

# MAN

METALWORKING IDEAS FOR TODAY'S JOB SHOP

## Etched in Steel: Choosing the Right Marking Technology

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# Engraving Bull's-eyes ID Marking Needs

**Smith & Wesson's new line of military and police weapons needed an engraving method that produced logos as sharp as their firearms**



The Datron Dynamics mechanical engraver etches logos and other identifying marks into stainless steel

ID marking has applications from engraving serial numbers, to part identification, to manufacturers' marks. Ensuring quality branding means projecting more than just a name. It means standing behind an image as well.

Few companies have the name recognition of Smith & Wesson. With firearm models dating back more than a century, the famous intertwined S and W company logo has a long and illustrious history since its' founding in 1856 by Horace Smith and Daniel B. Wesson.

Each firearm from Smith & Wesson, Springfield, MA, carries the company logo. In 2003, Smith & Wesson began new line of weapons, the Military and Police line – M&P – featuring pistols and rifles with a reinforced polymer chassis, superior ergonomics, ambidextrous controls, and proven safety features. The company name, brand logos, and other text appearing on the slides of the M&P handguns were roll stamped.

## Not on a Role

For Rich Mikuta, manufacturing engineer of the M&P line, the roll-stamped method was not acceptable for this line of firearms.

The stamped impression – which squeezed and displaced steel rather than remove material – didn't provide the crisp clarity for the M&P logos and marks. He set out to investigate state-of-the-art technologies for marking or engraving stainless steel.

Mikuta faced a number of challenges that both job shops and small contract manufacturers face as well:

- Mechanically engrave the stainless steel slides of M&P handguns to depth of 0.005" with excellent quality.
- Implement lean manufacturing – single unit pull – and process improvement.
- Make a part and all of its components when ordered, to reduce inventory and cost associated with the overhead.
- Keep up with the items produced by nine Tsugami machines that mill the slides from stainless steel bar stock. Integrate an indexing unit to rotate the slides so that two of the sides could be engraved.
- Deal with a high-mix challenge since there were three

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models with seven total variations.

- Use a fully automated door that meets all CE and OSHA safety requirements.

Mikuta investigated roll marking, stylus or scribe marking, lasers, and mechanical engraving.

Based on his experience, Mikuta ruled out roll marking.

He didn't consider stylus or scribe marking because it did not meet his quality standards and the technology couldn't meet a required 0.005" depth. This left laser and mechanical engraving.

Datron high-speed machining centers were an option. Mikuta engaged Datron Dynamics, Milford, NH, in a long-term project that would pit that technology against laser engraving.

But, the project didn't last as long as anticipated. Laser engraving was not as sharp and crisp as Datron's mechanical engraving.

Mikuta said he realized it was not a question of which technology to use, but how to leverage Datron's capabilities, including its engineering group, to improve the M&P slide manufacturing cell.

### Enter the OmniRaptor

The precision and speed required by Smith & Wesson, combined with the need for a large machining area, called for Datron's OmniRaptor. The machine features feedrates up to 800 ipm to produce optimized cycle times.

A steel bridge, reinforced with polymer concrete, provides stability and support for a 2kW – 2-3/4 hp – water-chilled, 60,000 rpm spindle, together yielding a resolution of  $\pm 0.00016$ " with an absolute accuracy of  $\pm 0.001$ " and a relative accuracy of 0.0005".

The Omni's Z-probing capability is the first step in maintaining a consistent 0.005" engraving depth, because the probe scans the surface topography of the handgun slides and feeds the data into Windows-based control software. Compensation for surface irregularities takes place in the program before machining begins.

For Smith & Wesson's engraving needs, a Renishaw TP-20 probe tip added additional measurement accu-

racy and was consistent with Renishaw probes used on other machines throughout the shop.

### A System with Pull

The machine's probing capability is also instrumental in attaining lean manufacturing standards like single unit pull. Within the M&P line of handguns,

three different slides are used for various models. Since these slides are used for a range of calibers, there are up to seven variations.

With the probe, an operator selects an appropriate slide for the required part and places it in an indexer to rotate the part and part fixture. The probe

*Continued on page 36*

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Smith & Wesson's new line of police and military weapons required exacting standards for the engraved logo

scans the slide and determines part definition – part type – and pulls the needed sub-program to appropriate specific markings and part numbers. Even when an operator sets up the wrong blank, the machine still produces a high-quality, usable part.

“An operator who’s constantly pulling different models out of here

can just put the part in and walk away,” Dave Simard, a company quality engineering manager, said. The Datron machine detects the model and caliber and engraves the part with the proper marks, without job setup or changeover.

The M&P handguns are marked on two different sides with the Smith & Wesson brand name, logos, serial numbers and stainless steel designation. Since the fixture that holds the slides is made of heavy steel, a heavy-duty indexer used to

rotate the fixture was needed, so an industrial rotary indexer was integrated to quickly position each part for engraving on two sides.

### Show Them the Door

To address the firearm manufacturer’s requirement for an automated door that met all safety requirements, Datron developed an electrically-powered door for lean manufacturing with single-unit pull. The door is program-controlled – independent of the machine software – to slide open and slide shut without manual assistance. A user-friendly remote control features a green “door enabled” light and two buttons: open door and close door. The remote attaches magnetically to a location that’s convenient for the operator.

Upon the completion of the part cycle, the green light comes on to indicate it is safe to open the door. Or, the door is automatically raised in less than three seconds by the program.

Once the new workpiece is positioned, the operator closes the door with the proper button. Within three seconds, the door is fully closed and machining can begin. The door also opens manually in a gull-wing fashion.

Whether opened automatically or manually, the safety features are immediately activated preventing machine operation until the door is securely closed. A 2” pressure-activated rubber sensing strip runs along the full length of the door bottom to prevent it from closing if the machining area opening is not

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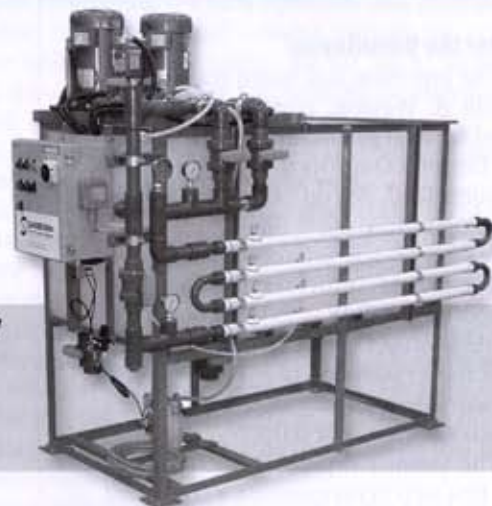
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## 151+ YEARS IN CRIMEFIGHTING



Smith & Wesson has been a partner to law enforcement since the late 1800s, developing crime-fighting tools that set the standard for the field. Their .357 Magnum was developed specifically for law enforcement agencies, and the Smith & Wesson .38 Special has been adopted as the caliber of choice by hundreds of police departments.

In fact, the .38 Special is so popular, the Smith & Wesson Model 10 firearm has been in continuous production since it was introduced in 1899. To date, more than six million units have been produced.

Today, law enforcement and military agencies around the world have used Smith & Wesson products. Most police departments in the United States depend on the company's firearms and accessories. As the needs of law enforcement change, so, too, must the tools used, thus the creation of the M&P line.

clear. The system not only facilitates agile single-unit pull, it also yields automatic safety enforcement.

"Datron's application engineering and service-oriented approach made it easy to integrate the machine into our production process," Mikuta said.

Datron is developing log specifications to output data to Smith & Wesson's main database to capture important information, such as cycle times, error messages, time stamps, and tool life. This is exported from the machine control in a Microsoft Excel format so managers can examine the data.

The Datron installation at Smith & Wesson in 2005 exemplifies lean manufacturing and automation for the firearm manufacturer. A manufacturer in business for 107 years can't rest on its laurels. It has to look ahead and apply advanced machining technology to stay competitive. *Datron Dynamics*

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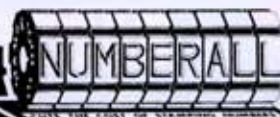
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