Solutions

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Particularities:

- Hardware Configuration Link – available solution for integration of E design and automation
- Handing-over of engineering information about the automation structure to a system manager in standard and series production
- Data not generated in duplicate
- Avoidance of delays and communication problems
- Elimination of sources of error and automation of the processes
- Automatic planning / assignment of the quantity structure from the preliminary planning with the automation components for individual manufacturing and process industry specified in the system manager
- Quick transparency in case of faulty planning
- Description of the automation system in a standard format based on XML
- The format is supported by the systems suppliers Siemens (STEP 7/HW-Config) and Beckhoff (TwinCat)

AUCOTEC

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Description:

Hardware Configuration Link – AUCOTEC offers components for integrating E-CAE with hardware configuration

Task:

The classical E design in mechanical engineering and plant construction concentrates - at least in medium-size to large enterprises - largely on the creation of circuit diagrams and switching center layouts as well as on documents derived therefrom, such as terminal and connector diagrams. With integration solutions for economic and organizational fields of activity (PLM, EDM and PDM) as well as for manufacturing and manufacturing preparation, E designers too participate in company information management.

Due to the growing influence of decentralized information processing and the increasing use of field bus and remote I/O systems and their hardware components, there is a concomitant increase in the “integration pressure” for E design and the field bus/ hardware configuration and the commissioning of the systems, respectively.
The reasons for this are apparent: The growing number of inputs/outputs to be processed in E design and the growing complexity and variability of the automation systems. Both areas of engineering must learn to understand each other automatically via information technology; using “manual” information transfer, the amount of information can be mastered only with difficulty and is accompanied by frictional losses.

On the side of the hardware configuration, system managers are increasingly used for defining and putting together subassemblies, addressing and parameterization as well as for the commissioning and diagnosis of the automation systems. Examples for this are STEP 7 / HW Config for the control system Simatic and the process control system PCS 7, the system manager TwinCat from Beckhoff, PC Worx from Phoenix Contact and RSNetWorx from Allen Bradley.

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Description:

The workflow for the users of E-CAE systems should be considered in a differentiated manner and can be divided into two user groups:

Mechanical engineering - standard and series production
The E designers usually use a small “module spectrum”, i.e. only a few of the multifarious automation components available on the market are used, in many cases always the same selection. In this case the supplier of machines or plants can select the “optimum” automation system. With machine types having the same or at least very similar designs, a mechanical engineering company will change its bus or control system only exceptionally.
With these prerequisites, the know-how in the electrical engineering department increases via the specific hardware configuration. All of the rules required for the setup and arrangement of the modules are known, there is no need for a special system management. Therefore the setup of the automation system is effected directly in the E-CAE system, including assignment of addresses (symbol operands/definition of variables and absolute addressing).

The requirements of these customers mainly concern the transfer of the engineering information on the automation structure to a system manager, thereby avoiding duplicate creation of these data. A unidirectional integration is sufficient.
In this way time can be saved, communication problems can be avoided, sources of error can be eliminated and the process can be automated.

Plant construction, mechanical engineering with a high degree of individual manufacturing and process industry - individual manufacturing and large projects
The spectrum of modules for these users can frequently not be mastered by an automation engineer without using special tools. He will need support by e.g. STEP 7 already when defining the system. He gets all necessary information via an I/O quantity structure originating from preplanning in the E-CAE systems. These inputs/outputs are ideally identified by means of a symbolic address (also called variable).
The demand on integration is therefore more complex: It contains the transfer of the input/output quantity structure to the HW manager in form of the list of symbols, the definition of the system structure in the system manager (specification of the modules), the subsequent assignment of the modules to the “symbolic” inputs/outputs of the quantity structure (an exemplary solution is integrated into TwinCat from Beckhoff) and the transfer of the automation project back to the E-CAE system. The latter evaluates the project information via the HW design and creates the module overviews and the linkages to the input/output representations. For this purpose the symbolic address is used, it is the key for the input/output information.
Thus there is an automatic planning / assignment of the quantity structure from the preliminary planning with the automation components specified in the system manager.
By eliminating “retrospective project planning”, time can be saved and communication problems can be avoided. Sources of error are minimized, and faulty planning is made transparent. The information flow can be automated.

Solution:

Integration format XML
The basis of any integration is a format description that defines the amount of data and objects that are of equal importance for both integration partners (E-CAE and hardware configuration/PLC management). Due to the hierarchical structure and the system-independent data structure, a standard format based on XML is the obvious choice for describing an automation system.
AUCOTEC has defined such a format and integrated it into all AUCOTEC products.
The format will be supported by the systems suppliers Siemens (STEP 7/HW-Config) and Beckhoff (TwinCat) and will thus be the basis for the coupling of the AUCOTEC products and the HW configurators.
The aim of AUCOTEC is to establish this format as an integration standard and thus to ensure openness for all future couplings and integration solutions while striving for system independence of the interface solutions for E-CAE and HW configuration.

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Description:

The information contained in the interface file encompasses network specifications, information on the rack, module descriptions and input/output assignments, thus containing all possible levels of information of an automation system.

Unidirectional transfer E-CAE -> HW configurator:
For this kind of application AUCOTEC has designed an interface that creates an XML file from the E-CAE data. Using a converter, this information can be transformed into the system-specific format, e.g. by using a STEP 7 processor developed by AUCOTEC or a special processor from Beckhoff.
The creation of the HW project can be started anytime with any selection of data. It can be effected "online" or "offline" (e.g. by another department/company).
The creation of e.g. the STEP 7 project or the XML structure required for this purpose is effected directly from ELCAD, RUPLAN or AUCOPLAN.

There are 2 possibilities to use this integration module:
1. The only outcome is the output of the XML file. This file is stored in the file system of the CAE workplace and can be forwarded or sent out as desired. To create the HW project, the converter (e.g. ELCAD -> STEP 7) is started at another workplace, the XML file is selected, and the HW project is created.
2. There is a direct conversion of the CAE data into a HW project via the XML format using a single process. In this case the converter is called directly from the CAE application. However, precondition for this is that the system manager (e.g. STEP 7) is installed at the same workplace.

During conversion into the HW project, system checks are carried out:
1. Overlap of assigned addresses (I/O ranges, user numbers, slot assignments, rack number allocations)
2. Assignment of the modules (master-slave, CPU I/O module)
3. Compliance with the system families via the order numbers of the module assemblies

Bidirectional transfer E-CAE -> HW configurator / HW configurator -> E-CAE
The AUCOTEC development team realized the following solution for "bidirectional integration":
An interface transmits the quantity structure of the I/O addresses (symbolic addresses + location + function text, possibly information on the external device) to the HW configurator. The modules required are defined in the configurator as a function of the quantity structure.
The modules and their HW channels are assigned the inputs/outputs of the quantity structure. Simultaneously the addresses are automatically assigned.
The completed automation concept is transmitted to the E-CAE system as XML file. The corresponding items are created in the E-CAE system from the system information.
The assignment of the symbolic addresses to the I/O modules can be evaluated from the information in the transfer file and is used for the automatic creation of references between I/O card and single-bit representation. An automatic assignment of the input/output quantity structure can be effected in the E-CAE system. Prerequisite for this is among other things the key attribute "symbolic address".

Summary:
The wish of the automation and electrical engineering sectors for usable, available solutions for integrating E design with automation that go beyond the conventional "PLC assignment lists" has become reality with AUCOTEC. Instead of time-consuming "retrospective project planning" of the input/output components on the automation side, all of the information concerning hardware setup, hardware assignment and the variables to be used for programming is transferred by means of an XML format usable by both sides. In this way it will be possible to further optimize the processes in E engineering in future.