control design

ESSENTIALS OF HIGHLY CAPABLE MICRO PLCs

A Control Design Essentials Guide, by the editors of *Control Design*

About the Control Design Essentials Series

The mission of the Control Design Essentials series is to provide industrial machinery designers with an up-to-date, top-level understanding of a range of key machine automation topics. Our intent is to present essential engineering concepts in a practical, non-commercial fashion, together with a review of the latest technology and marketplace drivers—all in a form factor well suited for onscreen consumption. Check in at ControlDesign.com/Essentials for other installments in the series.

—The Control Design Editorial Team

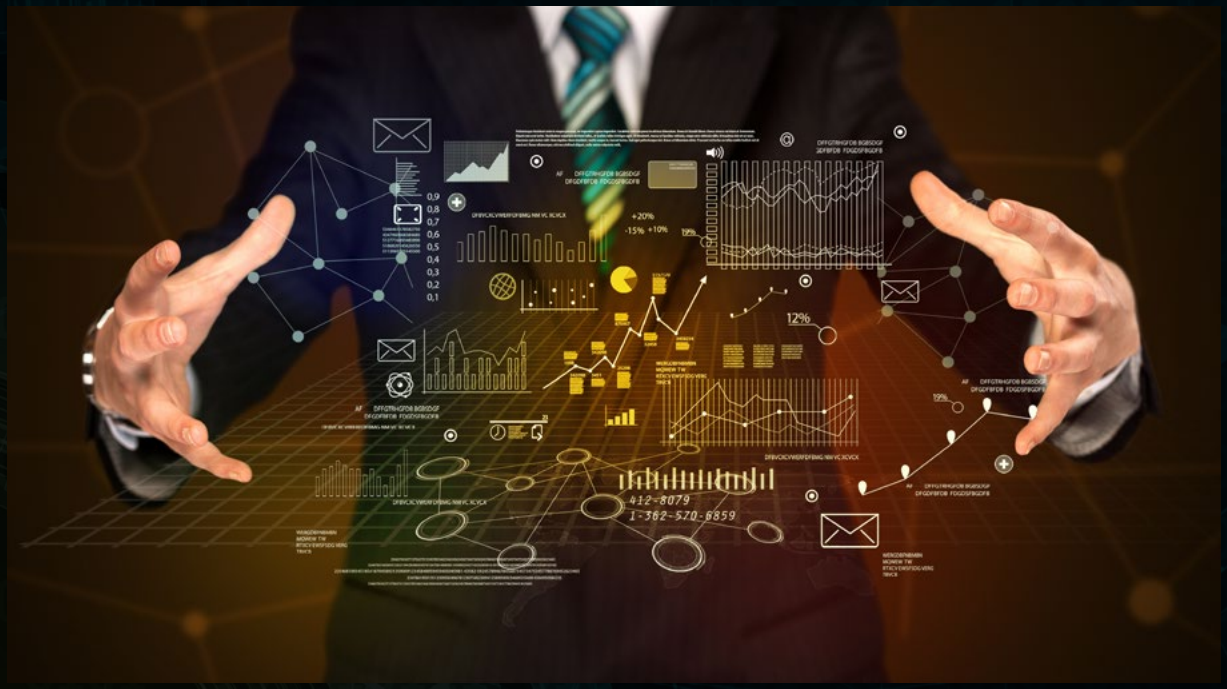
STATE-OF-THE-ART MICRO PLCs

Micro PLCs have moved to the next level. Today, they are providing PAC power capabilities and ease of programming all in a small form factor capable of providing a control solution in demanding applications.

The technology available is enabling a better and faster controller and more memory to get the job done. That teamed with quick and easy programming software are just some of the attributes needed for highly capable application solutions.

These micro PLCs must also make communication and remote access simple. Collection of data should also be built in and be accessible in a variety of ways. Mobile apps for PLCs are becoming reality, as well, and they fit well into a future-proof solution. That solution should also include a built-in HMI or Web pages for graphical functionality.

Check out how to match today's highly capable micro PLCs to one's application needs.



COMMUNICATION PROTOCOLS

There are many industrial Ethernet protocols to consider using when designing a control system. The two most popular industrial Ethernet protocols in the United States are Modbus TCP and EtherNet/IP. Most PLCs support these protocols, or they likely will be soon.

It's important to note that PLCs should have enough memory and processor power to allow vendors to provide field-upgradable capabilities, so, for example, EtherNet/IP could be added in the future if it's not already available. The ability to add protocols is an important flexibility in the PLC.

This functionality effectively adds code to the PLC to support a protocol with no need for additional hardware. The user simply downloads the PLC system firmware when available.

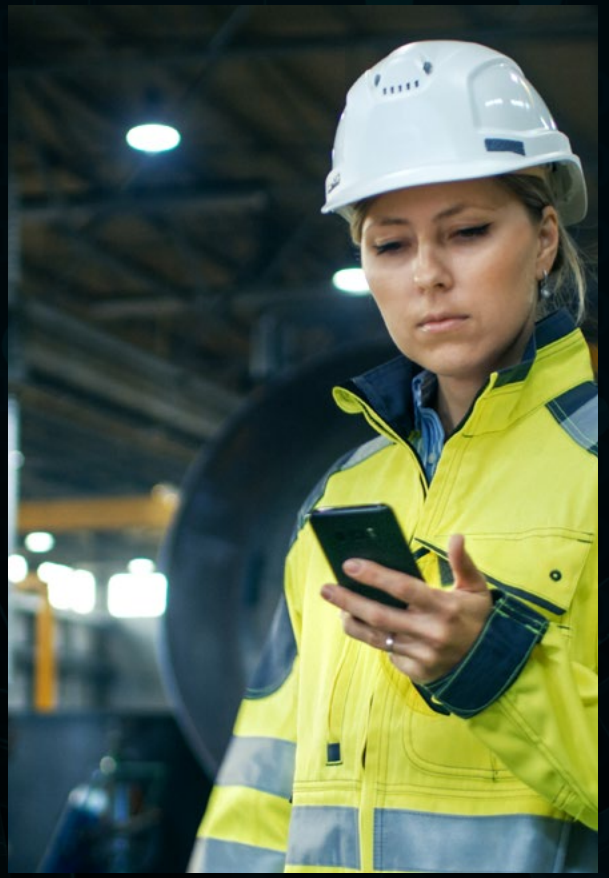
Other specialty protocols to consider include CAN J1939 which is specifically designed for use on utility vehicles and marine applications. It's used to monitor engines. BACnet is another protocol to consider that is application-specific. It is used for building automation. Whether it's a building or equipment that needs to connect to building automation, this protocol enables queries and access to that system. HVAC controls are an example.

Some PLC vendors have the future in mind, and Bluetooth will be making the connection. To keep things economical, end users don't install cellular modems or network hardware needed for remote access. However, when personnel are in the area and program updates are needed, Bluetooth can eliminate the need to physically connect to the equipment with a cable.

Bluetooth communication is becoming available and is built in to some PLCs as an option. This can be useful where there are no Ethernet, wireless or remote access connections available, especially in remote locations. If users are within about 10 meters of the controller, they can connect with Bluetooth. Using the app running on an iOS or Android device, the user can monitor and control the equipment via Bluetooth communication.

Security is needed to connect to any Bluetooth device. A password should be needed to pair to the PLC as a Bluetooth device. An additional username and password is required to monitor or change the PLC data. Read or write access should be definable, as well, depending on the user—for example, only read and no write privileges.

Bluetooth could also be configured to pair with a barcode scanner.



APPS FOR EASY ACCESS TO PLCs & THE CLOUD

With the availability of Bluetooth communication, the next logical step is the use of a mobile app to provide the ability to easily access the PLC. The app often provides a simpler and quicker connection, compared to browser-based access. With Bluetooth, the programming and maintenance personnel can connect to the controller without the worry of having the right cable or the latest programming software to download or upload. Using a smartphone or tablet they can then launch a free downloadable app for remote monitoring and control of the PLC.

The apps should allow users to monitor any PLC parameter and change set points. Standard dialog interfaces allow input, output, data register, timer and counter values to be monitored and controlled. For security, a custom dialog interface should be configurable to allow only certain PLC parameters to be monitored and controlled.

The PLCs, with Bluetooth communication, or Wi-Fi Ethernet, if available, and the apps that take advantage of that connection are also connecting to more commercial applications. The app running on a smart device connects to a cloud database sending or receiving logged data and trending that data.

Other applications that Bluetooth communication enables are email and text messages. Email and text messaging allow the user to send logged data, PLC programs and system snapshots to aid troubleshooting, updating and monitoring of systems.

The app could also send and receive PLC programs. An OEM could email the customer PLC program modifications. The customer could open the email on a smart device and, using the app, download the updated program to the PLC using Bluetooth.

Logged data can also be pushed to a local or cloud-based database, or to a data-storage platform such as Dropbox, Google Drive or Apple iCloud. In addition to logged data, other data such as user programs, firmware and recipes can be sent and retrieved from databases and storage platforms. A plant operator could also retrieve logged data from the PLC, attach the data to an email and forward it to a plant manager and a cloud-based historian.

EASY COLLECTION OF AND ACCESS TO DATA

With a PLC, it's mandatory that it do control. What is not a requirement is data collection. This is something PLCs should and can do, especially considering the Industrial Internet of Things (IIoT).

In many cases an industry-standard SD memory card is used, which allows the PLC to log data based on events or time. It also can provide storage for the PLC program and firmware. This data storage is important for medical and pharmaceutical industries. These industries log everything and need the data and information. Logging the data locally to the PLC makes it easily accessible.

Support of file transfer protocol (FTP) in the PLC also makes the handling and storing of information easier. If the user has an FTP client, such as a networked PC, the PLC can be a server of information, and the client can remotely access that data.

PLCs should also have email, text and cloud database access, similar to the app previously discussed. This allows open access and distribution of information. For example, at the end of the day, the production manager wants to know the productivity of the equipment, how many parts were made and what the problems were. To address this, the PLC can be scheduled to send out an email or text messages daily to provide status of the system. The PLC should be able to handle all of that.

Separate from an app, the PLC should have the ability to send emails and text messages to communicate things such as errors and daily log information and attach a file.

Configuring a PLC to send an email and configuring it to send a text message are similar functions. If connected to the Internet, a PLC uses a 10-digit cell number and enter a service, such as Verizon vtext.com, to send a text message, for example.

WEB-BASED HMI

IIoT capability is provided by custom Web pages. It is possible to create sophisticated and informational Web pages using the PLC programming software. For example, PLC program development software can have a built-in Web page editor with drag-and-drop simplicity to create human-machine-interface (HMI) graphical display screens. Once developed, these Web pages can then be accessed via any Web browser running on any Internet-connected device such as a remote PC, a tablet or a smartphone, enabling remote monitoring and control.

HMI is built using a Web page editor interface. The Web page editor is basically an HMI creation tool. The PLC, connected to a network with Internet access, allows phones to connect to an IP address and access the PLC's Web server.

This capability should include all the tools available to create the HMI interface. Simple drag-and-drop methods, not HTML or Java Script programming, should be used to create the HMI. Anyone should be able to build a Web page. This includes graphics, push buttons, pilot lights, trend chart, meters and color change. Simple factory displays can be provided as examples and a starting point. From there, the interface can be expanded as needed.

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