eM-PLC and STEP 7 Professional – eMPower for manufacturing process management
Model-based, automatic PLC program generation, simulation and verification

Summary
eM-PLC enables off-line verification and programming of programmable logic controller (PLC) programs. Such “virtual commissioning” prior to building the equipment on the shop floor saves significant engineering process and production ramp-up time.

Benefits
- Allow mechanical design and control departments to work concurrently by sharing manufacturing information
- Prove the feasibility of the production cell and its time cycle
- Increase the speed, consistency and reliability of design processes
- Catch logic errors well before ramp-up
- Cut time and cost by creating shop-floor documentation off line
- Visualize and optimize functionality and behavior early in the production engineering phase
- Evaluate PLC program changes on the virtual model instead of taking risks on the real equipment
- Allow pre-commissioning on real-hardware PLC
- Include operation of the cell by connecting the real Human-Machine interface (HMI)

With time and cost considerations putting pressure on new product introduction (NPI), PLC programming can no longer be seen as an isolated, independent function of moving a product forward onto the shop floor. By integrating eM-PLC, from UGS, and STEP 7 Professional, from Siemens, you can optimize your engineering process and help cut ramp-up time significantly.

eM-PLC and STEP 7 Professional allow engineers from both mechanical design and control departments to work in parallel and share information. The software enables the automatic generation of PLC programs directly from the virtual manufacturing cell and allows for “virtual commissioning” prior to building the equipment on the shop floor.

A seamless path from process design to shop-floor automation
eM-PLC enables you to generate optimized PLC programs to the shop floor. As part of the suite of eMPower solutions for manufacturing process management (MPM), it allows engineers to design manufacturing cells, digital special machines and processes in a 3D virtual environment and then introduce control information into that virtual environment. The system automatically generates a PLC code, which can be simulated and verified before it is downloaded to the PLC on the shop floor. By moving the testing and commissioning process from the shop floor onto the control engineer’s desktop, eM-PLC accelerates the planning and engineering process, the commissioning phase and production ramp-up.

Accelerating commissioning and time to ramp-up
During the ramp-up of production lines, as well as in the machine building and digital special machine building business, time to ramp-up and risk of error have become crucial factors. Repeated manual input of the same data throughout the design and programming process, a potentially high source of errors, can be avoided by implementing eM-PLC’s seamless path from process design to shop-floor automation.
Use case: automatic PLC program generation

eM-PLC fulfills all the basic and advanced requirements for PLC program generation much like a very experienced control engineer:

- It automatically defines all used variables (tags) in the symbol table, according to IEC 61131-3 addressing, while respecting user-predefined and protected input/output/memory areas.
- It translates the functional sequence of operations (SOP) into a sequential flow chart (S7-GRAPH). The splitting of such sequences into independent sub-sequencers and automatic synchronizing is a built-in functionality that allows for the integration of maintenance considerations as well.
- It supports ladder-logic, function block diagram, instructions list and SCL (structured control language).
- It fully integrates user-defined function block libraries, and enables automatic assignment of variables to library elements.
- Using “black-box” logic block elements, equipment without mechanical motions or without 3D representation may be integrated.
- The option to make manual changes in STEP 7 Professional and to recognize and use them (upload) in and together with eM-PLC is widely supported.
- Tested and approved programs may be easily integrated into existing PLC programs.
- Advanced variant handling allows for the effective re-use of resources to support various working modes.

Use case: virtual commissioning

Since control engineers do not have direct access to accurate, up-to-date data from the mechanical design, the resulting control designs and programs can be tested and validated only when real equipment is placed on the shop floor. The building and commissioning phase is usually on the critical path of bringing a new product to market. Direct costs, production start delays, lost revenue and, on occasion, lost market share can occur whenever there is any design change or rework.

By generating the PLC program in the design phase, and then using eM-PLC/STEP 7 Professional to simulate the production cell in a virtual 3D environment, the production cell can be validated and analyzed in the design phase. As a next step, an OPC connection lets the PLC program run on the real-target PLC and check the simulation one step closer to the shop floor. This also helps provide a full user environment that includes the real HMI (human-machine interface) to control the production cell. This process, called virtual commissioning, eliminates problems that might otherwise be discovered later on the shop floor.
Hardware requirements
Tecnomatix™ eM-PLC and Siemens STEP 7 Professional run on Microsoft Windows 2000 and XP and should be installed on the same computer.

Minimum PC configuration: Pentium III 766MHz with 512MB RAM.

eM-PLC/STEP 7 professional workflow sequence

Data preparation
- Step 1: Import the relevant CAD data into the modeling environment
- Step 2: Add the relevant kinematics behavior and additional model resources by taking advantage of the strong library handling
- Step 3: Define the functional sequences (sequence of operations) using drag and drop in a Gantt chart (as in Microsoft Project 2000)

This data preparation can be done either in eM-Workplace or by using the modeling functionality of eM-Engineer.

Automatic PLC code generation and programming
- Step 4: Take advantage of the automatic signal generation and automatic creation of the sequential function chart (SFC)
- Step 5: Add all the needed control definitions (such as transitions, supervisions, alternatives, integration of library function blocks, definition of call hierarchy, etc.)
- Step 6: Let the system automatically, and quickly, create an entire STEP 7 project

Virtual commissioning
- Step 7: Run the program on a virtual PLC (STEP 7 PLCSIM) and verify it using the virtual cell. Check for the correctness of the control logic, evaluate emergency scenarios and optimize behavior
- Step 8: Test your program using a real PLC and optional real HMI (human machine interface) against a virtual cell using OPC

eMPower solutions for MPM

The Tecnomatix eMPower suite makes up an end-to-end collaborative solution that enables the planning, design, analysis, optimization and operation of manufacturing processes – letting users create and share manufacturing information across the enterprise and throughout the supply chain.

eMPower solutions help manufacturers implement effective MPM strategies – from sharing product and process designs, to joint process planning and engineering by teams in distributed locations – helping planners to make decisions such as where, how and with what resources to manufacture products.

Leading manufacturers around the world are adopting UGS Tecnomatix solutions to expand revenue potential by reducing costs, accelerating product introductions, shortening time to volume and optimizing production execution.

For more information about UGS Tecnomatix solutions, visit www.ugs.com.

Contact
UGS
Americas 800 498 5351
Europe 44 1276 705170
Asia-Pacific 852 2230 3333
www.ugs.com

UGS, Teamcenter, Parasolid, Solid Edge, Femap and I-deas are registered trademarks. Tecnomatix and NX are trademarks of UGS Corp. All other logos, trademarks or service marks used herein are the property of their respective owners. ©2005 UGS Corp. All rights reserved.