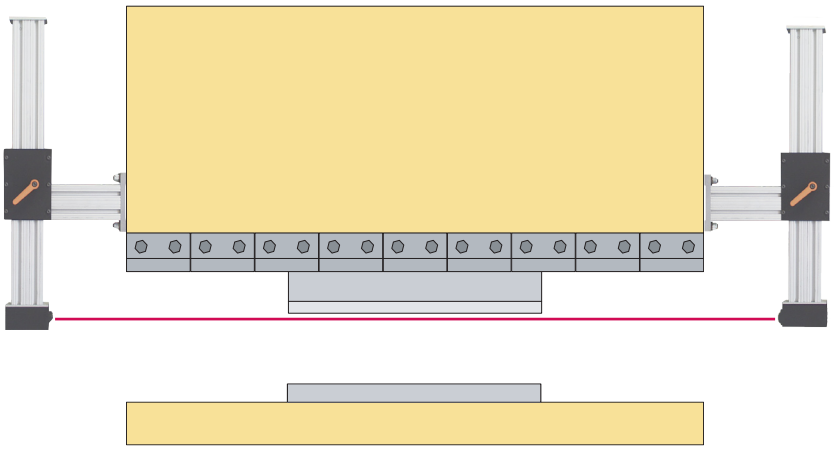
Diagnostics:
Displays the Diagnostic screen for trouble shooting. See the section "DIAGNOSTICS"

Part Detection:
Turn Part Detection ON or OFF. When ON the control looks for the part to be on the die, if it is not the ram returns. Often the parts you are forming are to thin to be detected by the laser beam. In this case turn this function OFF.

Ram Reverse:
The default setting for ram reverse is for the ram to reverse to its home position when any of the laser beams are interrupted during the hazardous portion of the stroke. Select [2] to change the setting so that the ram will only return to where the beam has been cleared.

Bypass Laser Sentry:
WARNING! Disabling (bypassing) the Laser Sentry is extremely dangerous and could cause serious injury or death. Do NOT disable the Laser Sentry unless it is absolutely necessary to make a particular part, and then only in slow speed! Restore the Laser Sentry Guarding System immediately after such use. When the Laser Sentry is disabled the LEDs on the front panel will flash and the LCD will display "DANGER" "LASER SENTRY DISABLED"

GUARD SETUP INSTRUCTIONS



QUICK TOOL SETUP:

Determine the depth of the die and move the Laser Transmitter so that the scale matches the die depth. Check to be sure the beam is centered under the die leading edge and the proper distance below the leading edge of the die. Align the Laser Receiver scale to the same setting. The green indicator lamp will be on when they are aligned.

```
LASER---* BRAKE GUARD
  BOX=OFF     REAR=ON
WAVY PART is OFF
Ram Reverse Time  065
```

This is the screen seen when in normal running mode. Press the MENU key.

```
1=QUICK MENU  2=SLOW
3=WAVY PART-OFF
4=BOX-OFF  5=REAR=ON
6=DISABLE   7=SETUP
```

This screen will appear.
Press [1] for QUICK MENU.

```
SET GUARDED RANGE

Move Ram to Material
To Set Guarded Range
```

The machine is placed in slow speed. Place the part to be formed or a scrap piece on the surface of the lower die and press the foot pedal and lower the ram down until the laser beam is broken by the part.

```
GUARDED RANGE IS SET
Press ENTER to Save
Press CYCLE to Redo
Press SKIP to Quit
```

If the setting is satisfactory, press the ENTER key. If you inadvertently interrupted the beam by accident press CYCLE and you will be instructed to lower the ram again. If you wish to quit the programming, press SKIP and you will return to the run screen.

CAUTION! This is a dangerous machine. Use extreme care when operating this machine. It is YOUR responsibility to insure that the machine safety devices are working properly. If they are not working properly IMMEDIATELY shut the machine down and advise a supervisor of the situation.

Operating the press brake with any of the Laser Beams disabled is hazardous and should only be done by a properly trained and authorized person. Use extreme CAUTION when operating the machinE with any of the Laser Beams disabled!

BOX FORMING

To form boxes or trays the front laser beam cannot be used because it is interrupted by the vertical flange of the part being formed. When form boxes or tray type shapes, turn the BOX function to ON.

```
LASER---* BRAKE GUARD
  BOX=OFF     REAR=ON
WAVY PART is OFF
Ram Reverse Time  065
```

Screen when in run Mode.

```
1=QUICK MENU  2=SLOW
3=WAVY PART-OFF
4=BOX-OFF  5=REAR=ON
6=DISABLE   7=SETUP
```

Screen after pressing the MENU key. Press the [4] key to select BOX forming mode.

```
  BOX FORMING MODE
Set Function = OFF
    1=ON          2=OFF
PRESS ENTER TO SAVE
```

To turn the BOX forming function ON, press the [1] key.

```
BOX FORMING MODE
Set Function = ON
    1=ON          2=OFF
PRESS ENTER TO SAVE
```

After pressing [1] the screen will now display "Set Funtion =ON". Press the [ENTER] key to save the function. Press [SKIP] to return to the run mode.

REAR BEAM BLANKING

There may be times when the REAR laser beam is interrupted by the backguage fingers or some other obstruction. If this occurs you can turn the REAR laser beam OFF.

```
LASER---* BRAKE GUARD
  BOX=OFF     REAR=ON
WAVY PART is OFF
Ram Reverse Time  065
```

Screen when in run Mode.

```
1=QUICK MENU  2=SLOW
3=WAVY PART-OFF
4=BOX-OFF  5=REAR=ON
6=DISABLE   7=SETUP
```

Screen after pressing the MENU key. Press the [5] key to select REAR.

```
  BOX FORMING MODE
Set Function = OFF
    1=ON          2=OFF
PRESS ENTER TO SAVE
```

To turn the BOX forming function ON, press the [2] key.

```
BOX FORMING MODE
Set Function = OFF
    1=ON          2=OFF
PRESS ENTER TO SAVE
```

After pressing [1] the screen will now display "Set Funtion =ON". Press the [ENTER] key to save the function. Press [SKIP] to return to the run mode.

OTHER LASER SENTRY FUNCTIONS

FREE STROKE (No Part Detection):

There may be times when you need to re-press a part, posibibly because the part was not pressed deep enough. You may do this for one cycle only by pressing the CYCLE key while in normal run mode. The screen will display 'No Part Free Stroke'. You may make one free stroke without have the laser detect the part.

Disable:

Selecting disable from the main menu gives you two options.

```
MAKE SELECTION

1=DISABLE MACHINE
2=DISABLE SAFETY
```

Disable the machine: When password protection is turn to 'ON' you can disable the machine so that no one else can use it (unless they also have a password). Select (1) and the following screen is displayed.

```
MACHINE DISABLED
TO ENABLE
Press the ENTER Key
Enter USERs Password
```

Press the ENTER key and enter your password and the machine will be enabled again.

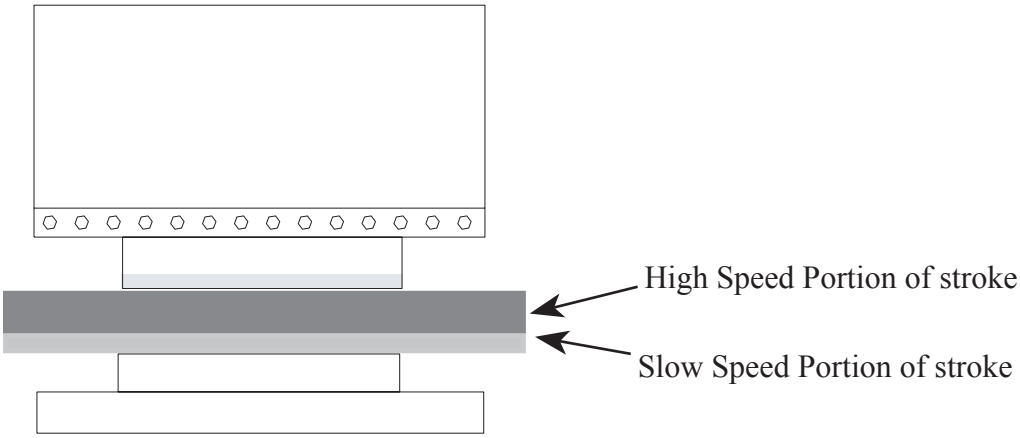
To disable the Laser Sentry: When password protection is turn to 'ON' you can disable the Laser Sentry (turn off the safety system) USE EXTREME CARE when using this function. **NOTE: this function is only allowed if the operator has been properly trained and authorized to use this type action with the machine.** Select (2). The machine will be disabled and will only run in slow speed.

```
MAKE SELECTION

1=DISABLE MACHINE
2=DISABLE SAFETY
```

When you have are ready to enable the safety function, press the ENTER key.

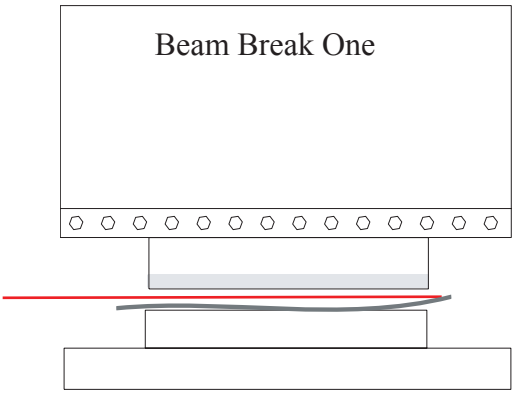
WAVY MATERIAL FORMING



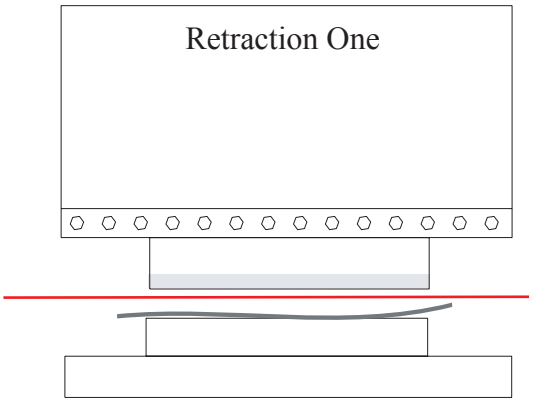
Safety First! It is the overall objective to provide a safe press brake for the operator and any other personnel around the machine. There are times when this is just impossible to do. Wavy or kinked material is one prime example. While the procedure explained below may seem ackward, we have found that once a person gets used to it, it is quite easy to use. Usually when a part is wavy, the first bend will straighten it out so that subsequent bends can be made in the regular manner. So be patient, and make parts safely.

Wavy material will break the laser beam causing the ram to retract. To overcome this problem the ***Laser Sentry*** has a function called "Wavy Part", selection [2] on the main menu. This function can be turned ON and OFF as required.

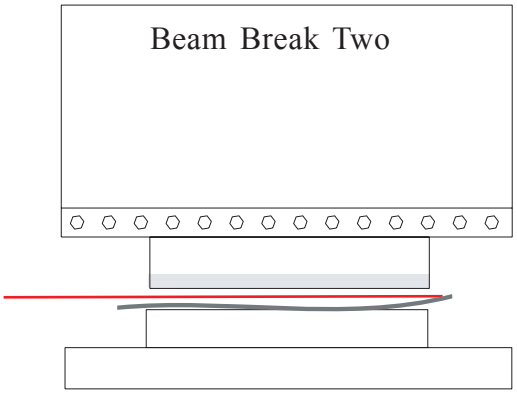
When "Wavy Part" is turned ON, the ram will descend at high speed then shift to slow speed as usual. Once the machine has reached the slow speed ram position and a wavy part or anything else interrupts the laser beam the ram will retract up until the laser beam is cleared, and then stop. By releasing the foot switch and re-pressing it the ram will attempt downward movement in slow speed, if the laser beam is broken a second time the ram will retract and stop. Release and press the foot switch again, if the beam is broken again the ram retracts and stops. Press the foot switch again and the ram will descend, the laser beam will be ignored and the wavy part can be formed in slow speed.



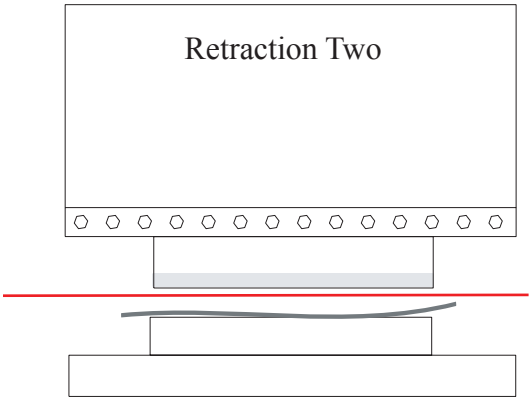
Laser beam encounters wavy material the first time.



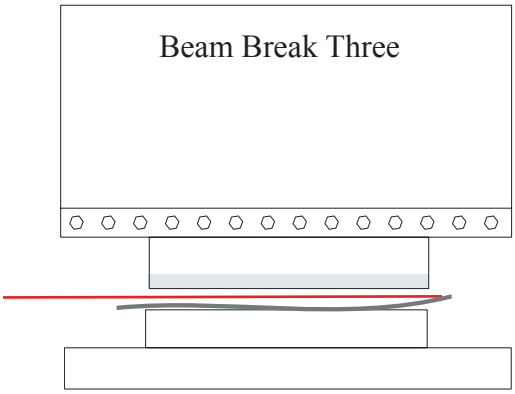
Retracts until the beam is not broken by the material.



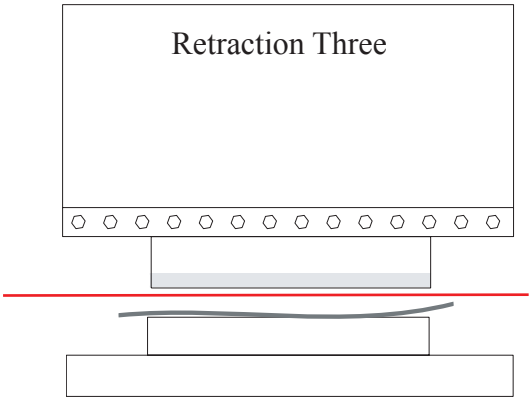
Laser beam encounters wavy material the second time.



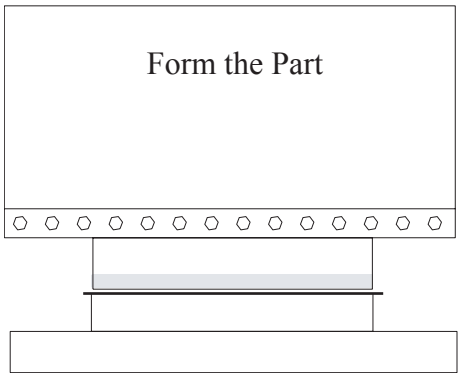
Retracts until the beam is not broken by the material.



Laser beam encounters wavy material the third time.



Retracts until the beam is not broken by the material.



Press the foot switch a 4th time and the ram will descend in slow speed, the laser beam will be ignored and the part can be formed without interference.

WARRANTY

Metal-Tech Controls Corp.. - herein after referred to as **MTCC** warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair the MAIN CONTROLLER BOARD found to be defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within TWO years from date of shipment. At MTCC's option: Upon receipt of a purchase order from the owner for the price of the part needing replacement or repair MTCC may opt to send a replacement part. Upon receipt of the defective part from the owner and inspection by MTCC and where the part is found to be defective by no cause of the owner a credit will be issued. For the RELAY INTERFACE piggyback Board there is a ONE year warranty with the same conditions as above.

Ten Year Main Controller Board exchange warranty and policy: After the initial 2 year warranty period MTCC will replace the defective MAIN CONTROLLER BOARD for the exchange fee of $600.00 provided the defective board is repairable. A purchase order for the full price of an exchange board must be provided to MTCC. Upon receipt of the defective board from the owner and inspection by MTCC and where the part is found to be defective by no cause of the owner a credit will be issued less the $600.00 exchange fee. The fee for an exchange RELAY INTERFACE piggyback board is $250.00. These prices are effective from the date imprinted on the front cover of this manual and are subject to change one year after said date. If the date is more than one year old, call the factor of current prices.

800-516-5516

Warranty is specifically at the MTCC's factory. Any on site service will be provided at the sole expense of the purchaser at MTCC's standard field service rates.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No representation or warranty, expressed or implied, made by any sales representative, distributor, or other agent or representative of MTCC which is not specifically set forth herein shall be binding upon MTCC. MTCC shall not be liable for any incidental or consequential damages or loss arising from reduced or lost production, or expenses directly or indirectly arising from the sale, handling, improper application or use of goods or from any other cause relating thereto and MTCC's liability thereunder, in any case is expressly limited to the repair or replacement (at MTCC's option) of goods supplied by MTCC.

All associated equipment must be protected by properly rated electronic/electrical protection devices. MTCC shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

Metal Tech Controls Corp.'s Terms and Conditions of Sale

Acceptance
Acceptance of orders by Metal Tech Controls Corporation (herein after referred to as MTCC), or affiliates whichever is appropriate is subject to credit approval and other terms that may be set by MTCC The laws of the State of Florida shall govern approved transactions and parties agree to resolve all issues in the State of Florida. MTCC's terms and conditions shall prevail notwithstanding any variance with terms and conditions o any order submitted by purchaser. No other terms and conditions shall be binding upon MTCC, unless specifically agreed upon in writing by an authorized official of MTCC.

Warranty and Warranty Restrictions
MTCC warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment foun defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within one year from date of factory shipment.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No representation or warranty, expressed or implied made by any sales representative, distributor, or other agent or representative of MTCC which is not specifically set forth herein, shall be bindin upon MTCC. MTCC shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and MTCC's liability hereunder, in any case, is expressly limited to the repair or replacement (at MTCC's option) of goods.

Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

Properly rated electronic/electrical protection devices shall be installed by the end user in compliance with Underwriters Laboratories, Inc. and o applicable state or federal regulations to protect all associated equipment. MTCC shall not be liable for any damage due to improper engineerin or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product become the responsibility of the user upon receipt of the product.

Returns and allowances must be authorized by MTCC in advance. MTCC will assign a Returned Goods Authorization (RGA) number, which mu appear on all related papers and the outside of the shipping carton. All returns are subject to the final review by MTCC. Returns are subject to restocking charges as determined by MTCC.

Force Majeure Clause
Fulfillment of any order is contingent upon the availability of materials. MTCC shall not be liable for any delay in delivery or for non-delivery in whole or in part caused by the occurrence of any contingency beyond the control of either MTCC or suppliers to MTCC including, but not limited to war, sabotage, acts of civil disobedience, failure or delay in transportation, act of any government or agency or subdivision thereof, judicial action, labor dispute, fire, accident, explosion, epidemic, quarantine, restrictions, storm, flood, earthquake or acts of God, shortage of labor, fuel, raw material or machinery or technical failure where MTCC exercised ordinary care in the prevention thereof. If any contingency occurs, MTCC may allocate production and deliveries among MTCC's customers.

If MTCC, in its sole discretion, determines that MTCC's performance hereunder would result in a loss to MTCC on this sale, as computed under MTCC's normal accounting procedures, because of causes beyond MTCC's control, then MTCC may terminate this agreement in whole or in pa without liability for any delay in the delivery of or failure to deliver the goods sold hereunder.

Terms and Credits
Payment shall be made net 30 days after date of invoice, unless specifically agreed upon otherwise in writing by MTCC All invoices paid after th date due may be assessed a late payment service charge of 18% per annum or the maximum allowed by applicable law, whichever is lower. Un invoice is paid in full purchaser hereby grants MTCC a security interest in product sold hereunder in accordance with the Uniform Commercial Code. Title of goods does not transfer to purchaser until invoices are paid in full.

If, in MTCC's judgment, the financial condition of the purchaser at the time merchandise is ready for shipment does not justify the terms specifie MTCC reserves the right to change these terms or to require full or partial payment in advance. MTCC may, at any time, suspend performance of any order or require payment in cash, security, or other adequate assurance satisfactory to MTCC when, in MTCC's opinion, the financial condition of buyer or other grounds for insecurity warrant such action. All sales are subject to the approval of MTCC's credit department.

Prices
Prices are F.O.B. (EXW for foreign sales Punta Gorda, FL, USA unless noted otherwise) and are exclusive of all taxes. All orders accepted unde any exception price agreement(s) must be dropped shipped directly to the end customer.

Risk of Loss
Delivery shall occur and risk of loss shall pass to the buyer upon delivery of the material to the carrier at the point of shipment. Transportation shall be at buyer's sole risk and expense, and any claim for loss or damage in transit shall be against the carrier only.

Delivery
The promised delivery date is the best estimate possible based upon current and anticipated manufacturing capabilities of when the product will be shipped. MTCC assumes no liability for loss, damage or consequential damages due to delays.

General Provisions
Any cause of action arising from this agreement, or breach of it, must be commenced within one year after the cause of action occurs. MTCC has the right to correct any stenographical or clerical errors in any of the writings issued by it. These terms and conditions of sale constitute a complete and exclusive statement of the terms and conditions of the sale of the goods by MTCC to buyer. There are no other promises, conditions, understandings, representations or warranties. This agreement may be modified only in writing signed by a MTCC corporate officer. No waiver of any right will be effective against MTCC unless supported by consideration and expressly stated in the writing signed by MTCC. The failure of MTCC to enforce any right will not be construed as a waiver of MTCC's rights to performance in the future. Buyer may not assign any rights to, or delegate any performance owed under, the agreement without the written consent of MTCC, MTCC shall have the right to credi toward the payment of any moneys that may become due MTCC hereunder and any sums which may now or hereafter be owed to buyer by MTCC