Logic module - with on-board Ethernet

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For 15 years logic modules have stood the test in automation technology among simple components such as time switches, contactor relays, which are programmed using wires and screwdrivers, and PLCs which require particular skill. With additional functions of the latest generation, such as on-board Ethernet interfaces, data logging on SD cards, astronomical time switch, macro creation, and more, the fields of application have widened considerably and configuration has become much easier.

There was a gaping void between conventional switch technology and programmable logic controllers (PLC), in the automation market when the author’s company introduced a particular logic module in 1996. It offered an efficient alternative for simple automation tasks in industry and building technology and lay the foundation for a new category of units, and to this day it has been very successful. The secret of this success? The flexibility in applications with easy configuration was a novelty. For the user, this meant:

- Space saving and less wiring work through the use of a programmable logic module instead of many conventional components. Even the first logic module with six digital inputs and four digital outputs impressed with its integrated display. To date, this enables programming even without a PC, simplifies commissioning and testing, replaces the additional text display for adjusting process parameters, as is normal with PLCs, and forms the basis for the simple handling of the unit.

Through consistent focus on user and market requirements and constant consideration of trends in automation technology, the logic module has become the market leader in this performance category. The stages of development along this path were:

- More digital inputs and outputs and larger programme memory.
- Additional use as intelligent slave on the fieldbus AS interface.
- Integrated analogue inputs and additional message texts for operator guidance.
- Transfer to modular, expandable basic units.
- Drastic reduction in cycle time, simple closed loop control and analogue outputs for variable speed drives.
- External display and improvement of the message concept with bilingual operator guidance.

Unique selling points such as the usability of all three power phases in one configuration or the option to combine units for 230 V signals in domestic use with analogue expansion modules eg for temperature regulation and the easy integration in a Konnex system make these logic modules favorites in the installation sector as well.

The numerous providers who have since added similar products to their portfolio also demonstrate that this product pioneered the flexible, efficient and cost-effective automation of small applications in industry and buildings.

Versatile communication opportunities open new fields of application

Today the communication standard Ethernet is dispersed just as equally in the commercial IT world, including the private PC networks, as it is in the industrial IT world, including building technology. The author’s company takes advantage of this world standard with two additional logic modules - '12/24 RCE' and '230 RCE'.

- The figures represent the supply voltage.
- R for relay output.
- C' for integrated real time clock.
- E for the integrated standard Ethernet interface for programming and communication between logic modules and units with Ethernet interfaces in this company's portfolio: Simatic S7 controls.
Logic modules can communicate with each other as master-slave or master-master
In a master-slave set-up only one logic module processes the user programme as master, while the number of usable inputs and outputs can be increased with a maximum of eight further logic modules as slaves. Maximum 88 digital inputs, 80 digital outputs, 40 analogue inputs and 18 analogue outputs can be used in the same system. Thus the slave units do not process any of their own programmes; they only provide the input information and execute the output commands.

In a master-master set-up, a maximum of eight Ethernet connections to the logic modules can be established. Each unit thus runs its own user programme and they exchange pre-defined data between each other. Thus small, linked automation systems can be created which increase the number of I/Os and indirectly expand the programme memory.

Communication with higher-level controllers enables new applications
Furthermore it is also possible to connect logic modules directly to the automation structures via Ethernet using the Ethernet interfaces, such as Simatic S7 CPUs, HMI panels or via OPC servers and PCs. This opens up completely new opportunities for data storage and graphic visualisation, for online remote access to the logic module for maintenance purposes or for operator guidance using touch screen technology. Two so-called CSM modules (Communication Switch Modules) each with four Ethernet ports are available for multiplying the Ethernet interface.

Cost-effective interfaces between different controllers and a management system
A project example: In a factory the production figures of machines made by different manufacturers should be collected for the management system. A direct connection of the machines was not economically viable. The new logic module was installed in order to record the production figures and to convey this to the management system via an HMI system (WinCC) and OPC server. The key to success here was the cost-effective connection via Ethernet and the maintenance electricians who learned about this in their vocational training.

Impressive solutions for building management systems as well
Another example: Cost-effective solutions could also be achieved in building management systems thanks to the new communication mechanisms.

In order to meet the requirements of the homeowner, a solution with the conventional building bus systems would have cost approximately EUR13 000 (approximately R136 890 at time of print), which the user was not prepared to pay. A solution based on the new logic module, coupled via Ethernet, could be offered for approximately EUR 3 500 (approximately R36 855 at time of print), including visualisation on a basic panel. This impressed house-builders and will certainly be copied by many followers.

Additional innovations result in simplifications and time and cost savings
Standard SD cards can be used as a cost-effective external storage medium. Therefore programmes can be copied but also data and projects along with comments can be saved easily and be readily available at the plant. With the data logging, process data for quality assurance, can be saved and evaluated later on the PC.

So for example, a complex system of PLC, PC and special software for the documentation of water level and water withdrawal from different lakes had to be renewed. This was achieved using the logic module described in this article! The benefits for the user:

• Very small space requirement.
• Considerably lower costs compared with updating the previous PC solution.
• The simplest handling through data logging on standard SD cards is CSV format (Comma Separated Value) and further processing on the office PC in Excel tables.
• Plant maintenance can be carried out by industrial electricians.
• More efficient programming and doubling of the memory capacity.
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• For processing the additional input and output signals though a master/slave communication on Ethernet, the programme capacity of the new logic module was doubled to 400 function blocks. Five new special function blocks now simplify the programming:
  • Astronomical time switch for automatic switching on and off at sunrise and sunset, for example for controlling blinds, energy saving measures for lighting systems, optimised feeding times in livestock breeding, etc.
  • Min/max function for evaluating analogue extreme values, for example for pressure or temperature.
  • Averaging over fixed, adjustable time periods.
  • Analogue filters for repressing interference pulses on analogue signals.
  • Stopwatch for measuring time during production processes.

Simple and professional configuration
Alongside the consistent development of the hardware and firmware, the software ‘LOGO! Soft Comfort’ has also been continuously optimised over the years. It is compatible with Windows, Mac OS and Linux operating systems. According to the manufacturer, simplicity and flexibility are top priorities and ensure that the configuration can be performed simply and quickly by both ladder diagram and function block diagram. The individual function blocks can be linked to the user programme using drag and drop. Programme tests are
possible as offline simulations or as online tests. The software offers professional documentation and printing functions.

Figure 4: The system software offers simple configuration with professional test and documentation functions compatible with Windows, Mac OS and Linux.

Important new features of version 7 of the software are the implementation of the commands for communication, the creation of macro function blocks with a library function, the support of the data logging and the five new function blocks. In particular the macro block functionality reduces the work with recurring applications. The programme parts are tested once and can then be used further in any other programme.

The current version of the software can be used for all previous units. By pre-selecting an old unit type, the functions offered will be adjusted to the corresponding unit type. Programmes created with previous versions can be used in the new units and expanded around the configuration of the new functions.

All-round comfortable accessories

In the mean time there are five suitable mini power supplies in the same design available: with different voltages and load currents (12 V/1.9 A, 12 V/4.5 A, 24 V/1.3 A, 24 V/2.5 A, 24 V/4 A). These recently innovated power supplies offer an improved performance level, 50% less power loss during idling, optimised switch-on characteristics for capacitive loads and an expanded operating temperature range of -25°C to +70°C and thus helps to reduce the energy consumption.

Figure 5: Power supply units with high performance level help to save energy.

Ideal additions to the units with Ethernet interfaces are two new switch modules: the CSM 230 and CSM 12/2’ in the same design for direct integration in building distribution boards. They are available with operating voltages of 12/24 V or 110/230 V and offer four RJ45 ports, one of which is mounted on the front. Thus small networks, such as in apartment buildings, can be achieved directly in the building distribution board. The switches enable the access via a PC without having to open a cover in the distribution board.

Figure 6: The CSM nables simple net-working in control boxes.

Starter kits

There are also attractive starter kits available for the new units. These contain everything that is needed become familiar with and test the performance range of the logic module: basic unit (choice of ‘LOGO! 12/24 RCE’ or ‘... 230 RCE’), system software ‘LOGO! Soft Comfort’, Ethernet cable and the HMI software, WinCC Basic V11’, with which ‘Simatic Basic Panels’ are configured. Thus a complete project incl. HMI can be configured and simulated.

Figure 7: Starter kits simplify the initial training in modern automation technology with more than 1 000 fields of application.

Conclusion

The new units open up a host of additional, cost-effective solutions in the different applications through communication via Ethernet and other system innovations. Meanwhile they already have over a thousand uses and have impressed users with their expanded range of functions.

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