Contrary to some predictions PLCs are thriving

PROGRAMMABLE LOGIC CONTROLLERS (PLCS) ARE DEVELOPING ON SEVERAL FRONTS AND LOOK SET TO REVERSE SOME OF THE PREDICTIONS MADE FOR THEM JUST A FEW YEARS AGO. THE TECHNOLOGY IS NOT JUST SURVIVING, BUT POSITIVELY THRIVING.

It's not long ago that the death of the PLC was being predicted as, it was thought, PCs (personal computers) would come to dominate. But in a reversal of fortunes, it now seems that the PLC is gaining ground at the expense of the PC.

Large PLCs are moving into the domain of plant-wide control – SCADA (supervisory control and data acquisition) and DCS (distributed control systems). They are not actually replacing computers, but are complementing them, allowing simpler, more efficient and flexible architectures to be realised. And the functionality that has been developed to allow this to happen is migrating down to medium-sized and even compact PLCs.

PLC with two racks: *New Mitsubishi FX3U has both left and right hand racks which allows the third generation PLC to be configured for optimised program construction and high speed operation*

Large PLCs now typically have two processors: not to double data handling capacity, but rather to provide redundancy so that if one processor fails the other instantly and seamless switches in. This capacity is vital when controlling a continuous production plant, such as in oil refining, or those intensively used machines that are common in plastics production, paper mills and so forth.

Medium and compact PLCs are increasingly based around 'multi-processor capability', but this is a rather different idea – add-on modules dedicated to specific functions. Each module contains a single specialist processor and clips straight onto the main body of the PLC to perform a specific function, such as communications, motion control, protocol conversion, or temperature monitoring.

When a PLC has expansion modules fitted, its central processor unit (CPU) performs the core machine monitoring functions, while processors in the clip-on modules focus on their specialist functions. Some of the specialist functions require considerable processing capability, which if performed in the CPU would slow down or otherwise compromise the overall performance of the control system. Most PLCs can be fitted with several such modules and so configured to meet the exact requirements of the machine they are controlling.

While many of the modules' functions are not new to compact-medium PLCs, several represent a significant step forward for the technology. An obviously important new module provides Ethernet capability, allowing PLCs to interface with complete 'shop floor to top floor' production control and enterprise management control systems.

Other modules that are opening up whole new worlds to the PLC provide IT functions, such as database management, web connectivity, word processing and spread sheets. The key role these modules fulfil is to offer person-friendly – as opposed to just engineer-friendly – direct interface to machine control and production information. With them it is possible, from a fairly simple control system, to produce management and production reports, trending information and alarm analysis in a format that is readily understood by engineers and non-engineers alike.

This opens the possibility of one seamless management team running complex manufacturing and production plants in real time. While there are few such installations yet anywhere in the world, it is no longer technology that is holding them back.

It is also to be noted that PLCs are advancing on some comparatively routine fronts. In recent years they have become faster at processing data, more reliable, I/O capacity has increased and memory is an order of magnitude greater.

New dawn arrives

An early indication of the shape of things to come may have been provided with the launch last autumn of Mitsubishi's third generation compact controller, the FX3U. The original FX, launched 25 years ago, was the world's first compact PLC (linguistic fashion has previously referred to them as 'micro' and 'brick' PLCs) and it defined what has become one of the most important tools available to the machine control engineer.

The new FX3U looks like proving just as revolutionary. As with a conventional controller, it can be expanded to the right hand side with input and output blocks and special function blocks. These communicate with the CPU over an enhanced bus that automatically switches to high speed mode when required, providing an increase in operating speed of nearly 500 per cent.

But the most revolutionary development is an adapter expansion bus on the left hand side of the unit, onto which additional analogue, temperature and positioning blocks can be mounted.

The major benefit this provides to the user is that adaptor units no longer require the use of application software to configure and operate a control system. All control is through direct access data registers and setting bits. This gives rise to faster, easier initial set-up, optimised architecture, simplified use and above all processing speeds so much higher that they stand to completely redefine the expectations of potential users.

The FX3U appears to be the precursor of a new generation of compact programmable controllers, and it is notable that most manufacturers say they will be updating their offering in this sector within the next year or two. Whether they follow Mitsubishi's lead or not has yet to be seen, but it may be that the new unit will be as influential as the first FX was in the 1980s.

Logic blocks

While it has taken 25 years for compact PLCs to get to their third generation, the smaller, simpler logic blocks have done it in under ten years. Logic blocks were originally introduced as 'slightly programmable' replacements for the trusty relay switches that had served electrical engineers for as long as anyone could remember.

The real reason for developing logic blocks was probably to save space in control cabinets, since an array of relays can take up a disproportionate amount of space. However, once six or a dozen switches had been built into a single unit, it was just too tempting not to add a bit of solid state processing capability.

Originally marketed as relay replacements – and priced accordingly – it was not long until users realised that they could perform small programs of logic with them and thus control, say, a small machine or a single function within a larger machine. The designers took this on board and a second generation soon followed that reduced the hard wring required for installation and increased their programmability.

Third generation logic blocks, already on the market from some manufacturers with others expected to follow suit in 2006 and 2007, are now definitely closing the gap with compact PLCs. At present it looks like logic blocks will never form a true continuum with PLCs, but perhaps we need to wait and see what the fourth generation will bring – which at the current rate of developments is probably only three years away.

However, one of the limiting factors for logic blocks is the programming method. While most are programmed using a few simple push buttons and even have a built-in micro screen showing a graphic of the program as it is built, they are in fact based on old-fashioned ladder logic. While this is quite easy to use for simple and even moderately complicated programming, it is time consuming and does not lend itself to certain maths based functions and other high level operations.

Additionally there is a generational shift to be considered. Younger engineers have been brought up in a world of computers and are only truly comfortable using software programming tools. To them, ladder logic is as arcane as slide rules and pneumatic logic. So users of PLCs want to leave ladder logic behind and perhaps logic blocks will have to become programmable in a high level language too.

A similar trend can be seen in the take up of IEC 61131, the international standard for structured programming. This has been around for a good few years and most engineers are familiar with it. But while older engineers are equally happy without it, younger engineers treat it almost as their default setting and use it virtually constantly.

End users are now increasingly requiring that their specific applications are standardised to IEC 61131 and often write their own function blocks. This allows them to keep control of their programs, while making it easier to change suppliers and train up new personnel. As a result, software houses are using it more and more, which in turn places a demand on hardware manufacturers to increase the memory capacity on their PLCs (the Mitsubishi FX3U for instance has eight times the memory capacity of its predecessor).

A final trend worthy of comment is the building in of PLCs into other field devices such as inverter drives and HMIs (human machine interfaces). Just a few years ago these seemed like novelties dreamt up by bored hardware designers in the same way that automotive engineers produce concept cars. But like the concept car they have indicated possibilities worthy of exploration.

It is notable that the first companies to market combined devices have tended to be those, such as specialist drives makers, without a PLC in their catalogue. This allowed them to expand their sales somewhat into the PLC domain. But now users are beginning to cotton onto the fact that combined units can be cheaper to buy and easier to install than separate components.

Experienced production engineers – possibly otherwise known as world-weary old cynics – will question their use on grounds that a small parts failure will shut down a greater part of their capacity – and indeed this is valid grounds for concern. But the flip side of the situation is that OEMs are always looking for ways to trim costs from their machine building activities. So perhaps combined units will attain much-favoured status with OEMs and in this way gain themselves a defendable market share. ■

Compact general purpose PLC launched

Panasonic has introduced a new general purpose, compact PLC aimed in particular at small and medium sized machine control.

The FP-X is said to be extremely flexible and is available in three controller sizes of 14, 30 and 60 I/O points. Each controller is expandable with its own I/O system, but can be further expanded with existing I/O combinations from the established Panasonic FP0 range, allowing a total I/O count of up to 366.

In addition to these capabilities there is a range of plug-in cassette modules that allow the FP-X to perform numerous functions including serial communications, high speed counting and analogue processing.

An 85-265 VAC power supply has been incorporated in the FP-X allowing use throughout the world. In addition, the OEM user has the ability to eliminate the possibility of their

program code being copied by disabling the ability to upload the PLC code. This feature is in addition to an eight digit password protection facility.

T: 01908 231555

E: info-uk@euro.demew.com