Partner Product

EBG 253-EN

NXT CONTROL

MITSUBISHI ELECTRIC
Changes for the Better

nxtStudio

Distributed system programming

Hardware independent programming with
top down programming for higher reusability

e-F@ctory Partner Product

- **INTELLIGENT DESIGN** — Visualising the hardware makes it available as a software object
- **SPEED UP** — Fast commissioning and maintenance
- **FULL INTEGRATION** — IEC 61499 compliant programming environment
- **VISIBILITY** — Overcomes system design complexity

The future of automation programming

Unscheduled downtime is significantly reduced

The IEC 61131-3 standard has revolutionised automation system programming, providing a standardised programming environment that has delivered huge benefits in reuse of code, scalability to different system sizes, and portability between control platforms. But as automation projects increase in complexity, is IEC 61131 always the best approach?

In the most complex automation applications where control needs to be distributed between multiple products at different levels of the control hierarchy, IEC 61499 provides an alternative. It provides a function block approach to system programming, where users don't need to worry about the device where the code itself will reside, aiding distribution and reusability of code. And as an internationally defined standard, it ensures interoperability and portability of code even in highly sophisticated control systems.

When automation components such as PLCs, inverters, motion controllers, actuators, sensors and robots are programmed in different environments, not only can programmers find themselves having to working in many different platforms, but in many cases the memory and CPU resources within the products are not fully used. With IEC 61499, we can have a single tool for all of these products, making it easier to distribute control functionality, to make the most efficient use of the available resources.

To enable users to take full advantage of this new programming standard, Mitsubishi Electric has worked with e-F@ctory Alliance partner nxtControl to provide an IEC 61499 compliant programming environment for the full suite of Mitsubishi Electric automation products within the iQ Automation Platform. This can dramatically simplify the programming of systems that may include sequential control, distributed motion, servo systems, HMIs and more in complex industrial applications, whilst ensuring improved interoperability and portability.

Hardware independence

The solution from nxtControl is nxtONE – an integrated IEC 61499 development environment, runtime system and HMI. The nxtONE concept provides a hardware abstraction level in control engineering, such that the software program (application) is completely independent of the control hardware finally used and even the topology selected. Software and hardware are separate.

The connection to the process level and control hardware is made by virtualising the hardware. nxtONE makes the hardware available as a software object (via hardware libraries). The process connection is made in the engineering tool. The virtual hardware is also ideal for functional testing, commissioning and maintenance of the system, operating independently on a visualisation device.

In the nxtONE concept, individual technologies interact to form a unified whole. For the user, this provides a single platform within which even the most complex projects can be implemented and managed. Control engineering, visualisation (HMI/SCADA), process connection and documentation are planned with one and the same engineering tool. This object orientated, IEC 61499 environment for distributed control system brings a number of important advantages:

- Efficient engineering
- Hardware independence
- Modularity for plants and machines
- Data consistency and integrity from the process level to the ERP system
- Fast commissioning and maintenance
- Overcomes complexity

CATs facilitate engineering

In nxtONE, real devices and functions are converted to software objects called CATs (Composite Automation Type). These CATs are summarised in branch-specific libraries and these make it easier to plan machines and plants. Each CAT incorporates:

- Control logic / control engineering according to IEC 61499
- Visual representation (HMI/SCADA) including symbols, operating dialogues, etc
- Process connection of the hardware-specific I/O
- Documentation

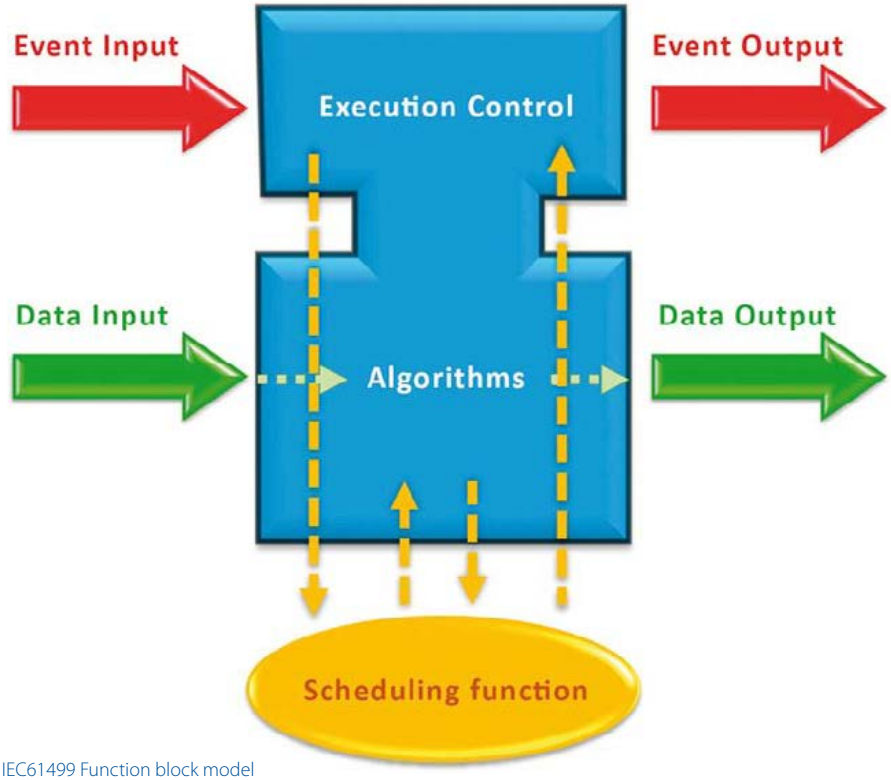
During planning, engineers can create and process instances of a type without limitation, and use them repeatedly. Complete subsystems are encapsulated as an object by hierarchical CAT-in-CAT structures. This CAT approach enables extremely fast system engineering, assured quality, and easy reusability. And users can develop their own CATs, leveraging their special applications know-how.

Single line engineering

With single line engineering, nxtControl has addressed the increased complexity of systems with distributed control engineering and visualisation. Prefabricated CATs are connected to only one single line, and this line is intelligent and detects the object to which it is connected. The function is adapted accordingly and incorrect connections are prevented. All communication connections are between the distributed control systems and the visualisation/HMI systems.

With this structure, the underlying complexity of the automation system remains hidden, but the engineer retains the overview. Error sources are eliminated and engineering is accelerated.

Further, the concept allows a combination of top-down and bottom-up engineering as appropriate, and engineers have the freedom to use prefabricated CATs or custom program these objects. By using prefabricated objects, engineering is further accelerated, object integrity is assured, and reusability is guaranteed.



IEC61499 Function block model

Virtualized hardware for efficient testing, simulation and commissioning

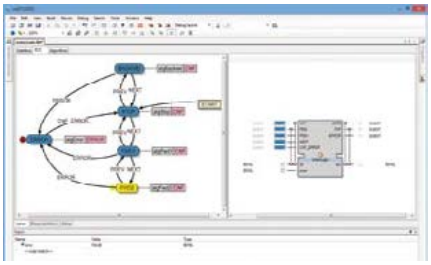
Distributed control systems

Within nxtONE functional objects are simply dragged from the library into the IEC editor, and interconnected according to the required function. The same object instances are dragged into the HMI editor within the engineering tool. The planned control logic is distributed (mapped) to the selected control hardware. The inputs and outputs of the control system are connected to the control program.

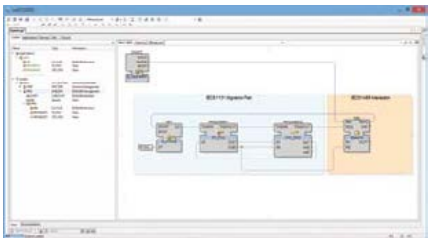
This innovative IEC 61499 sits well with Mitsubishi Electric's approach to integrated hardware within the iQ Automation Platform. The Q Series PLC backplane, for example, might contain the PLC CPU, high speed motion controller, CNC and robot controller, all with high speed shared memory and linked on a multiple CPU high-speed bus. This is very close to an IEC 61499 model for distributed control.

With tight integration of Mitsubishi Electric and nxtControl software for system design, and with nxtControl software running on the Mitsubishi Electric C controller on a Q Series backplane, engineers have it within their grasp to quickly and easily design and implement complex distributed control and visualisation systems, with assured confidence of portability, interoperability and reusability.

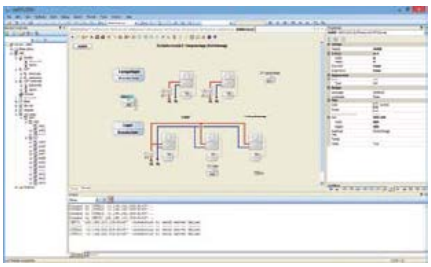
Typical application setup



Test environment for Function Blocks



Single Line Engineering - programming as simple as that



Editing visual appearance of applications

Prefabricated objects have major advantages

- Very fast engineering is made possible
- The objects are quality assured
- Re-usability
- They can be used flexibly and can, if necessary:
  - be purchased as extras
  - be prefabricated and further developed by specialists
  - be tailored by nxtControl for customers

Possible procedure:

- The system is broken down into individual functions and organised hierarchically
- Instances of the required functional objects (CATs) are dragged from the library into the IEC editor of the engineering tool (Drag-&-Drop).
- The objects are interconnected according to the required function
- The same object instances are dragged into the HMI editor of the engineering tool
- The planned control logic is distributed to the selected control hardware ("mapped").
- The inputs and outputs of the control system are connected to the control program
- Drag the hardware CAT object from the library into the engineering environment
- Select control hardware (manufacturer and type)
- Establish topology and number of control hardwares used
- Communication paths are generated automatically

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