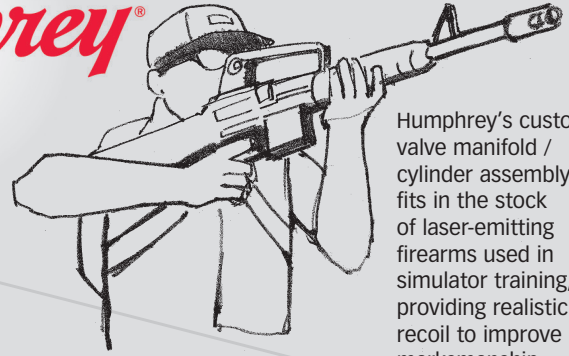
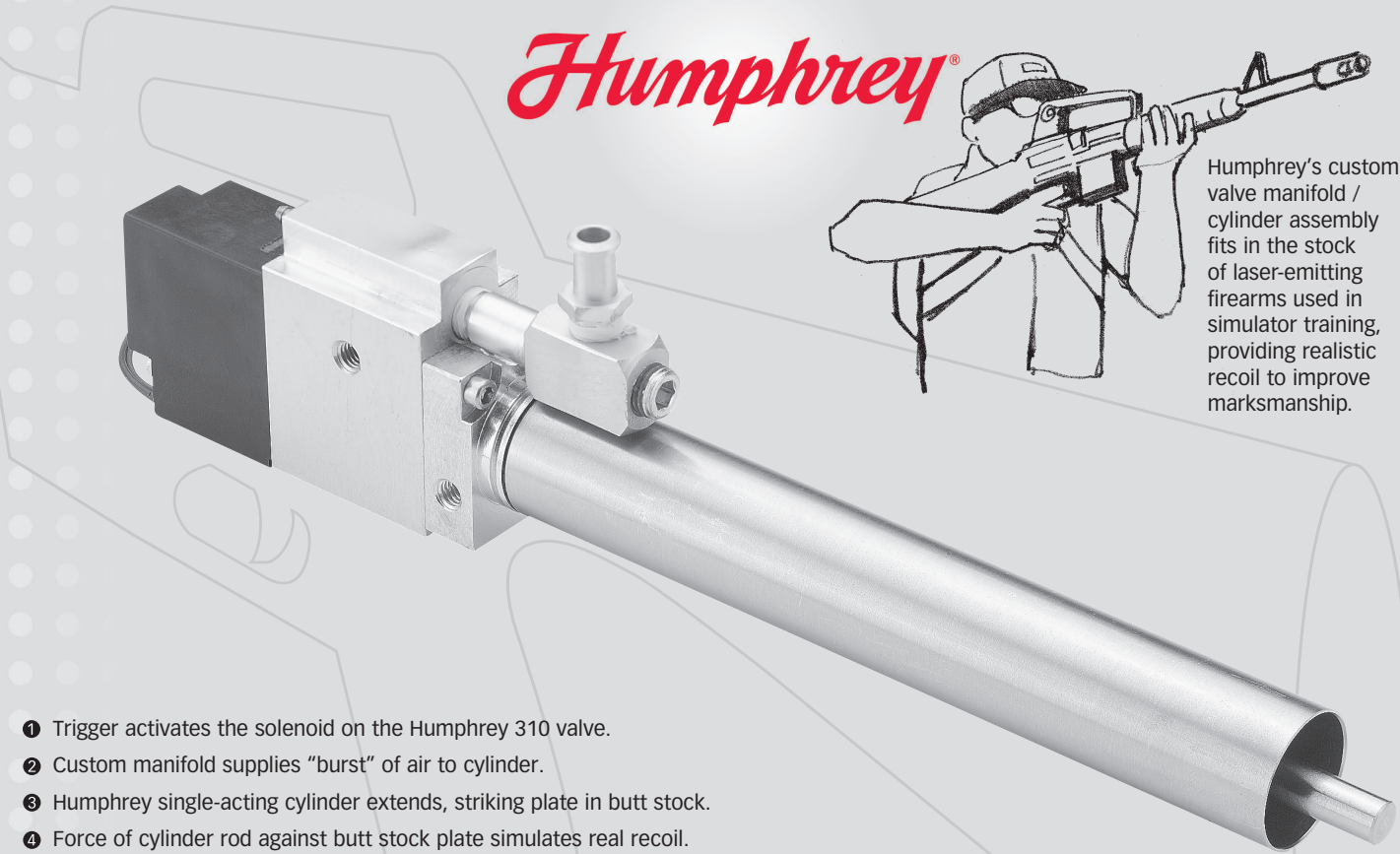


**Humphrey**



Humphrey's custom valve manifold / cylinder assembly fits in the stock of laser-emitting firearms used in simulator training, providing realistic recoil to improve marksmanship.



- ❶ Trigger activates the solenoid on the Humphrey 310 valve.
- ❷ Custom manifold supplies "burst" of air to cylinder.
- ❸ Humphrey single-acting cylinder extends, striking plate in butt stock.
- ❹ Force of cylinder rod against butt stock plate simulates real recoil.

## Custom Valve Manifold/ Cylinder *Assembly Provides Realistic Firearms Training Simulation*



**FIREARMS  
SIMULATION  
SIC:3484**

### THE CUSTOMER'S PRODUCT

- The customer designs and manufactures a range of simulated firearms training systems used by military and civilian law enforcement agencies to train personnel.
- The firearms are real weapons that have been modified to shoot bursts of laser light.
- To enhance the realism in the simulated environment, the customer wanted to provide the same recoil ("kick") that the trainee would experience firing a real weapon.

### THE REQUIREMENTS

- Design an assembly consisting of a valve, a manifold with custom porting and mounting holes and a cylinder that will fit inside the stock of a modified M-16 rifle.
- The air supply is provided by a reservoir tank contained in a backpack and connected to the rifle with a hose.
- A battery in the rifle supplies the necessary current to active the valve.
- Flow rate and cylinder recovery time must closely match the force and fire rate of a real rifle.

### THE HUMPHREY ENGINEERED SOLUTION

- A Humphrey 310 solenoid valve, mounted on a custom manifold with porting and mounting holes per customer specifications to height and width.
- Modified Humphrey air cylinder to reduce bore friction, speeding cycle time.

## THE SOLUTION

The Engineered Solutions approach started with a Humphrey engineering team working directly with the customer's engineering department to identify all the requirements. In this case, the customer wanted to simulate the actual recoil of an M-16 rifle when it "fired" bursts of laser light during a training simulation in hostile environment. Because the customer uses actual rifles, which are then modified to emit laser beams, the Engineered Solution had to fit inside the hollow rifle stock.

Humphrey started with the 310 Series solenoid valve to provide optimal flow, low current usage and reliability. Next, Humphrey created a custom manifold to the required dimensions, with all the porting and mounting holes per customer specifications. Finally, Humphrey modified one of its standard air cylinders to increase the cycle time by reducing bore friction.

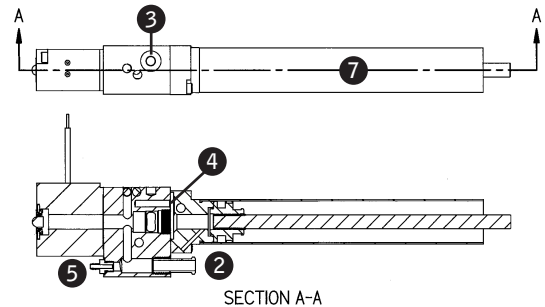
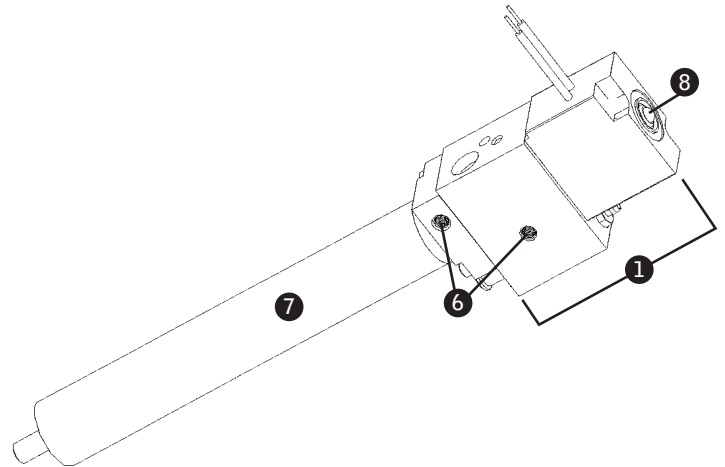
## THE PROCESS

Responding to the customer's desire to replicate recoil in a non-firing rifle, the Humphrey Engineered Solutions team worked closely with the customer's engineers to develop the solution. The goal was to fully understand all the requirements as well as the factors involved in reproducing the "feel" of firing a real weapon before actually designing a prototype.

The customer's training simulators for this application consist of creating various scenarios where the trainee is placed in as stressful a situation as possible. Under these conditions, the trainee soon becomes familiar with being under "hostile fire" and can work to improve his marksmanship.

The customer utilizes a real M-16 rifle, with the working parts removed and replaced with a laser generator that "fires" bursts of light. Because target acquisition (keeping the "bad guy" or the "enemy" in your sights) is critical, the simulator rifle had to recoil. This would give the trainee vital experience in firing multiple rounds with greater accuracy.

The customer's engineers had experimented with various solutions, using off-the-shelf products. But none met their requirements -- either the standard products were too large, or the performance was not satisfactory. Understanding this, Humphrey developed a custom manifold to meet the size requirements, and then modified one of its standard single acting cylinders to reduce bore friction. This, in turn, reduced the flow requirements, making Humphrey's 310 Series solenoid valve ideal for the application -- both for flow and current consumption.



- ① 310 Series Solenoid Valve
- ② Supply Port
- ③ Exhaust Port
- ④ Cylinder Port
- ⑤ Supply Port -- From Separate Air Reservoir
- ⑥ Thru Mounting Holes
- ⑦ Cylinder
- ⑧ Manual Override

*Humphrey*

BUILD ON OUR EXPERIENCE

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