MICRO SOLUTIONS

FX PLC & GOT1000

Precision control
to rely on

Over 9 million users /// **World leaders in Micro PLC control** ///
Reliability /// **Ease of use** /// **Precision** /// **Speed** ///
Data management ///

A world of applications

Flexibility

A PLC is at the center of control for every application, therefore it is vital that the chosen PLC meets the needs and requirements of the system.

The FX Family is designed so that the PLC CPU acts as a platform which can be customised to the needs of the application, creating solutions that fit perfectly.

With a wide range of PLC base units that form the basis of the FX Family range, users can build a system that answers their application and cost requirements with few compromises. The FX family covers several independent yet compatible series, all of which have been designed with 4 key principles in mind:

- Speed with Precision

- Flexible Design

- Backward & Forward Compatibility

- Low cost

Visualization

It's essential to know what a process is doing at all times and human-machine interaction is a key part of this. The GOT1000 range of HMIs enables customers to design interface screens that visualize the application in the easiest way possible. The intuitive GOT software and setup utilities allow users to create easy-to-use screens for more efficient processes.

Leadership

The FX Family is the PLC of choice across the world's industries and applications. At Mitsubishi Electric we pride ourselves on our close relationship with our customers. Through listening to customer needs, we have developed a highly successful range of PLCs that address modern application requirements. This approach has lead to Mitsubishi Electric being recognized as the leading global PLC supplier by units sold*, proving again that our partnership with our customers consistently delivers benefits back to those customers.

As expected from a global leader, our products meet all major compliance regulations such as CE, UL, RoHS and key shipping approvals.

*According to independent research published by the Automation Research Corporation (ARC)

Confidence

Mitsubishi Electric has a reputation for producing high quality, leading edge, automation hardware; a fact that is easily demonstrated by over 9 million users of Mitsubishi's FX PLC family or the 11 million users of Mitsubishi's frequency inverters as two examples.

In today's world of manufacturing, durable products that operate continuously year after year are essential. To ensure our high levels of product reliability, Mitsubishi Electric's quality control program leaves nothing to chance, resulting in unrivalled customer trust and confidence in the products we produce.

Improving timber productivity
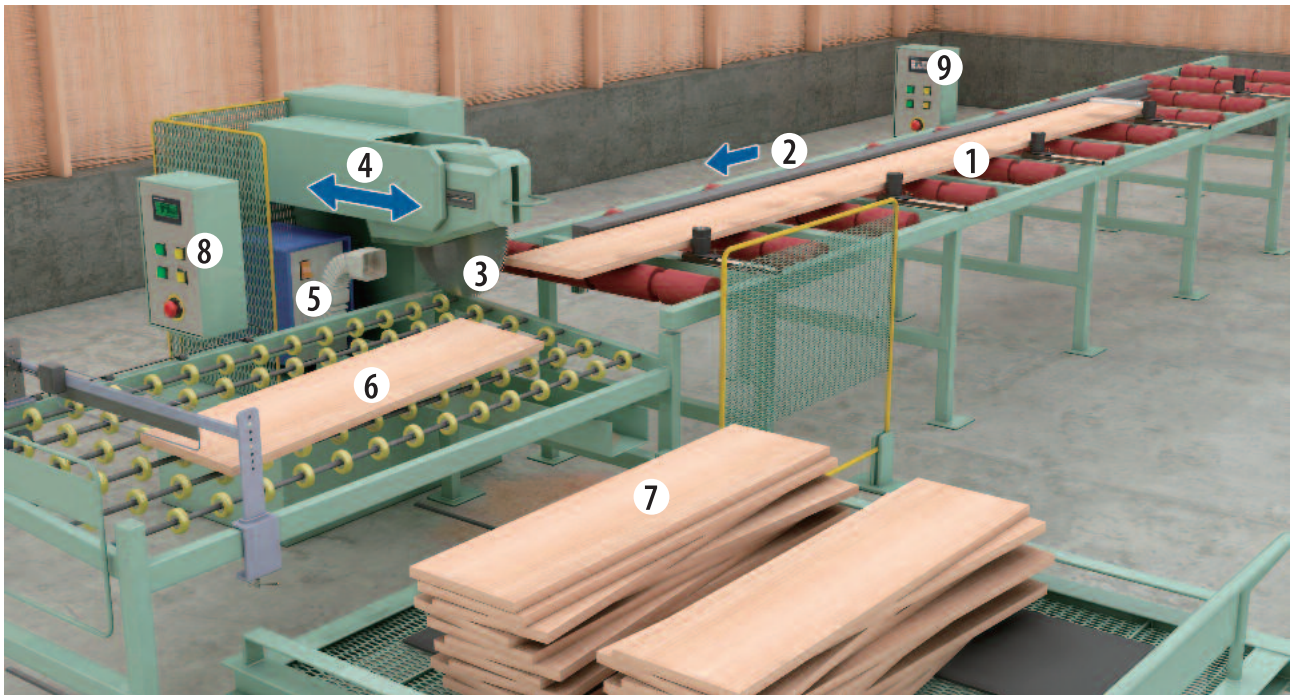
Improve productivity, increase safety and maintain accuracy: ① Plank being cut. ② Plank positioning axis. ③ Saw blade. ④ Saw blade positioning axis. ⑤ Saw dust extractor. ⑥ Cut plank. ⑦ Plank stacking. ⑧ Control panel 1. ⑨ Control panel 2

The timber industry is active worldwide with a diverse range of applications from sawmills to CNC routing. Consider a straightforward cut-to-length application. Here productivity can be increased with automatic feed control, safety improved with automatic saw control and all while maintaining length accuracy.

More planks per hour

Create a cost effective solution by pairing an FX1S with three Mitsubishi inverters. The FX1S uses the first inverter to control the cut length, while the second drives the saw's travel across the material. The third controls the saw blade speed. As well as improving control, the inverters reduce running costs with more efficient use of energy.

Control can be achieved with simple limit switch inputs to monitor the position of system components such as the saw, etc. In the case of plank feed control, two switches could be used:

- One to detect the presence of a plank to cut before feeding begins

- One to stop feed of the plank when it passes the required length point
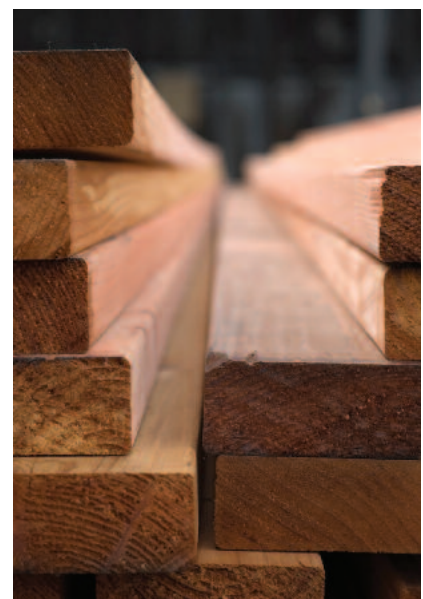
The first limit switch needs to be activated to prevent operation when no plank is present.

Activating the second switch stops the motor feeding the plank and activates a clamp to hold it while the saw makes a cut. The saw returning to its home position releases the clamp and starts the motor to begin the next feed cycle.

This approach provides a cost effective solution. For higher accuracy, servo position control could also be considered. The application of inverters adds additional benefits such as monitoring blade sharpness via motor load, hence improving quality and reducing machine maintenance.

More flexible motor control

The FX1S can be fitted with an Analog to Digital or Digital to Analog expansion board on the front panel of the PLC. By using the FX1N-1DA-BD board, it is simple to control the saw speed with a varying analog voltage to the inverter. This also allows thicker or denser material to be easily dealt with.

For applications that require analog inputs, the FX1N-2AD-BD is available. This provides 2 analog inputs which could be used to measure extraction air flow to indicate when filters need cleaning.

Intuitive machine diagnostics

Using a small but high resolution screen the GT1020 provides clear visualization of the process, as well as a touch screen interface. The 3-color LCD screen (available in green, orange and red or white, pink, red) can be used to provide clear and easy to understand signals regarding the status of the machine, maximizing the potential of this micro-HMI.

Control inputs
- User control panel 1
- User control panel 2
- Limit switches (Plank presence and feed control)
- Limit switches (Saw stroke position sensing)
- General input handling

Control outputs
- User control panel 1
- User control panel 2
- Plank positioning (Inverter 1)
- Saw blade positioning (Inverter 2)
- Saw speed (Inverter 3)
- General output handling
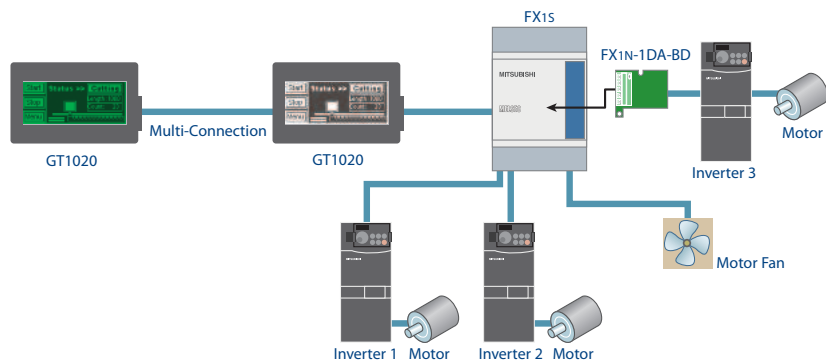
Example system diagram

Further flexibility is offered by a multi-unit connection. This allows multiple HMIs to be located around the machine, insuring operators can always monitor progress regardless of their position.

Finally, add additional value to the system by importing system diagrams so that machine operation is better understood or problems can be addressed more quickly. This also allows the HMI to show manufacturer's logos and other brand information.

Other applications

This is one of many possible applications the FX PLC family could address in timber industry applications. Other possibilities include:

- XY control of router tables
- Temperature control of drying kilns
- Automated dowel insertion
- . . . and lots more

Precise heat control
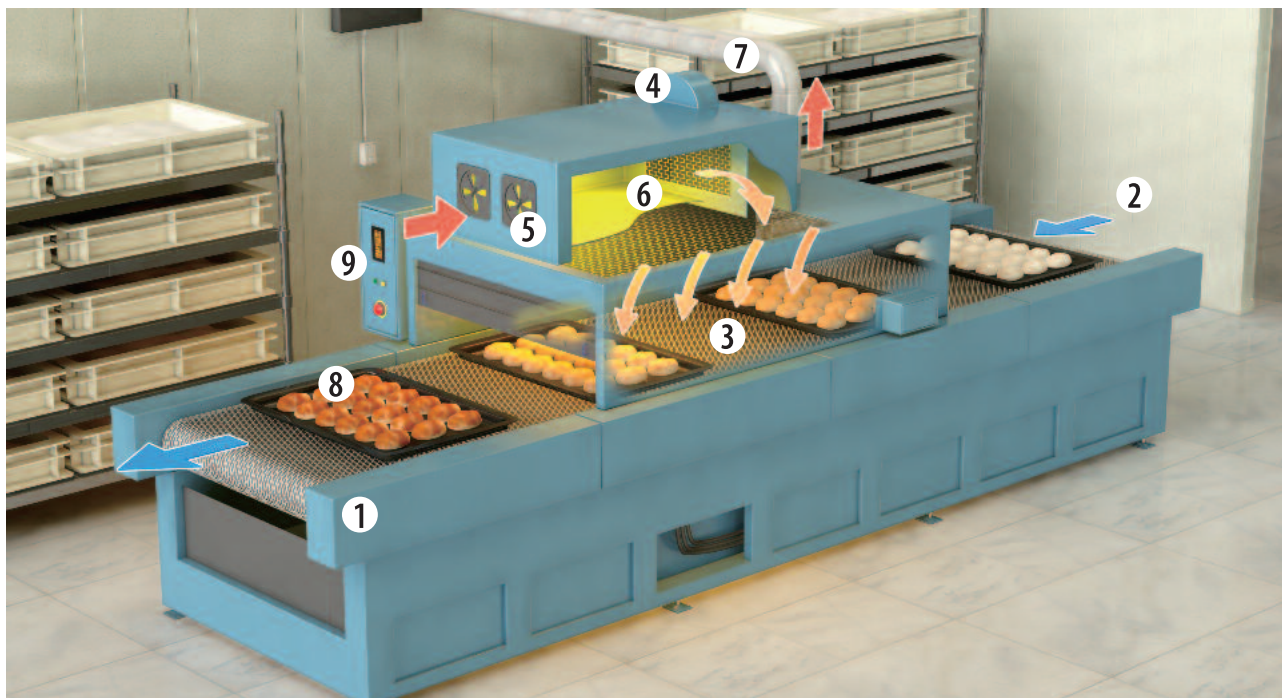
Get consistent results while improving productivity: ① Conveyor. ② Product queuing. ③ Heating chamber. ④ Circulation fan. ⑤ Air intake. ⑥ Heaters. ⑦ Extractor fan. ⑧ Baked product. ⑨ Control panel

The food and beverage industries have some of the most demanding applications, being driven by various regulatory as well as customer pressures. This section shows how the FX1N can be used to address a more sophisticated application that combines process, motion and sequence control.

A heating conveyor is an application that can be typically seen within the food processing industries. You can also see similar versions of this system in automotive, pharmaceutical and ceramic applications.

Precise heat control

Within the conveyor oven, the key challenge is maintaining precise temperature control. To achieve this successfully, the control system relies on both analog to digital control and digital to analog control. The FX1N meets this challenge with flexible temperature sensing and analog output options.

To provide the analog to digital input required for monitoring the temperature of the oven, the FX2N-4AD-PT option uses a 3-wire platinum resistance thermometer sensor (PT100) with a compensated range of -100 to + 600 °C (-148 to 1112 °F). The module has a resolution of 0.2 to 0.3 °C (0.36 to 0.54 °F), meaning it can provide precise control of even highly temperature sensitive processes.

To provide heater control, the system is fitted with an FX2N-4DA option. This offers four analog outputs, providing multiple zone control via separate heaters. The unit provides a resolution of either 5 mV or 20 µA as well as responsive conversion time of 2.1 ms for 4 channels.

Combine this with the FX1N's built-in PID capabilities for a cost effective but sophisticated loop controller system that can handle the most demanding applications.

The control system also uses an analog output to control the speed of a Mitsubishi inverter. This drives the conveyor at varying speeds in order to control how well baked the product is.

Trouble free export

A high capacity back-up battery (the FX1N-BAT) provides up to a year of memory and data retention. This means machine builders can export systems worldwide without concerns of program or data loss.

Cost effective batch control

In today's food processing environment, it may not be acceptable to have processes dedicated to only one product. Applications need to be able to handle a range of products, while setup for changes should be kept to a minimum. To help achieve this, the GOT1000 features recipe handling, which allows the user to completely reconfigure the system's settings at a touch of a button.

The GT1030 is also equipped with a number of features that enhance the end-users, interaction with the application. Using a 4.5 inch digital touch panel display, users are able to press two buttons simultaneously to activate critical tasks, reducing the chance of the wrong button being accidentally pressed. The GT1030 also features a real time clock, enabling the end user to automate oven on and off times from within the HMI.

Control inputs
- User control panel
- Oven temperature
- Valve status
- General input handling

Control outputs
- User control panel
- Conveyor (Inverter)
- Circulation fan
- Extractor fan
- Oven heater
- Air intake valve open
- General output handling
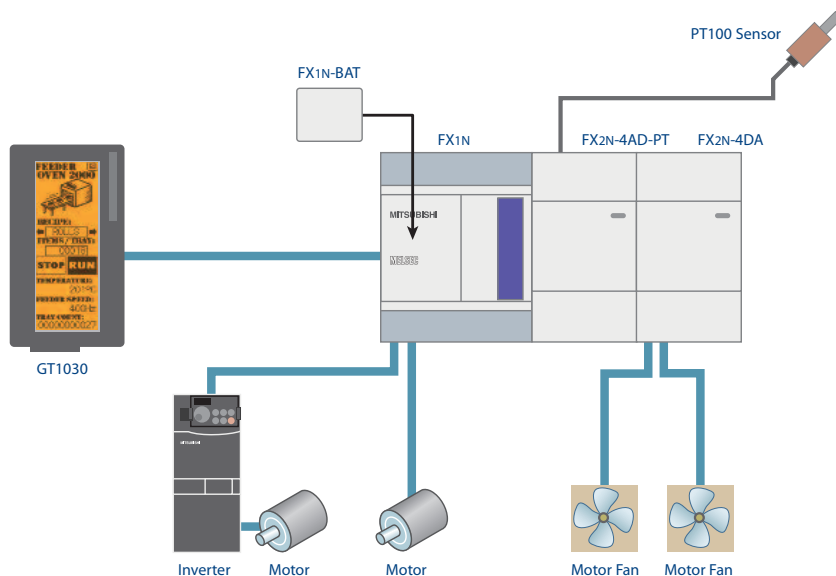
Example system diagram

Finally, the GT1030 screen can be oriented in either landscape or portrait mode. This enables the optimal screen layout with respect to the application and versatility for space critical applications.

Other applications

This is just one of many food applications the FX Family can tackle. Other possibilities include:

- Meat grinding/mincing machinery
- Sausage manufacturing equipment
- Slicing machines

. . . and lots more

Water treatment
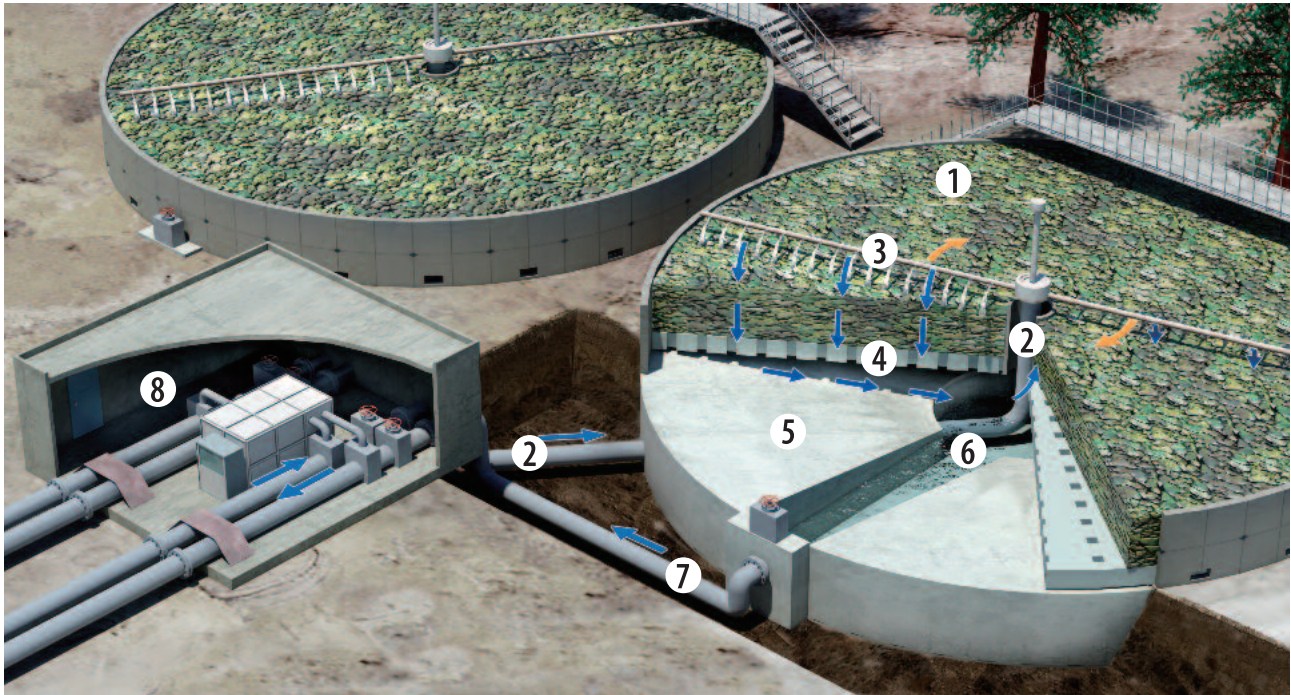
Precise control of large systems with FX: ① Trickle filter. ② Inlet pipe. ③ Distributor arms. ④ Outlet orifice. ⑤ Filter bed. ⑥ Drainage channel. ⑦ Outlet pipe. ⑧ Pump house

To sustain the health of the community, a crucial factor is to ensure that water treatment is correctly managed. To do this, a range of applications exist from large treatment plants that handle 1000 s of I/O to compact PLC applications, like the trickle filter.

The trickle filter is a wastewater treatment system that biodegrades organic matter and can also be used to achieve nitrification. To do this, a rotating distributor evenly distributes wastewater onto a circular bed of coarse stones. The micro-organisms in the wastewater attach themselves to the stones, which are covered with bacteria. This bacteria breaks down the organic waste and removes pollutants from the water.

Energy efficient pumping

A key element of this application is providing a continuous flow of water through the tanks. For this task, Mitsubishi Electric's inverters are the answer. A key advantage of using inverters is that they save energy via their variable torque load, enabling the system to increase power to the motors when increased pumping is required. The inverters can easily be connected to the FX3U PLC using Mitsubishi's FREQROL protocol. This provides cost effective control of multiple inverters over a single cable via a simple serial link. Hence costly wiring harnesses can be eliminated, with the added bonus that inverter parameters can also be changed remotely, for more efficient system operation.

Remote system maintenance

With these types of installations often being located at remote sites, it is not cost effective to have service personnel frequently visiting the site to perform routine checks. To prevent this, the control system features an Ethernet connection to enable remote monitoring and maintenance of the application. A number of different stations can be monitored from one location, all of which reduces labor costs and in-turn reduces the overhead costs.

A further enhancement is the ability to exchange email with the PLC. Alarm management is easily handled, and data can be exchanged.

Empowering maintenance staff

For the occasional times when personnel visit the application in person, the cost of the control system can be reduced by removing the need for fixed HMI displays. The use of the GOT-Handy type terminal allows service personnel to directly plug their mobile HMI into the system, providing a user interface that has been created especially for servicing the application, and helping maintenance staff to perform service in the most efficient manner possible.

Using technology from the GT11 series, the GOT-Handy terminal also features a number of functions that ease operation in a mobile environment:

Push-button switches – These six buttons with LEDs for operation status provide inputs to control external equipment.

Emergency stop switch – This switch immediately stops the system in an emergency. A Normally Closed contact is adopted to assure safety. In addition, a switch guard is offered as an optional add-on to prevent unintentional operation.

Control inputs
■ Water pressure
■ Valve status
■ Distributor arm encoder pulse input (x2)
■ Water flow rate
■ Distributor rotation speed
■ General input handling

Control outputs
■ Water pump in (Inverter 1 & 2)
■ Water pump out (Inverter 3 & 4)
■ Distributor arm control (Inverter 5 & 6)
■ Output data (GT11 handy)
■ General output handling
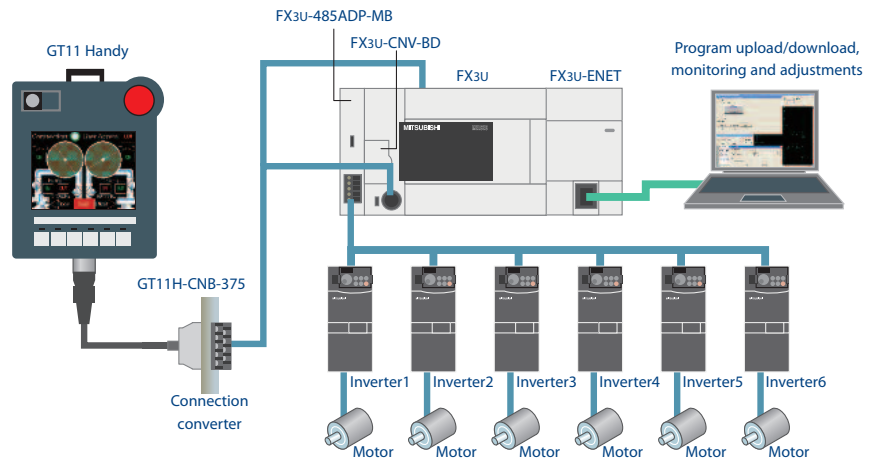
Example system diagram

Selector key switch – Operation of the GOT can be adjusted according to the key switch status. Manual vs. Automatic operation or Visible vs. Hidden objects are among the possibilities.

Three-position grip switch – The three-position (OFF-ON-OFF) type 'dead-man' switch is adopted for preventing operation mistakes and prohibiting operation of a machine. The switch can also directly control external equipment to give immediate stop commands to a machine.

Other applications

The FX Family is well suited to a variety of other water industry applications. Other possibilities include:

■ Pump sequence control
■ Operation of gates and valves
■ Remote terminal units
. . . and lots more

9

Improving data tracking
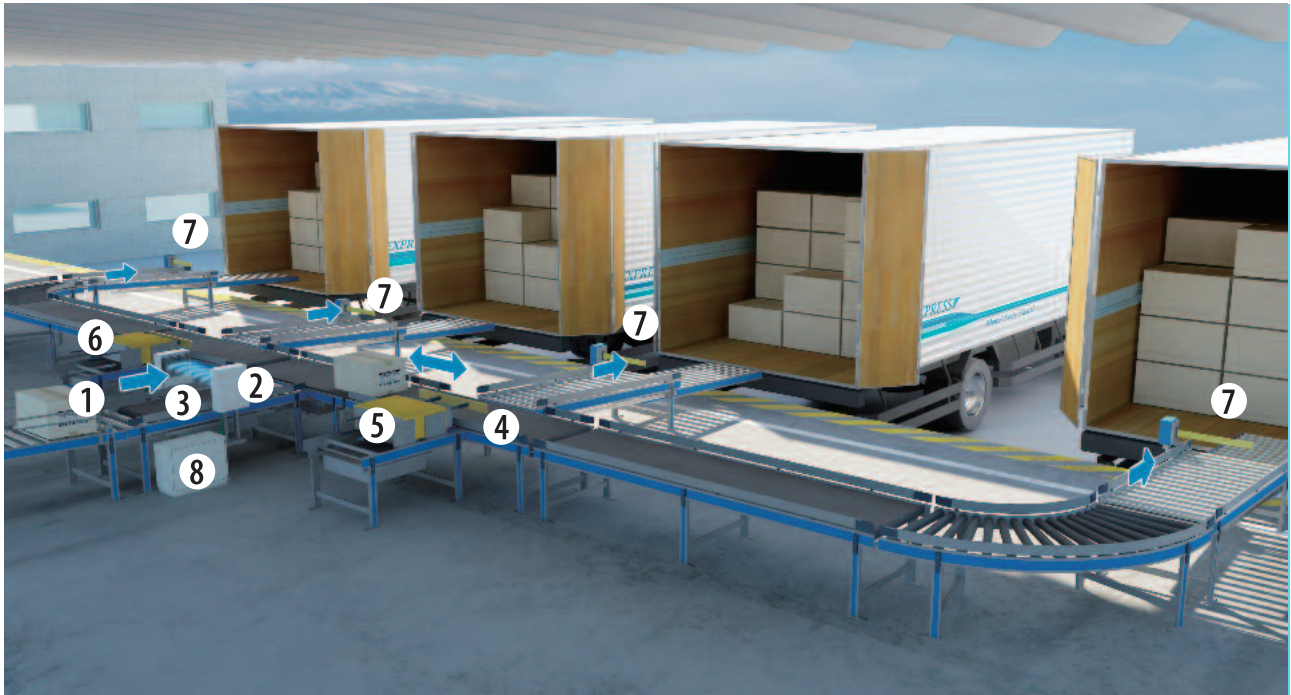
Distribution systems require intensive line side data tracking: ① Box stacking. ② RFID scanner. ③ Conveyor 1. ④ Conveyor 2. ⑤ Pusher 1. ⑥ Pusher 2. ⑦ Box receive switch. ⑧ Control cabinet

Reliable communication is a necessity for every application – whether to provide a connection between actuators and switches, FX series products, or other third party devices. When communication types are appropriately selected, they increase the effectiveness and efficiency of the application.

Effective data management

Material handling is an industry that defines its existence on effective data management. It is of the utmost importance that accurate information is continuously and reliably passed through the system, enabling database-updates and allowing users to access information at any given moment. To meet these demands, the FX3U offers a range of serial and network communication options for flexible easy to use communication functionality.

Tracking visibility

Package tracking is something that is vital within the material handling industry, allowing system users to see exactly where a specified package is at all times. To do this, the PLC is situated in the application as a communications gateway, passing information received from an RFID scanner up to IT systems. The RFID scanner, a third party device, connects to the FX3U via a serial communication option board. This is combined with the FX3U's ability to emulate third party communication protocols to allow the scanner's data to be read.

Once data has arrived in the PLC, two processes are then initiated. The first is for the PLC to determine the destination target. This is carried out by using outputs of the FX3U PLC to provide control signals to the pusher system, thus creating a destination path for the package.

The second process is to update the main database with package data received by the PLC. To set up this communication path, the Computer link protocol is used. This allows all information received and sent by the FX3U to be recorded within the computer. Once recorded, data can be easily managed and manipulated using third party software, allowing users with little experience to successfully interact with the activities of the application.
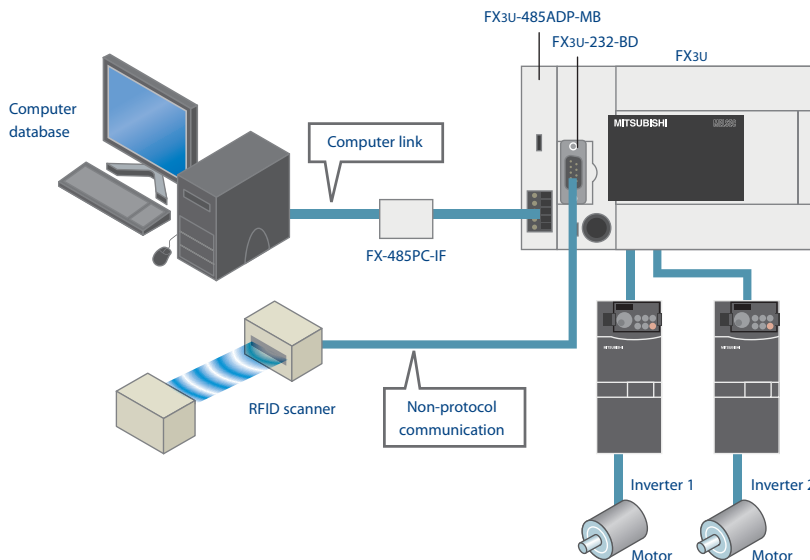
Room for the future

A design feature of the FX3U is the new adapter expansion bus on the left hand side of the base unit. Through this bus users can add additional analog and temperature units as well as multiple communications and positioning blocks. All control is carried out through direct access data registers and setting bits within the base unit – allowing quicker set-up, easier use, and above all much higher processing speeds.

Distributed intelligence

Since distribution systems are typically large, it helps to have a PLC that can also cover large distances. The FX3U allows 16 controllers to be networked to a computer on a single, cost effective cable over 500m. This flexibility also allows controllers to be positioned where necessary and relocated when required.

The FX series also features a range of other serial networks that enable better realization of the application depending on the given requirements. These include support for industry standards such as MODBUS®.

To enhance network setup, Mitsubishi Electric's own PLC programming software, GX Developer, features parameter windows that facilitate the configuration of networks. Through simple drop down menus, users can quickly and easily select key parameters thus reducing the coding time for the programmer.

Control inputs
- Box send switch
- Box receive switch
- Operator control panel
- RFID scanner (Non-protocol communication)
- General input handling

Control outputs
- Operator control panel
- Conveyor 1 (Inverter 1)
- Conveyor 2 (Inverter 2)
- Package pushers
- General output handling

Example system diagram

Other applications

In addition to package tracking, the FX Family can handle other tasks including:

- Control of loading dock equipment
- Sortation
- Modular conveyor systems

. . . and lots more

Cutting cargo spoilage
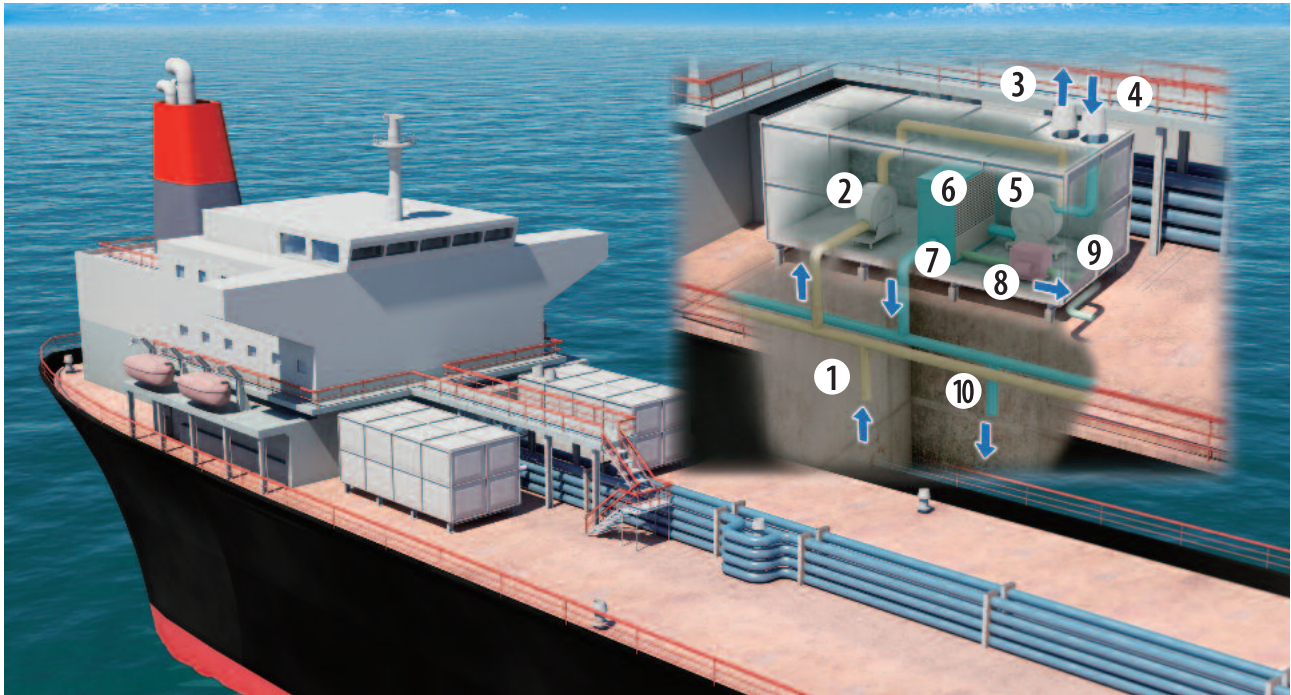
Use FX PLCs to handle non-traditional applications: ① Non-treated air inlet. ② Non-treated air fan 1. ③ Exhaust air. ④ Fresh air inlet. ⑤ Non-treated air fan 2. ⑥ Cooling fins. ⑦ Water tank. ⑧ Pump. ⑨ Water outlet pipe. ⑩ Dehumidified air return duct

Due to the nature of today's business, applications are produced for a variety of purposes and installed in a number of different environments. To create control systems for these applications, we provide products that are flexible as well as robust, so that they can operate in a variety of different environments with confidence.

International approvals

Shipping plays a vital role in today's transportation networks. Within modern ships, whether cargo or cruise ships, there are a range of different applications where PLC control plays a vital part. However, before a PLC can be fitted to a ship, certain regulatory requirements must be first met.

The FX series product line is compliant with a number of key shipping approval organizations, including: Germanischer Lloyds (GL), Lloyds Register (LR), American Bureau of Shipping (ABS), Registro Italiano Navale (RINA), Det Norske Veritas (DNV) and Bureau Veritas (BV). These approvals give the user confidence that an FX based control system will operate safely in this strict operating environment.

Mission critical reliability

To maximize vessel operating life and prevent costly cargo spoilage, it is critical that the ship's compartments are kept at the correct humidity. Therefore, moist air, a catalyst for for causing rust and mildew, must be strictly regulated.

This process of handling moist air within the ship is carried out by a dehumidifier system. The application itself is simple, taking air from the ship holds, passing it over cooling fins, condensing the moisture from the air and then passing the dry air back into the ship.

To enable control of the application, the PLC is equipped with two analog units. The first unit, the FX2N-4AD, takes humidity measurements from the sensors located in the various hull compartments of the ship. These humidity measurements are used to alter the temperature of the cooling fins. The greater the humidity in the air, the cooler the fins become. Accurate temperature control of the fins is provided by the second analog unit, the FX2N-4DA.

Direct motor control

To remove condensed water from the system, the control system takes readings of the water levels from the condensed water collection tank. Once the threshold value is reached within the tank, the PLC turns on an output which is connected to a motor, and water is pumped from the collection tank until emptied. Once empty, the motor is shut down until next required.

No need for specialists

In applications such as this, when a program change is required, the crew is unlikely to be familiar with the internal workings of the application and cannot program the desired change. To overcome this problem, an EEPROM cassette can be used by the application builder to store a new program, after which it can then be sent to the end user. Upon receiving the EEPROM cassette, the end-user simply plugs the cassette into the PLC, and the new program will automatically run. This simple process insures serviceability at sea and avoids needing specialist knowledge.

Control inputs
- Temperature of cooling fins
- Humidity monitoring
- Fresh air inlet
- Fresh air outlet
- User control panel
- General input handling

Control outputs
- Valve control
- Non-treated air fan (Fan 1)
- Non-treated air fan (Fan 2)
- Cooling fins temperature
- Water pump
- User control panel
- General output handling
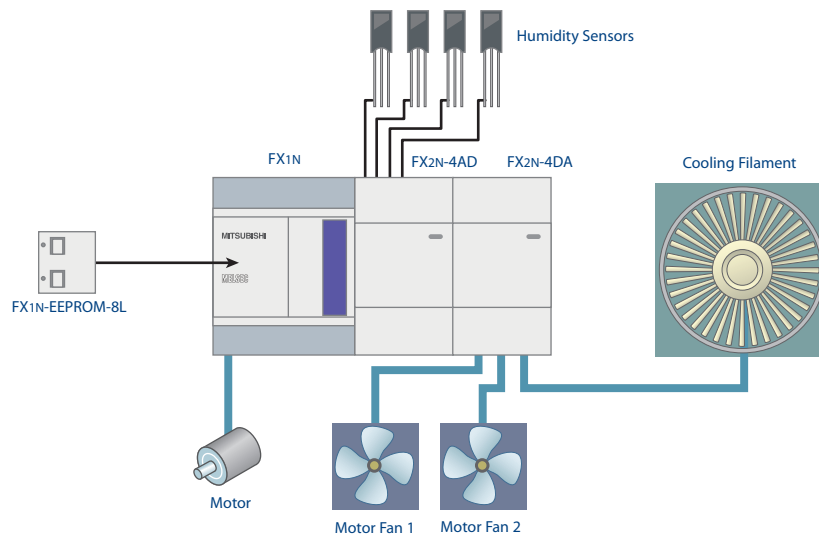
Example system diagram

Intuitive programming environment

For the machine builder who creates the PLC program the FX Family of controllers has a simple programming structure. Using GX (IEC) Developer's straightforward programming environment, easy to use help functions, and advanced PC to PLC communication, programmers can quickly develop systems that meet the demands of the application.
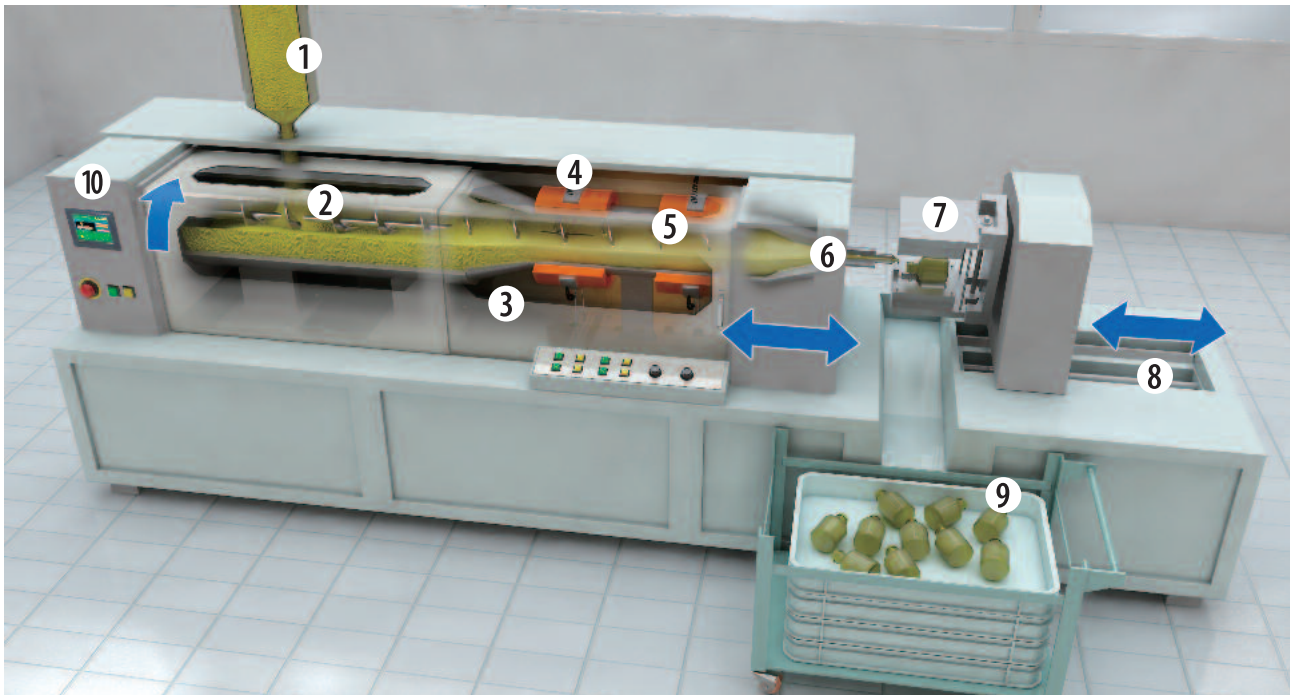
Other applications

The comprehensive marine certifications for the FX PLC line-up mean other shipboard applications are possible, which include:

- Controlling thrusters
- Waste water management systems
- General shipboard applications

. . . and lots more

High speed plastics production

Insure consistent forming with the FX PLCs: ① Hopper. ② Worm screw. ③ Heating chamber. ④ Temperature Controllers. ⑤ Heaters. ⑥ Reciprocal injection mechanism. ⑦ Mold mechanism. ⑧ Product ejection mechanism. ⑨ Product out. ⑩ Control panel

In modern society plastics are something that most of us take for granted. The process of producing bottles, jars, toys etc. has become a refined process where speed and consistency are two qualities that distinguish the good applications from the rest.

With injection molding applications, the process involves turning raw plastic granules into products. Although a straightforward process, the control system must handle analog and positioning procedures with high processing speed. To set a new benchmark within the compact PLC market, the FX3U was developed with a new high-speed bus that implements control via direct access to the controller's memory areas from peripherals, enabling higher processing speeds for enhanced productivity.

All electric machine control

The plastics industry has generally accepted all-electric injection molding machines are a superior technology for a variety of reasons. Better control, higher reliability and enhanced cleanliness are some key benefits. With its high speed motion control capabilities, the FX3U provides simple control of up to 4 servo axes using differential line drivers. This improves machine control and reduces noise problems.

Support for third parties

A Modbus connection provides a simple connection for the temperature controllers which monitor the temperature of the heating chamber and provide control to the heaters. Modbus allows a simple connection of both FX3U PLCs and third party devices compatible with the protocol. This opens the customer to a range of new opportunities, ensuring that the optimum input and output devices are fitted to the control system. The FX3U supports standard Modbus communications with up to 16 slave devices.

Reduced operator error

To enable the operator to successfully interact with the application, the control system is equipped with a GT1155 that provides sharp data representation via the 256-color display and 3MB storage space for screen designs. Among the many functions available, the GOT is equipped with extensive alarm handling as well as graph functionality that gives the user a range of options to select the best method to present application data. Screens can be tailored to the end user's needs so that high-level control is always one touch away.

CF cards are a useful accessory for transferring screen projects quickly, particularly when a large number of terminals need to be simultaneously updated. The CF cards can also be used to store alarm related information as well as other specified data, allowing service engineers to complete application analysis offsite.

Mitsubishi Electric's data transfer tool also allows users to upload/download GOT project data from/to the HMI, without needing the GT Designer 2 software.

Control inputs
- User control panel
- Temperature input (Modbus)
- High speed counters
- General input handling

Control outputs
- Worm screw motor (Servo 1)
- Worm screw reciprocal injection mechanism (Servo 2)
- Mold mechanism (Servo 3)
- Heater control (Modbus)
- User control panel
- General output handling
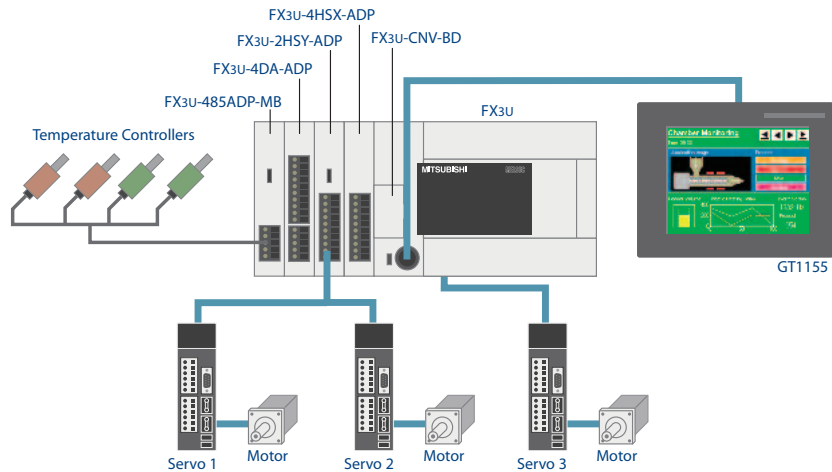
Example system diagram

A window into the system

One of the most valuable features of the GOT is its ability to perform PLC system maintenance directly with its built in program List Editor. This means maintenance personnel can take immediate action on arriving at the machine, without the need to carry a laptop.

Using the System Monitor within the GT11, Mitsubishi Electric PLC devices can be monitored and changed. Monitoring can be performed by selecting individual devices to be monitored, or by specifying the first device in a range. Current values and set values of timer and counter devices can also be changed, along with the buffer memory of attached special function blocks.

Other applications

The FX can handle a variety of other plastics applications, including:

- Control of raw material feedstock supply
- Control of auxiliary equipment such as chillers and dryers
- Finished product removal pick and place control

. . . and lots more

Leading edge label printing

Easily integrate sequence and motion control with an FX PLC: ① Unwinding reel. ② Reel size compensator. ③ Start/Stop sensor. ④ Printing device. ⑤ Dancing roller. ⑥ Drive train. ⑦ Winding reel. ⑧ Winding motor. ⑨ Control panel

Printing is an industry where the FX range has always proven successful. Whether the customer seeks reliability, accuracy or speed, the FX range offers the correct attributes to give the customer's application a leading edge in the market.

Precise label motion

For the majority of applications the FX3U's built in high speed inputs and outputs offer sufficient control for the customer's application. However, in certain circumstances the user may wish to increase the positioning control performance. This can be carried out by simply connecting a FX2N-10PG Special Function Block, which provides a pulse train output of up to 1 MHz.

This highly accurate pulse output can be used to drive a single-axis stepping or servo motor enabling advanced control within the application. To limit the effect of noise within the system, the FX2N-10PG is also equipped with a differential line driver. The differential line driver cancels out any noise that may be present within the system, providing more precise positioning data to the drive train and thus more accurate printing results.

With special functions that include the selection of absolute or relative positioning and 7 different operation functions, such as jog mode, zeroing and speed increase or decrease functionality, the FX2N-10PG provides an array of options to control the application.

Improved data transfer

For control of third party devices, the FX range can also emulate third party protocols for connecting to devices such as printers, barcode readers, etc. This technique allows ample data transfer capability, coupled with a reach of up to 15m, ideal for both small and large machines alike.

Speed with precision

The FX3U has the fastest processing speeds within the FX range, allowing basic instructions to be processed at 0.065µsec. For users this means faster program response and more accurate process performance as inputs, outputs and actions are processed and monitored more times per second.

Furthermore the FX3U comes with a large standard internal memory of 64 k steps. Larger memory allows the user to write larger and more complex programs as well as store more data in the file registers for recipes, data logging and similar functions.

Overcoming the language barrier

For applications that are exported to different parts of the world, it is essential that the HMI language can be reconfigured to end-users' native tongue. To do this, the GOT1000 series features easy language switching which allows a variety of spreadsheet based dialogs to be loaded within the user's program, permitting the user to switch the user language at a touch of a button. The GOT1000 series is compatible with Unicode 2.1 enabling a host of character sets to be chosen, whatever the language.

Control inputs
- User control panel (label test input)
- Start stop sensor
- General input handling

Control outputs
- User control panel
- Drive train (Servo)
- Printing device
- Winding motor
- General output handling
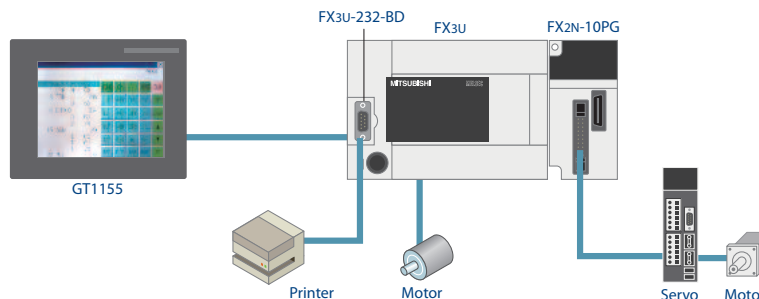
Example system diagram

Using the GOT's ASCII input feature, new dialogs can be written within the HMI and sent to the PLC. This feature allows the user to modify the alphanumeric strings that are printed to the labels without the complications of additional hardware or software.

With a range of fonts, graphical charts and alternative startup screens, the GOT1000 range allows the user to create a personalized interface to display in-depth information about the application. Also by using the available graphical tools, machine builders have a range of options from which to choose the most efficient method of representing data thus utilizing the maximum amount of available screen space.

Finally, with the front mounted USB port, service staff can quickly enter the PLC program, allowing the ladder code to be quickly monitored and changed as necessary. The USB "transparent mode" simplifies the connection setup, thus reducing down time of the application.

Other applications

Other applications, including:

- Screen printing machinery
- Stackers

. . . and lots more

Multifaceted control
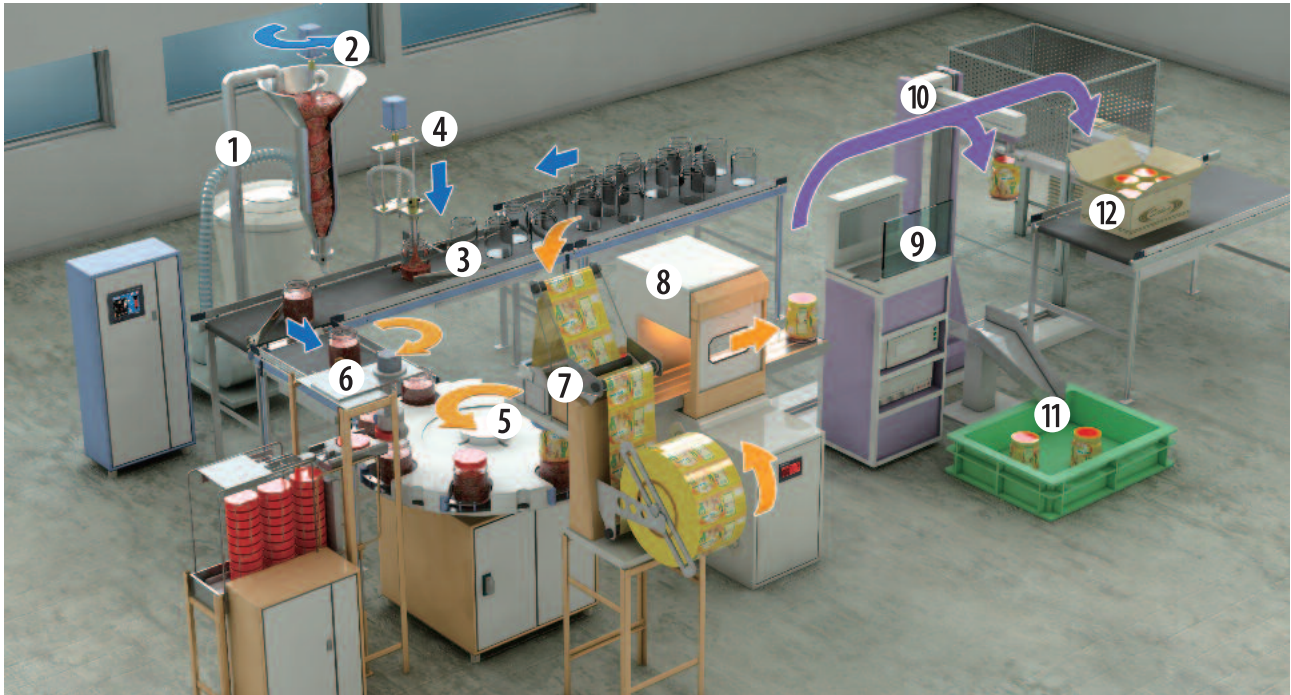
Link multiple FX systems to create complete packaging lines: ① Valve control. ② Worm screw. ③ Jar stop switch. ④ Filling mechanism. ⑤ Cam table. ⑥ Cap placer with torque control. ⑦ Sleeve placer with manual pulse generator. ⑧ Heat chamber for shrink wrapping. ⑨ Test chamber. ⑩ Pick and place arm. ⑪ Failed product bin. ⑫ Final product placemen

Whether the product comes from the food industry, pharmaceutical industry or consumer goods industry, it is highly likely that the product undergoes some form of packaging during the production process. With a variety of packaging applications available, the PLC system must be flexible so that it can adapt to the requirements of each solution. Whether it is filling, capping, sleeve placing, heat shrinking, or palletizing, the PLC system must provide multifaceted control for every stage of the packaging process.

Sustaining Pace with Technology

To sustain pace with the technological improvements within the market and for customers' businesses to stay competitive, it is important that control systems can be upgraded as the need arises.

As new products arrive in the market, it is unreasonable for users to bear the cost of upgrading their entire control system to accommodate new technologies. It is for this reason that the FX family of base units have been developed with backward – forward compatibility, allowing users to upgrade their base unit without needing to upgrade extension modules.

Increased flexibility & productivity, reduced costs

With the SSCNET optical fiber motion control network, the FX PLC provides a new chance to improve motion applications.

Torque control allows precise closure of jar caps, while a manual pulse generator input provides easy set-up of sleeve rolls. Dual axis interpolation insures product moves smoothly between stations.

SSCNET's Target Address Change function also improves productivity. This allows movement to a pass or fail location on the fly without having to stop to recalculate a new position.

Reliability and performance is assured with fiber optic cables. While eliminating noise problems, these also permit axis placement up to 50 meters away from a network node while maintaining 50 Mbps communications.

Simple machine configuration is achieved with the FX Configurator FP software. When integrated with GX Developer, it allows positioning instructions and patterns to be quickly created.

Third party compatibility

It's essential that individual applications can be coordinated along a whole production line. An open network which allows multiple types of devices to communicate is an ideal solution.

The CC-Link open device level network meets this need. Use it to link PLCs, displays, bar code readers and many other device types. With up to 10 Mbps and 1200 m bus length, CC-Link is up to the task of synchronizing multiple applications along extended production lines. A PC can also easily connect to the network, providing simple monitoring and control.

Controlled inputs
- User control panel
- Start stop switch
- Temperature control
- General input handling

FX1N   FX0N-3A
FX1N
FX2N-32CCL
Servo 1   Servo 2   Inverter
Motor

CC-Link

Controlled outputs
- Valve control
- Worm screw (Servo 1)
- Filling mechanism (Servo 2)
- Conveyor motor (Inverter)
- General output handling

Controlled inputs
- User control panel
- Cam switch
- Heat chamber temperature control
- Manual pulsar
- General input handling

FX3U-CNV-BD
FX3U-4AD-TC-ADP
FX3U-4AD-PT-ADP   FX3U   FX3U-20SSC-H x 2   FX2N-16CCL-M
Inverter 1   Inverter 2
Servo 1
Manual pulsar
GT1020
Motor   Motor   Servo 2   Servo 3

Controlled outputs
- User control panel
- Heat chamber heater
- Torque control cap (Servo 1 & 2)
- Sleeve placing (Servo 3)
- Pre-cam table conveyer (Inverter 1)
- After-cam table conveyer (Inverter 2)
- General output handling

Controlled inputs
- Test chamber
- General input handling

FX3U   FX3U-20SSC-H   FX2N-32CCL
Servo 1   Servo 2

Controlled outputs
- 2 axis arm (Servo 1 & 2)
- Address change
- Box ready output for box sealing application
- General output handling

Example system diagram

A complete system solution

Any given application requires a wide variety of system components in order to automate it. The FX PLC family is the heart of the applications shown in these pages. However, Mitsubishi offers a complete automation solution that will handle all aspects of your system design.

FX PLC family

Tailor the controller to precisely match the needs of the application. Choose from either simple to use fixed I/O count base units for basic applications, or more flexible controllers with expansion capabilities. Base units come equipped with a wide variety of different I/O device configurations meaning no matter what kind of voltages and currents are present, the FX can offer a solution to work with them. Expansion I/O units are also available that mirror these capabilities.

For more sophisticated applications, the FX line up also includes an array of analog signal processing options. These range from simple monitoring and generation of voltage and current signals up to specialized capabilities like temperature sensing in various forms. For motion control, the FX also offers a selection of capabilities, from built in pulse inputs and outputs, to full support of Mitsubishi's SSCNET III optical fiber motion control network. The need for rapid response in motion applications is addressed by the FX's high speed processing capabilities.

Finally, as no machine is an island, the FX offers comprehensive communications capabilities to integrate with the rest of the plant. These range from networks such as Ethernet and MODBUS to more basic serial communication links to insure you always know the status of a machine or process.

GOT HMI family

Mitsubishi is recognized as an industry leader in HMI technology. Our family of units include large touch screen units down to the economical GT1020 & 1030 shown here. These units are a perfect complement to the FX family for providing the key human-machine interface functions required by smaller applications. But while these units are compact, their size belies their capabilities. Their high resolution touch screen display has sufficient flexibility to show manufacturer logos or machine drawings. The backlight displays multiple colors, and there is a full alarm and recipe capability to enable rapid batch changes between jobs. Their displays can even be mounted in a portrait or landscape format to offer maximum control panel design flexibility.

Inverters

Mitsubishi Electric has long been regarded as a global leader in inverter technology. Our systems range from enormous drives handling hundreds of horsepower down to microdrives ideally suited to saving energy on small machines when paired with an FX PLC. In particular, our newest FR-E and D700 families offer a wealth of sophisticated features such as vector control and auto-tuning while being easily controlled from a FX PLC via digital or analog signals. The bottom line is no matter which type of inverter is used, significant energy savings (up to 60 %) can be realized over a direct supply connection to the motor.

Motion control

While some applications can be adequately handled with an inverter to control motion, there are many that require higher precision. Mitsubishi addresses this with a comprehensive line up of motion control products such as our MR-J3 servo line. These systems offer a range of unique, patented functions such as real time adaptive auto-tuning and vibration suppression. This insures each system runs as smoothly as possible, free from unwanted resonances, while maintaining maximum performance.

Engineering productivity tools

In today's world, programming software is regarded as being more vital than the hardware itself. Customers place more focus on reusable program code and user friendly features. This helps to reduce errors, reduce programming time and manage the programming process.
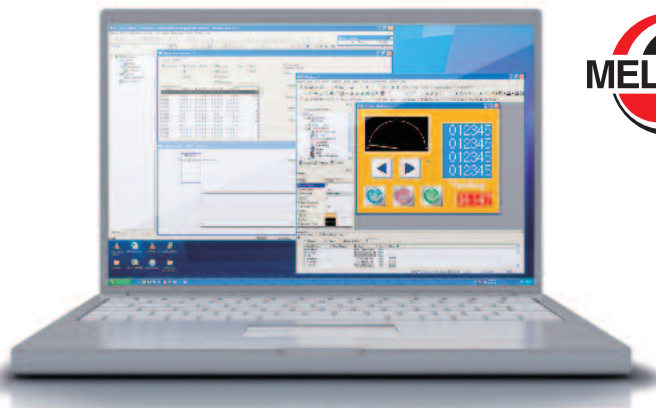
GX Developer

The key to any good software is that it is simple to use and intuitive. The GX Developer PLC programming package has achieved this by using a design that is simple to understand yet has access to powerful functions and tools. It also features help functions and an advanced communications setup utility, ensuring safe reliable data transfer to and from the target PLC.

GX Developer has also been designed so that it can interface directly with other FX programming packages, such as FX Configurator-FP and FX Configurator EN, allowing customers to access different programs in a straightforward manner.

GT Designer 2

GT Designer 2 is a screen design program used to create HMI screens for the GOT series HMIs. A user-friendly Windows® environment provides the customer with a simple and recognizable interface, facilitating a fast learning curve for new users. GT Designer 2 is equipped with a parts library, a range of touch-switches and lamps, screen preview functionality, a GOT communication settings utility and a project consistency check function. Together these features combine to make GT Designer 2 a platform that produces screens that simplify the control interface between the user and the machine.

GT Simulator 2 & GX Simulator

Mitsubishi Electric has created simulation packages to help designers increase development efficiency and ease.

GX Simulator and GT Simulator 2 allow users to create a virtual PLC or GOT respectively on their PC. PLC code and GOT programs can be tested and any errors debugged without the need of hardware.

GT Simulator 2 and GX Simulator have been developed so they can operate simultaneously, allowing full application environments to be created within the user's PC.

MELSOFT

A world of automation solutions

Robots

Motion control and servos

LV circuit protection

Inverters

Laser machines

CNC controllers

HMI and GOTs

EDM machines

Micro PLCs

Modular PLCs
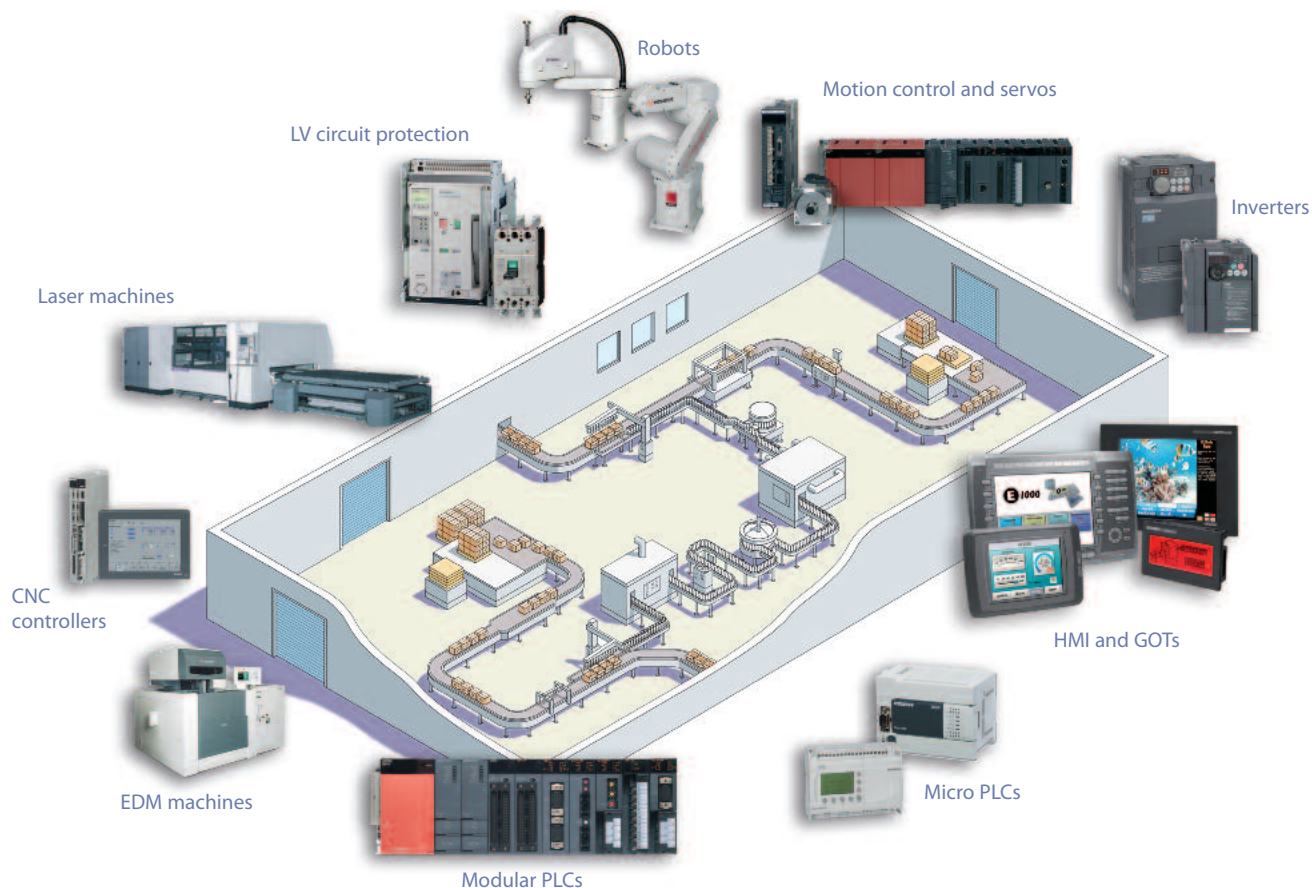
Mitsubishi offer a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

A name to trust

Since its modest beginnings in 1870, Mitsubishi has long since emerged as one of the world's leading companies, with 45 subsidiaries specializing in finance, commerce and industry. A symbol of premium quality, the Mitsubishi brand name is recognized around the world. Mitsubishi Electric Corporation is active in aerospace, transportation, semiconductors, energy systems, communications and information processing, audiovisual equipment, home electronics, building and energy management and automation systems, with 237 factories and laboratories in over 121 countries.

You can rely on Mitsubishi automation solutions because we know firsthand the need for reliable, efficient, easy-to-use automation and control systems in our own manufacturing facilities.

With global sales of approximately $40 billion and over 100,000 committed employees, Mitsubishi Electric has the resources needed to deliver the world's best products and the ultimate in service and support. Today Mitsubishi supplies a wide range of automation equipment extending from PLCs and HMIs to CNC and EDM machines.

Global Partner. Local Friend.