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## “Gunning For Greatness with Datron”

Smith & Wesson is one of the world’s most recognizable brands. They’ve been a partner to law enforcement since the late 1800s, developing crime-fighting tools that set the standard for the field. Their world-famous .357 Magnum® was developed specifically for law enforcement agencies, and the Smith & Wesson .38 Special has been adopted as the caliber of choice at one time or another by hundreds of police departments. In fact, the .38 Special is so popular, the Smith & Wesson Model 10 firearm is the only handgun in the world that’s been in continuous production since it was introduced in 1899 ... and to date, over 6 million units have been produced.

Today, almost every major law enforcement and military agency in the world has used Smith & Wesson products, and most police departments in the United States depend on Smith & Wesson firearms and accessories. But, the needs of law enforcement are constantly changing, and Smith & Wesson is always developing sophisticated new tools to answer them. Enter the M&P (Military & Police) line — featuring pistols and rifles with a reinforced polymer chassis, superior ergonomics, ambidextrous controls and proven safety features.

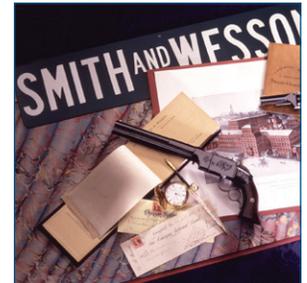
In 2003, the company name, brand logos and other text appearing on the slides of the M&P handguns were being roll stamped. To Smith & Wesson manufacturing engineer, Rich Mikuta, this roll-stamped method was not acceptable for a new elite line of firearms. The impression resulting from the stamp literally squeezing and displacing steel (rather than removing material) didn’t provide the enough crispness or clarity for the M&P logos and marks. So, he set out to investigate state-of-the-art technologies for marking or engraving stainless steel.

### CHALLENGE:

To mechanically engrave the stainless steel slides of M&P handguns to depth of .005” with excellent quality. To implement lean manufacturing (single unit pull) and process improvement at Smith and Wesson for new firearms. To have the ability to make a part and all of its components when ordered, to reduce inventory and cost associated with the overhead. To keep up with the supply of slides being produced by 9 Japanese-made Tsugami machines that mill the slides from stainless steel bar stock, a rugged indexing unit needed to be integrated in order to rotate the slides so that 2 of the sides could be engraved. Also, the M&P line presented a high-mix challenge since there were 3 models with 7 total variations. Finally, Smith & Wesson specifically required a fully automated door that meets all CE and OSHA safety requirements.

### AVAILABLE TECHNOLOGY:

- 1) Roll Marking
- 2) Stylus or Scribe Marking
- 3) Laser
- 4) Mechanical Engraving



Smith & Wesson has been a partner to law enforcement since the 1800’s providing police departments with cutting-edge firearm technology.



The Model 10 is the only handgun in the world that’s been in production since it was introduced in 1899.



Answering the changing needs of law enforcement and military Smith & Wesson has developed a M&P or Military & Police line of firearms and engraves these guns on DATRON M8 high-speed machining centers.

Based on his experience to date, Rich Mikuta had already ruled out roll marking. Stylus or scribe marking wasn't a viable option because of poor quality and an inability to achieve a .005" depth. This left laser and mechanical engraving to duke it out. Having identified Datron high-speed machining centers as a viable option, Mikuta decided to engage Datron Dynamics in nearby Milford, NH in a long term project that would pit them against laser technology to prove stainless steel engraving superiority.



But, the project wouldn't be as long-term as anticipated. The laser engraving produced marking that was not as "sharp" and "crisp" as the mechanical engraving done on the Datron machine. To Mikuta's delight, it was no longer a question of which technology to use, but rather how to leverage Datron's robust capabilities, and the superior application engineering of the Datron group in New Hampshire, to improve the M&P slide manufacturing cell beyond his greatest expectations.

**SOLUTION:**

The precision and speed required by Smith & Wesson combined with the need for a large machining area called for Datron's M8 model. The M8 features feed rates of up to 800 i.p.m. to produce optimized cycle times making it ideal for a high-volume production schedule like the multiple-shift environment at Smith & Wesson. A steel bridge reinforced with polymer concrete provides superior stability and support for a 2kW (2 3/4 H.P.), water-chilled 60,000 RPM spindle -- together yielding a resolution of  $\pm 0.00016"$  an absolute accuracy of  $\pm 0.001"$  and a relative accuracy of 0.0005"



Datron's Z-probing capability was the first step in maintaining a consistent .005" engraving depth because the probe scans the surface topography of the handgun slides and feeds the data into the Windows-based control software. Any surface irregularities are compensated for in the program before machining begins. A Renishaw TP-20 probe tip added additional accuracy in measurement and was consistent with Renishaw probes used on other machines throughout Smith & Wesson.



Datron's probing capability was also instrumental in achieving lean manufacturing standards like single unit pull. Within the M&P line of handguns, there are 3 different slides used for various models. Since these slides are used for a range of calibers, there are up to 7 variations. With Datron's probing, an operator simply selects an appropriate slide for the required part and places it in an indexer used to rotate the part and part fixture. The probe then scans the slide and determines part definition (part type), and pulls appropriate sub-program to appropriate specific markings and part numbers. This way, even in a worst case scenario, where an operator sets up the wrong blank, the Datron 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. The Datron machine detects the model and caliber and then engraves the part with the proper marks — all without job set up or change over."*

— Dave Simard, Smith & Wesson Quality Engineering Manager

Smith & Wesson's M&P handguns are marked on two different sides with the brand name, logos, serial numbers and of course the stainless steel designation. Since the fixture that holds the slides in place is made of heavy steel, the indexer used to rotate the fixture also needed to be heavy duty. So, an industrial rotary indexer was integrated to quickly position each part for engraving on two different sides.

To address Smith & Wesson's requirement for an automated door that meets all CE and OSHA safety requirements, Datron developed an electric-power door designed specifically for lean manufacturing with single-unit pull. As such, the door is program controlled with its own intelligence (independent of the machine software) to slide open and slide shut without the manual assistance of an operator. A user-friendly door remote control features a green "door enabled" light and just 2 buttons the "open door" button and the "close door" button. This remote can be magnetically attached to a location that's convenient for the operator. Upon the completion of the part cycle the green door enabled light comes on to indicate that it is safe to open the door by touching the open door button, or the door can be automatically raised by the program. The door is automatically raised in less than 3 seconds. Once the new part (blank) is positioned, the door is closed by pushing the close door button. Within 3 seconds the door is fully closed and the machining can begin. The door can also be opened 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-inch rubber, pressure-activated sensing strip runs along the full length of the door bottom to prevent the door from closing if the opening to the machining area is not completely clear. So this system not only facilitates agile single-unit pull, it also yields automatic safety enforcement.

*"Datron's excellent application engineering and service oriented approach made it easy to transition the machine into our production process"*

— Rich Mikuta, Smith & Wesson Engineer

Currently, 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 Datron control in a Microsoft® Excel format so that Smith & Wesson production managers can examine the data.

Since the first Datron installation at Smith & Wesson in 2005, this machine has become a showcase of lean manufacturing and automation for this time-honored firearm manufacturer. Even for a manufacturer that has been producing the .38 Special Model 10 for 107 years, it is obvious that the way forward is to look ahead as Smith & Wesson continues to turn to Datron for vanguard machining technology.

*"You can't tackle tomorrow's challenges with yesterday's technology. This Datron M8 machine is a real miracle."*

— Konstantinos P. Giannakopoulos, Smith & Wesson Manufacturing Engineer

Today, Smith & Wesson is placing more Datron machines in their Springfield, MA plant and mechanical engraving will likely become their preferred method of marking new models and lines of firearms — setting an industry standard for attention to detail and overall quality.





The slide of this Smith & Wesson M&P40 was engraved on 3 sides with a Datron M8 high-speed machining center. Detail image shows engraving before final finishing.

A single Datron M8 high-speed machining center keeps up with the supply of slides produced by 9 Tugami machines in Smith & Wesson's M&P handgun production cell.

