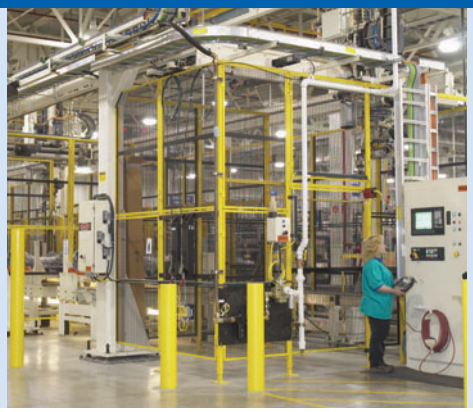


Application Story: Daimler Chrysler

COMMON CONTROL SCHEME ACHIEVES UNCOMMON RESULTS

AT CHRYSLER GROUP TRANSMISSION PLANT...PRACTICALLY SPEAKING

With over 250 pieces of machine tool, material handling, transfer line and other equipment, development of the new Indiana Transmission Plant II (hereinafter ITP2) was a real challenge, according to Julian Joe, DaimlerChrysler Advance Manufacturing Engineering (hereinafter AME) controls/plant engineering manager.

Different machine tools and other equipment were to be constructed in various countries worldwide for this plant.

Chrysler Group operates three transmission plants in Kokomo, Indiana, with ITP2 producing the W5A580, a rear-wheel drive transmission designated for use in the various vehicles including the Chrysler 300, Dodge Magnum and Jeep® Grand Cherokee.

Initial production at ITP2 only began in June, 2003 and production goals were quickly reached.

During the design phase of the ITP2 facility, over 40 machine tool supplies were issued a comprehensive set of performance and data transfer requirements. For each machining operation, there were specific targets to be achieved.

At the other two existing Chrysler Group transmission plants in Kokomo, a majority of the machine tools had resident (non-network) CNC or PLC controls onboard. Based on input from these other plants, AME drafted a white paper on the control technology, previous experience with suppliers, the need for operator interface commonality, the quality control system and the connectivity requirements for ITP2. Siemens was able to incorporate Chrysler Group's requirements into its TRANSLINE System Solution. The result was a system-wide solution for the ITP2 plant that leveraged the global standards of TRANSLINE along with Chrysler Group's plant-specific requirements.

Simultaneously, the core strengths of existing hardware at NAG1 were evaluated by the AME team, following visits there. As Kulraj Randhawu, AME controls engineer, pointed out, "For our purposes at ITP2, everyone agreed connectivity was key, plus we were beginning to realize the need for a common PC front end on all the controls. This conclusion was driven by our personnel allocation strategies and flexibility requirements, more so than either NAG1's protocols or even our own experience at the other Kokomo plants."

Approximately 160 CNC and 400 ancillary PLC devices were required for the plant's various machine tools, transfer lines, robots and other materials handling devices.

One of the essentials in assigning the controls specifications, according to Julian Joe, was "to develop an overall framework of operations which was as comprehensive as possible, to determine if the machine builders might utilize common display language and screens."

In a massive time project, AME isolated all the specifications and functionalities for ITP2 and arrived at a commonality for all operator interfaces.

Every machine builder was then given the option to choose a control provider. As Joe observed, "The more we came back to the notion of common control schemes, the more we favored Siemens and their TRANSLINE system solution. However, we did not mandate a control to any machine builder, at any time during this process," he emphasized.

Siemens offered its web-based Sitescape technology to facilitate better transfer of all information, especially changes, to all the builders whose machines would ultimately communicate on the factory floor at ITP2.

Above left: Cinetic Automation provided this first stage of clutch front carrier assembly equipment. All operator screens are identical, using the Siemens TRANSLINE system. All process data run to an intermediate zone controller, via PROFIBUS. 18 zone controllers are located throughout ITP2.

Above center: Siemens SINUMERIK 840D with HT6 handheld pendant on a VILO unloading gantry system. As the transmissions are completed, each pallet is scanned and identified by vehicle destination before final packaging and shipment.

Above right: Heller transfer lines feature Siemens 840D CNCs on all machines, as well as the TECH-TRAK asynchronous pallet transfer system from Westech Automation. Three (3) zone controllers and a master control operate this massive system.

Working with the Siemens account program manager, Gary Bash, the AME engineers authored a staged execution plan for all the builders, which included onsite inspections of the machines in process. The control supplier provided utilization opinions, design expectations, technical and application advice to both Chrysler Group and the builders on how best to implement the particular CNC, PLC, motor and drive packages, plus the PROFIBUS networking and data transmission hardware, for optimum results. AME assigned four full-time engineers to the task of executing the plan process. As Joe observed, "Getting expert advice from their (Siemens) engineers simply made our guys better. A trust was established. It was especially helpful to have Gary and his counterpart in Germany, Klaus Kasperuk, as interfaces between us and the dozens of builders involved in this project."

As the machine tools were in production at plants in multiple countries, a program seminar was conducted in May, 2002 at the Siemens office in Stuttgart, with representatives from Chrysler Group and all the machinery/equipment suppliers in attendance. All changes were reviewed and the entire control scheme was finalized. As Bash notes, "Siemens had to build to Chrysler Group and North American automotive standards. One of our chief engineers, Andrew Grimshaw, visited nearly all the builders personally to resolve the communications (between machines) issues."

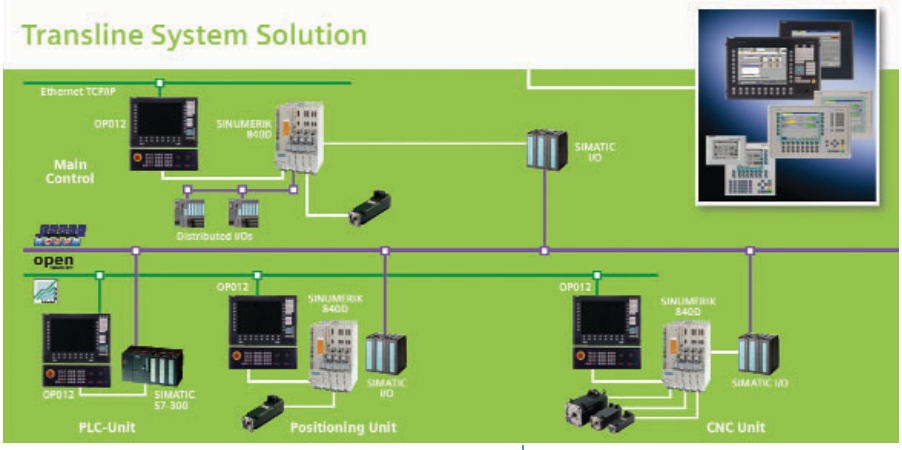
Numerous field trips followed to review the final build stages and runouts, by both Chrysler Group and Siemens engineers.

"In early 2003, as the machines came into Kokomo," states Joe, "we literally plugged them in and they all ran together. It was the same way I imagine a symphony conductor feels when he first hears all the instruments on the same page, so to speak," he quipped.

ITP2's plant manager echoed this sentiment. "This was the most successful start-up in Chrysler Group history, despite the considerable challenges of creating such a unified production picture," said Ed Vondell, who also noted the training his team received was key to their fast achievement of production targets.

"The learning curve on the TRANSLINE system solution was quite short, because of the ongoing projects we'd observed in Europe" added Joe. "This made linking the and-on (bingo) boards together with zone controllers and host server on an information highway much easier."

To further facilitate start-up, Siemens has onsite engineers at not only ITP2, but also at



the machine builders who supplied large sections of the equipment content. These included Heller, ICA and Gleason.

Cooperation among the machine, equipment and controls suppliers, DCS AME engineers and the ITP2 staff resulted in the delivery of all system components, on time and within budget.

On the factory floor at ITP2, cast iron, steel and aluminum are machined and assembled into the W5A580 transmission. Feeding from satellite work cells like spokes, the intermediate components travel to the hub assembly area, where final assembly into the housing, pressure/leak testing and transfer to the staging area occur. At the staging area, a pallet bar code is scanned which identifies the specific model destination for each transmission. The units are then packaged and sent off to the appropriate plant for vehicle installation.

Five operating principles drive ITP2, as detailed by Dan Cornell, manufacturing engineering manager. "We support our operators, utilize standardization where possible, implement a binary communication protocol of red/green for go/no-go on the bingo boards, maintain a simplified centric assembly strategy to minimize distances of personal travel and, above all, rely on our continuous improvement techniques to keep this plant at max efficiency."

The quality control and tool changing philosophies are likewise consistent throughout this facility. Chrysler Group Controls engineers Rich Schrauben and Yancy Laubsch, as well as tooling engineer, Dean Bazata, confirmed this fact. Rich is responsible for the aluminum machining sections, while Yancy oversees the steel gear and shaft machining sections.

Commenting on TRANSLINE in his area, Schrauben noted the different blocks and programs took some time to learn, as the different machines feed their PLCs, but the SINUMERIK 840D (CNC) common control

TRANSLINE is an automotive-specific application offering developed by Siemens as a system solution for the integration of powertrain manufacturing functions such as milling, turning, drilling, grinding, assembly and testing, under a common architecture. Based on the onboard functionality of its SINUMERIK CNC and SIMATIC PLC platforms, Siemens TRANSLINE utilizes common hardware and software components, as well as the HMI on all machine tools and other equipment. One PLC programming tool and standard programming language could thus be used by all 40 machine builders for ITP2. As AME's Joe attests, "This system made training easier for the ITP2 operators and the maintenance service teams, who could work on various machines with greater efficiency and drastically reduced learning curves."

made it easier to transition from machine to machine. Ironically, he pointed out, the programming flexibility of the Siemens control and its open architecture create myriad possibilities for combining different language protocols within the same programming block. Some challenges do occur when merging source code files, especially if changes have been made.

Laubsch echoed this assessment. He'd not previously worked with Siemens controls, having come to ITP2 from ITP1, where he worked primarily with other manufacturers. He especially cited the direct integration of Siemens PLC, CNC and PROFIBUS field bus. "Because of the simplicity of the PROFIBUS system, there are far fewer hardware I/O issues." He further noted the common TRANSLINE HMI screens work extremely well in terms of operator identification and troubleshooting.

Laubsch did mention one particular challenge his team faced, as the machines began to arrive from the builders. "Ladder logic had been specified for all the machine tools. Our electricians had some trouble understanding what they were seeing," though he noted replacements were sent immediately.

"Our operators respond very positively to the TRANSLINE system solution, as there are nearly 100 machines and ancillary equipment in our area and all but a few are on the system." Siemens also provided the drive and motor packages for most of the machine tools, rotary indexers and heat treat equipment in this department.

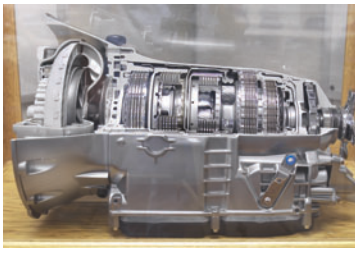
Dean Bazata approaches TRANSLINE from a somewhat different angle, as his focus is tooling at ITP2. He had extensive experience on GE Fanuc and Allen-Bradley controls, but little on Siemens.

"What we noticed from the outset was the training time reduction. The common screens gave our operator great flexibility in-plant, as most of them can run several different machines with ease."

He described the process for tool changes. "Chrysler Group design will take suggestions from us for cost improvements or their engineers will develop better durability solutions. The changes then pass through manufacturing engineering and come to me. We review the changes and, if we agree, a change is implemented. These changes can involve materials, speeds, feed rates, tooling styles, even programming tool orientations. The PC-based front end and especially the Siemens HMI are very easy to navigate and that makes changes much easier to execute." ■

Magdeburg slant bed lathe and two indexing turrets with 840D and HT6 pendant control, used for clutch retainer machining. The machine features Siemens Moore gaging, using PCU50 controls for the gaging, probes and data storage. All are linked on TRANSLINE system. The handheld pendant here is used to teach the gantry its control functionality.

Friction and separator plate build-up for the clutch housing on the W5A580 rear-wheel drive transmission. A Siemens SIMATIC PLC and SIMODRIVE 611U drives manipulate the Nachi robot. The robot stacks four plates, a camera checks the sequence and a scanner reds the RF tag on the pallet.



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