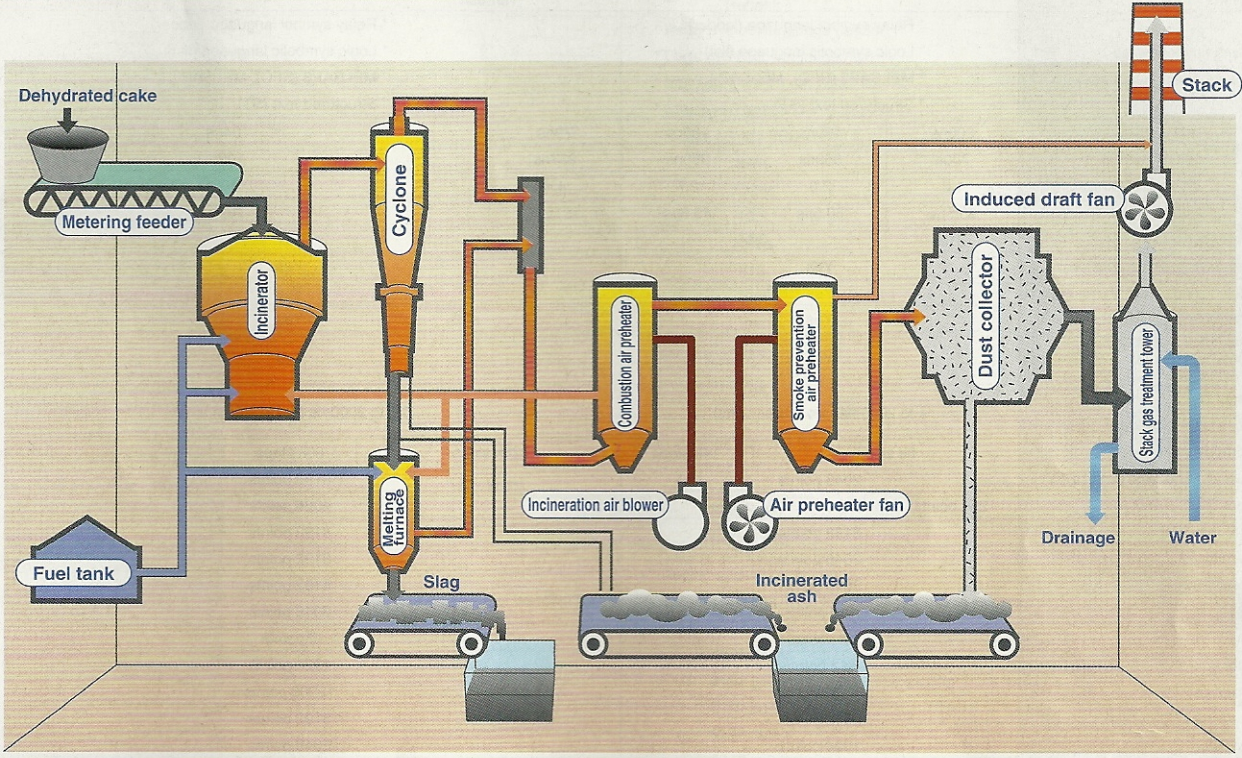
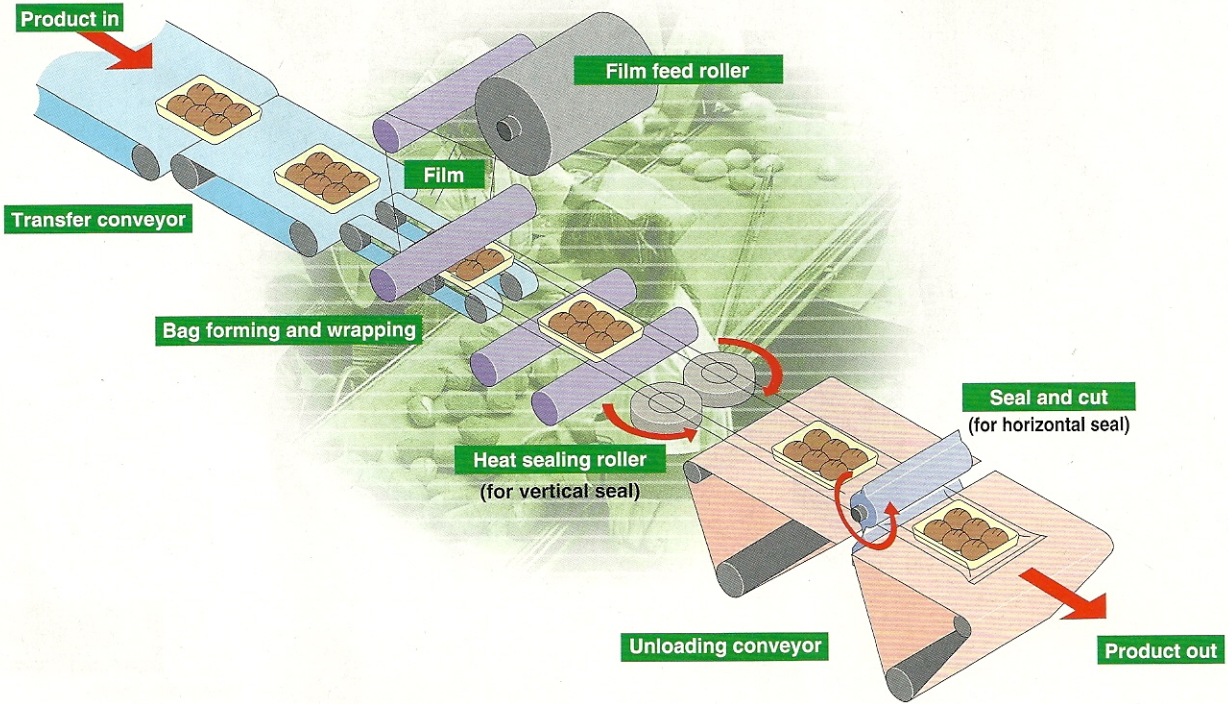
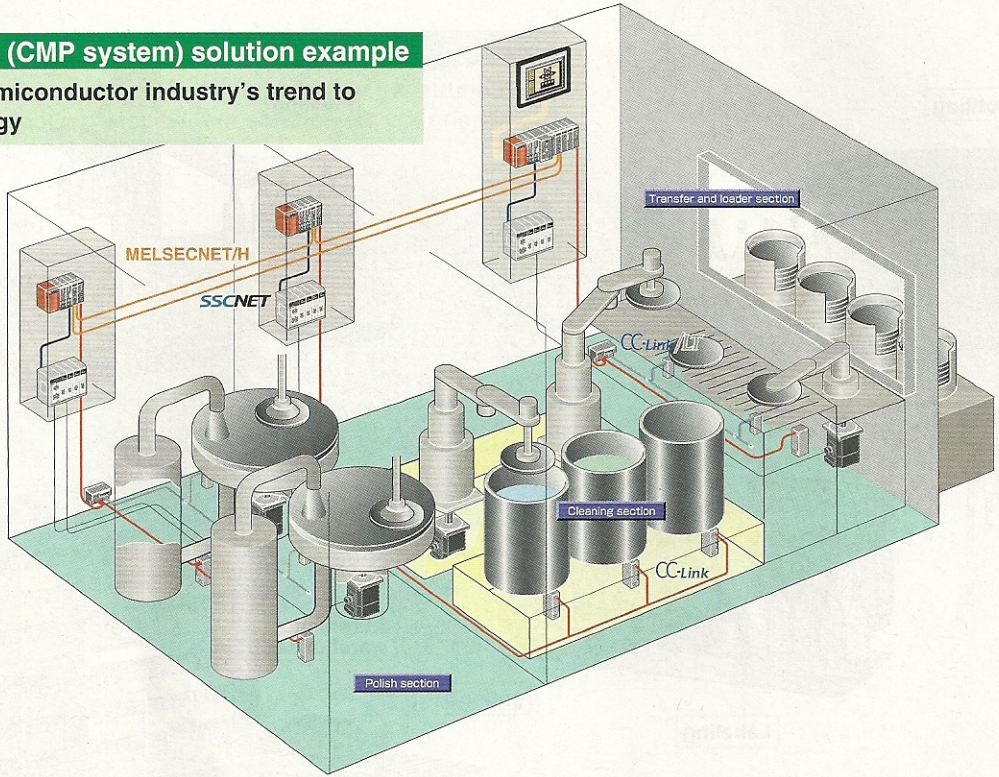
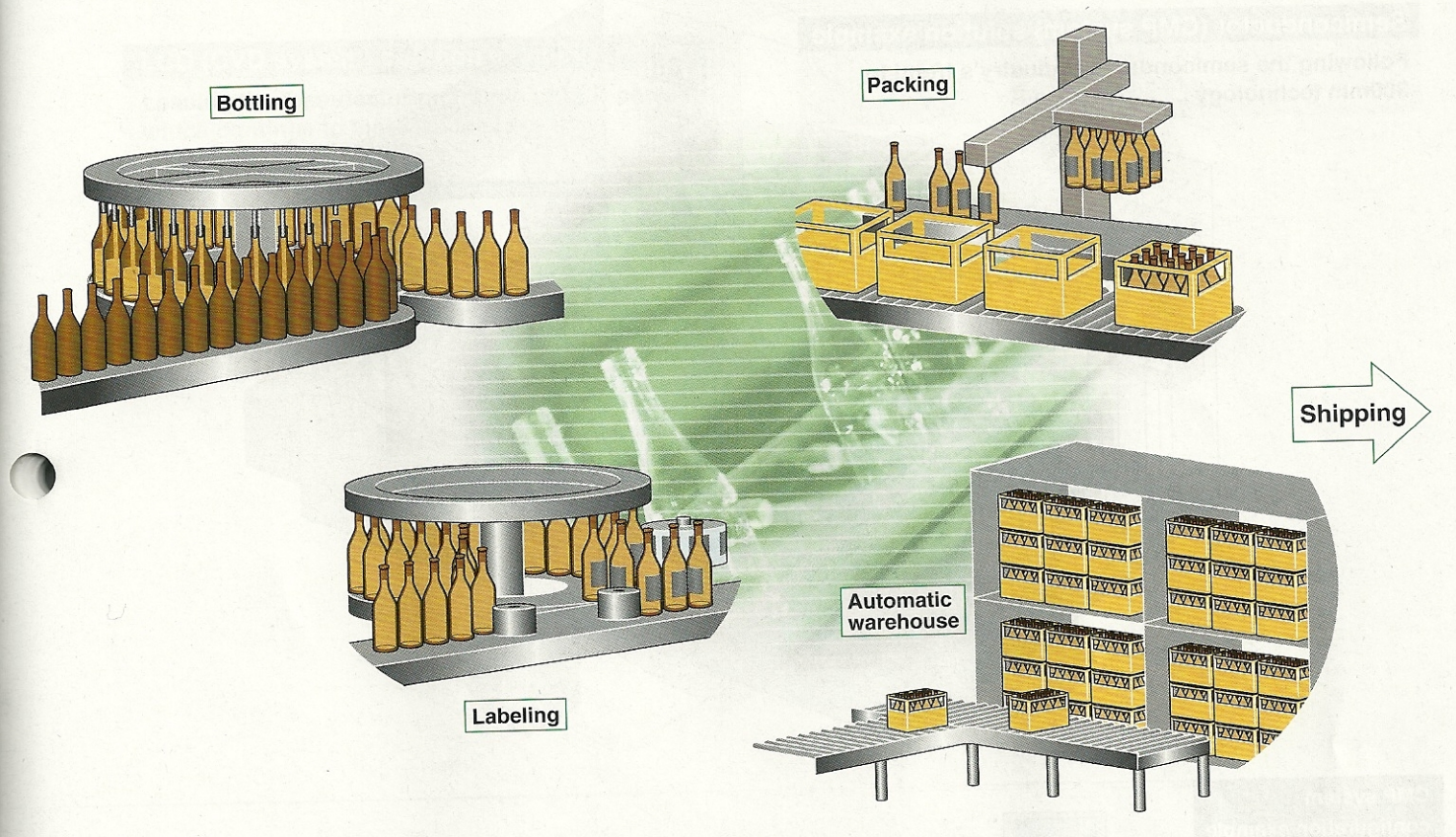

Dehydrated cake
Metering feeder
Incinerator
Cyclone
Melting furnace
Fuel tank
Slag
Combustion air preheater
Incineration air blower
Smoke prevention air preheater
Air preheater fan
Incinerated ash
Dust collector
Induced draft fan
Stack
Stack gas treatment tower
Drainage
Water


Product in
Film feed roller
Film
Transfer conveyor
Bag forming and wrapping
Heat sealing roller
(for vertical seal)
Seal and cut
(for horizontal seal)
Unloading conveyor
Product out

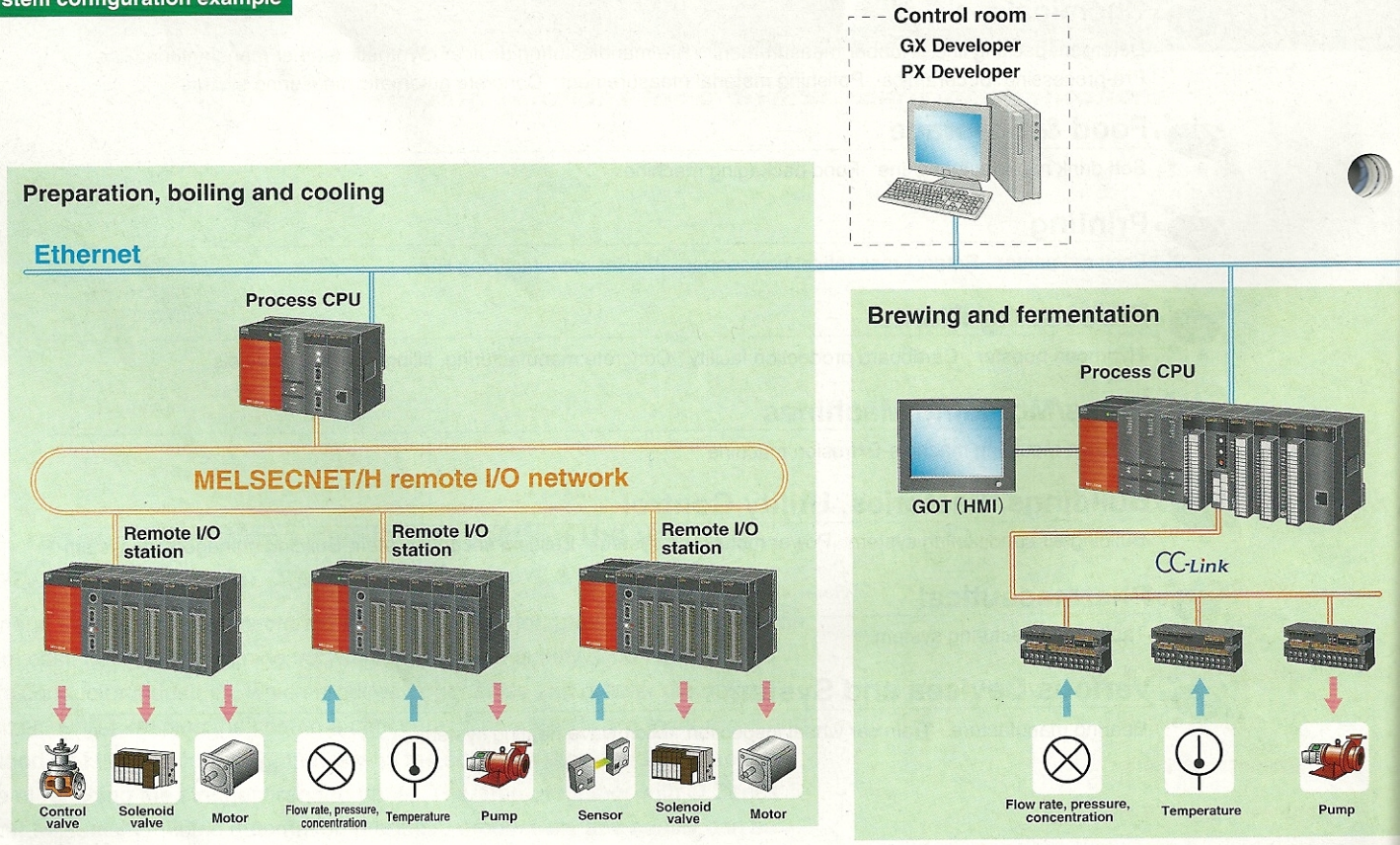
Semiconductor (CMP system) solution example

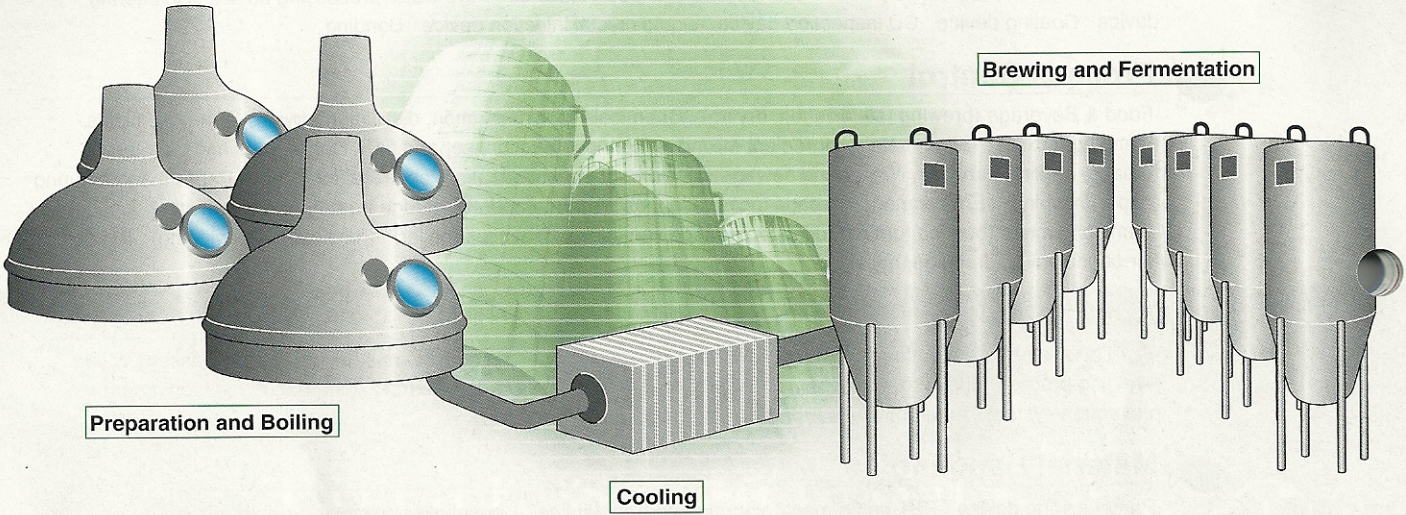
Following the semiconductor industry's trend to 300mm technology




Bottling
Packing
Shipping
Automatic warehouse
Labeling

System configuration example




Brewing and Fermentation
Preparation and Boiling
Cooling

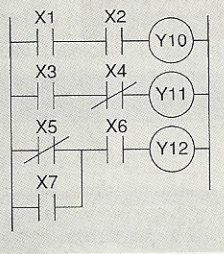
The ideal programming technique for the required application

Sequence Program Environment

Q Series supports all major sequence control programming methods in use today. These include Ladder Diagram (LD), Instruction List (IL), Sequential Function Chart (SFC), Function Blocks (FB) and Structured Text (ST). Additionally, the high performance Q Series CPUs allow multiple programs to co-exist in the processor, and can be executed in variable ways, further improving the performance of the controller.

Manual operation program

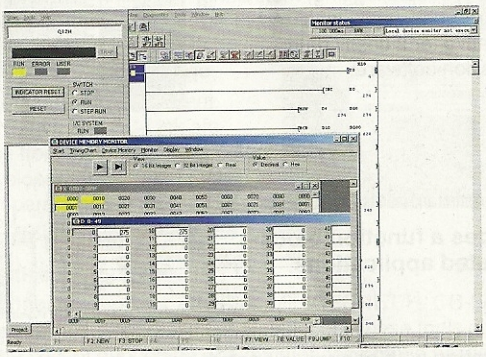
Ladder (circuit representation)



Communication processing program

Instruction list (list representation)

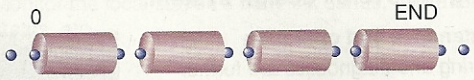
```
LD X50
MOVP K1 D0
MOVP K4 D3
MOVP H3412 D10
MOVP HBC5A D11
MOVP HF0DE D12
MOVP H0A0D D13
GP.BIDOUT U8 DO D10 M0
```



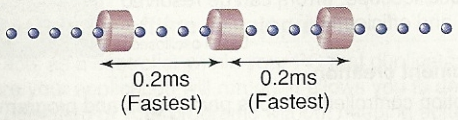
Fixed Scan Program

Q Series offers the ability to fix the program execution scan at a predetermined interval between 0.5ms-60s (High performance model QCPU, process CPU and redundant CPU). This allows the determinism of a system's execution to be improved for applications where execution timing is critical. To further improve response to brief events, a 0.2ms interrupt function is also available.

Ordinary scan execution program

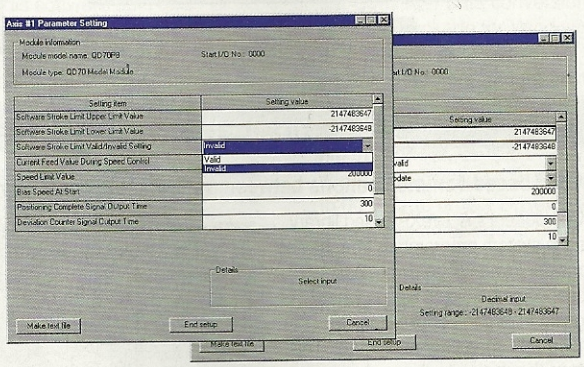


Cyclic execution program



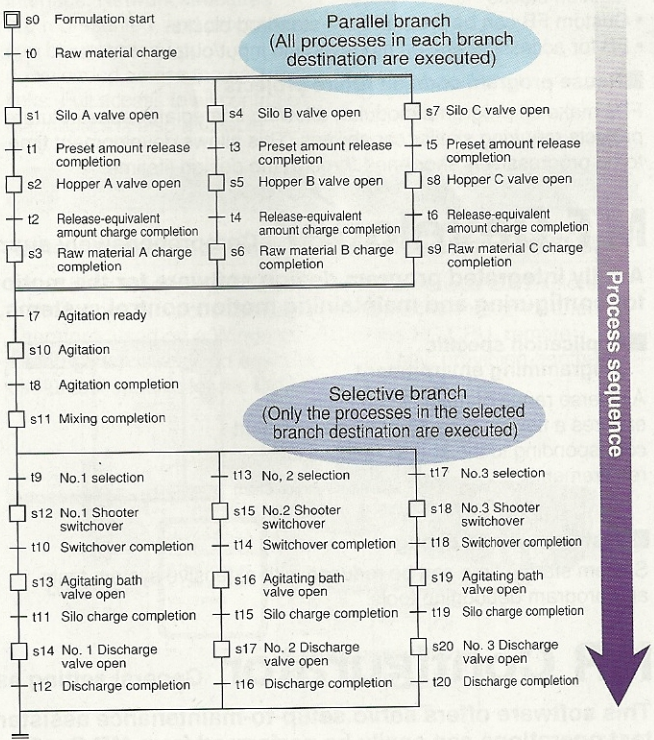
Program-free Initial Settings

GX Configurator frees the system designer from having to waste engineering time on writing and debugging code just to configure the controller's intelligent function modules. All modules such as analog and serial communications have GX Configurator tools associated with them that reduce configuration to a simple menu based system. Further, the automatic refresh capability of the Q Series insures that using GX Configurator to monitor system configuration during maintenance always shows real time system data.



Sequential Function Chart Programming

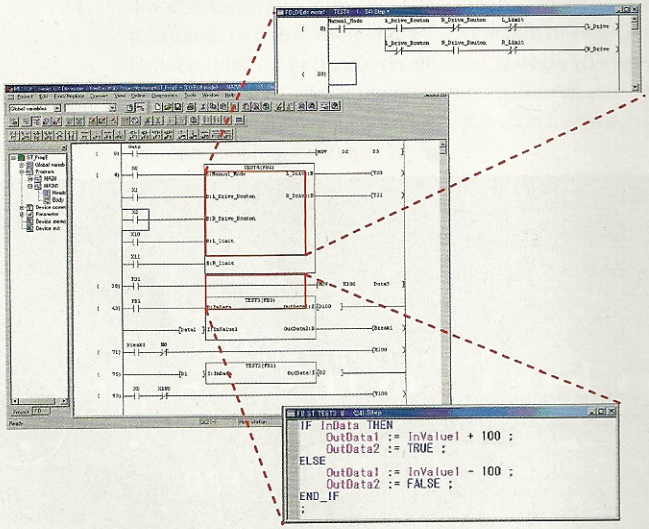
Sequential Function Chart (SFC) is an industry standard programming method that improves the readability of a program via a graphical representation similar to a flowchart. Q Series fully supports SFC, offering you the chance to simplify the organization of your programming by using multiple program states to control and sequence the operation of your application. During maintenance, SFC can also be used to follow the operation of a system graphically, improving the productivity of maintenance personnel.



Function Blocks (FB)

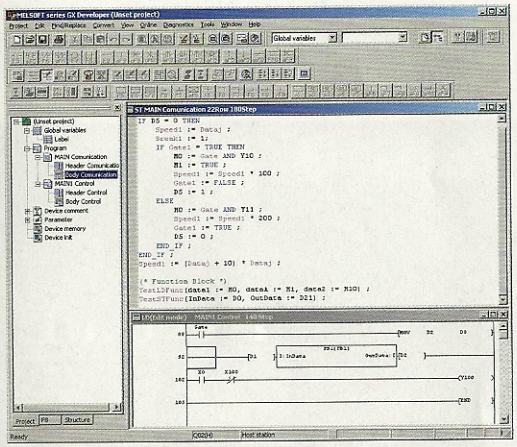
Function blocks (FB) allow sections of programs to be represented as a single function block.

- Complex ladder programs can be made easier to read, simplifying debugging and troubleshooting on the shop floor.
- Program code can easily be reused by cutting and pasting function blocks.
- Use ladder diagram or structured text to create function block code.



Structured Text (ST)

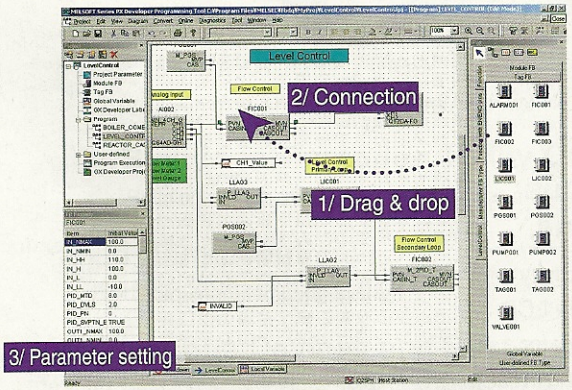
Structured text allows the Q Series to offer a new dimension in automation programming. ST breaks with the traditional methods of sequence programming by using a format similar to conventional computer programming languages. This offers the benefit of giving programmers a tool to describe processes that are not readily described using other languages. Additionally, ST offers newer programmers who are not familiar with automation in general an immediate opportunity to become productive based on their existing experience.



Process Control Function Block Diagram Programming

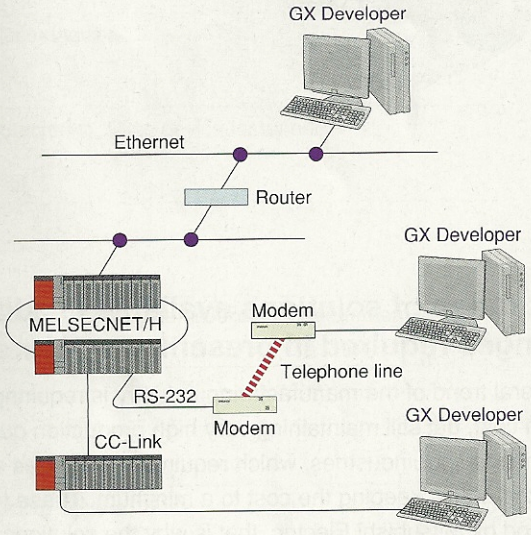
With the process CPU and redundant CPU, Q Series Process Control Function Block programs can be created by PX Developer. This allows easy creation and editing of loop control programs simply by dragging and dropping the required function blocks and connecting them together in the desired way. Loop parameters and other essential process properties can be easily configured. Process control programs can share data with sequence control program if label programming is used.

* GX Developer Ver. 7.20W or later must be installed in the same personal computer to run PX Developer.

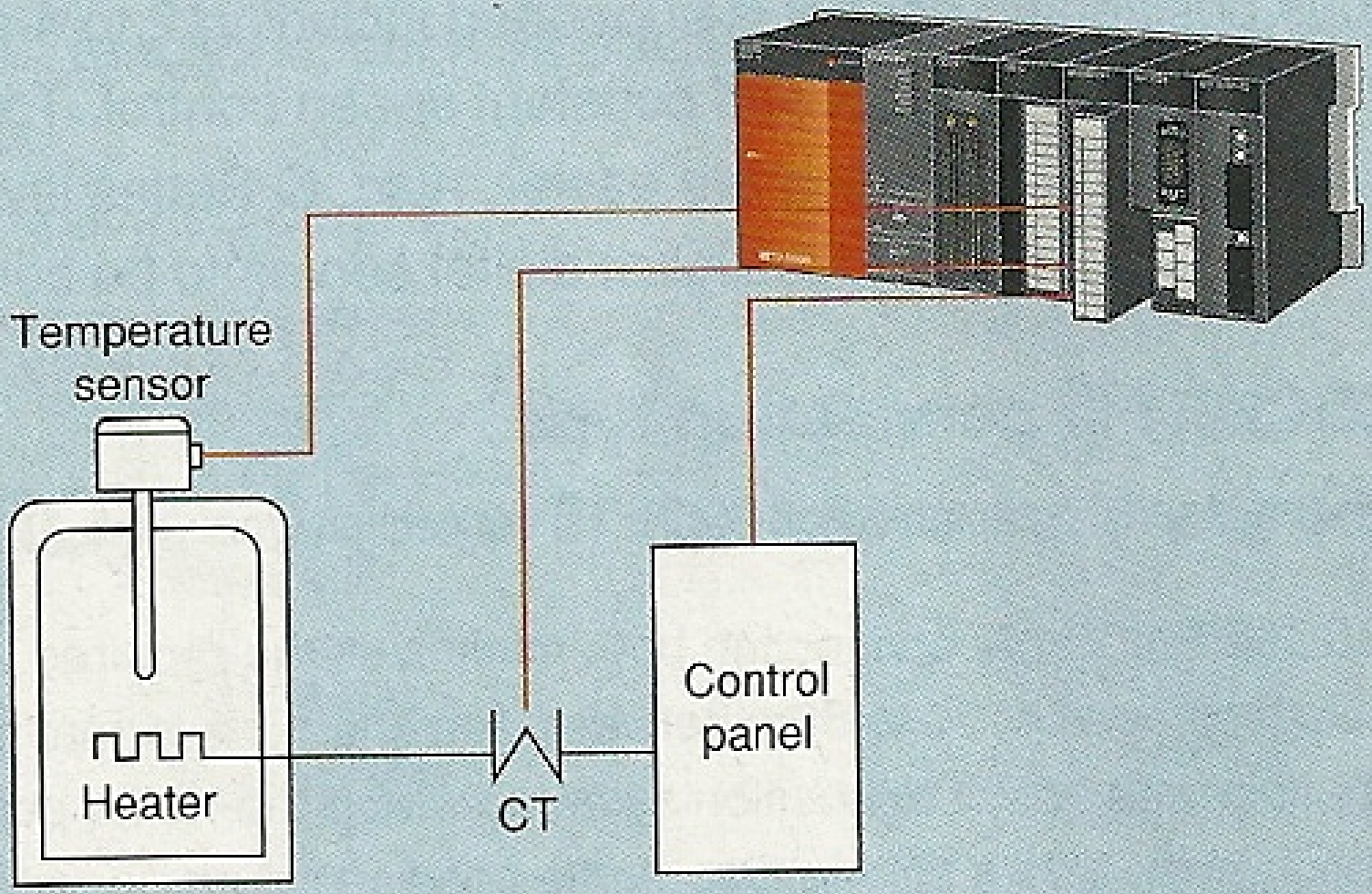


Remote Programming

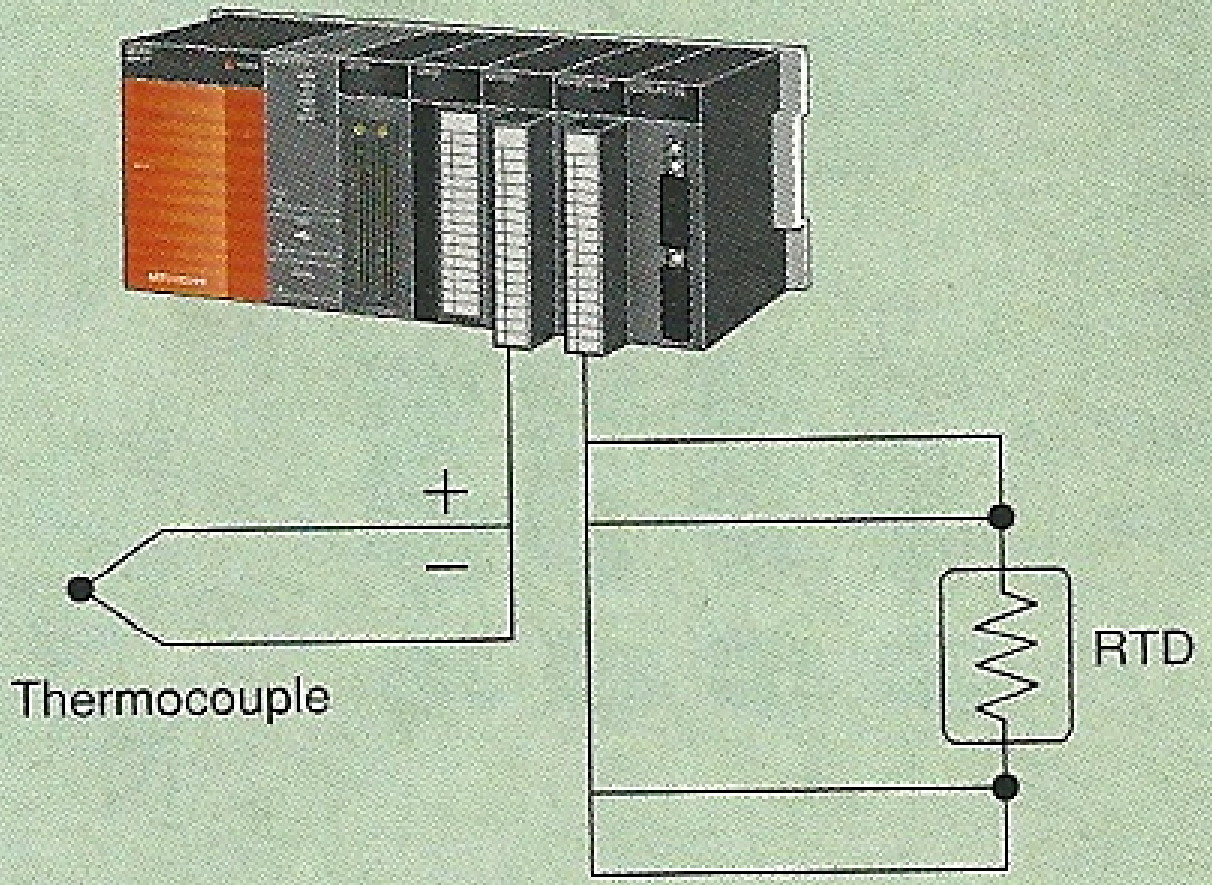
GX Developer fully supports the remote maintenance of distant installations, whether via dial-up access or through the Internet to systems on the other side of the world. Once connected to a system, and security requirements are met, this type of connection allows full access to all aspects of the Q Series in the same way as a local connection via a programming cable.



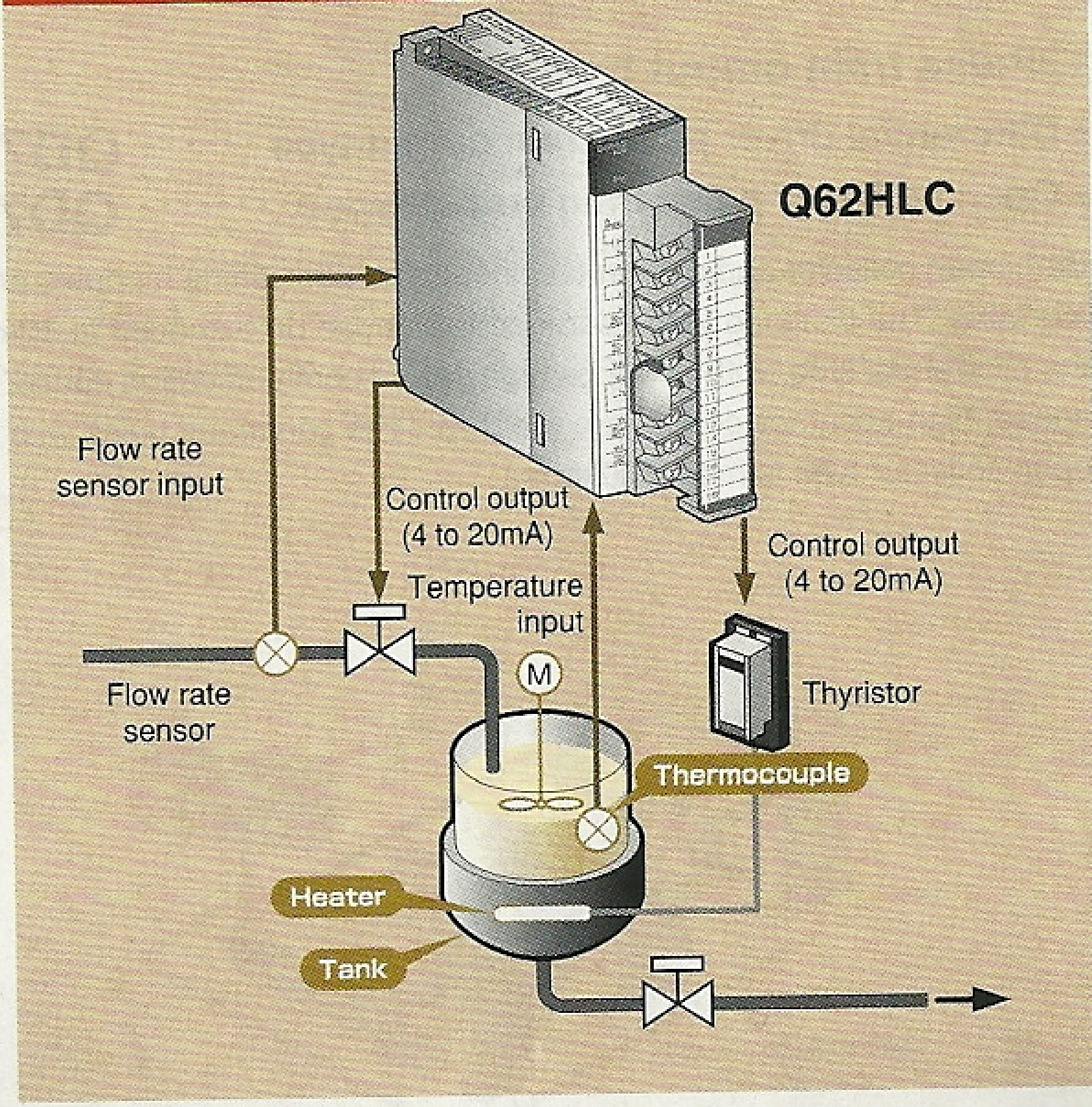
System configuration example



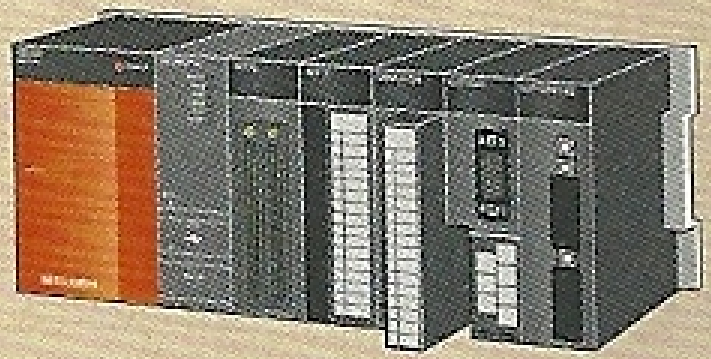
System configuration example



System configuration example



System configuration example



Analog input signals

Flowrate

Temperature

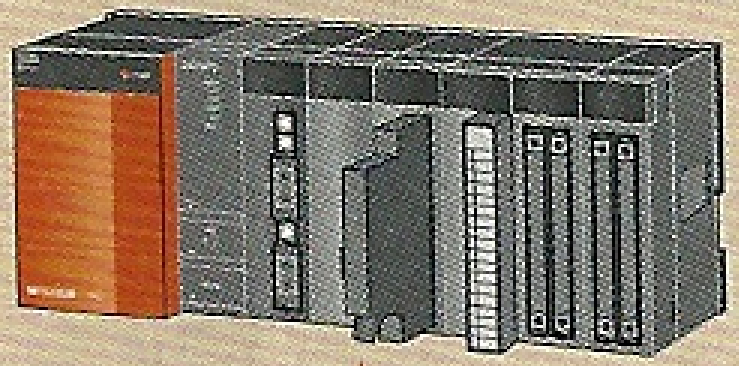
Pressure

Current

Voltage

Power, etc.

System configuration example



Analog input signals

Flowrate

Temperature

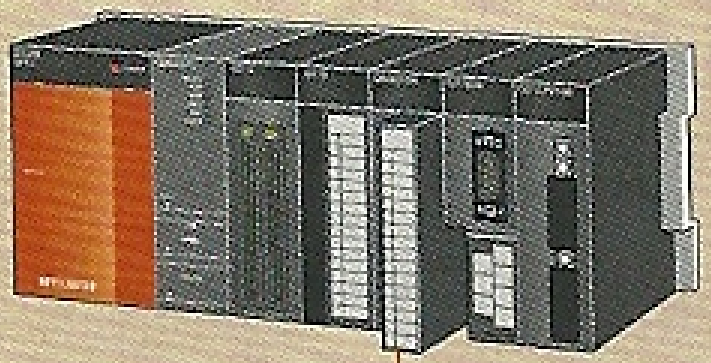
Pressure

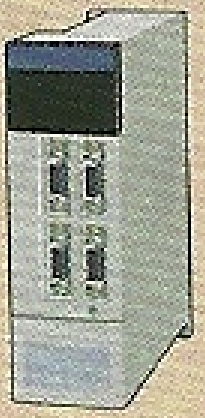
Current

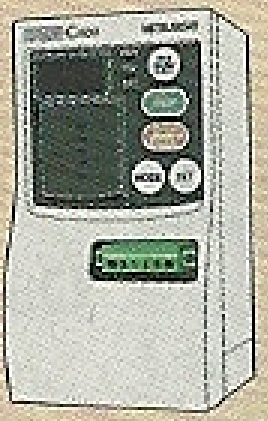
Voltage

Power, etc.

System configuration example





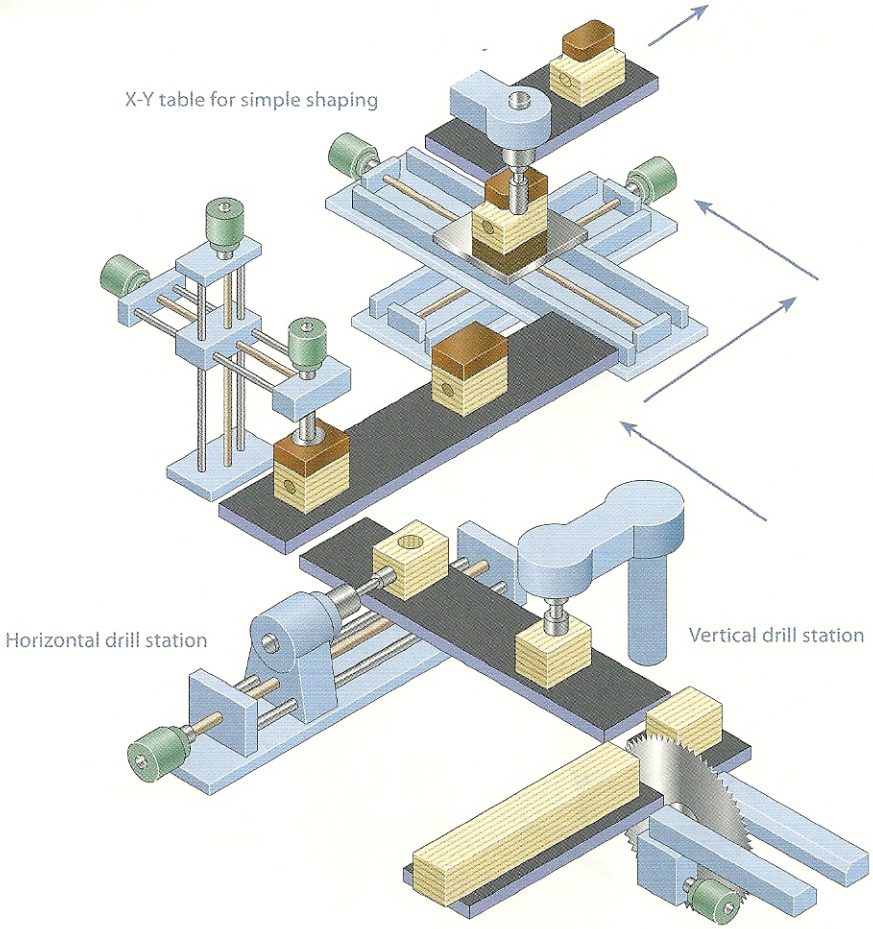


Servo

Inverter

Analog output signals

Easy Positioning solutions



Simple positioning solutions can be effectively managed within a standard FX PLC.

Using simple positioning solutions can help increase the accuracy of the work process, reduce waste and rework as well as provide a higher quality of production.

Typical applications

Simple positioning applications typically involve independently controlled operational axis and can sometimes have many requirements. In the example of an X-Y table, a relative position is achieved by driving each axis until its target position is achieved, regardless of what happens with the other axis. There are two main elements to achieve this type of positioning control.

■ Pulse train outputs

A stream of output pulses can be used as a drive signal to a line driver, stepper motor or servo amplifier, which then causes the connected motor to perform the positioning activity.

The larger the range of output pulse frequencies available means greater speed and/or accuracy is achievable. For example, if a stepper motor with a larger number of steps is used, the travel distance per step can be reduced, resulting in an increased system accuracy.

■ High speed counter input

When a motor is being driven, its relative position can be controlled by counting the number of output pulses.

However, for a more accurate process, reading the actual position from an encoder feedback directly into a high speed counter is preferred. This helps to overcome issues of backlash and slippage as the actual position is measured and not assumed.

Positioning built in as standard

FX PLCs come with high speed counters (in some cases up to 100kHz) and pulse train outputs (also in some cases up to 100kHz) as standard. The high speed counters can be configured in single pulse train inputs, The high speed counters can be configured in a single or two phase input.

Pulse train outputs can be configured to provide continuous pulse streams at different frequencies or a set quantity of pulses at a single frequency.

There are also optional modules and adapters that can provide additional high speed counters with performance up to 200kHz. The same is true for pulse train outputs with 200kHz and 1Mpps (1MHz) output options available.

Example of conveyor belt control.

Analog solutions

Analog control is one of the most important areas for any automation system. Critically for users the concern is to match the performance demanded by the application to the available solutions in a cost effective way.

Where is analog used?

Analog control is widely used. In simple terms it allows a variable signal to be used to control items such as a motor's speed or to sense inputs such as fluid levels.

■ Digital to analog (D-A) control

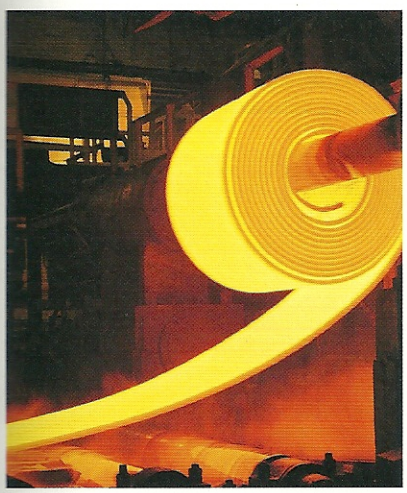
Here a digital PLC value is output as an analog signal. It can be used, for example, to send a speed command to an inverter which in turn causes the motor to increase or decrease speed.

■ Analog to digital (A-D) control

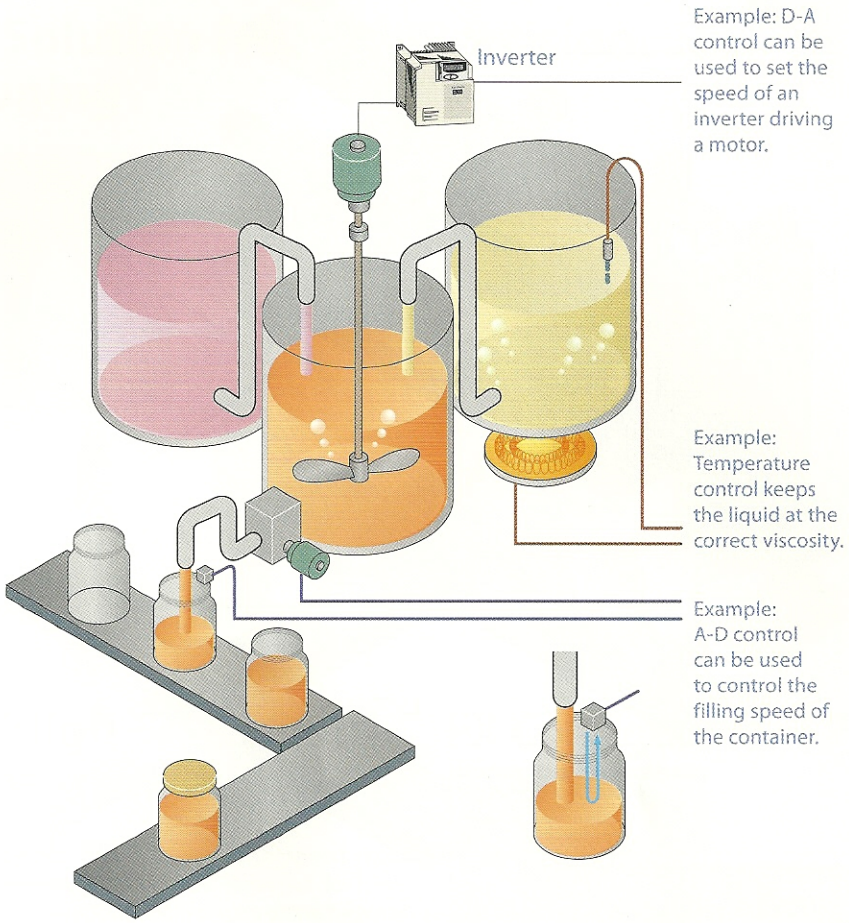
In this type of control a variable signal is sent to a PLC where it is converted in to a direct digital value. An example of this could be the measurement of the level of a liquid in a storage tank so that the exact amount of stored liquid can be controlled by the PLC.

■ Temperature control

Temperature control is the third type of analog control. An example of use could be where the temperature of a furnace is measured and compared by the PLC against a set range. Additional heating or cooling can then be applied to maintain a constant temperature.



Example of temperature control.



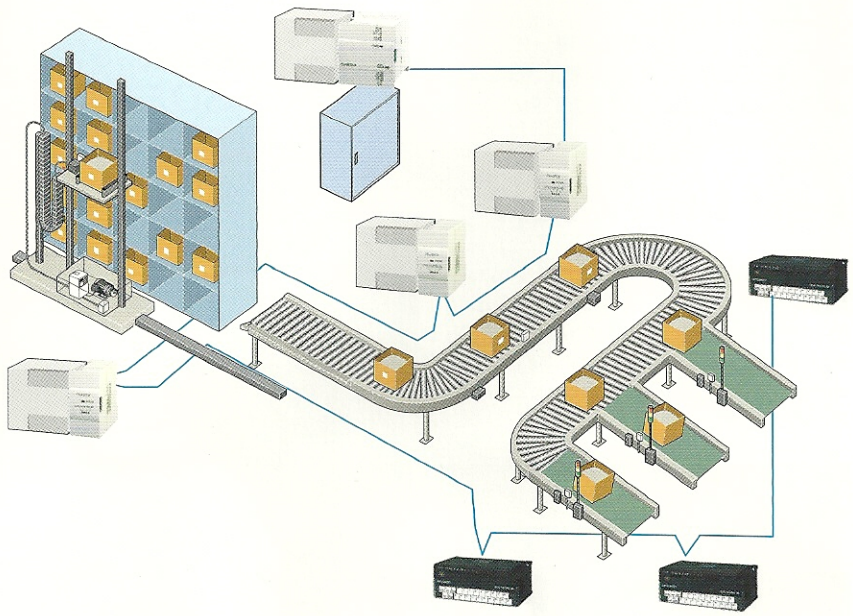
Analog solutions are an important part of control engineering and can be used to simplify and accurately control actions happening in the production environment.

16 solutions to choose from

The FX Family offers a wide range of analog solutions from 1 and 2 channel BD boards for FX1S up to 8 channel input blocks like the FX2N-8AD where temperature, voltage and current input can be mixed on the same block. FX analog blocks also come in a range of resolutions from 8 bit up to 16 bit signal processing. Overall there are 16 different analog options available to users of the FX PLC Family.

With this range of choice and flexibility it is sure that there will be a solution here for most applications.

Networking and communication solutions



FX Family PLCs have a wide range of communications options.

Applications are often required to integrate between each other across a factory, to report production or tracking data back for office based processing and in some cases be remotely monitored and maintained when the application is in an inaccessible location. The FX Family of PLCs has evolved to match this demand at all levels.

Networks make sense

Networked solutions to complex applications often make the overall solution easier to achieve and more cost effective. For example a conveyor system integrated with a warehouse pick and place system may extend over many hundreds of meters, and by using a fieldbus, such as CC-Link, wiring, troubleshooting and maintenance can be dramatically reduced.

Remote maintenance

With communications technology it is now possible to put PLC control in the most remote locations. Using a PLC with a RS232 interface to a telemetry solution, such as a GSM modem, allows the user the ability to remotely monitor and maintain the system. It can also allow the remote system to send alarm messages, warnings or general status information back to the user's central data processing centre.

Example of remote pumping station.

Easy communications

Today's FX Family of PLCs share a basic communication concept where additional RS232, RS422 or RS485 communications boards can be added to the main base unit without increasing the required cabinet space. These can then be used for communication to various third party devices like bar code readers, printers and modems.

FX Family PLCs, such as FX1N, FX2N and FX3U, have a wider range of communications modules. These include options for connection to open and bespoke networks such as CC-Link, and ASi for example.