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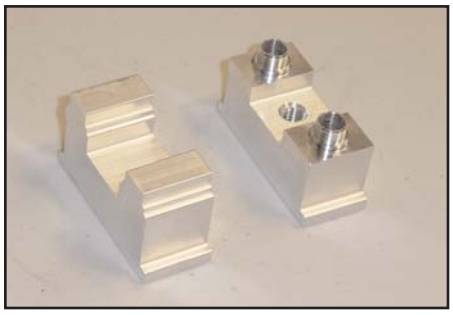
CC-Link AMERICAS

IN ACTION

CC-Link helps T&L Automatics export machined parts to China and globally

With so many manufacturing facilities moving production offshore to remain competitive, one American company is increasing manufacturing output and exporting precision machined parts to Asia and Europe as well as serving the U.S. marketplace. T&L Automatics, Inc. of Rochester, NY makes high quality precision machined parts having complex features and intricate details for the automotive, aerospace and defense industries.

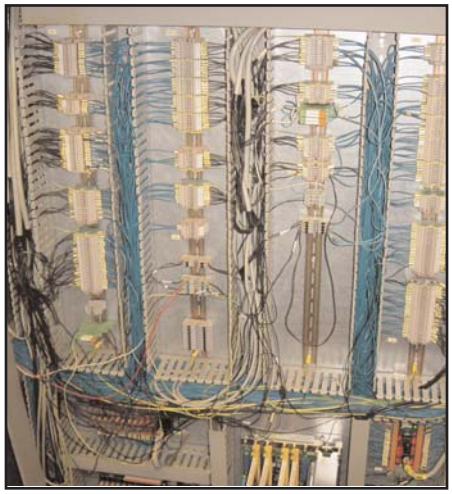


Automotive air conditioner manifold machined from bar stock

In order to reach the required level of precision and productivity, T&L Automatics had to significantly improve the capability, reliability, and output of its machining centers. The original control system on their existing IMASFLEX seven-station dial index machining centers experienced shut-downs and resulted in significant down-time at least once per week. In addition, the maintenance contract fees to correct those control problems was costing tens of thousands $ per year. T&L Automatics wanted to eliminate those control problems and maintenance costs, as well as increase productivity, reduce downtime and increase quality. Working with Unique Automation, LLC (a Mitsubishi Distributor located near Rochester, NY), they decided to retrofit their IMASFLEX machining centers by replacing the existing problematic CNC controllers and hard-to-maintain point to point wiring scheme. In its place, they installed a high-performance, networked control system

IMASFLEX machining center

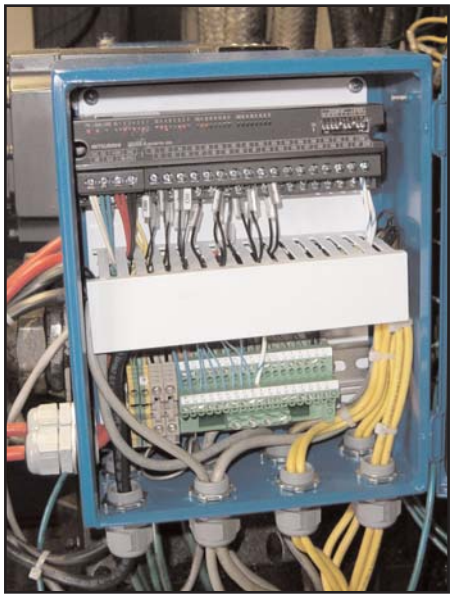
using Mitsubishi C64 CNC controllers, Q-Series automation controllers, GOT operator interfaces, all tied together with high-speed CC-Link networking.



A portion of the original central control panel showing just some of the wiring that was eliminated

Significant Wiring Reduction

By utilizing CC-Link networking, over 25,000 feet of wiring was eliminated per machine. Prior to this retrofit, broken, loose and shorted wires were a significant source of problems and downtime.



CC-Link Remote I/O Station located at one of the seven machining stations. Networking eliminates the need to route individual I/O wiring back to a central control panel.

Diagnosing machine mechanical problems and adding new I/O points is far easier and much faster due to CC-Link networking which connects the remote I/O stations to the Mitsubishi Q-Series automation controller and GOT operator interfaces.

Mitsubishi C64 CNC Controller (3 Axis & Spindle)

Multi-axis, high-precision machining is delivered by Mitsubishi C64 CNC controllers that are connected to the Q-Series controller via CC-Link.

Reduced Maintenance

The first IMASFLEX retrofit has been operating for over one year without a single control system failure. The old control system experienced electrical problems on a weekly basis. As a result of the retrofit, T&L Automatics was able to cancel the maintenance contract with the original control manufacturer thus saving tens of thousands $ in annual maintenance fees. In addition, production productivity increases of up to 20% have been realized.

System Configuration

The upgraded IMASFLEX CNC machining center consists of seven machining stations, each with an X, Y and Z-Axis as well as a spindle control. An eighth station is used by the operator for loading and unloading.

Q Series rack with 2 CC-Link Masters and other modules

Using CC-Link to network the complete CNC machining center, Unique Automation employed a Mitsubishi Q-Series Automation Controller with two CC-Link Master stations to control two independent CC-Link networks.

The first CC-Link network includes four C64 CNC controllers to manage the seven machining stations within the IMASFLEX machine. Each C64 controller is a local station device and occupies four CC-Link network stations. Three C64 controllers manage six machining stations having X, Y and Z-axes and spindle control for a total of 24 axes of control.

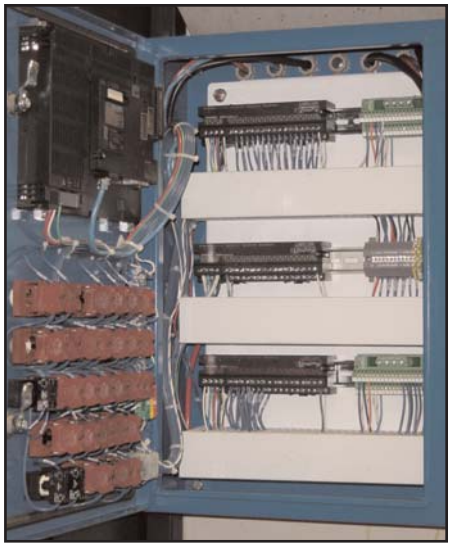
The fourth C64 controller manages the seventh machining station with four axes of control. Therefore the first CC-Link network serves a total of 28 axes of movement. This CC-Link network handles over 1000 I/O points for communicating status to the four C64 CNC controllers as well as transmitting commands to control other functions of the machine.

The second CC-Link network consists of 24 Mitsubishi Remote I/O modules to handle the various inputs and outputs on the IMASFLEX machining center. This second network connects more than 600 inputs and outputs to manage the actions necessary to machine complex features and intricate part details. These I/O consist of operator push buttons and selector switches for complete machine operation, pneumatic valve manifolds to control tool and part manipulations, tool changer inputs, over-travel / home switches, cooling pumps / valves, lubrication systems, hydraulic systems, and chip removal and filtration systems, as well as various outputs and indicators to assist the operator in managing the IMASFLEX machining center.

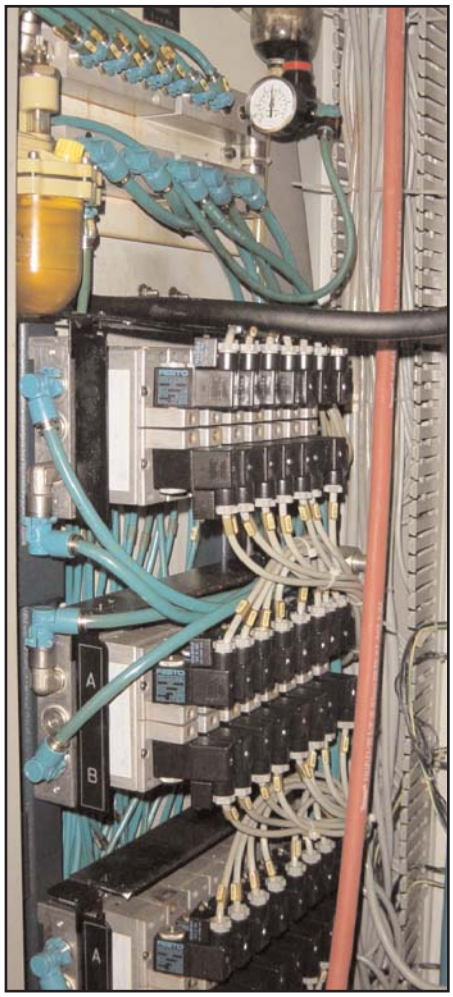
One of the seven machining stations within the IMASFLEX

Control cabinet with Mitsubishi C64 CNC Controllers

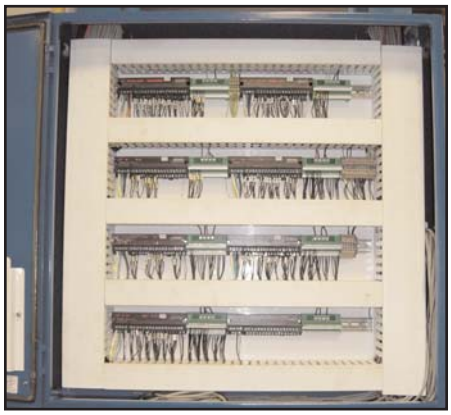
Front of one of the operator control panels


Inside of the operator panel with CC-Link Remote I/O modules enabling considerable reduction of wiring


Black cabinet contains the pneumatic valve manifolds. Blue cabinet contains the CC-Link Remote I/O modules that control the valve manifolds. Wiring distances are minimized.



The existing pneumatic valve manifolds were retained during the retrofit, and were connected to CC-Link Remote I/O modules. An alternate approach could have utilized valve manifolds with a built-in CC-Link interface, thus eliminating the need for wiring to Remote I/O modules.


CC-Link Remote I/O modules connected to the pneumatic valve manifolds

High Speed Processing

Using the Q-Series Automation Controller and the two CC-Link Master stations, the control program is able to read all inputs and outputs on the second CC-Link network, execute the control program within the Q-Series Automation Controller (which consists of over 15,000 steps of ladder code), set all outputs, and communicate necessary information to the four C64 CNC controllers on the first CC-Link network. With each of the four C64 CNC controllers executing 7,500 steps of ladder code for a total of 30,000 total steps of code within the CNC controller setup, the total number of ladder steps exceeds 45,000. The total processing time for this entire control loop is approximately 7.3ms – a significant improvement over the previous system.

Tighter Tolerances

In addition to the cost savings and increased productivity associated with the installation of the CC-Link network, quality of the machined parts was also vastly improved. This reduced variation so T&L can maintain tolerances right-on-center. With the original (replaced) CNC control system, circular interpolation was difficult to accomplish. With the Mitsubishi C64 CNC Controllers, T&L can hold tighter tolerances enabling them to produce a wider variety of products for any market.

CNC Operator Interface on a moveable track

Closer view of the Operator Interface

Efficient Parameter Setup

To make set-up of the CNC machining parameters easy, a single CNC operator interface panel is used for all 7 machining stations. This panel is easily moveable on a circular track so that the operator simply positions the panel adjacent to the particular station upon which he is working.

CC-Link in conjunction with Q-Series Automation Controller easily handles complete re-mapping of the operator interface panel I/O to control any of the seven machining stations at the touch of a station selection pushbutton. The operator panel is completely re-mapped and connected to the appropriate C64 CNC controller seamlessly and instantaneously.

More Retrofits Underway

CC-Link networking and Mitsubishi controls have proven so reliable and cost effective that two more IMASFLEX machining centers and one Liberty machine will be retrofitted with CC-Link networking and Mitsubishi controls within the next year. A fourth IMASFLEX will be retrofitted with the same CC-Link networking and Mitsubishi controls next year. With the cost savings and improved productivity using the CC-Link network, the economics of installing and using CC-Link provided T&L Automatics with the capability to produce parts at a cost to compete globally. They now ship products manufactured in their Rochester, New York facility to customers across the globe including Asia, Europe and South America.

Extremely Fast Commissioning

Unique Automation is a motion control and fluid power distributor and system integrator that builds relationships and partnerships with their customers, and provides value-added services. They provided a cost effective solution for this challenging application. Their business philosophy is built on competitive pricing and professional service. They have had prior experience with two other major industrial automation control networks. Their experience with the CC-Link network resulted in a network application that was far easier to install and configure, and has proven to be far more reliable and cost effective. According to Unique Automation Engineers and T&L Automatics personnel, once they started the initial power-up sequence the CC-Link networks were operational within hours, allowing the debug and commissioning phase to commence almost immediately without the need to diagnose any network related issues. In fact, the retrofitted IMASFLEX CNC machining center was completely functional the first day they started the commissioning process.

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