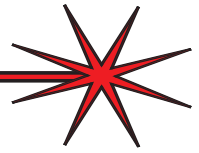


LASER

Sentry



Instruction Manual

August 26, 2014 PCB 22e



Laser Based Hydraulic Press Brake Guarding

METAL TECH

800.516.5516

Fax 941.575.9038

6035 Taylor Road ~ Punta Gorda FL 33950



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 Metal 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 1910.212(a)(1) 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, OSI-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 point of operation hazards and other equipment-related hazards.

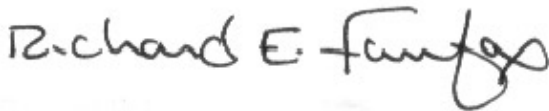
While the Agency has determined that the laser guarding device may be considered an acceptable form of guarding under 29 CFR 1910.212, OSHA cautions employers that guarding systems generally are appropriate only if they are designed, installed, used, and inspected in a manner that will effectively and reliably prevent injury. Thus, OSHA will 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 1910.303.

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,

A handwritten signature in black ink that reads "Richard E. Fairfax". The signature is written in a cursive, flowing style.

Richard I. Fairfax, Director
Directorate of Enforcement Programs

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Trouble Shooting Guide

Problem	Cause	Remedy
NO FOOT SWITCH INPUT or FOOT SW INPUT ERROR!	There is no foot switch input to the Laser Sentry TB2	Check for a foot switch input at terminal TB2, if there is one go to the Diagnostic screen and see if Input 4 changes from 0 to a 1 when the switch is pressed. If it doesn't call the factory.
PART NOT DETECTED!	Part Detection is selected to 'ON' in the Setup Menu and the part is not detected.	The part is not on the die. The TOOL SETUP was not done correctly. The part is too thin to be detected at all times. In this case set the MUTE point to the lowest point of the die or used the mask to reduce the window on the center lens
WAVY PART or something on the part is obstruction a laser beam	When WAVY PART DETECTION is not 'On' and a laser beam is broken by the wave or part obstruction.	In the Setup Menu, turn WAVY PART DETECTION to 'ON'
NO RAM MOVEMENT	The Laser Sentry senses no ram movement when the foot switch is pressed	If the ram moves and you get this message the position sensor is not functioning or there is an input failure of the LS controller board. Use the Diagnostic screen to view the position sensor status. <i>Broke wire magnet missing</i>
RELAY FAILURE	The contacts of relay K1 or K2 are failing or have failed to open properly	Call the factory for replacement relays. Check to make sure the relay is properly inserted into its' socket. Temporarily switch K1 & K2 with K3 & K4. However they should be replaced as soon as possible.
PROCESSOR FAULT	Usually caused by surges in electrical current.	Put surge suppressors on all relay driven circuits
MACHINE RUN INPUT is ON and should be off.	he controller detected that the Foot Switch input is in the ON state when it should be OFF.	Check the Foot Switch circuit input at TB2. Defective foot switch or input module on LS board
POSITION SENSOR FAILURE	Cable and/or Magnet on the Transducer Sensor. Sensor defective. Defective input circuit on LS controller board.	Make sure the cable is connected properly and is not broken or kinked. Make sure the magnet is installed properly. Go to the Diagnostic screen to determine if the sensor is sensing movement.
LASER RECEIVER FAILURE	Broken or loose cable, possible LS controller failure.	Make sure the cable is connected properly and is not broken or kinked. Check connection to LS controller. Make sure the cable connector is not disconnected from the Laser receiver.
RELEASE FOOT TREADLE	Some functions require the release of the foot switch before the LS will allow continuation of ram movement	RELEASE FOOT TREADLE

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 or 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 reaching 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.

Indicator lights and the screen clearly display the controls status. All user messages are in plain language. Error messages are displayed as well as suggestions for a solution.

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 laser's 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 ram's 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.

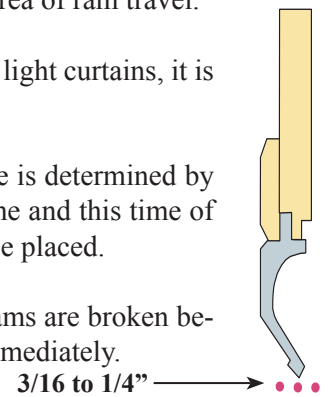
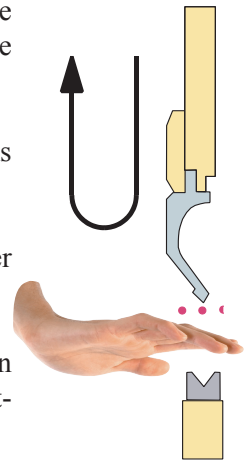
The machine's slow speed function is used to reduce the risk of pinching even further. As the ram approaches to within a minimum of 1/4 inch above the part, the *Laser Sentry* forces the machine into slow speed. In slow speed the reaction time of stopping and reversing the machine is considerably reduced, 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 machine's 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 cross 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*.

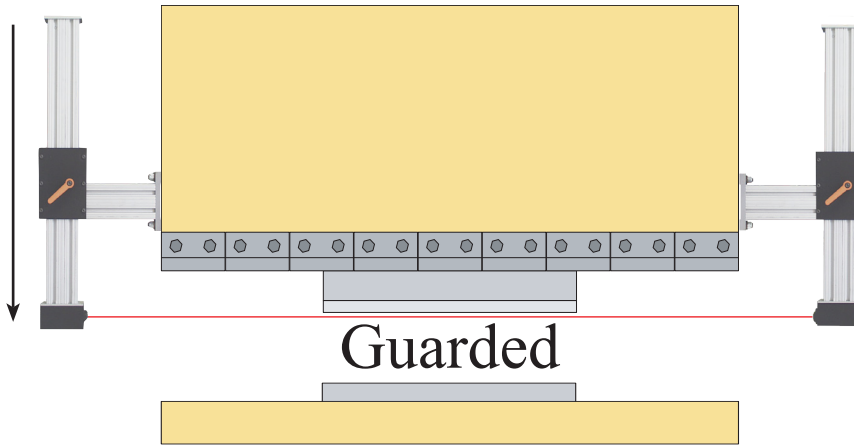
The machine on which the ***Laser Sentry*** is to be installed **MUST** be capable of stopping and reversing motion anywhere in the stroke or cycle in a safe time and within 1/4 inch of ram travel.

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

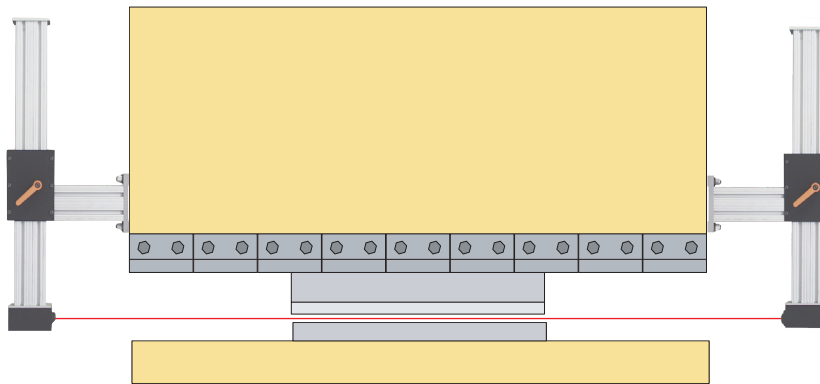
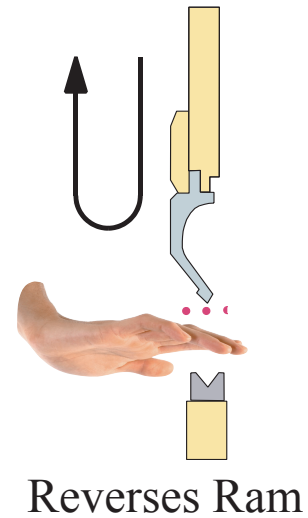
When the ***Laser Sentry*** is used to protect a machine operator from a hazard, the purchaser and or employer has the responsibility to ensure that all applicable federal, state and local Occupational Safety and Health Act (OSHA) requirements and any such rules, codes and regulations which may apply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



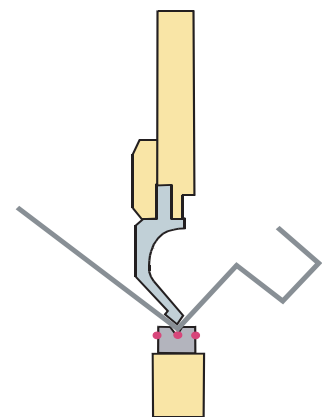
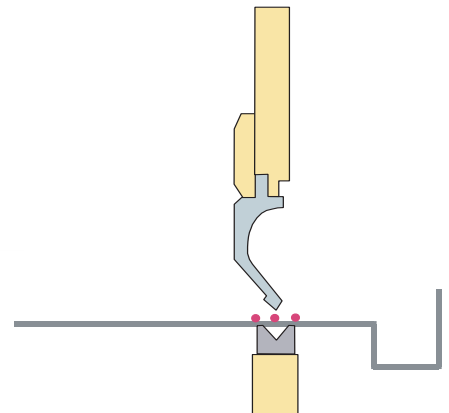
The laser beams (see BOX BENDING mode) are active when the ram is closing, should the laser beam be broken before it reaches within .100 of the part being formed the machine will be immediately reversed.



When the ram is closing, the machine is guarded by the **Laser Sentry**. At 1/8 inch or greater above the part being formed, the **Laser Sentry** shifts the machine's ram into slow speed. If relay K4 is wired into the slow speed circuit of the machine.

If the laser beams are not interrupted by the part resting on the lower die, the ram will immediately reverse. (PART DETECTION) is selected to 'ON'.

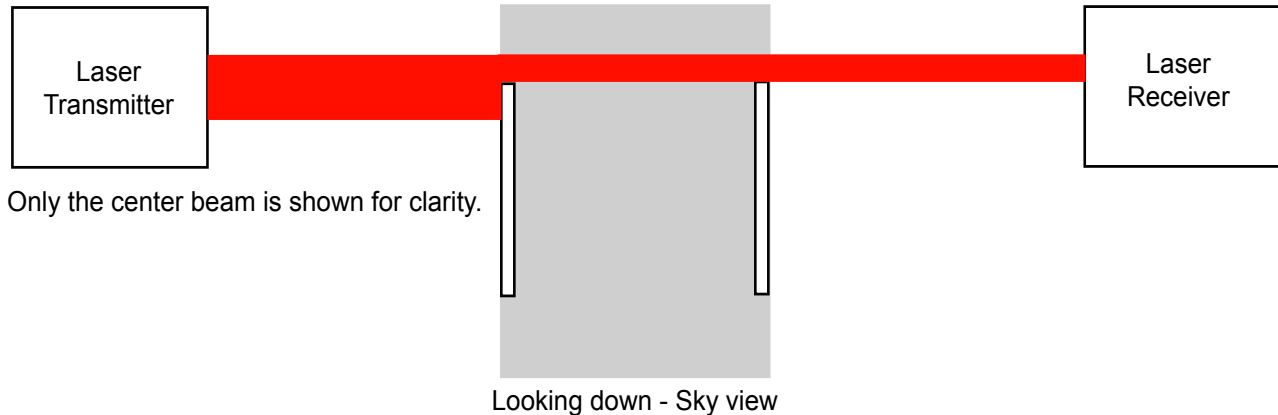
When the laser beam/beams (see BOX BENDING mode) reaches the surface of the part being formed the **Laser Sentry** allows the ram to continue through the forming portion of the machine cycle allowing the part to be formed in the same manner as though there were no guarding laser beam.



BOX BENDING MODE

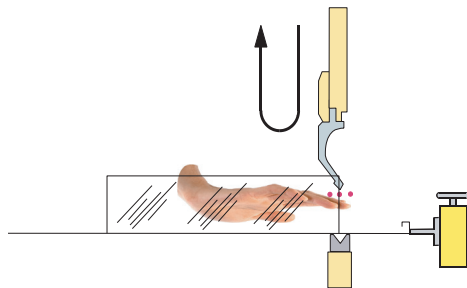
Box or tray shapes are formed by selecting the BOX FORMING MODE. When in the Box Mode the **Laser Sentry** mutes the front laser beam (ignores it). As the ram descends the center laser beam is only partially blocked by the box flange, the portion of laser beam that passes beyond the box flange is enough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

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



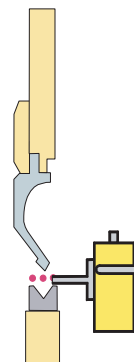
In Box Mode the front laser beam is muted. As long as the box flange is held against the back stop and the vertical flange is only partially blocking the center beam the box or tray can be formed.

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 ram's travel so that the laser beam is only partially blocked.



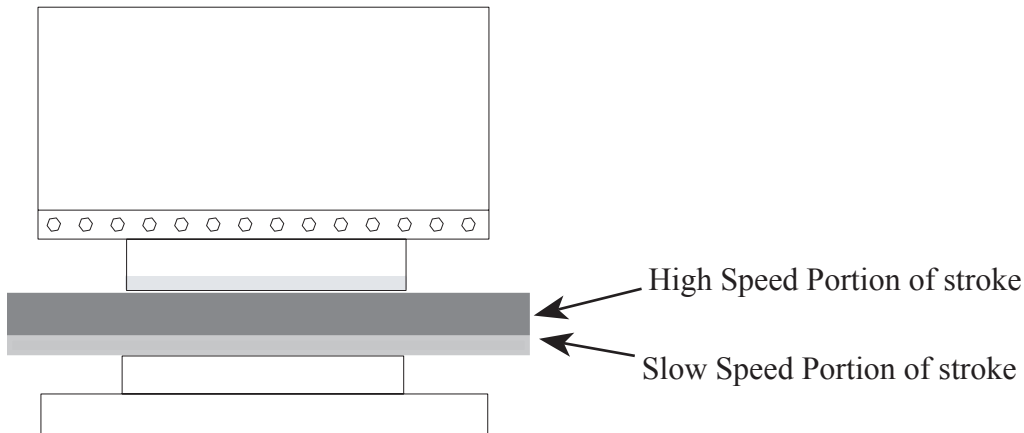
The operator is protected even if his/her hand is placed between the two vertical flanges.

BACK BEAM BLOCKED



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

WAVY MATERIAL FORMING



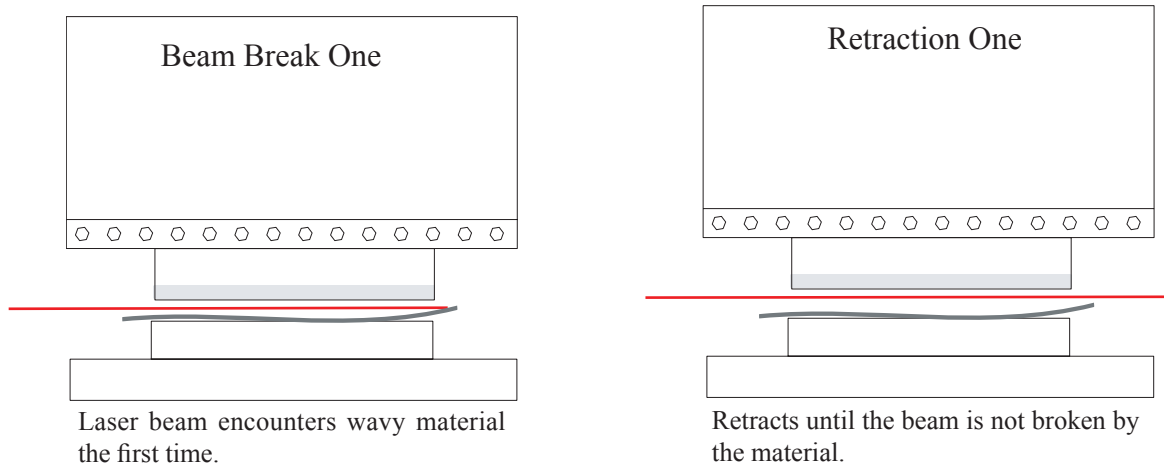
Safety First! It is the overall objective to provide a safe press brake for the operator and any other personnel around the machine. There are times when this is just impossible to do. Wavy or kinked material is one prime example. While the procedure explained below may seem awkward, we have found that 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.

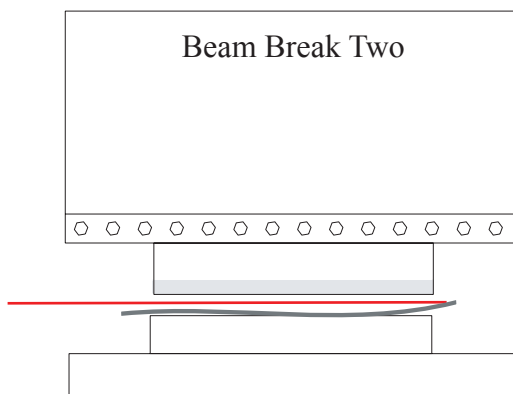
Wavy material will break the laser beam causing the ram to retract. To overcome this problem the **Laser Sentry** has a function called "Wavy Part", selection [3] on the main menu. This function can be turned ON and OFF as required.

When "Wavy Part" is turned ON, the ram will close 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 until the laser beam is cleared, and then stop. By releasing the foot switch and re-pressing it the ram will attempt closure 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 and the ram will close and the laser beam will be ignored allowing the wavy part can be formed in slow speed.

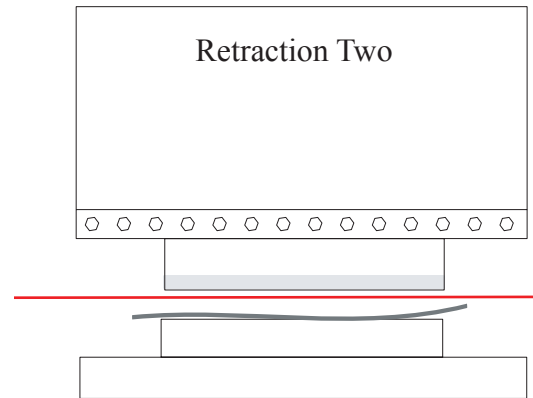
NOTE:

For the ram to retract only until the laser beams are no longer broken you must set the **RAM REVERSE** function in the **SET UP** menu to **PART(ial)** return.

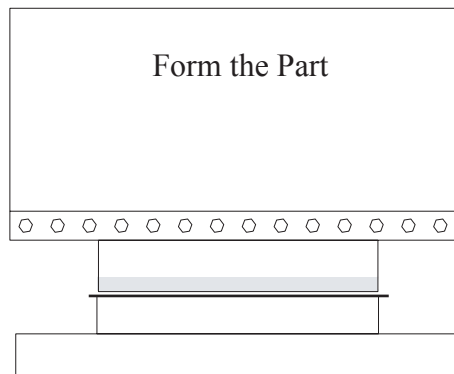




Laser beam encounters wavy material the second time.



Retracts until the beam is not broken by the material.

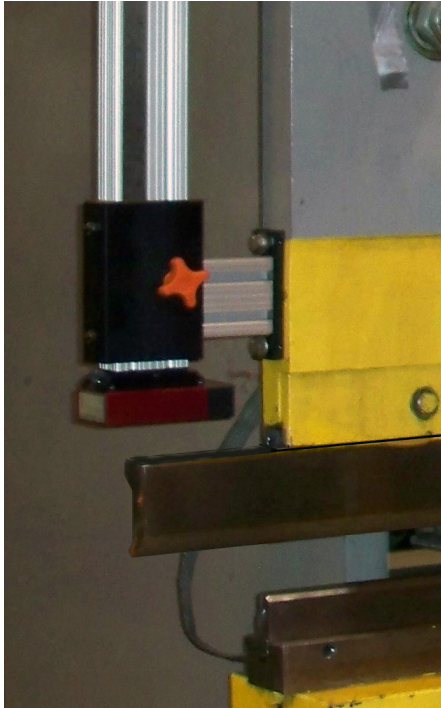


Press the foot switch a 4th time and the ram will descend in slow speed, the laser beam will be ignored and the part can be formed without interference.

Note!

If the ram is not cycled for 20 seconds during the WAVY MATERIAL sequence the stroke counter will be reset to 0 and you will have to start over. This is to prevent accidental closing of the ram if the obstruction has been removed.

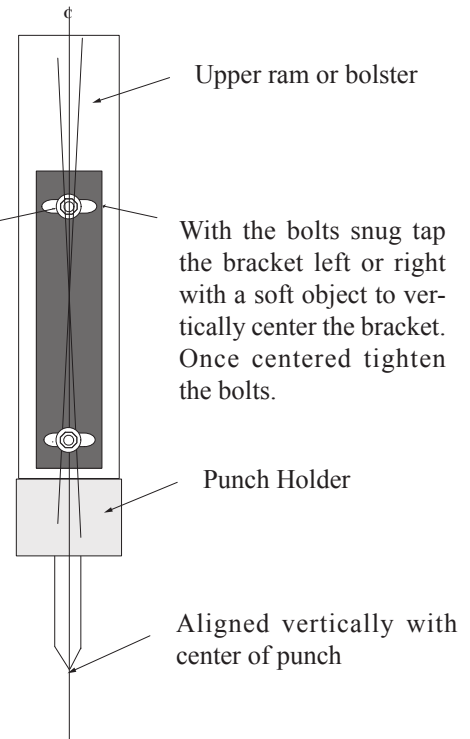
INSTALLING THE *LASER SENTRY*



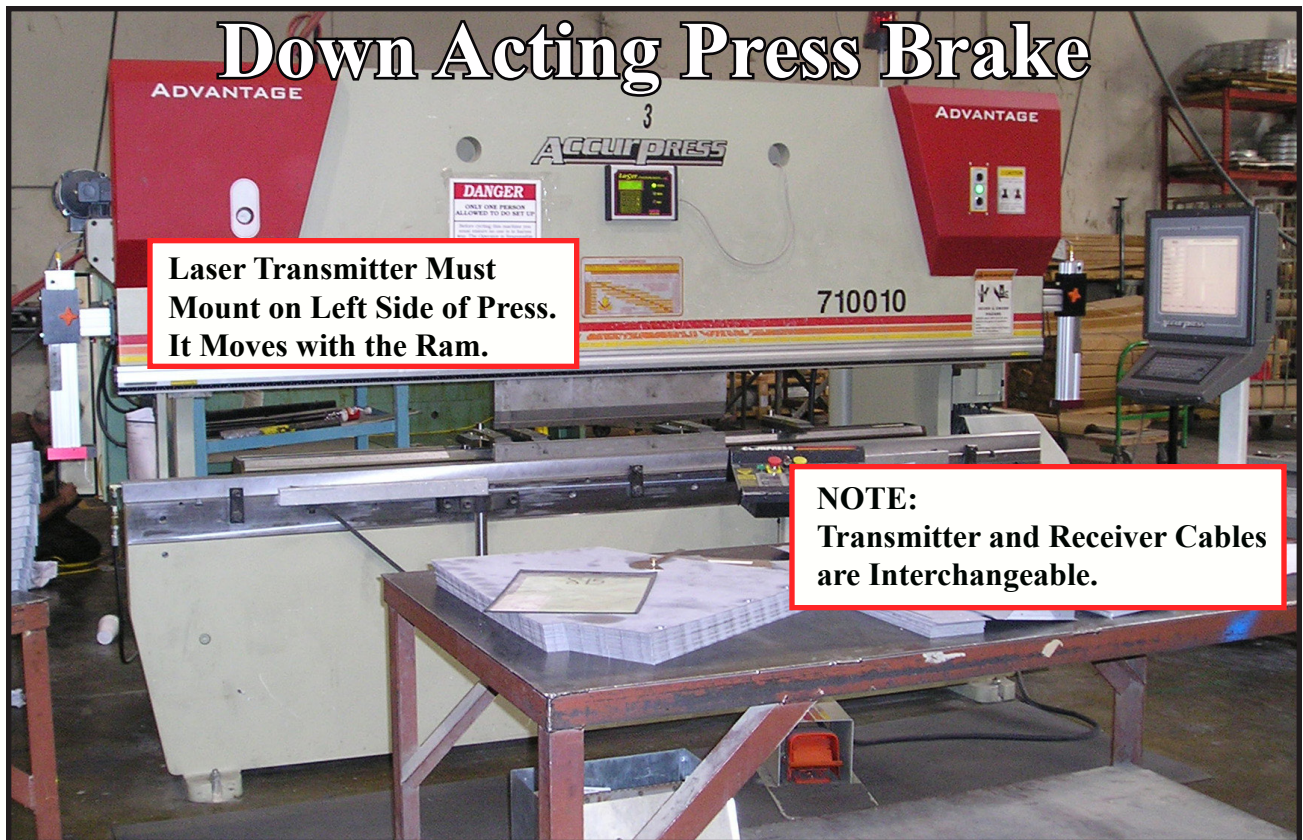
MACHINE END MOUNTING BRACKET

5/16 - 18 Tap 3/4 to 1 inch deep.

Use the supplied hardened washer under the class 8 hex bolt. Tighten to "snug" to allow for micro adjusting the vertical position of the bracket. Once aligned tighten the bolts to torque.



Mount the brackets so that when it is raised, the die can be safely removed without interference with the laser bracket and laser housing.



Down Acting Press Brake

Laser Transmitter Must Mount on Left Side of Press. It Moves with the Ram.

**NOTE:
Transmitter and Receiver Cables are Interchangeable.**

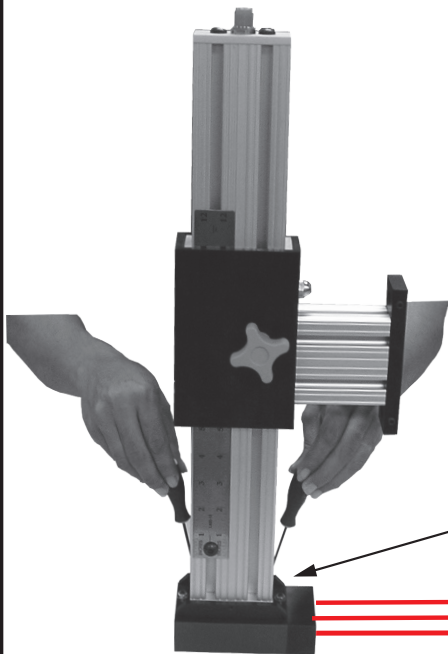
Up Acting Press Brake

Laser Transmitter Must Mount on the Left Side of Press and on the Upper Stationary Part of the Machine

NOTE:
Transmitter and Receiver Cables are Interchangeable.



ADJUSTING THE LASER BEAMS PARALLEL UNDER THE UPPER PUNCH TOOL



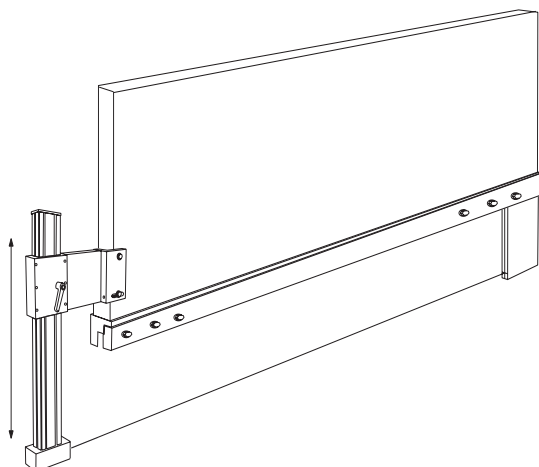
The laser beams must be horizontally aligned perfectly parallel to the upper tool holder.

You will need a punch mounted in the tool holder the full length of the machine. It would be easier if you mounted a small section of tooling at each end of the machine.

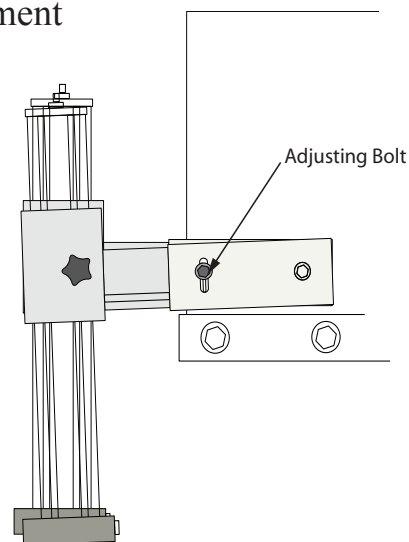
Using two ball end allen screw drivers loosen one while tightening the opposing screw so that there is constant tension on the rocker plate. (Tension, as in light finger pressure) Adjust them so that the laser beams are perfectly in parallel with the punch.

Two 3/32 ball end allen screw drivers

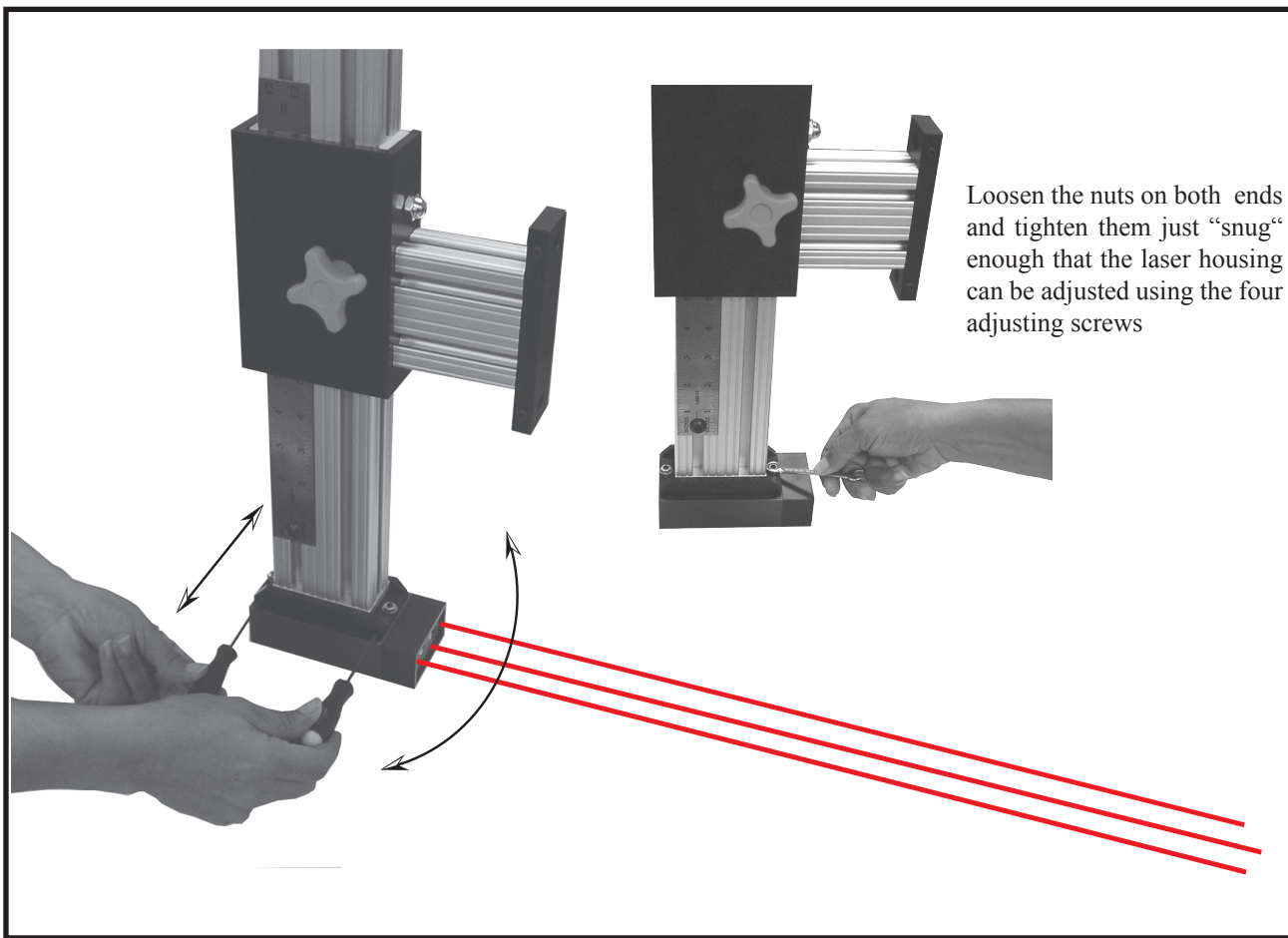
Adjusting Vertical Alignment



The brackets need to be adjusted for vertical parallelism to the machine's vertical plane so that when the bracket is adjusted vertically the lasers remain under the point of the punch tool.

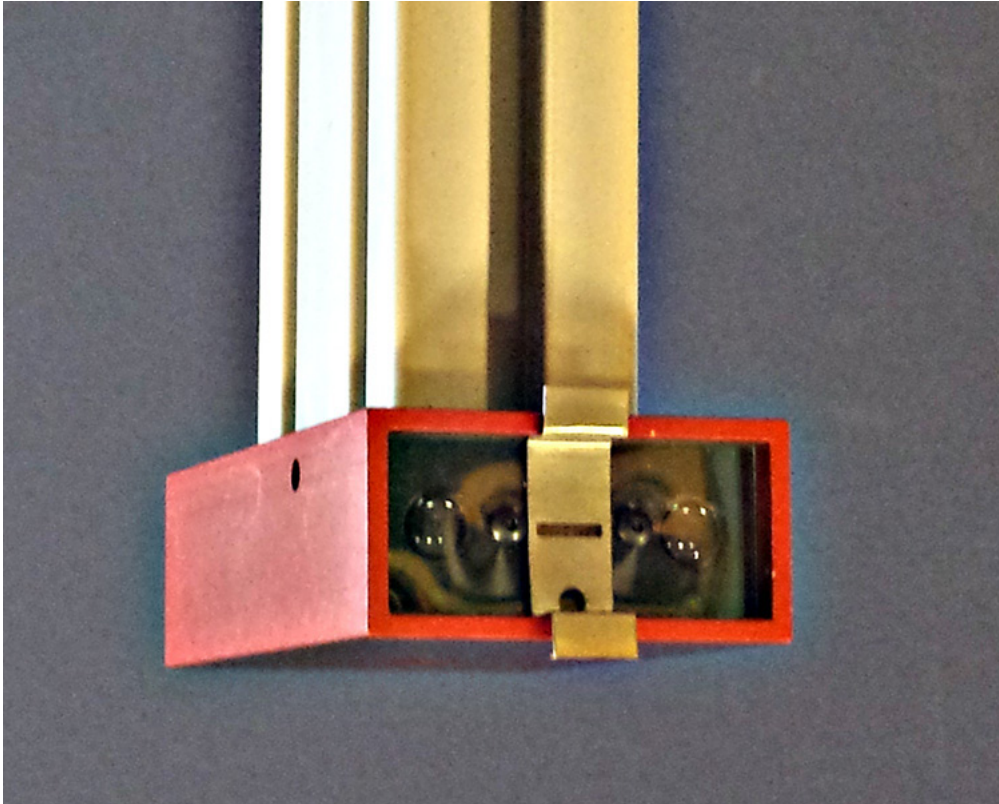


If you have the optional front surface mounting hardware loosen the bolt locking the adjusting slot and using the set screws micro adjust the bracket until you have the laser beams perfectly parallel with the upper punch



Loosen the nuts on both ends and tighten them just “snug” enough that the laser housing can be adjusted using the four adjusting screws

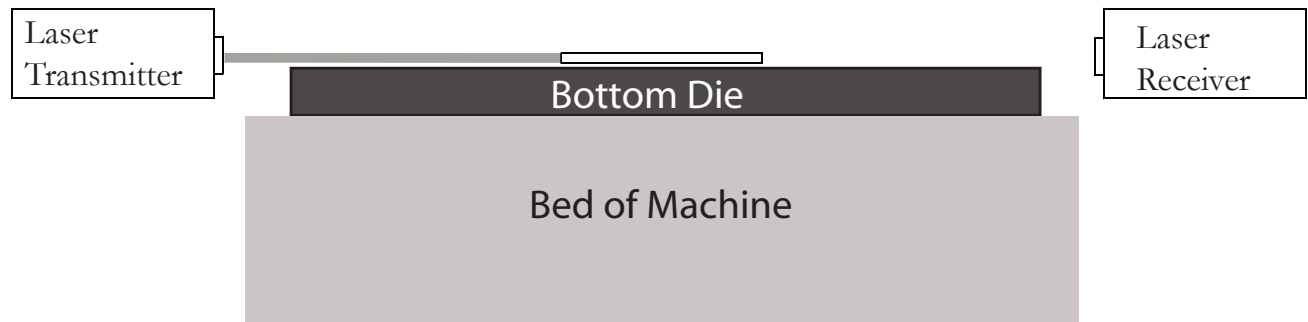
By loosening the nuts slightly you can micro-adjust the skew of the beams. Using two allen wrenches loosen the micro adjusting screws in the direction you want to move the head and tighten the opposite screws until reaching correct alignment. Tighten the opposing screw and recheck alignment. Micro-adjust the screws until you have perfect alignment and both screws are “snug” tight.



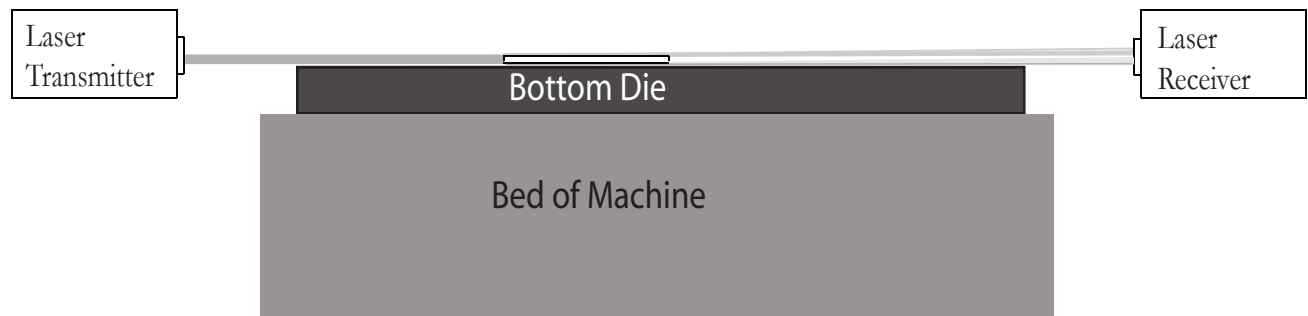
For small and or thin parts clip the metal mask in the receiver as shown above.

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, material thickness could be important.



Part detection: Part blocks enough of the beam to prevent the laser beam from reaching the receiver, in this condition the "Part has been detected", no error. If the part is not detected you will receive an error "PART NOT DETECTED" and the ram will stop and or return to its' up position.



If you are forming small thin parts (see page 14), 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 forming thin small parts and you get "PART NOT DETECTED" errors then it would be best to use the die itself as the set-point. When teaching the Laser Sentry "top of material", just leave the part out and lower the ram until the laser beam is interrupted by the die. Now the press is protected for the complete stroke and since the part cannot be detected it does not cause a fault.

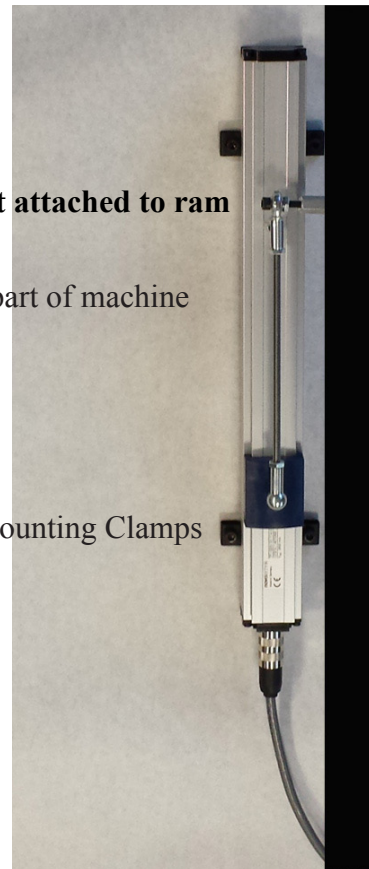
MOUNTING THE RAM POSITION TRANSDUCER

DOWN-ACTING MACHINES

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



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.



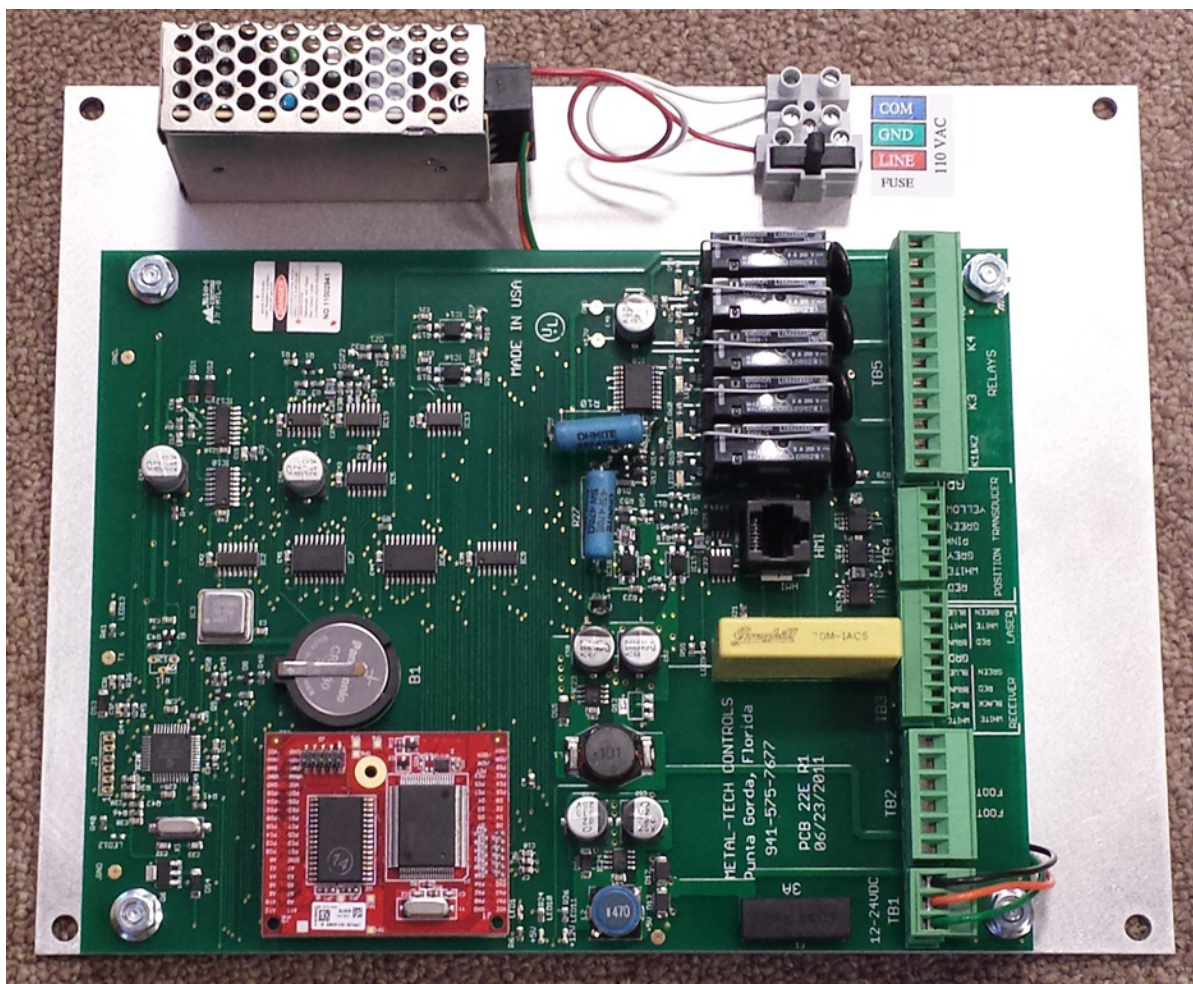
UP-ACTING MACHINES

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

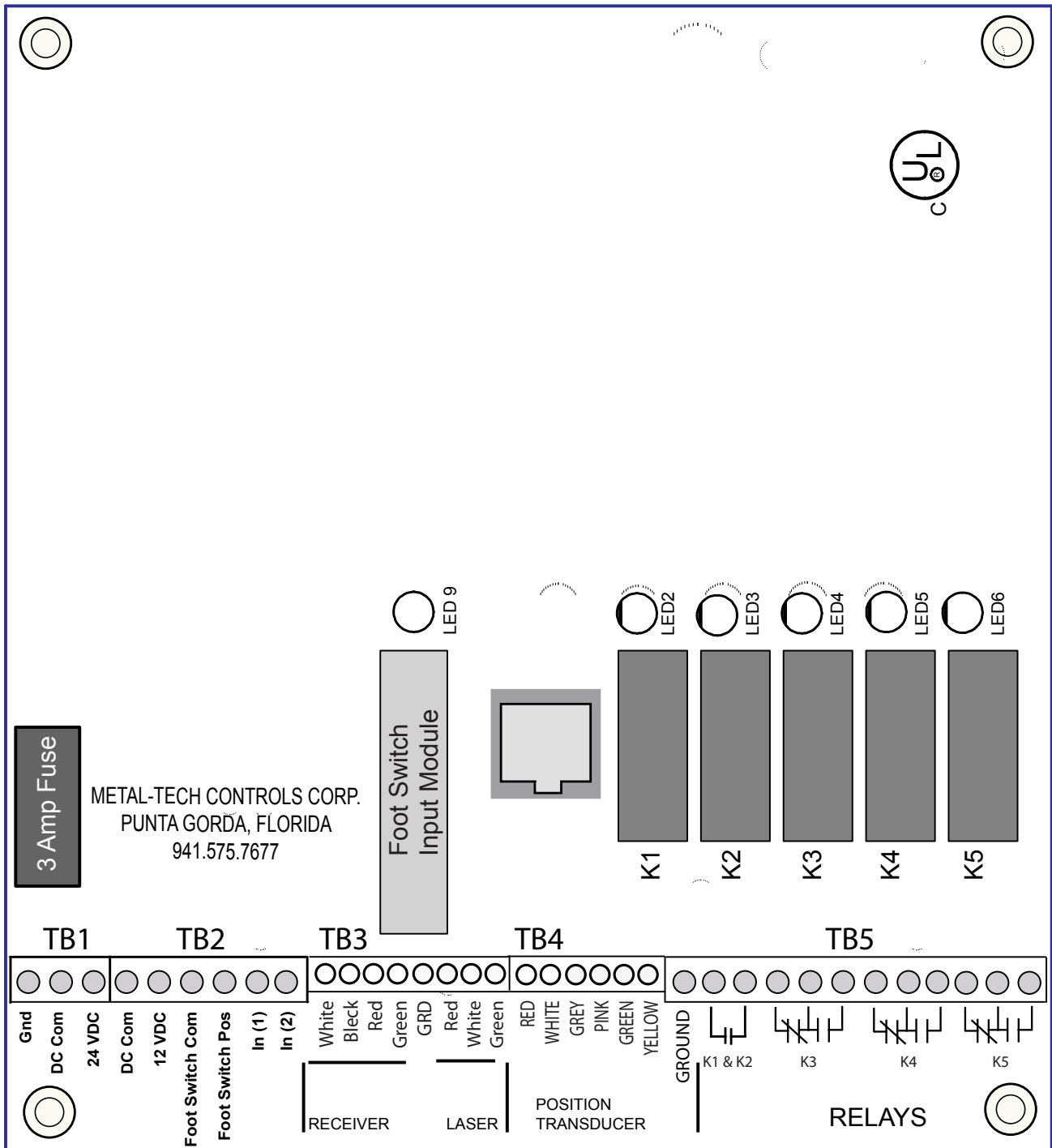


Laser Sentry HMI

The Laser Sentry HMI (Human Machine Interface) has two powerful strip magnets on the back so it can be mounted anywhere 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.



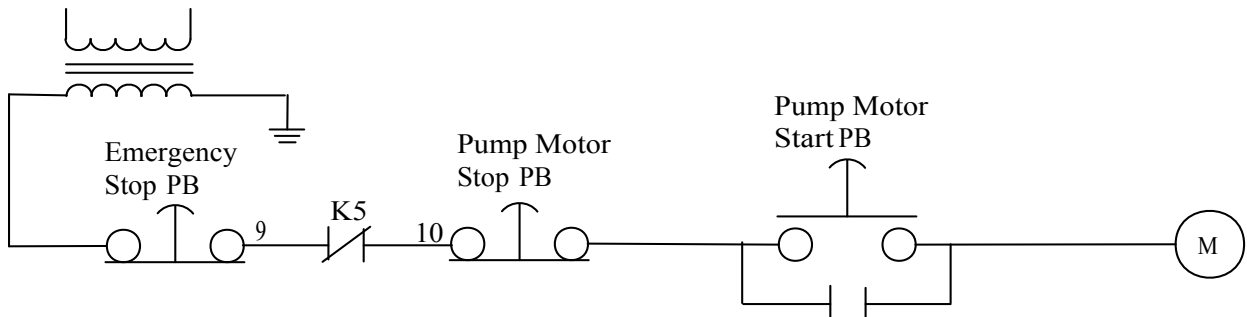
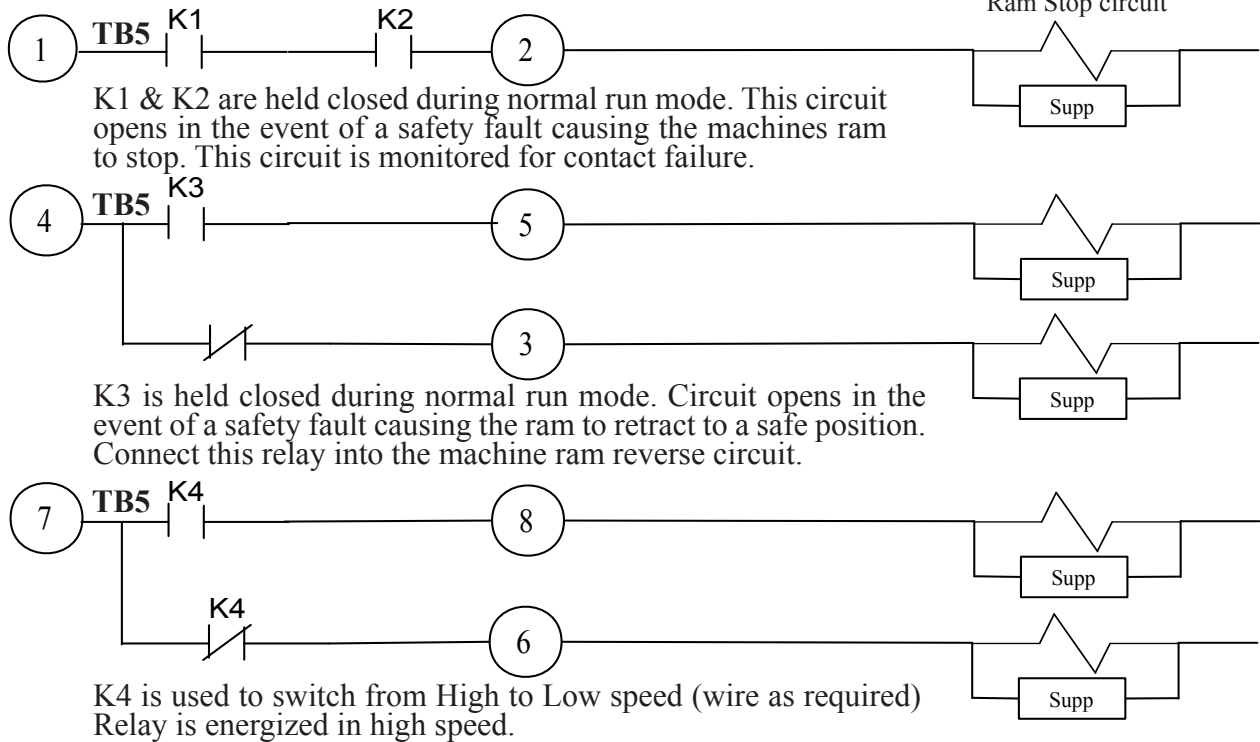
The controller board rack must be mounted in its own enclosure as supplied with the Laser Sentry System, (Do not mount the controller stack near any high power switching devices. Route all cables to it away from any high power switches devices or cables. Secure connection cables to the sub panel to insure that they do not vibrate or move the prevent the connections from breaking.



Surge Suppression

Failure to suppress all driven circuits will void the warranty!

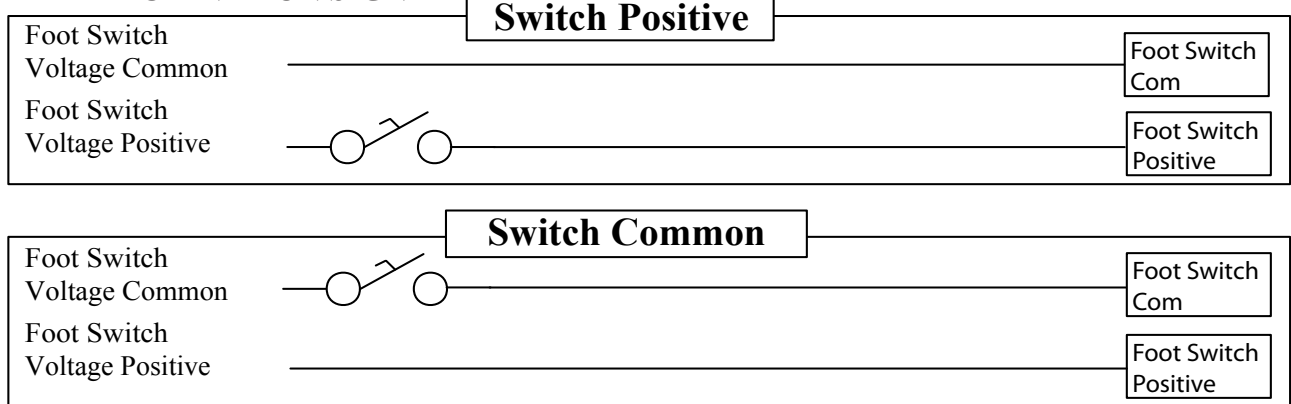
WIRING EXAMPLES



K5 is wired into the Machine's Hydraulic Pump Motor Start/Stop circuit. When K5 is energized the motor should shut down!

Terminal TB2

TB2 - MACHINE RUN SIGNAL



Machine run signal - Input from a foot switch circuit or ram closure valve circuit. (TB2) Terminal #3 & 4: The Board is supplied with a AC input module installed (Yellow). This module uses 90 to 140 VAC/VDC. Connect the Common to TB2 (3). Connect the Positive from the N/O circuit to TB2 (4). **If you require a DC input, install the (White) DC module. Wiring is the same except it requires 3 to 32VDC.**



Improper connections could cause board component failure resulting in voided warranty.

TB1 Power Supply

TB1 is the DC power supply terminal. The *Laser Sentry* comes equipped with a 24 VDC, 40 watt or greater regulated power supply pre-mounted on the back panel and connected to TB1 via a plug.

TB2 Foot Switch 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 32 volts using the DC Greyhill 70M-IDC5 or 120 volts AC/DC using the Greyhill 70M-IAAC5. Dry contacts to ground may be used to switch the common Terminal [Foot Com] however Terminal [Foot Pos] would have to have the corresponding Positive voltage connected. Install the appropriate Input Module based on voltage used.

When using the Wavy Material Function, the ram is retracted when the laser beam is interrupted by the wave in the material (or anything else). The ram retracts until the laser beam is no longer broken then the ram is stopped. The *Laser Sentry* requires the machine (run) input to TB2 to go low, (foot switch is released), before allowing the ram to try to close again.

TB5 - 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-energizes the machine's ram should stop and or reverse. (Stop and reverse is required for use of the Wavy Material Function). See next page for further details.

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). K4 relay is the high/low speed control relay. Connect into the machine's high/low speed change valve. Many up-acting machines do not have this type valve, on these machines K4 is not used.

K5 relay is used to shut the machine's hydraulic pump motor off in the event of a serious error, such as a position sensor failure or a K1 or K2 error. See previous page for circuit example.

SEQUENCE OF OPERATION

ON=Foot Switch is Pressed - OFF=Foot Switch is Not Pressed							
		Foot Switch	K1	K2	K3	K4	K5
A	RAM CLOSING AT HIGH SPEED	ON	X	X	X	X	O
B	RAM CLOSING AT SLOW SPEED	ON	X	X	X	O	O
C	RAM RETRACTING NORMALLY	ON	X	X	X	X	O
D	RAM RETRACTING-LASER BEAM BROKEN	ON	O	O	O	X	O
E	SERIOUS FAULT - MACHINE SHUT DOWN	N/A	O	O	O	O	X
WAVY MATERIAL FUNCTION							
1	RAM CLOSING BEFORE SLOW SPEED	ON	X	X	X	X	O
2	RAM CLOSING AT SLOW SPEED	ON	X	X	X	O	O
3	BEAM BROKEN (Ram Retracting)	ON	O	O	O	X	O
4	RAM STOPPED (Laser Beam Cleared)	ON	O	O	X	X	O
5	RAM STOPPED (Now in Slow Speed)	OFF	O	O	X	O	O
6	RAM CLOSING (Repeats 3 thru 6 for 2 Times)	ON	X	X	X	O	O
Repeats 2 through 6							

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 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 by a wave in the material; ram retracts until the beam is no longer broken and stops, the **Laser Sentry** waits for the “Go Signal” or foot switch input to clear, it then waits for the “Go Signal” to come back ‘ON’ before allowing the ram to close by re-energizing K1 & K2. It will do this 3 times if the obstruction remains. After the 2nd time the ram will be allowed to close at slow speed.

This requirement may cause the machine’s circuit to do strange things. If it does, a means must be found to overcome this. You may have to delve deeper into the machines control circuits to get around this situation. Call the factory for help if you are having a problem with this. One way to do it is to isolate the **Laser Sentry’s** foot switch input 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.

DIAGNOSTICS

When in the RUN mode press the UP Arrow key to display the Diagnostic screen, Skip or DOWN arrow key to switch back to RUN or from the MACHINE SETUP menu select (6) for diagnostics then (1) for the Diagnostic Screen. 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.

Mach Pos=04536	Dir=1
Mute Pos=03876	Slow=05630
1234567890	Mute=1
1110111101	Input Status

Numbers shown are representative

Mach Pos= is the Linear Position Transducer’s reading of the ram position. The number should increase when ram closes.

Dir= is the direction the ram is moving 1=closing 0=opening.

Mute Pos= the programmed MUTE position recorded when SET-MUTE function was performed.

Slo=05630 is the transducer position where slow speed is started

Mute=1 will change to Mute=0 when the ram has reached the slow speed position programmed into the **Laser Sentry**.

INPUT Status, the 1234567890 represents inputs 1 through 10 as follows. A 1 indicates ON 0 is OFF

- | | |
|-------------------------------------|-------------------------------------|
| 1-Laser Status Front Beam | 6-Input (2) Terminal TB2 (not used) |
| 2-Laser Status Center Beam | 7-K1 & K2 Test Status |
| 3-Laser Status Rear Beam | 8-PosFault |
| 4-Machine Go Input (foot Switch) | 9-PosReady |
| 5-Input (1) Terminal TB2 (not used) | 10-Ram in Motion |

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

Supervisor Lock Out of Machine Setup Menu:

A key switch can be installed in the enclosure with a connection from terminal block TB2 12vdc to In(2) through N/C contacts. When the input is positive the 7=SETUP is locked out. You may also lockout 2=DIESET by entering the Machine Setup Menu and pressing (0). Here you can choose to Lockout 2=DIESET as well.

Run Menu

1

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.

3

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

2

1=SET-MUTE 2=DIESET
3=WAVY PART-OFF
4=BOX-OFF 5=REAR=ON
6=DISABLE 7=SETUP

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

4

*** SETUP MENU ***

1=SET SLOW POSITION
2=LOST MOTION
Press Down For 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
2=SET LOST MOTION
3=RAM STOP TIME
4=CHANGE PASSWORD

5=UP ACTING MACHINE
6=DIAGNOSTICS
7=PART DETECTION
8=RAM REVERSE
9=DISABLE GUARDING

These are your menu choices. As you scroll through the menu you will have access to each of these functions.

1=DISABLE SAFETY
2=LASER SLEEP TIME
3=TRANSDUCER FAULT

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 but can be set to anywhere in the stroke.

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 pressing the foot switch a timer begins. 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 stopped and or reversed the time it takes to stop is timed. If the stop time exceeds the programmed stop time check value a fault occurs preventing the machine from further operation until the problem is corrected. To determine the best stop 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 closed position. Cycle the machine and each time it stops and reverses record the displayed stop time. Do this about ten times. Take the highest stop time and 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 every ones password. All passwords must be greater than 1000 and less than 65535. 65535 which is the limit of a integer word in machine memory.

Factory Preset Codes:

User	1234
Setup	4321
Supervisor	5678

PASSWORD MENU

1=USER 2=USER = ON
3=SETUP 4=SUPERVISOR

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.

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.

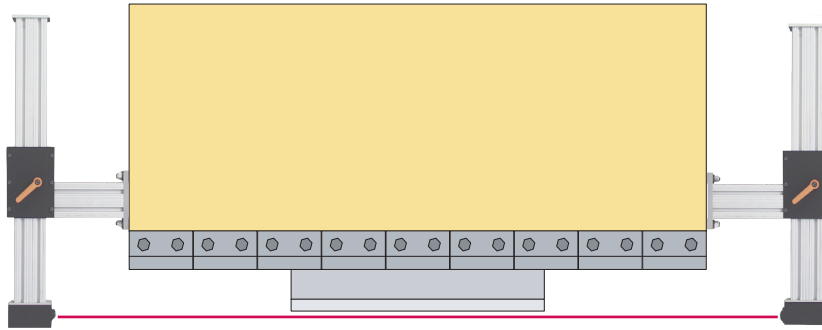
Ram Reverse:

Ram Reverse PART or FULL. PART(ial) reversal reverses the ram until the laser beam obstruction is cleared. FULL (the default setting) reverses the ram until it is stopped by the machines reverse TO position setting. The Laser Sentry does not have an input for the machines reverse TO setting, therefore a time delay is provided in the FULL selection Menu. The default time setting is 1 second. You can enter zero to five seconds for the delay time. The delay time causes the ram reverse relay to stay switched until the time setting expires at which time the K1, K2 and K3 are turned back on.

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"

DIE SETUP INSTRUCTIONS



FUNCTION FOR SETTING MACHINE DIES AND DEPTH

This function allows free access to the machine for two minutes with guarding disabled so that you can set the dies and depth of penetration. If supervisor key switch is installed DIESET can be locked out so that only a supervisor can select this function.

1

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.

2

1=SET-MUTE 2=DIESET
3=WAVY PART-OFF
4=BOX-OFF 5=REAR=ON
6=DISABLE 7=SETUP

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



3

DIE SET FREE TIME
120 Seconds

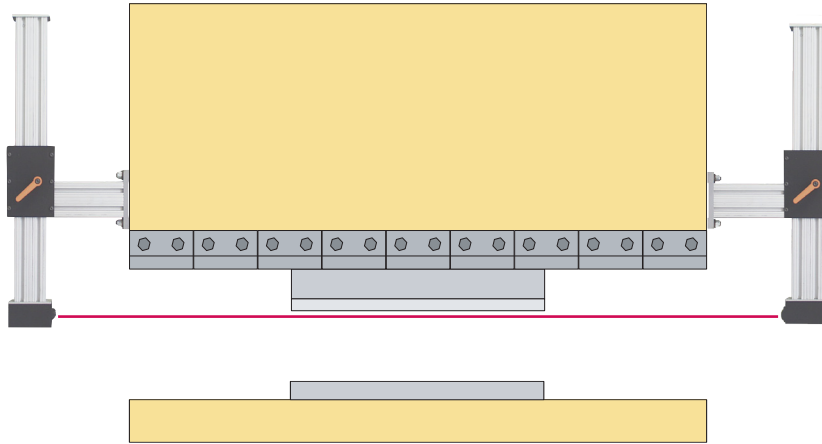
SAFETY DISABLED

CAUTION !! By selecting this function the laser guarding is disabled! The machine should only run in slow speed. If it does not run in slow speed call you supervisor. This is caused by not having the Slow Speed relay connected to the machines slow speed circuit.

The yellow and red indicator LEDs will flash as a warning that the Safety is disabled.

This function will only work if the USER PASSWORD protection is turned ON.

GUARD SETUP INSTRUCTIONS



MUTE POSITION SETUP:

Position the laser beams 1/4 inch or less below the leading edge of the punch. (if you had set the rulers on the transmitter and receiver supports you could use them to determine the position) Always check to be sure the distance is correct! Position the laser receiver so that the green LEDs are ON and the laser beams are exactly center of the receivers lenses.

1

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.

2

1=SET-MUTE 2=DIESET
3=WAVY PART-OFF
4=BOX-OFF 5=REAR=ON
6=DISABLE 7=SETUP

This screen will appear. Press [1] for the SET-MUTE position function.

3

SET GUARDED RANGE

Move Ram to Material
To Set Guarded Range

The machine should be in slow speed. If not have relay K4 wired into the machine's slow speed circuit. Place the part to be formed or a scrap piece (of the same thickness) on the surface of the lower die and press the foot pedal and close the ram until the laser beam is broken by the part.

4

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 forming boxes or tray type shapes, turn the BOX function to ON.

1

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

Screen when in run Mode.

2

1=SET-MUTE 2=DIESET
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.

3

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.

4

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

After pressing [1] the screen will now display "Set Function = 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 backgauge fingers or some other obstruction. If this occurs you can turn the REAR laser beam OFF.

1

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

Screen when in run Mode.

2

1=SET-MUTE 2=DIESET
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.

3

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.

4

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

After pressing [1] the screen will now display "Set Function = 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 are times when you need to re-press a part to obtain the correct bend angle, especially during setup. Normally PART DETECTION will not allow this because the partially formed part will be recessed into the die. By pressing the CYCLE key while in normal run mode you can bypass PART DETECTION for one stroke. The screen will display a WARNING that the front and rear Laser Beams are NOT active during the free stroke (no part detection). You may make one free stroke without having the laser detect the part. If you require another FREE stroke you must repress the Cycle key.

!!!! WARNING !!!!
PART DETECTION IS OFF
FRONT & REAR LASERS
!! ARE INACTIVE !!

Disable:

When password protection is set to 'ON' you can disable the machine so that no one else can use it (unless they also have a password). Select (6) from the Main Menu and the following screen will be displayed.

MACHINE DISABLED
TO ENABLE
Press the ENTER Key
Enter USERs Password

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

Disable Safety:

To disable the Laser Sentry Safety: From the Main Menu select (7) SETUP, enter the proper password then select (9). USE EXTREME CARE when using this function.

MAKE SELECTION
1=DISABLE MACHINE
2=LASER SLEEP TIME
3=TRANSDUCER FAULT

NOTE: Disable Safety function is only allowed if the operator has been properly trained and authorized to use this type action with the machine.

Laser Sleep: From the Main Menu select (7) SETUP, enter the proper password then select (9).

To conserve the life of the laser transmitter diodes, the laser transmitter will automatically go into a 'SLEEP MODE' if the machine is not used for a period of time. When "sleeping" the laser diodes are turned off. Pressing the foot switch or foot treadle will instantly turn the lasers back on. You may also press the ENTER key or Menu key or Skip key to turn the lasers back on. By selecting (9) then (2) from the menu you can set the machine idle time from 1 to 5 minutes.

NOTE: This function does not disable the Laser Safety System!

Transducer Fault:

Use only on instructions from Factory Technical Support.

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 one year 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 and the HMI there is a ONE year warranty with the same conditions as above.

Laser Transmitter: The laser diodes are warranted for 120 days, should they require replacement after 120 days there will be a charge of \$120.00 per laser diode. Laser diodes have a estimated life of 10,000 hours. It is advisable to turn the power to the *Laser Sentry* off when not in use.

Ten Year Main Controller Board exchange warranty and policy: After the initial one 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.

Returns and allowances must be authorized by MTCC in advance. There will be a 30 percent restocking charge on items normally held in inventory. There will be a percent restocking charge for custom or special request items. MTCC will assign a RETURNED GOODS AUTHORIZATION (RGA) number which must appear on all related papers and outside of the shipping carton.

WARNING! Any attempt to repair or troubleshoot MTCC's products except as limited to the user replaceable components will void the warranty and may render the product unsafe for use. MTCC's products contain complex electronics which may only be tested and repaired by an authorized MTCC trained technician.

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 on 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 found 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 binding 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 or applicable state or federal regulations to protect all associated equipment. 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 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 must 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 part 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 the date due may be assessed a late payment service charge of 18% per annum or the maximum allowed by applicable law, whichever is lower. Until 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 specified, 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 under any exception price agreement(s) must be dropped shipped directly to the end customer.