



Giddings & Lewis 515 VTL Control Retrofit

Customer: The Harrison Steel Casting Company - Attica, IN
System Integrator: MasterControls Inc., L.L.C. (MCI) - Pendleton, IN

The Harrison Steel Casting Company was formed in 1906. Harrison is known as being one of the world's largest producers of top quality, carbon and low alloy steel and ductile iron castings. The company has been family owned and operated since its inception. The facility is approximately 650,000 square feet and employs more than 800 people. They serve the mining, construction and power transmission industries.

Harrison continuously seeks to add machining capacity for their customers. In this pursuit, they look for used equipment which can meet their needs for machining large parts. Older equipment is available and the mechanical condition of this older equipment is still very good. Typically, an older machine in good mechanical condition can be purchased and a new control package can be retrofitted onto the machine for far less than what a new machine would cost.

A year ago, Harrison found a large Giddings & Lewis 515 VTL (built in 1974). The machine was purchased and moved to their facility for storage. When Harrison was ready for it, they contacted MCI and began the process of a control retrofit. They had decided that the original control, a Westinghouse PAC2000 CNC, had not been powered up for over a year and was not going to be capable of providing dual-station control. They believed that in order to optimize machine performance and part throughput, dual-station control was required.

Harrison was familiar with **MACHINEMATE** CNC products. They have many Giddings & Lewis machines in their facility. Their used machinery dealer is a **MACHINEMATE** distributor and has a long relationship with **MACHINEMATE INC.** and Giddings & Lewis. When asked, Harrison listed six reasons for choosing the **MACHINEMATE** Control and for MCI to perform the retrofit. Listed below are those reasons:

- 1) Lead Time: Controls and Related Hardware are readily available.
- 2) Cost: Compared to other CNC controls, **MACHINEMATE** is very economical.
- 3) Ergonomics: The control is laid out very well and has an intuitive operator interface.
- 4) Capabilities: The **MACHINEMATE** CNC could easily handle Dual-Station Control.
- 5) Service: MCI is close and has tremendous expertise in **MACHINEMATE** CNC control.
- 6) Parts: Repair Parts are readily available from **MACHINEMATE** in the U.S.

MCI was contacted by the customer and asked to provide a complete retrofit solution to the control problem. Jeff Petry from MCI made a visit to the customer's site. During this site visit, he performed a thorough evaluation of the control requirements. These control requirements were discussed with the engineers and operators. It was important to understand the expectations before the project could be quoted properly. Copies of machine manuals and schematics were collected for further study.



The goal of the retrofit was to reuse as much machine hardware as possible. With this in mind, MCI was able to keep both retrofit costs and installation time to a minimum. The customer wanted to keep the existing axis and spindle drives and motors. MCI also wanted to keep the magnetics cabinet in place to minimize any required rewiring on the machine. By doing this, MCI could build an operators pendant and CNC Control panel off-site and bring the panels to the site for a quick installation.

All of the control engineering and panel building was performed off site. When the retrofit package was complete, a time convenient for the installation was set. The retrofit package was delivered to the customer's site and the installation started. Installing the control and operator pendant and doing the wiring in the magnetics cabinet took two to three days. As soon as the installation was powered up and tested, the operator started preparing a part for machining. By the end of the week, the operator was trained and comfortably running parts.

Most of the part programming is done by the machine operator at the machine. More complex parts require the use of a CAD/CAM system (GibbsCAM). Parts created at the machine as well as those created with the CAD/CAM system can be graphically checked on the machine control. Programs created using the CAD/CAM system are copied onto a USB memory stick and then taken to the machine and loaded into the control. This is another advantage of using a modern CNC. Many standard USB devices can be hooked directly to the CNC. All part programs, tool offsets and machine parameters can be stored to the CNC or saved from the CNC using many external USB devices.

The customer uses this VTL to rough machine castings that they produce in-house. This rough machining operation is done to provide their customer a consistent part which will then be finish machined. These large parts often have complex profiles. Additionally, many parts require both heads to be performing machining operations at the same time. This would not have been possible using the old control. With these applications in mind, MCI decided to use a dual-station **MACHINEMATE** CNC control for the retrofit. The new CNC control is set up to control both heads simultaneously. When two operations are performed simultaneously, cycle time is greatly reduced!

Dual-station control gives the operators a lot of flexibility. The operator can choose to run both heads at the same time or he can choose to run either of the heads alone. The operator also selects which head will be the master when it comes to controlling the table. The slave head simply synchronizes to the table start. When one head finishes ahead of the other, it waits for the second head to complete its cycle. If a head is not used, it can be turned off and the servos will be shut down (parked). Each head has its own federate override and there is a single spindle override.

Even though this is a dual-station CNC, block processing is still amazingly fast. You never see transitions or pauses during the execution of the part program. This yields extremely accurate parts with very smooth contours and surfaces. With these smooth transitions wear and tear on the machine mechanical parts is kept to a minimum. This will allow many more years of service out of this machine.



With the successful completion of this retrofit, Harrison has realized the goal that they had set for this machine when they purchased it. They now plan to standardize with **MACHINEMATE** CNC controls. In the future, when they look at used machinery, they plan to add the cost of a control retrofit into their justification for the machine purchase. Planning to add the control right away helps them with standardization. Their operators and maintenance personnel will already be familiar with the control and they can stock parts for a standard control.

See the following pages for photos of the installation and a quick overview of the project scope.

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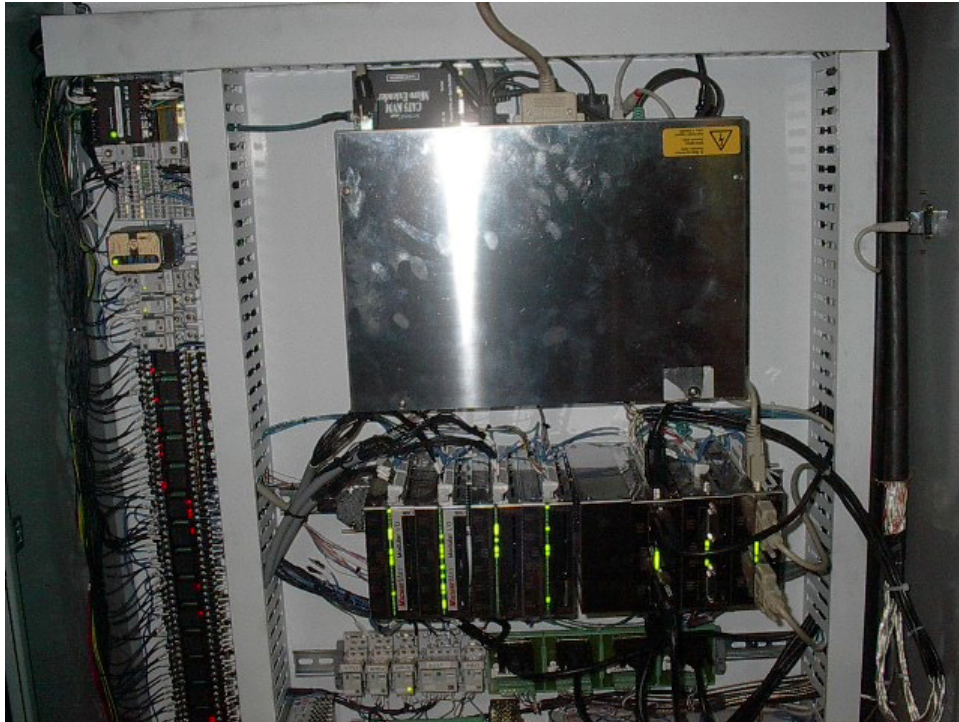
VTL Machine

This is a very large machine! The table you see in the background behind the control is 84" in diameter. Very large parts can be accurately machined on this VTL with the new CNC control.



Operator Panel

Notice the dual handwheels and dual joysticks. Machine flexibility is greatly enhanced. Operators can easily move the machine to set it up or for clearance when loading large parts. The large display is bright and easy to read.



New MACHINEMATE CNC and I/O

This picture shows the new **MACHINEMATE** CNC and I/O. This new CNC really makes for a clean and compact installation. The CNC and I/O are easily accessible for maintenance and troubleshooting.



Original Drives

Here are the original drives. These drives stayed in place and were easily interfaced to the new **MACHINEMATE** CNC control. As these drives fail, they will be upgraded with new technology.



Quick Project Overview:

CNC

MCI replaced the existing CNC control with a new **MACHINEMATE** dual-station (dual-channel) CNC control. The dual-station CNC allows the operator to run both stations independently in Manual Mode. There are separate handwheels for each station. The operator can select the station and move the axes into position using the handwheels or joysticks to perform set-ups and touch-offs. In Auto Mode, the machine can run either station individually or run both stations simultaneously.

The new control represents the state-of-the-art in modern CNC controls. The control has an intuitive easy to use operator interface. This intuitive interface enables the operators to perform quick set-ups and adjustments. The customer loves the ease-of-use. The control allows part-programs to be loaded via USB memory stick. The control also has a powerful part-program editor to allow for programming at the machine. Parts can be graphically checked right on the CNC. The customer does a large percentage of their part-programs right at the machine. When necessary to do the programming off-line, GibbsCAM CAD/CAM software is used and the resulting part-programs execute after being processed by the CAD/CAM system post processor. Again, these part-programs can be verified graphically at the CNC.

Another important feature of the new control was the ability to implement “AutoDrift Compensation”. Older axis drives tend to have problems with motor drift. By setting up and enabling “AutoDrift Compensation”, MCI was able to eliminate axis drift and optimize drive tuning at the same time.

Operator Panel

A new Operator Panel was installed on the machine in a new pendant. The operator panel includes a 15” touch screen, rugged keyboard and mouse.

Drives

The customer wanted to keep the original motors and drives. The Table Drive is Westinghouse and all the Axis Drives are Gettys. These drives can be replaced later if necessary. The **MACHINEMATE** CNC is equipped to control a very wide variety of Analog and SERCOS Servo Drives and many third party Spindle Drives.

Position Feedback

Inductosyn® (Farrand Controls and Giddings & Lewis) feedback devices were replaced by Newall Scales (1 micron). The customer really likes the set-up and ruggedness of these new feedback devices. The Newall linear feedback devices were furnished by **MACHINEMATE** as part of the CNC package.

Note: Resolver feedback is not compatible with the new **MACHINEMATE** CNC control. If resolvers are used for feedback, a converter must be added in the feedback loop to convert resolver feedback to encoder feedback. **MACHINEMATE** offers size 11 encoders to replace size 11 resolvers. The problem is that an encoder requires two additional wires more than a resolver. Since the wiring was not changed on this retrofit, converters were used.



Magnetics

The magnetics cabinet remained in place and was largely unmodified. Some small wiring modifications were required by the retrofit.

Field Devices

All existing field devices remained in place for the retrofit. None of the limit switches, solenoid valves, lamps, etc. required replacement.

Tool Changers

The Ram/Railhead has a Tool Changer and the Sidehead has a turret. Resolver converters were added between the feedback of these devices and the CNC. Both methods of tool change are easily handled in logic by the new control.

Installation Time

The new controls were installed in two to three days. This time included power-up, testing and machine checkout. Once the installation was complete, part set-up began. MCI was training the operators and running parts by the end of the week.

Integration Time

Integration time included producing machine schematics, creating a Bill of Material, ordering and receiving all the hardware, building the required panels for the CNC and the operator panel, writing all the machine logic and configuring all the machine parameters. This typically takes six to eight weeks from the time an order is placed to installation.



Original Machine Specifications

84" Giddings & Lewis 4-Axis CNC Vertical Boring Mill

Age: 1974

Serial Number: 515-4-74

Left Hand Ram with 12-Station ATC

Horizontal Side Head Power Indexing Tool Block

Table Diameter: 84"

Maximum Swing: 96"

Maximum Height Under Cross Rail: 96"

Maximum Height Under Ram Face: 104"

Rail Travel, Vertical: 84"

Vertical Ram Travel, Z-Axis: 62"

Ram Horizontal Travel (Left of Center): 50.50"

Ram Horizontal Travel (Right of Center): 60"

Minimum Bore, Ram Entry: 11"

Side Head Vertical Travel Above Table: 89"

Side Head Vertical Travel Below Table: 4.625"

Horizontal Travel of Side Head: 32"

Size of Tool Block: 6.5" x 6.5"

Size of Tool Maximum: 1.5" x 1.5"

Table Speeds, 2-Ranges, (Inf Variable): 2-200 RPM

Equipped With:

84" 4-Jaw Combination Hydraulic Power Operated Chuck

Westinghouse C41 4-Axis CNC Control

12-Station Automatic Tool Changer for Vertical Ram

Power Drawbolt for Tool Retention

Full Pendant Control for Manual Operation

Right Hand Side Head w/4-Position Power Index Tool Block

Ball Screws and Individual Servo Drives

Hardened Replaceable Cross Rail Ways

Power Rail Clamping

Rail Leveling Device

Flood & Mist Coolant System

12" Wide Chip Conveyor

Table Speed Indicator Display

Percent Load Indicator

Table Reverse

Blower Ventilation

Bellow Type Way Covers on Cross Rail

75 HP Spindle Motor 460/3/60 Hertz