Laserdyne®

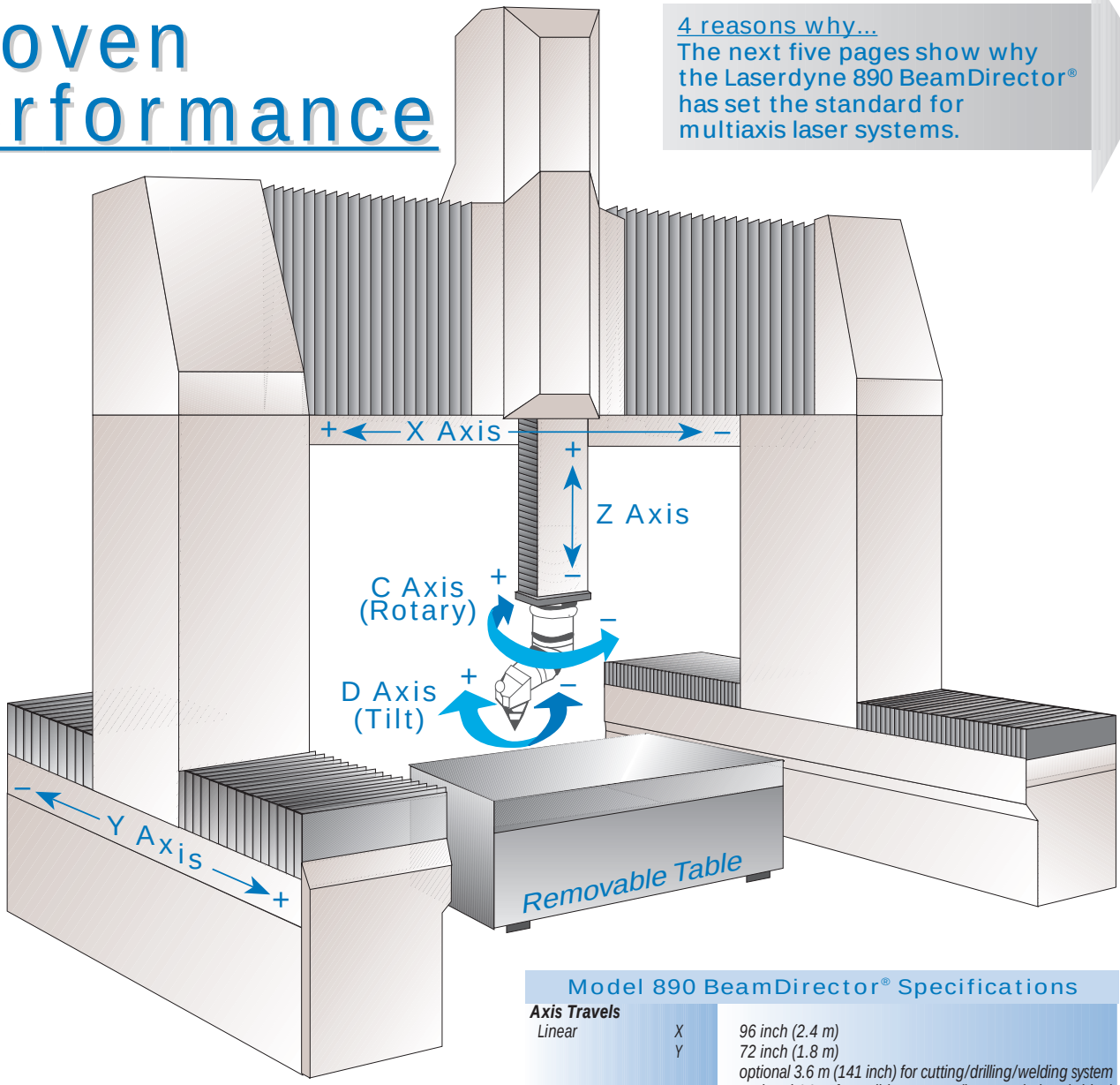
890 BeamDirector®
Multiaxis Laser
Processing System

Cutting, drilling and welding flat and 3D parts for aerospace, automotive, job shop and your industry.

LUMONICS

Proven Performance

4 reasons why...
The next five pages show why the Laserdyne 890 BeamDirector® has set the standard for multiaxis laser systems.



Field proven...

The Laserdyne 890 BeamDirector® is a field proven laser system with satisfied users in many industries. You will find 890 BeamDirector® systems operating 7 days per week, 24 hours a day cutting, drilling and welding the toughest parts in aerospace, automotive, appliance, and other important manufacturing industries.

Read what users say...

Throughout this brochure you will see proof that the Laserdyne 890 BeamDirectors' unique features are helping users meet the challenges of today's highly competitive manufacturing environment.

Free demonstrations...

Contact Lumonics for a demonstration of a Laserdyne 890 BeamDirector® processing your parts. A FREE video tape describing the 890 BeamDirector® is available on request.

Model 890 BeamDirector® Specifications

Axis Travels		
Linear	*X*	*96 inch (2.4 m)*
	Y	*72 inch (1.8 m)* *optional 3.6 m (141 inch) for cutting/drilling/welding system* *optional 14 m for scribing system (laser carried on bridge)*
	Z	*36 inch (0.9 m)*
BeamDirector®	*C*	*±450° degrees C axis (45° above horizontal)*
	D	*±135° degrees D axis*
Feed Rate		
Linear	*X-Y*	*0-800 inch/min (0-20 m/min)*
	Z	*0-600 inch/min (0-15 m/min)*
BeamDirector®	*C-D*	*0-27 rpm*
Accuracy		
Linear	*X-Y-Z*	*±0.0005 inch/foot (±0.013 mm per 305 mm) of travel* *±0.002 inch (±0.05 mm) maximum* *±0.001 inch/foot (±0.025 mm per 305 mm) of travel for extended Y axes with linear encoders* *±0.005 inch (±0.127 mm) maximum*
BeamDirector®	*C*	*±15 arc second* *±0.0004 inch (±0.01 mm) at beam focal point*
	D	*±15 arc second* *±0.0006 inch (±0.014 mm) at beam focal point[1]*
Repeatability		
Linear	*X-Y-Z*	*within 0.0015 inch (0.038 mm) over full travel*
BeamDirector®	*C*	*within 15 arc second over full travel* *0.0004 inch (0.01 mm) at the beam focal point*
	D	*within 15 arc second over full travel* *0.0006 inch (0.014 mm) at beam focal point[1]*

1. *Optional rotary tables provide part indexing and contouring.*
2. *Optional shuttle table provides additional travel parallel to the Y-axis.*
3. *Accuracy and repeatability specifications are 6 sigma limits determined according to AMT (formerly NMTBA) "Definition and Evaluation of Accuracy and Repeatability of Numerically Controlled Machine Tools," Second Edition.*
4. *Based on a 5.0 inch (125.0mm) focal length lens. Lens focal lengths up to 12 inches (300 mm) are available.*

"The moving bridge design of the 890 BeamDirector® provides us with flexibility for large parts or multiple setups of smaller parts. Efficiency is extremely important in our prototype shop and the 890 allows us to turn small lots quicker and is typically twenty times faster than hand work."

Pat Woody, President, Auto Metal Craft

Reason 1

Moving Bridge Design

By positioning the laser beam in five axes, the Laserdyne 890 BeamDirector® provides:

- ***Multiple setups** of similar or different parts. This reduces setup time and maximizes laser beam on-time. Since the workpiece remains stationary during processing, one part is processed while a part just completed is unloaded and another is fixtured. The system can include multiple linear indexers or rotary tables.*
- ***Capability for processing large workpieces**. The moving bridge design provides for handling parts much larger than indicated by the axes travel. The table is easily removed to handle large workpieces, even larger than the automobile shown at the left. The 890 BeamDirector® is available with the Y axis travel extended to 14 meter for applications such as chemical mill maskant scribing of large aircraft components. Optional shuttle tables are also available for longer effective Y axis travel (see back page for further details).*
- ***Easy access.** The stationary walk-around table makes part load and unload fast, easy and convenient. Reduces operator fatigue.*
- ***Simplified tooling.** The workpiece remains stationary during processing. This eliminates inaccuracies caused by the workpiece moving during processing. The result is reduced cost and more accurate parts.*

Reason 2

Direct Drive BeamDirector®

Laser Contouring Head

Direct drive means that the laser beam positioning mirrors are directly connected to the motors and feedback devices.

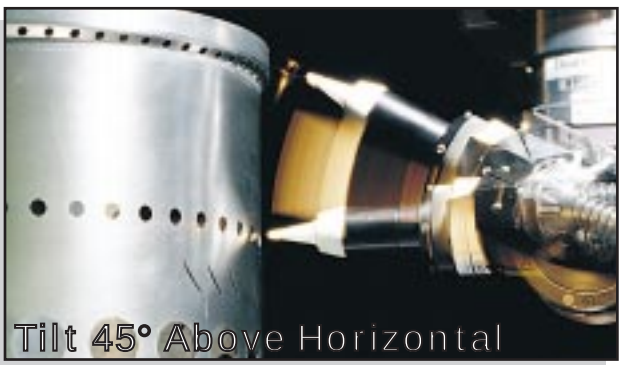
Benefits of direct drive include:

- ***Offset design** provides flexibility to process tall vertical surfaces along the full travel of the Z axis.*
- ***Process 45° above horizontal.** The ability to tilt the nozzle 45° above horizontal (±135° tilt travel) gives access to difficult to reach surfaces in one setup.*
- ***Multi-level, fast response crash protection** prevents system damage in a crash.*
- ***Accepts a wide range of lens assemblies.** Quick-change assemblies with 2.5 to 12 inch (63.5 to 300 mm) focal length lenses are available. Right angle nozzles are also available for processing inside difficult-to-reach surfaces.*
- ***Highest accuracy.** Direct drive does not have backlash and inaccuracy inherent with gear and belt drives.*

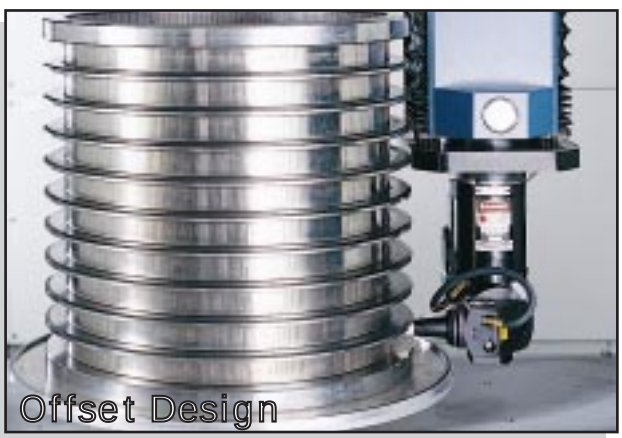
▲ *Photograph shows that the Laserdyne BeamDirector® immediately disengages on impact to avoid damage in a crash. The system remembers its position for quick startup.*

"The 890 BeamDirector® Crash Protection is unmatched. Crash protection and the BeamDirector's compact size and ability to work in tight areas are the primary reasons we bought the system."

Scott Lattimore, General Manager, Lattimore & Tessmer



Capability to tilt the BeamDirector® 45° above horizontal (± 135° tilt travel) provides access to difficult-to-reach surfaces in one setup.



The offset design provides capability to process along the full travel of the Z axis.

Exclusive 5 Year, Unlimited Hours Warranty Covering Crash Related Damage

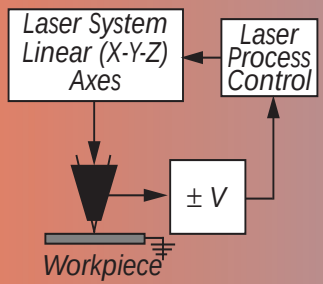
Multiple levels of crash protection mean:

- Highest uptime
  Crash protection helps to maximize laser system reliability by virtually eliminating downtime associated with crashes.
- Fewer scrapped parts
  The motion system is disabled and free to move when the BeamDirector® contacts the workpiece.
- Avoids expensive repairs
  When the inevitable collision occurs, the system is not damaged. Experience has shown that this is not true of systems which use gear or belt drive design rotary-tilt heads.
- Quick recovery
  Recovery from a crash is fast and easy. The system always monitors position so recovery is simply a matter of jogging away from the collision and pressing the CONTROL ON key to restart the system.
- Higher productivity
  Operators can be free from fear of crashing the system. Operator productivity is increased, regardless whether the system is being programmed, setup, or is processing parts.

☐ Ask for a demonstration of Laserdyne crash protection.

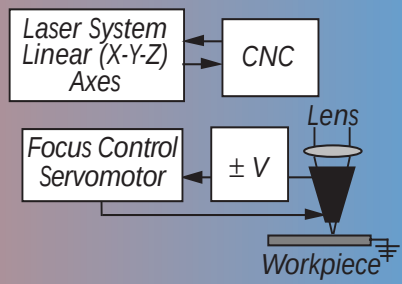
Comparison of Laserdyne and Lens Servo (Sixth Axis) Approaches To Automatic Laser Beam Focus Control

Laserdyne Integrated AFC Offers Much More Capability

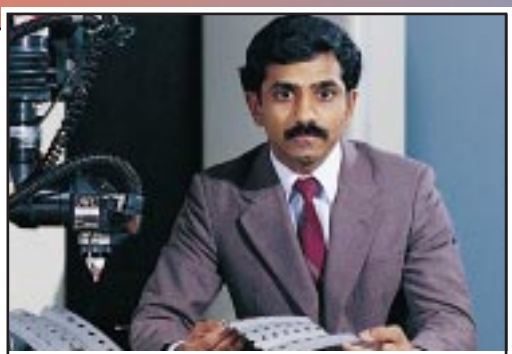


- *Laser system linear axes are positioned along the axis of the laser beam or in any user selected direction to maintain laser beam focus*
- *The focal point position is precisely known at all times*
- *Travel is unlimited*
- *No additional moving parts to damage or maintain*

Lens Servo Approach (Also known as "Sixth Axis" Focus Control)



- *Focusing lens and nozzle are positioned independent of the laser system axes to maintain laser beam focus*
- *Focal point position is not known because the focus control offset is independent of system axes*
- *Travel typically limited to ±0.5 inch (±12.5mm)*
- *Uses separate positioning mechanism*



"AutoNormal™ has reduced by 12.5 to 50% the time to teach BeamDirector rotary and tilt axis positions perpendicular to the part surface."

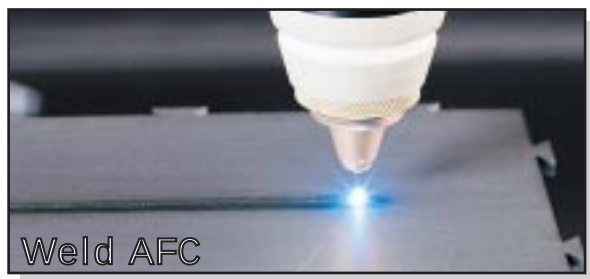
Madi Rathinavelu, Vice President
Corry Laser Technology, Inc.

Reason 3

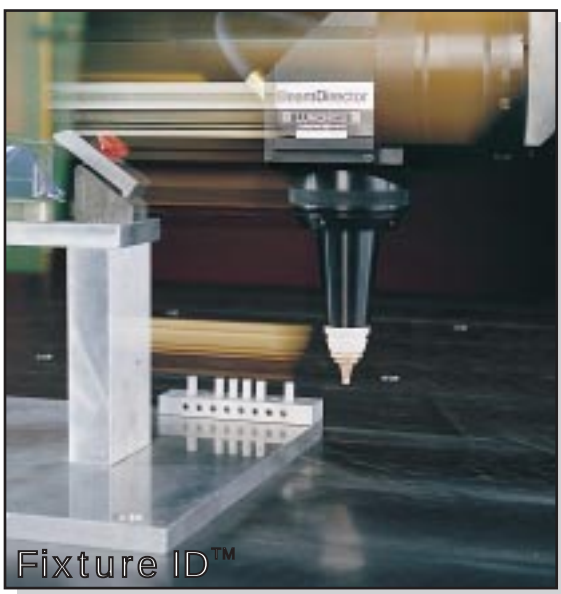
Fully Integrated Automatic Focus Control (AFC)

The Laserdyne AFC includes valuable capability not available on other systems (covered by U.S. Patent 5,340,962). This includes:

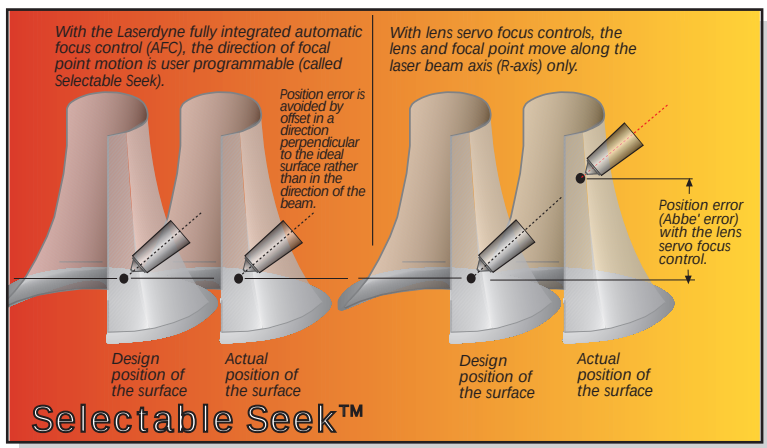
- ***Selectable Seek™*** *allows for automatic focus control along the beam axis or in any user programmable direction. The result is higher part accuracy and repeatability.*
- ***Feature Finding™*** *locates tooling and part reference features. This reduces set up time and compensates for part variations to give more consistent laser processed parts.*
- ***Fixture ID™*** *reduces setup time by automatically identifying the next part to be processed and loading the correct part program from the hard disk.*
- ***In-Fixture Gaging™*** *verifies correct workpiece location before processing. Avoids expensive scrap and increases part repeatability.*
- ***AutoNormal™*** *quickly and accurately orients the BeamDirector® perpendicular, or normal, to the part surface. Significantly reduces programming time.*
- ***Weld AFC*** *provides focus control for laser welding. It accomplishes this by eliminating effects of the weld plume that prevent other capacitance sensors from being used for welding focus control.*



Weld AFC (covered by US Patent 5,340,962) provides automatic focus control for laser welding.



Fixture ID™ automatically identifies the next part to be processed and loads the correct program from the hard disk drive of the laser process control. This reduces cycle time and makes single part lot size production economical.



Selectable Seek™ provides for automatic focus along the axis of the laser beam or in any user specified direction, such as the part "waterline."

Reason 4

System 94 Laser Process Control

- ***Program with G and M codes*** *(EIA RS274D).*
- ***Designed specifically for laser processing*** *(cutting, drilling and welding).*
- ***Based on an industrial PC***
- ***Provides integrated laser and motion control*** *including automatic slowdown and power ramping on corners and automatic adjusting of laser pulse rate.*
- ***PC compatible*** *operating system and disk format.*
- ***DSP*** *(Digital Signal Processor) and* ***high speed Serial Bus*** *provides:*
  - *200 microsecond servo update time for accurate, high speed contouring. (Note: this servo update time is 25 to 50 times faster than available with general purpose CNC's used for laser processing).*
  - *Zero following error.*
  - *Digital servo control provides stable, long-term performance.*

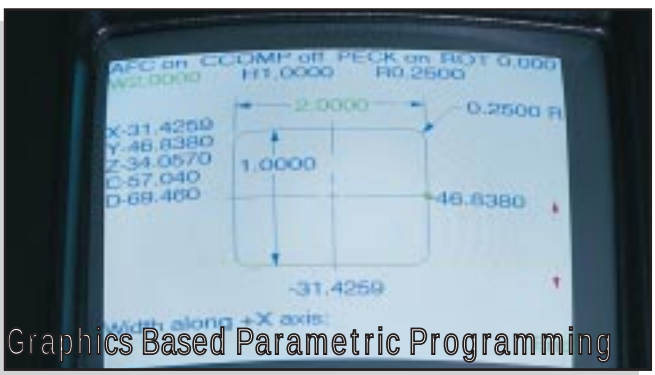
System 94 Laser Process Control

"Our laser system operators quickly learned to program and operate the laser system largely due to the powerful software and controller. Now we can produce consistent, burr free parts quickly with minimal tooling costs."

Jim Yates Jr., General Manager, Casey Tool and Machine Co.

Interface For Process Sensors

The System 94 accepts inputs from a wide range of sensors for closed loop adaptive control. Shown in above photograph is a three axis probe for gauging actual positions of workpiece features from which laser cut holes are referenced. Probe data is recorded and used to adjust the location of the laser cut holes.



Graphics Based Parametric Programming

Software makes programming standard geometric shapes, such as circles, rectangles, 2D and 3D arcs, and patterns such as bolt circles, fast and easy even for the new user.

System 94 Features

Computer	*32 bit Industrial PC*
Servo control	*Serial Bus Architecture for high speed communication with Texas Instruments Digital Signal Processors (DSP)*
Servo update time	*200 microseconds*
Number of axes	*Up to 10 axes of simultaneous contouring motion control*
Operating system	*PC compatible*
Part programming language	*Conforms to EIA RS274D (Standard G and M code machine tool programming language)*
Program storage	*User programmable RAM* *3.5 inch PC compatible floppy disk drive (1.44 Megabyte)* *Hard disk drive*
Keyboard	*Full travel IBM PC (QWERTY) industrial sealed keyboard for manual data input*
Screen	*Full color (VGA) 14 inch diagonal CRT*
Communications methods	*RS-232/422 serial interface to 19200 baud,* *Parallel printer interface,* *DNC interface for high speed remote control and file transfer (optional)*
I/O	*Easy integration of digital and analog I/O*
Enclosure	*NEMA 12*
Other features	*-Graphics based programming of standard geometric shapes and patterns* *-Materials processing database* *-Part Surface Coordinate programming,* *-Laser Process Manager™ (optional) for:* *•recording laser and process condition* *•decision making based on comparing recorded data* *•measuring average power delivered to the workpiece* *•determining absolute focal point position*

For a detailed listing of System 94 features and commands, request the publication "Laserdyne System 94 Laser Process Control Software and Hardware Features."

TeachVision™ (Covered by U.S. Patent 5,339,103) provides fast, accurate and easy teach programming of 3D parts! The image of the scribe line defining the trim line or location of a feature is displayed on a lightweight, hand-held teach pendant.

Benefits include:

- greater operator safety and comfort.
- programming time reduced by 85%.

"Switching from the TeachVision™ camera assembly to a cutting assembly is fast with the quick-change feature."

Bill Bean, General Manager, Vehma International

Programming Laserdyne Systems

Laserdyne systems include features designed from input of users to provide fast, easy and accurate programming. Laserdyne systems can be programmed by teaching, from CAD math data, and through combinations of these. A summary of programming methods and key features supporting each method is shown below.

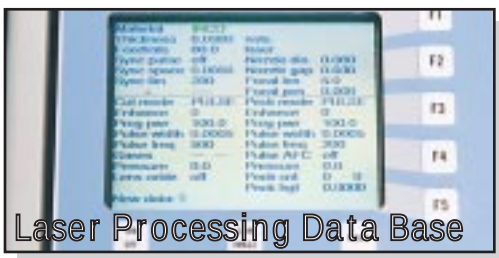
Programming Method	Key Features of Laserdyne Systems
Teach	TeachVision™ •CCTV camera for imaging the scribe line (includes integral lighting) •AutoNormal™ •Hand-held remote pendant with joystick and liquid crystal display (LCD) •Graphics-based parametric programming •Laser processing database
Offline using - CAD/CAM - specialized languages such as APT	•Part Surface Coordinate (PSC) programming •AutoCorrect •EIA RS274D (G, M code) programming language •Graphics-based parametric programming of geometric shapes and patterns •Laser processing database •Postprocessor
Combined 3-axis off-line CAM programming and Teaching	•AutoNormal™ •Part Surface Coordinate (PSC) programming

CO_2 Laser Control

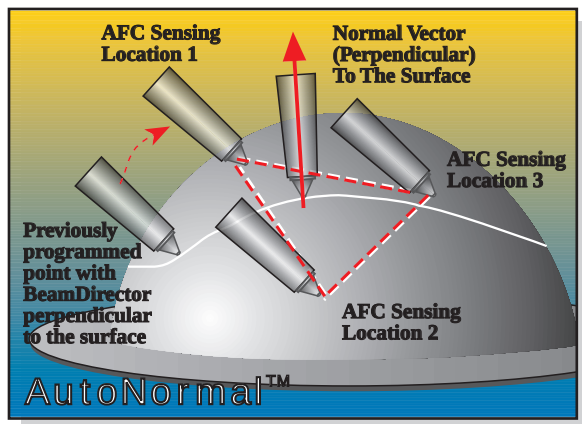
M50	Laser Continuous Mode
M51	Laser Pulsed Mode
M52	Laser Pulse Duration, 0.01 millisecond increments
M53	Laser Pulse Rate, continuously variable
M54	Laser Pulse Burst, 1 to 32,000 pulses
M60	Laser Beam ON
M61	Laser Beam OFF
M100	Laser Shutter OPEN
M101	Laser Shutter CLOSE
P	Laser Power, 0.01 Watt increments
G64	Laser Power Ramping with distance
G65	Laser Power Ramping with time
G78	Synchronous Pulsing ON for pulsing the laser as a function of distance
G79	Synchronous Pulsing OFF
M300 / M307	Assist Gas (4) ON/OFF

Nd:YAG Laser Control

M17	Begin definition of laser parameters, including pulse shape
M18	End definition of laser parameters
M53	Laser Pulse Rate, continuously variable
M55	PosiPulse™ (Pulsing as a function of position for drilling on-the-fly)
M58	Ramp laser power up over one second period
M59	Ramp laser power down over one second period
M62	Multipulse ON for pulse burst
M63	Define number of pulses in multipulse operation
M100	Laser Shutter OPEN
M101	Laser Shutter CLOSE
M300 / M307	Assist Gas (4) ON/OFF
$Pn	Activate up to 10 previously defined pulse shapes



Another standard feature is the user expandable laser processing database. Laser conditions are directly inserted into programs.

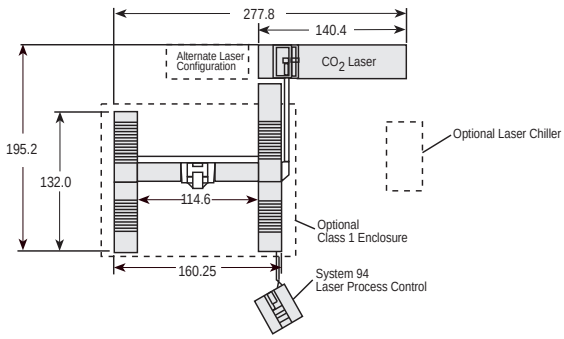


AutoNormal™ quickly, accurately, and automatically adds BeamDirector® C and D axis angles to X, Y, Z part surface positions generated by teaching or three axis CAM software. The benefit is reduced programming time, increased path accuracy, and higher cut quality.

Laserdyne 890 BeamDirector® Installation

With CO_2 Laser

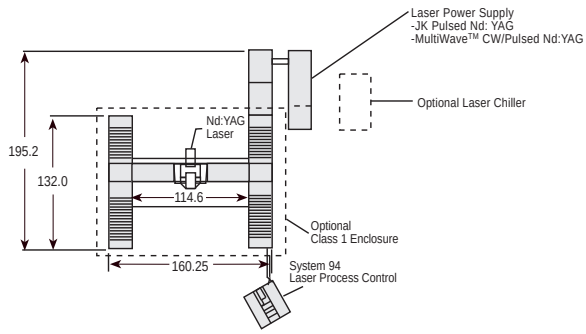
890 BeamDirector® System with CO_2 laser. Alternate laser orientations are shown. Detailed pre-installation drawings and foundation requirements are available.



Maximum height approximately 160 inches (4.1 m)

With Nd:YAG Laser

890 BeamDirector® System with Nd:YAG laser. Detailed pre-installation drawings and foundation requirements are available.



Maximum height approximately 160 inches (4.1 m)

Weights: Laserdyne 890 BeamDirector® workstation including System 94 control and removable table--10,600 lbs. Note: All dimensions are inches.

LUMONICS

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