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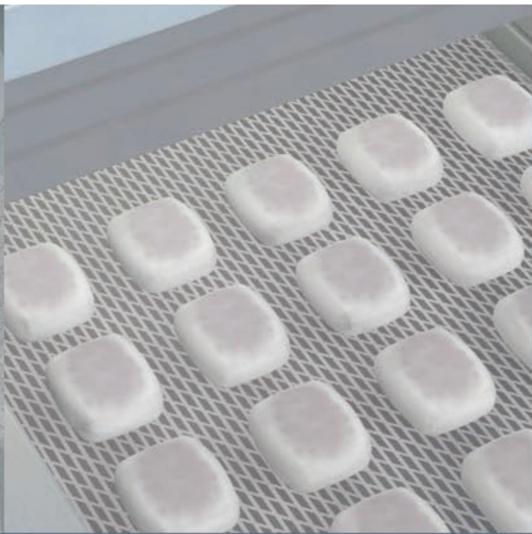
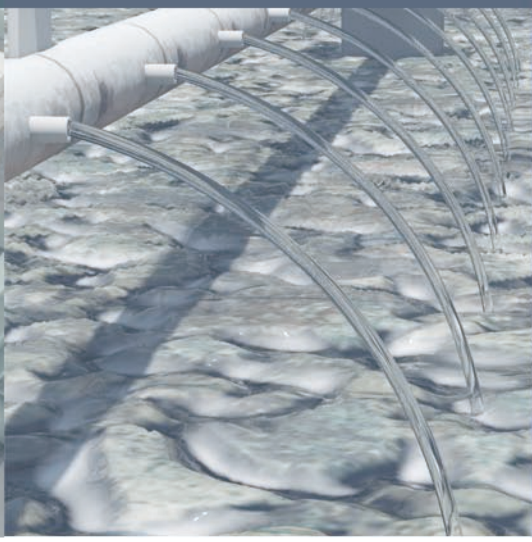
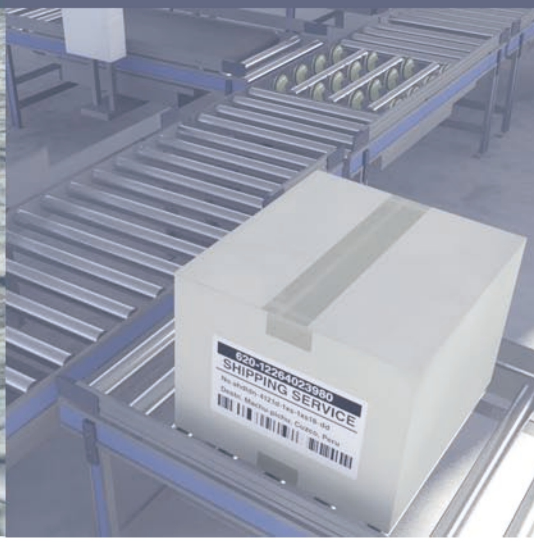
MITSUBISHI ELECTRIC

PROGRAMMABLE LOGIC CONTROLLERS

FX Applications




Pure Control - Designed for your application

Mitsubishi Electric Corporation Himeji Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001(standards for quality assurance management systems)

ISO 14001 UKAS ENVIRONMENTAL MANAGEMENT 051 EC97J1234

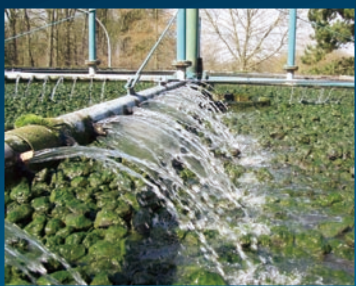
Certified ISO 9001 by BVQI UKAS QUALITY MANAGEMENT 008

Empowering Industries

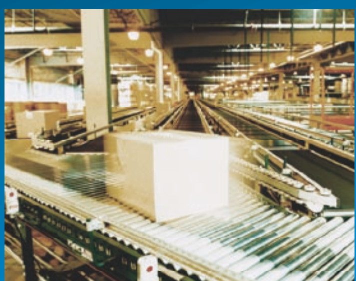
A World of

Wood Cutting

Baking



Water Industry



Material Handling

Shipping

Understanding

A PLC is essentially at the heart of every application; therefore it is vital that the chosen PLC meets the needs and requirements of the application - ultimately giving satisfaction to the end user.

The FX Family is designed so that the main PLC CPU acts as a platform to which you can add and customize to your needs, allowing customers to create compact PLC solutions that fit perfectly within their systems.

With a wide range of PLC base units that form the FX Family range, customers can select products that fit their applications and cost requirements with few compromises. The range offers four independent yet compatible products: FX1S, FX1N, FX2N and FX3U, all of which have been designed with 4 key principles in mind:

- ***Speed and precision***
- ***Flexible Design***
- ***Backward & Forward Compatibility***
- ***Low cost***

Visualization

Efficient data management is a key component to achieving successful human machine interaction. The GOT1000 range of HMIs has been specifically built to enable customers to design interface screens that visualize the application in the easiest way possible. The intuitive GOT software and setup utilities allow customers to create functional screens and reduce setup time.

Applications

Customer Confidence

The FX Family is the PLC of choice across the world's industries and applications. At Mitsubishi Electric we pride ourselves on our close working relationship with our customers. By listening to customer needs Mitsubishi Electric has learnt to understand the requirements of modern applications and have developed PLC solutions that offer quality, reliability and a product that customers want. The success of this approach has been reflected in the sales figures of our products – now surpassing the 7 million milestone.

International Recognition and Reliability

Mitsubishi has a reputation for producing high quality products. This comes, in part from our commitment to understanding and meeting the requirements of international standards and directives.

In today's world of manufacturing, customers require durable products that can cope with the day in day out tasks of the application they control. To ensure our high-levels of product reliability, Mitsubishi Electric's quality control program leaves nothing to chance, resulting in high-level of quality that customers can rely on.

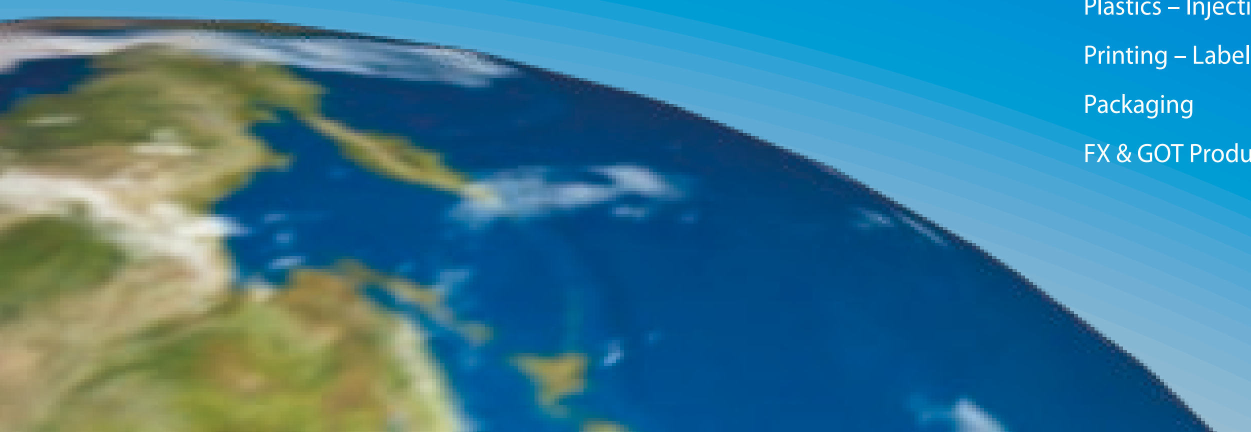
INJECTION MOLDING

LABEL PRINTING

PACKAGING

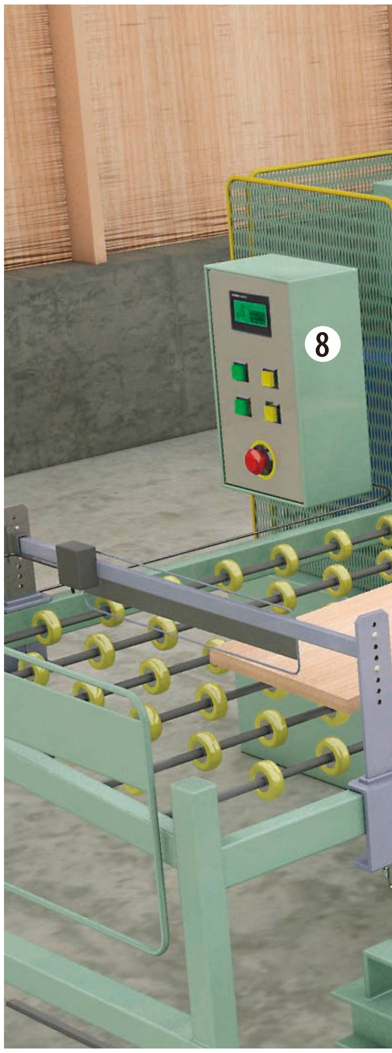
CONTENTS -

World-Wide.



Wood Cutting Industry

– Plank Cutting Application



Features

- *FX1S – A low maintenance Micro-PLC*
- *Simple Connection Analog Expansion Boards*
- *GT1020 touch screen micro-HMI with multi-connection functionality*

Application Overview:

Wood is a commodity that is being used every day around the globe. To handle the different types of needs for this material the applications are many and range in complexity. For the smaller applications where customers require an affordable, robust PLC, the FX1S often is the controller of choice.

FX1S – An affordable and robust Micro-PLC

For effective woodcutting of different sized planks within the application, the FX1S PLC is equipped with two inverters. Control of the first inverter is responsible for moving the plank through the saw so that smaller plank sizes can be created and the second inverter is necessary to drive the spinning saw across the plank.

The method used to control both the position of the plank and the saw blade is known as the Limit Switch Method. To provide control of movements within the system two switches are provided in places where a moving part passes. For example when considering plank positioning there is two points where these switches occur:

- At the backboard which determines the length of the plank to be cut. (To change the length of the plank being cut the backboard can be manually adjusted to users requirement)
- At the loading position required for placing new planks on to the application.

Once the first limit switch has been activated, the motor speed is reduced. On activation of the second limit the motor turns off and the brake turns on to stop the movement of the plank. For requirements where greater precision is required the user can reduce the operation speed of the inverters to reduce overshoot of the second limit switch.

Although this method does not provide the accuracy as associated with servo control, using inverters and the limit switch method, the application control system can be realized at a much lower cost.

Analog Expansion Boards

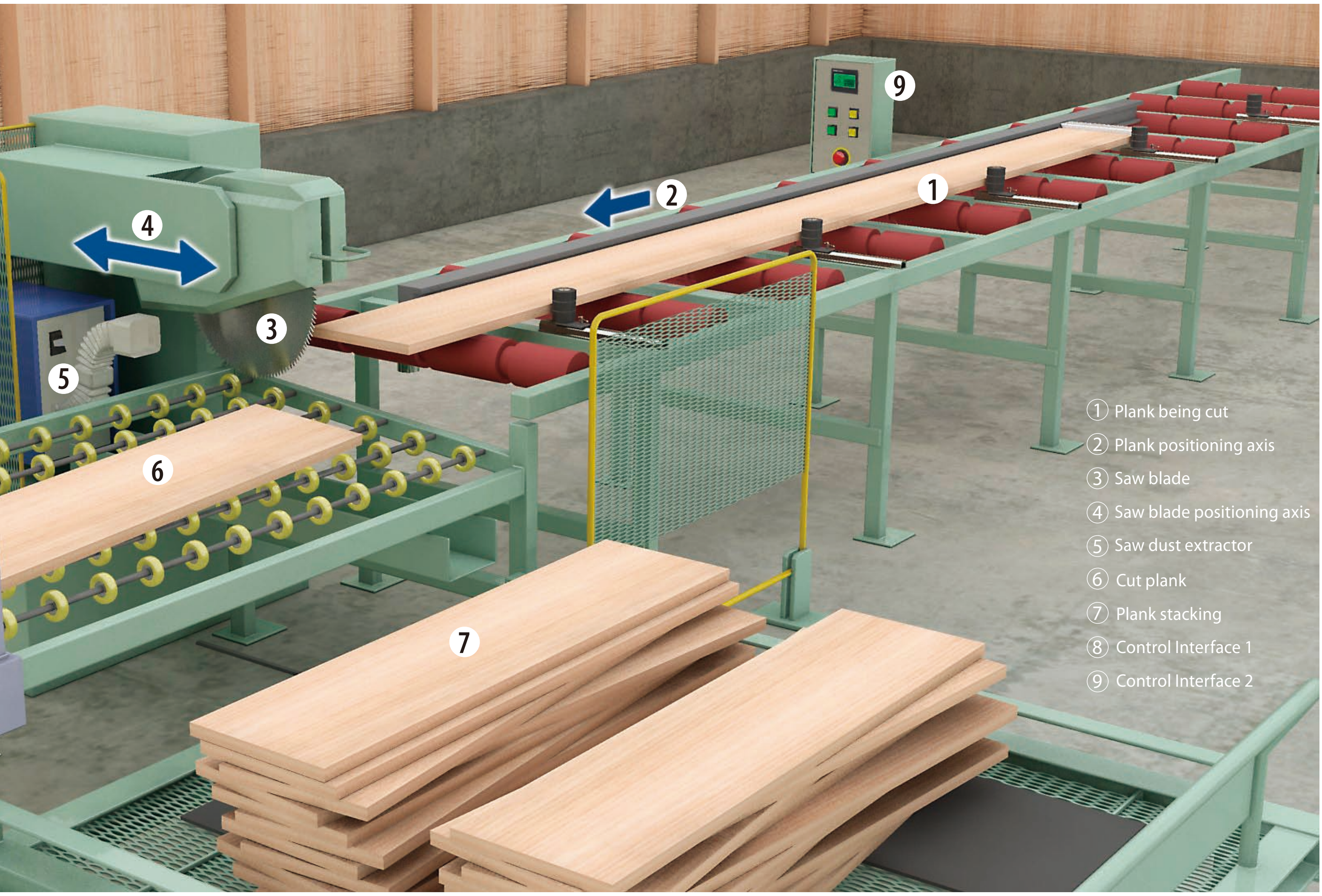
The FX1S can also connect an Analog to Digital or Digital to Analog expansion boards to the front panel of the PLC. By using the FX1N-1DA-BD, the user has one analog output that can be used to control the speed of the cutting saw. Using a variable sinusoidal output into an inverter, the saw speed can easily be varied according to the size of the plank being cut.

Alternatively for applications that require analog inputs the FX1N-2AD-BD is available. This product permits 2 analog inputs to be integrated to the PLC which is particularly useful for when acquiring such data as speed or pressure that is to be used internally within the application.

GT1020 - Just Right!

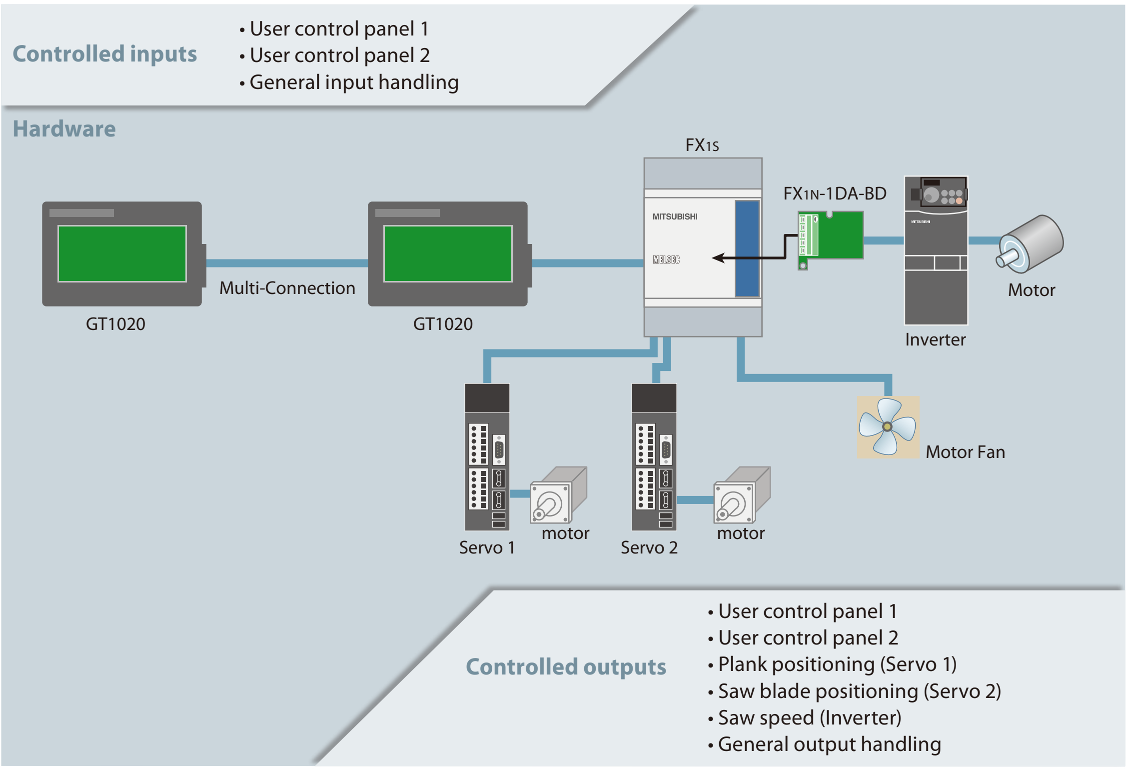
Using the small but high resolution screen the GT1020 provides clear visualization of application data, as well as providing the user with a touch screen interface. The 3-color LED screen (green, orange and red) also provides clear and easy to understand data regarding the status of the machine, maximizing the potential of this micro-HMI.

For high performance cost ratio, the GOT1000 series also features multi-unit connection. This feature allows the applications to be enhanced with two HMIs, allowing the user to access application data from more than one place on the application. Thus when preparing the plank for cutting the user benefits from a more ergonomically friendly application.



The GOT1000 series also permits the use of alternative start-up screens during start-up of the GOT, enabling machine builders to feature there own brand logos when the customer starts the application, giving a more personal touch to the end customer.

SYSTEM CONFIGURATION



Food Industry
– Heating Conveyor Application

Features

- *FX_{1N} PLC – An Entry Level Expandable Controller*
- *High precision Analog Special Function blocks*
- *GOT series with Recipe Handling*
- *Wide screen 4.5 inch display via GT1030*

Application Overview:

Food is an important part of our every day lives. To cope with the multitude of products that we take for granted, applications are continuously being modified and improved to sustain their competitive edge within the market.

The FX_{1N} – An entry level expandable controller

A heating conveyor is an application that can be typically seen within the food processing industries; however other connotations of the application are also apparent in industries such as the automotive industries, pharmaceutical industries and ceramic industries. The application is principally based on both analogue controls with secondary requirements for positioning. To meet this demand the FX_{1N} steps to the forefront providing respectable processing speeds, control of up to 130 I/O as well as a range of other attributes that make effective control possible.

Effective Analog Control

Within the conveyor oven, the challenge of providing optimized heater control is of the up most importance. Two achieve this successfully the control system relies on both analog to digital control and digital to analog control. Using Mitsubishi Electric's range of Special Function Blocks the heating of the chamber can be tailored to the needs of the specified industry.

To provide the analog to digital control required for monitoring the temperature of the furnace, the FX_{2N}-4AD-TC using a 3-wire platinum resistance thermometer sensor (PT100) and a compensated range of -100 + 600 °C (-148 to1112 °F). With a resolution between 0.2 to 0.3 °C (0.36 to 0.54 °F), the application can be setup to a quire precise data aquisition from even the most temperature sensitive of products.

To provide output control to the heaters, the control system is setup with an FX_{2N}-4DA, which using the 4 outputs allows more than one heater to be controlled, permitting large applications to feature different temperature zones. For plastic industry applications different temperature zones may be useful for such processes as curing. The accuracy of the unit provides a resolution of either 5mV or 20μA as well as an adequate conversion time of 15ms per instruction.

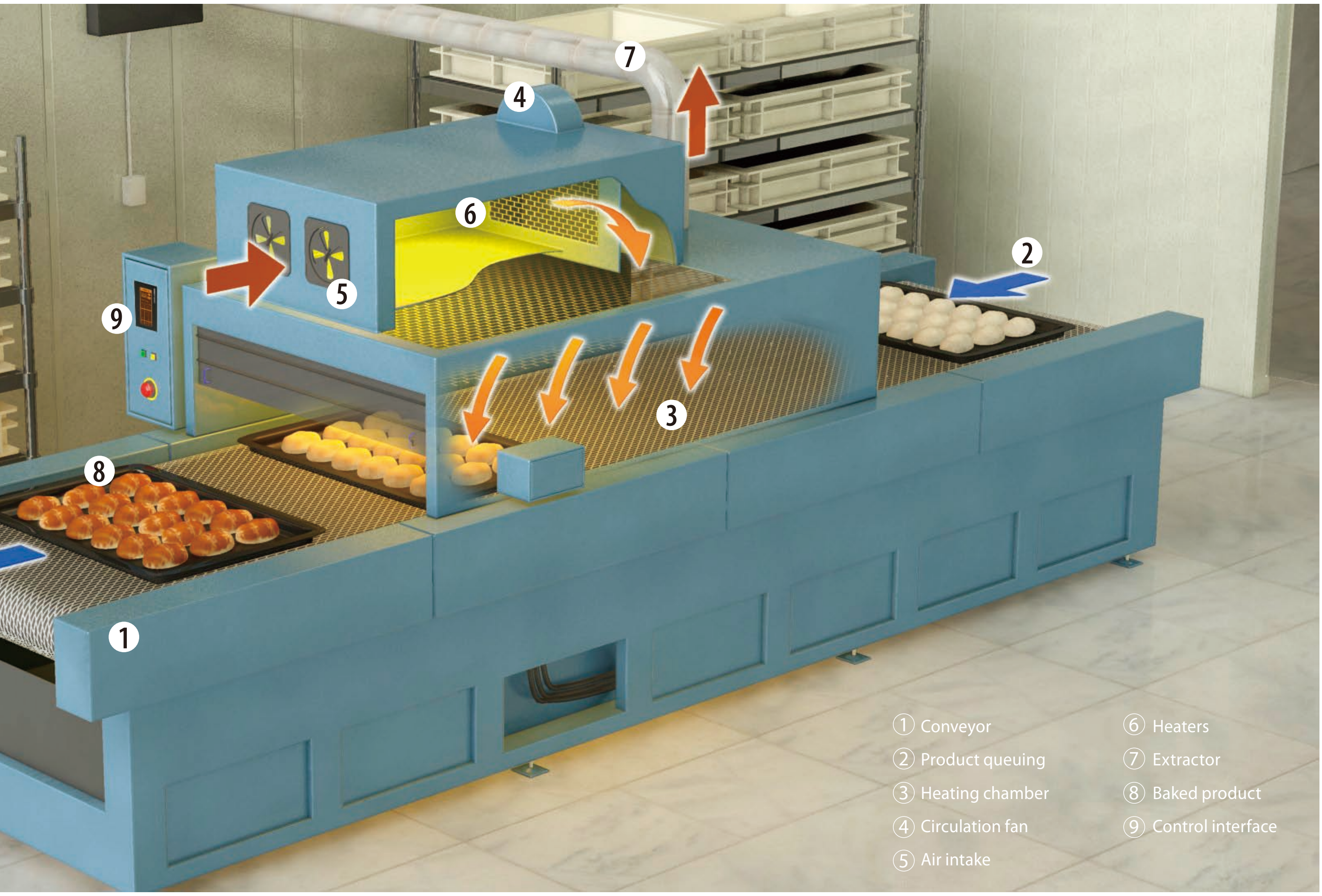
Through the use of the Analog Special Function Blocks the customer can easily set up a closed loop control system that meets even the toughest application requirements.

The application also makes use of the FX_{1N}'s built in positioning instructions that allow the product being processed to be quickly and accurately positioned in the oven via control of the conveyor belt.

GT1030 - Bright

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

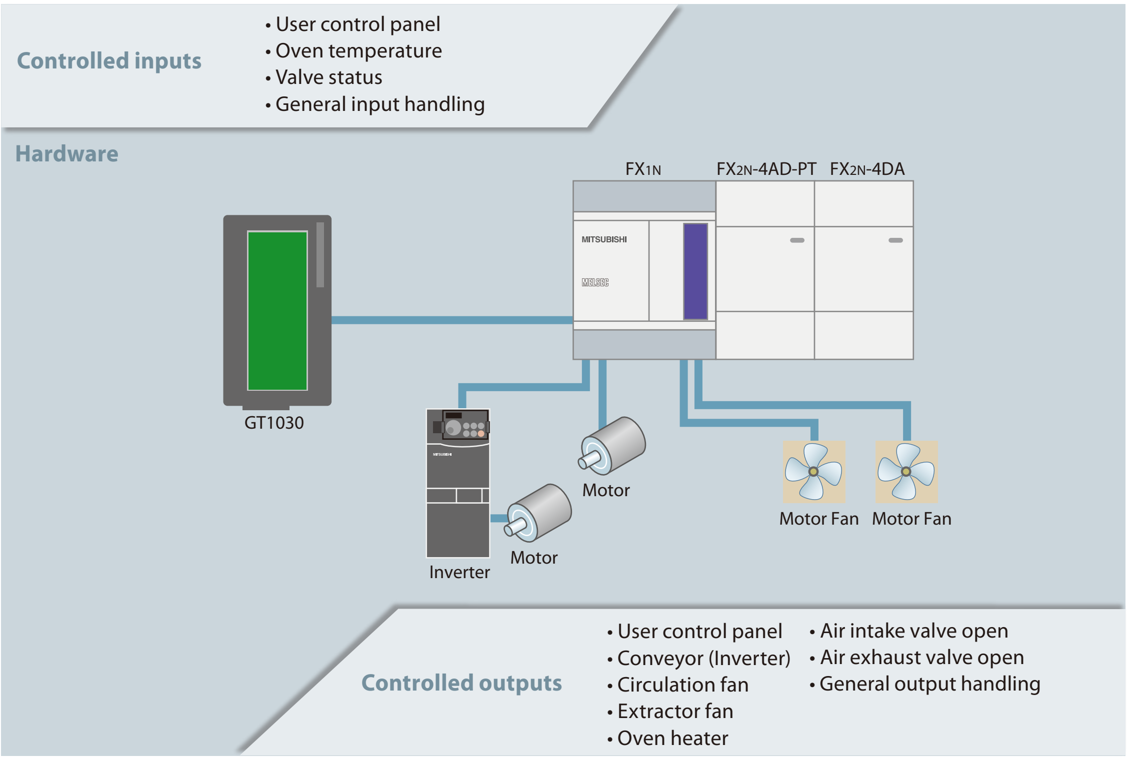
The GT1030 is also equipped with a number of features that enhance the end-users interaction with the application. Using a 4.7 inch wide screen touch panel display the customers are able to press two buttons simultaneously to activate critical tasks, reducing the chance of



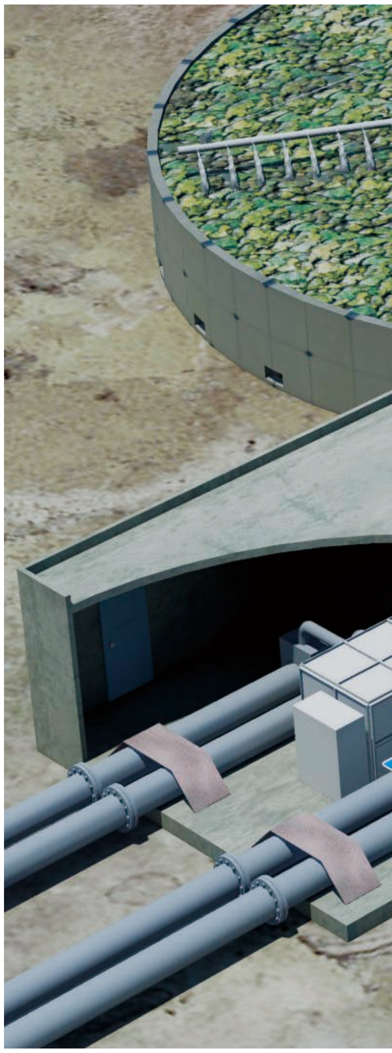
the wrong button being accidentally pressed. The GT1030 also features a real time clock, enabling the end user automate oven on and off times from with the HMI.

Physical layout of the GT1030 is also versatile enabling the user to vertically or horizontally mount the HMI to the application. This allows the optimization of the screen layouts for the application and mounting options for space critical applications to the machine builder.

SYSTEM CONFIGURATION



Water Industry
– Trickle Filter Application



Features

- Remote monitoring and maintenance via Ethernet communication

-FREQROL Protocol for simple setup of inverters

-Energy saving inverters

-Handy HMI

Application Overview:

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 for large treatment plants that range into 1000s of I/O to compact PLC applications, like the trickle filter illustrated here.

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 the wastewater from above the bed, where the wastewater trickles through a circular bed of coarse stones. The microorganisms in the wastewater attach themselves to the bed which is covered with bacteria. This bacteria breaks down the organic waste and removes pollutants from the wastewater.

Mitsubishi Inverters

The key element to this application is providing a continuous flow of water through the tanks. For this task Mitsubishi Electrics Inverters are specified. A key advantage of these Inverters is that they allow for energy saving via their variable torque load, enabling the system to increase power into the motors when increased pumping is required. For ease of setup the inverters can easily be connected to the FX3U PLC using the FREQROL protocol. This protocol allows connection of an FX PLC and up to eight inverters that communicate in accordance with RS-485, permitting inverter monitoring as well as reading and writing parameters to the inverters – all of which enables the customer to keep a sharp eye on events happening within the system.

Ethernet - Remote Connection

With these types of application often being located at remote sites, it is no longer cost effective to have service personal frequently visiting the application just to perform checks. To overcome this problem the control system features an Ethernet connection to enable remote monitoring of the application. Remote monitoring allows the user to setup control rooms where a number of different stations can be monitored from one location. All of which reduces the labor costs and it in-turn reduces the overhead costs of running the application.

To enhance remote monitoring, the FX3U-ENET connection also features E-mail, allowing the FX3U PLC to actively contact the user giving status information and notifying the operator in the event of an alarm within the application.

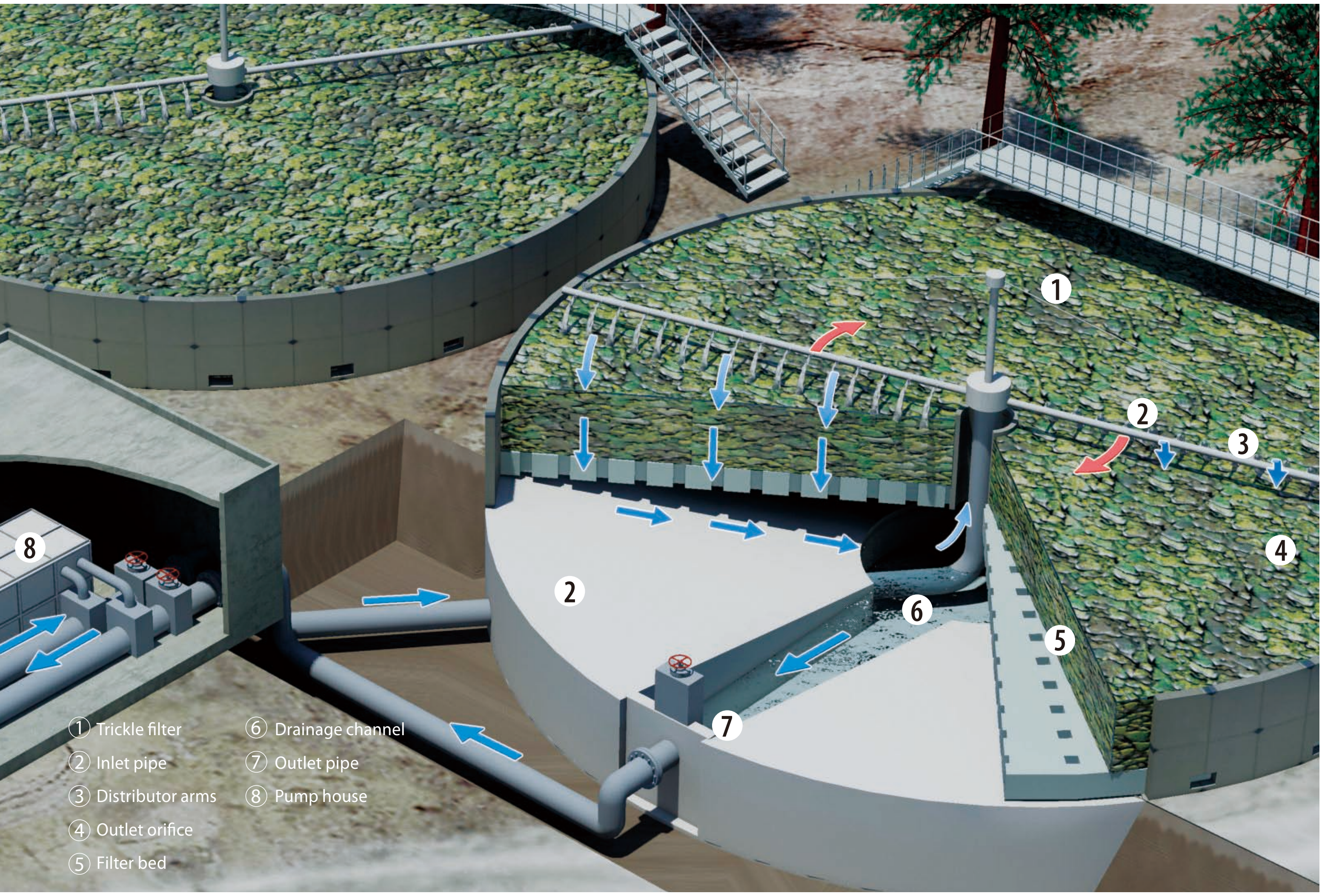
A Mobile HMI for Mobile Users

On the occasional times where personal 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 personal to directly plug their mobile into the HMI, providing a user interface that has been created especially for servicing the application, helping maintenance staff to service the application in the most efficient manner possible.

Although technically based on the GT11 series, the GOT-Handy terminal also features a number of functions that help realize operation in a mobile environment:

Pushbutton switches- with LEDs for operation status check are provided for inputs to the external equipment.

Emergency stop switch - This switch immediately stops the unit in an emergency. A Normally closed contact is adopted to assure safety. In



addition, the switch guard is offered as an optional device to prevent operation mistakes.

Selector key switch - The operator can be limited for each type of operation such as mode changeover (between manual and automatic), mode selection and setup change.

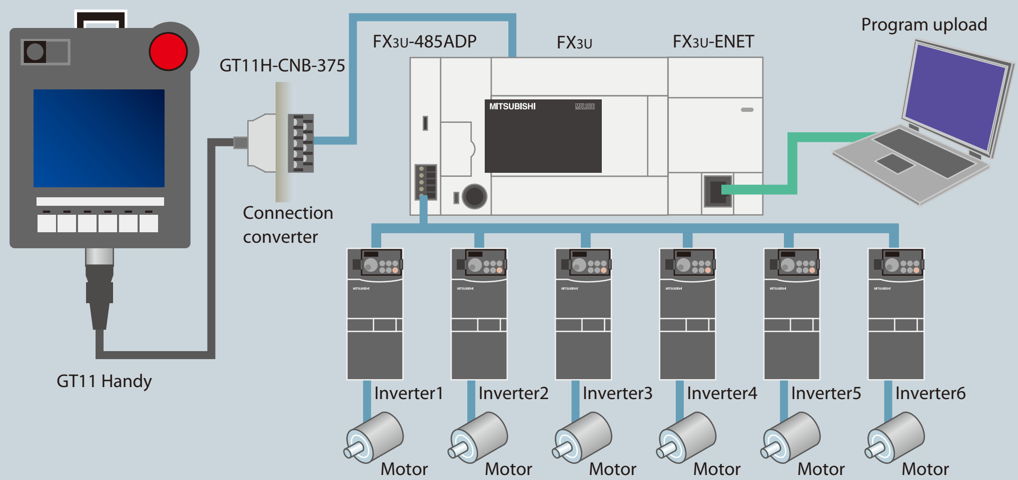
Three-position grip switch - The three-position (OFF-ON-OFF) type 'dead-man' switch is adopted for preventing operation mistakes and prohibiting operation of a machine. The switch can directly control external equipment to give immediate stop commands to a machine.

SYSTEM CONFIGURATION

Controlled inputs

- Water pressure
- Valve status
- Distributor arm encoder pulse input (x2)
- Water flow rate
- Distributer rotation speed
- User input data (GT11 handy)
- User input data (Ethernet connection)
- General input handling

Hardware

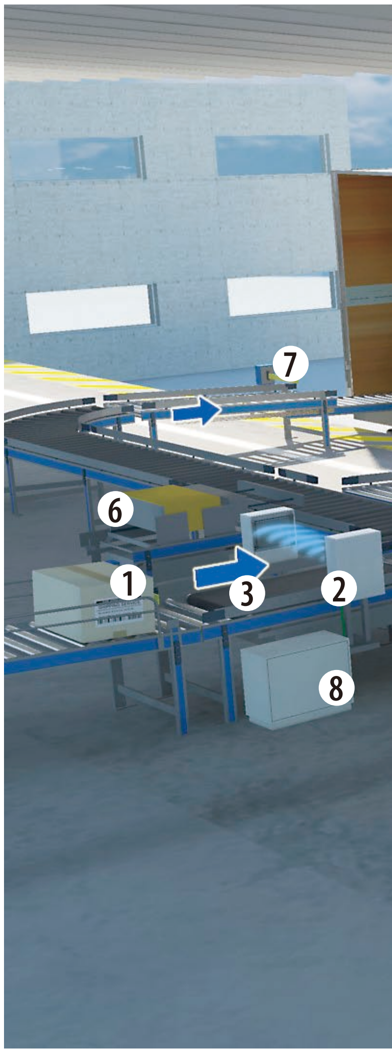


Controlled outputs

- FX3U-485-ADP x 2 (Pump control)
- FX2N-ENET – program upload and download
- Water pump in (Inverter 1 & 2)
- Water pump out (Inverter 2 & 4)
- Distributor arm control (Inverter 5 & 6)
- Output data (GT11 handy)
- Output data (Ethernet connection)
- General output handling

Note: Direct disconnection of the handy unit will cause the emergency stop switch to activate unless a design such as configuring an external parallel circuit is implemented. Refer to GOT Handy manual for details.

Material Handling Industry
– Package Distribution Application



Features:

- Multi-network connection

- Easily expandable system

- Third-Party device Connection

- ROHS Compliance

Application Overview:

Good communication from a PLC is a necessity for every application – whether it is to provide a connection between actuators and switches, communication between other FX brand products or other third part devices. When communication channels are appropriately selected they increase the effectiveness and efficiency with the way application completes its tasks.

Effective Data Management

Material handling is an industry area that defines its existence on effective data management. It is of the up most importance that accurate information is continuously and reliably passed through the system, enabling updating of databases and allowing the user to access information at any given moment. To meet these demands the FX3U steps into the fold, offering a range of serial and network communication options for flexible easy to use communication functionality.

Straightforward Communication

Today package tracking is something that is taken for granted within the material handling industry, allowing system users to see exactly where a specified package is at any given moment. To do this the PLC is situated in the application as a handling device, passing information received from the RFID scanner up to the master computer. An RFID scanner, a third party device, is also connected to the FX3U via a FX3U-232-BD board mounted on the front of the PLC. Using Non-Protocol communication, package location data from the RFID scanner can be quickly passed to the FX3U PLC.

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 the positioning outputs of the FX3U PLC to provide control signals to the longitudinal/latitudinal conveyors, thus creating a destination path for the package.

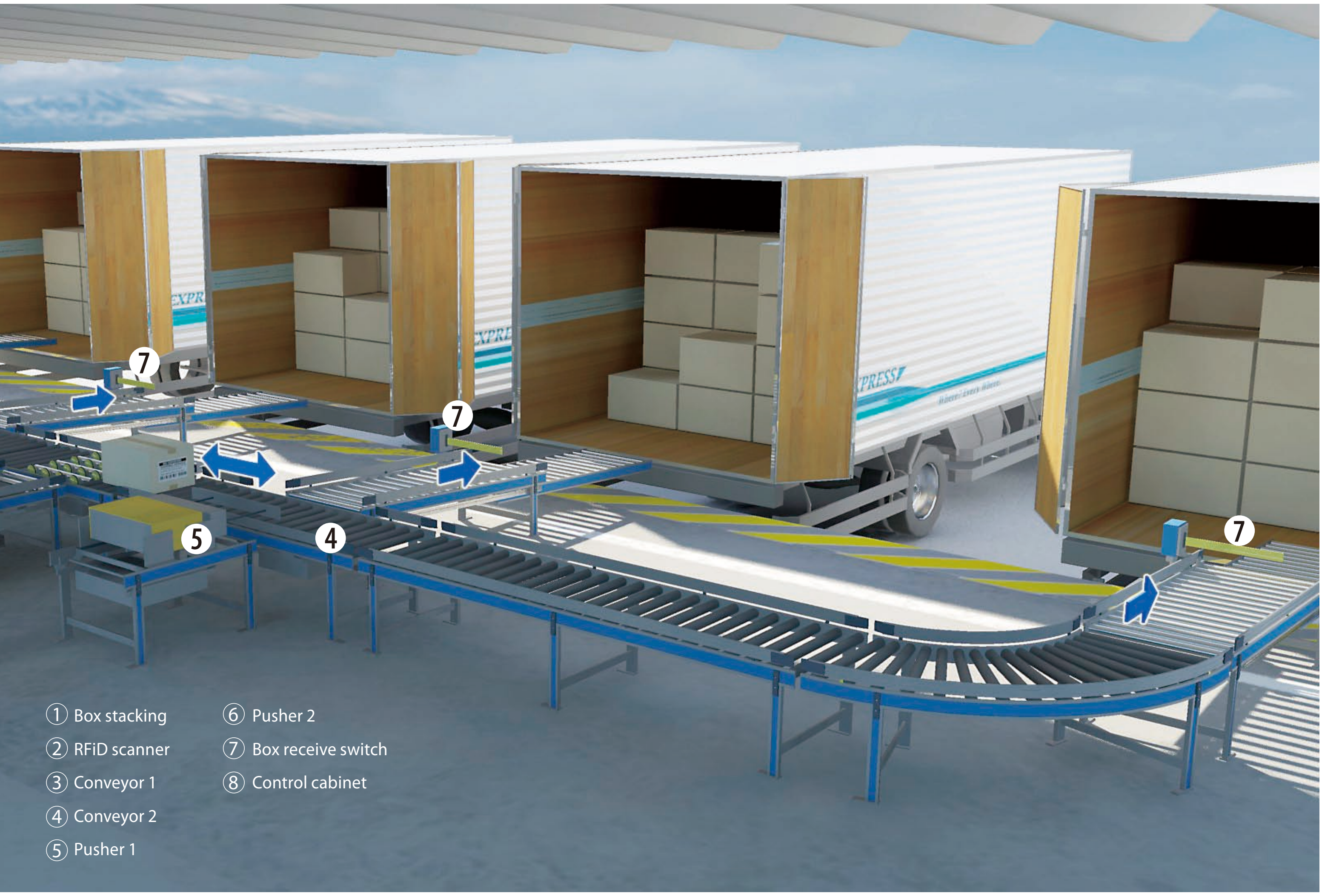
The second process is to update the Master computer with package data received by the PLC. For this the Computer Protocol is used, creating a master station in the form of a PC. This allows all information received and sent by the FX3U to be recorded within the Master station. Once in the PC, data can be easily managed and manipulated using everyday appliances, allowing users with little experience to successfully interact with the activities of the application.

Expandability

Using the FX3U-485-ADP hardware connection the Computer Link Protocol network is easily expanded, permitting up to 16 FX PLCs to be placed on the network up to 500m away from the master PC. This flexibility offered by the FX3U allows users to expand their applications easily giving them the flexibility to operate within modern day businesses where change is constantly present.

The FX range also features a range of other serial networks that enable better realization of the application depending on the given requirements. These serial networks include N:N networking, Parallel Link and AS-I system.

To enhance serial network setup, Mitsubishi Electric's own PLC programming software, GX Developer, also features parameter windows that facilitate the setting up of networks. Through simple drop down menus, users can quickly and easily select the channel that the network will operate on, the network type, communication speeds and time out periods, thus reducing the



coding time for the programmer.

Taking Care of the Environment

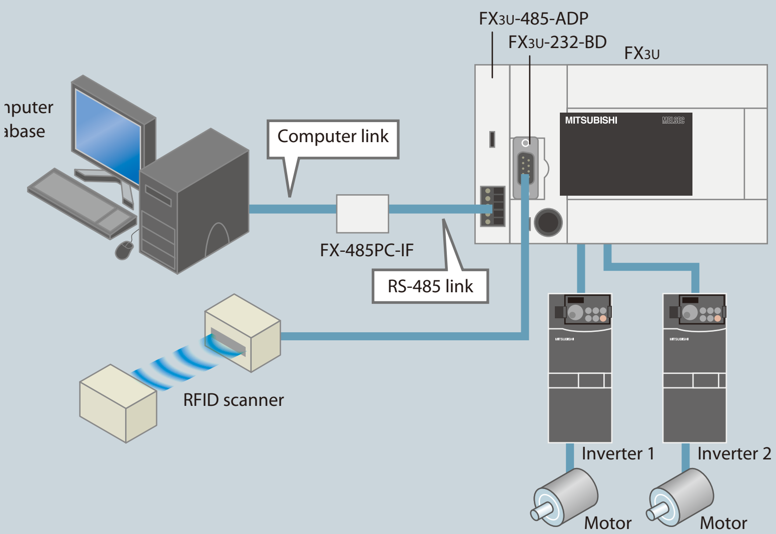
With RoHS compliance as standard for the complete product range, customers are assured that the purchasing of FX and GOT products falls inline with the directives placed within the market, making for a more environmentally friendly control system.

SYSTEM CONFIGURATION

Controlled inputs

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

Hardware



Controlled outputs

- Operator control panel
- Conveyer 1 (Inverter 1)
- Conveyer 2 (Inverter 2)
- Package data (Computer link)
- General output handling

Shipping Industry
– Dehumidification Application

Features

-Shipping approvals

-Easy program change via EEPROM cassette

-High accuracy Analog Special Function Blocks

-Intuitive programming environment

Application Overview:

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, customers require products that are flexible as well as robust, so that they can operate in a variety of different environments without fear of stoppage.

International Acceptance

Shipping is a large industry area that has evolved to handle one part of this transportation process. Within modern ships, be them cargo ships 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 legislative requirements must be first met. The FX series base unit range along with a range of SFBs, ADPs and other accessory products are compliant with a number of key shipping approval organizations, including: Lloyds, German Lloyds, American Bureau of shipping, Registro Italiano Navale, DET Norse Vetaritas and Bureau Veritas. All of which gives the user confidence that the FX control system will operate safely within the bounds of this strict operating environment.

Adapting to the Application

To care for the condition of the steel and the products being transported it is imperative that the ship interior is kept as dry as possible. Therefore moist air, a catalyst for rusting and causing mildew, must be removed. This process of handling moist air within the ship is carried out by a dehumidifier application. The application itself is simple, taking air from the ship holds, passing it over a cooling filament, condensing the moisture from the air before then passing the dry air back into the ship hold.

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

Direct Motor Connection

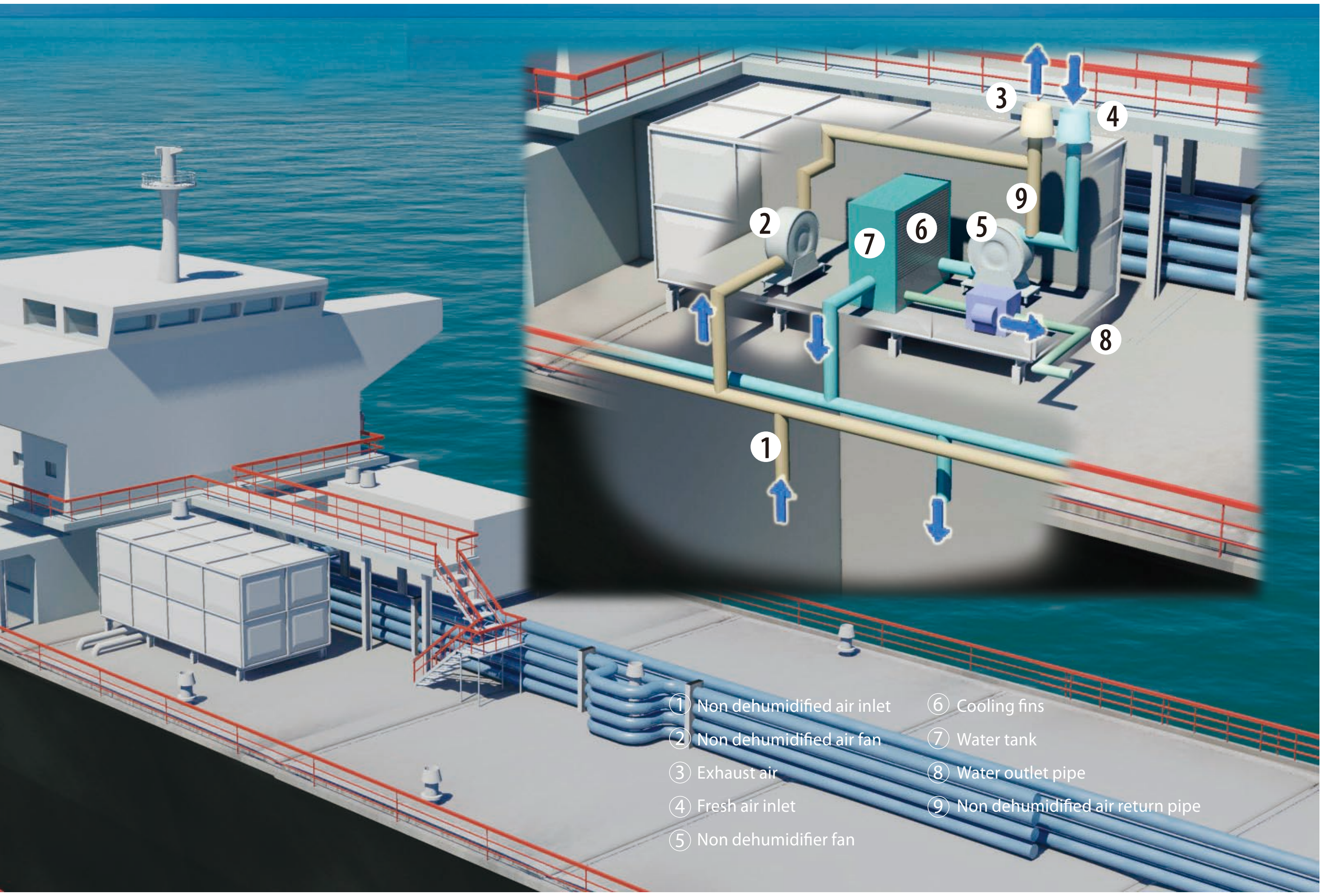
To remove condensed water from the system, the control system takes readings of the water levels from the condensed water collection tank. Once the threshold value is reached within the tank the PLC turns on an output which is connected to a motor, and water is pumped from the collection tank until emptied.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

Simple Program Change

In applications such as those fitted to ships, when a program change is required, often the personnel around the device are not familiar with the internal working 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 the modified program, after which it can then be sent to the end user. On recital of the EEPROM cassette, the end-user just simply plugs the cassette into the PLC, where the EEPROM program will automatically run. This process minimizes complications and avoids the need for costly application engineers on site to make program changes.

Intuitive Programming Environment

For the machine builder who makes the original application FX Family of controllers has a simple



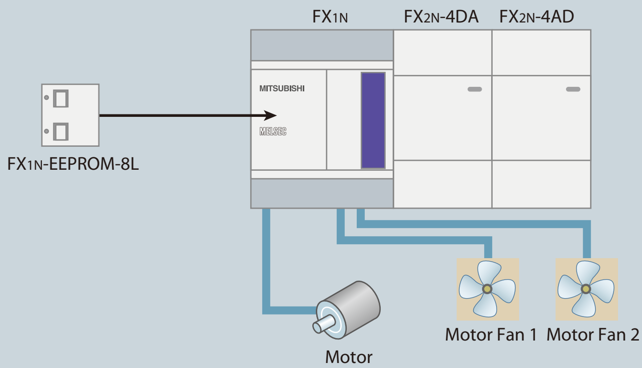
programming structure. Using GX-Developers straightforward programming environment, easy to use help functions, and advanced PC to PLC communication layer machine builders can quickly develop application programs that meet the demands of the application.

SYSTEM CONFIGURATION

Controlled inputs

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

Hardware



Controlled outputs

- Valve control
- Non-dehumidified air fan (Fan 1)
- Dehumidifer fan (Fan 2)
- Cooling fins
- Water pump
- User control panel
- General output handling

Plastics Industry
- Injection Molding Application

Features

-New FX3U ADP bus for high-speed precision control

-3rd Party device connection via Modbus

-High speed input/output ADPs with differential line drivers

-HMI with CF card interface and List Editor

Application Overview:

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

With injection molding applications, the process involves turning raw plastic granules into usable commodities. Although a straightforward process, the control system must handle analogue and positioning control, communication and provide speed when processing instructions. To set a new benchmark within the compact PLC market the FX3U was developed along with a new high-speed Special Adapter (ADP) bus that implements control via direct access to data registers and setting bits within the PLC, enabling realization of higher processing speeds for the customer's application.

High speed I/O Control

High speed I/O control is an integral part to the application. The application relies on control of the worm screw that drives the plastic granules down the heating chamber of the application, control of the reciprocal motion that drives the melted plastic into the mold, and once the plastic is set in the mold it is also responsible for the mechanism that opens the mold and ejects the plastic and re-closes the mold again. The high-speed input and output ADPs provide simple control of up to 4 axes that can process signals at up to 200kHz. Both the FX3U-4HSX-ADP and the FX3U-2HSY-ADP use differential line drivers which improve positioning accuracy and reduce the effect of noise within the system.

Explore the Possibilities - Modbus

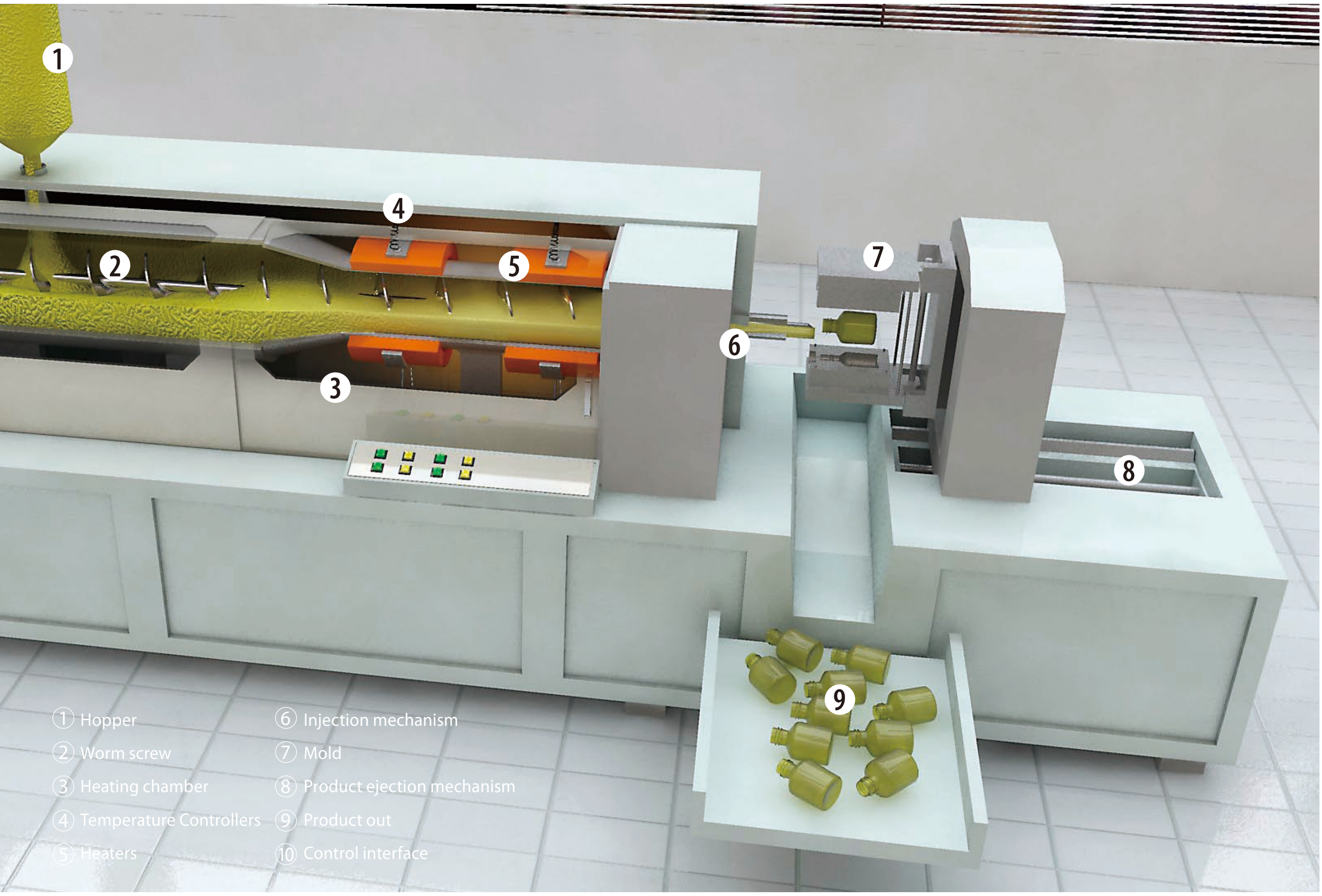
A Modbus connection provides a simple connection for the temperature controllers which monitor the temperature of the heating chamber and provide control to heaters. Modbus allows a simple connection of both FX3U PLCs and 3rd party devices as long as they are compatible with the protocol. This opens the customer to a range of new opportunities, making sure that the optimum sensory devices and output devices are fitted to the application control system. The FX3U-485-ADP-MB hardware connection allows communication with up to 16 slaves with a transmission speed of up to 19.2 kbps.

Data Visualization and Storage

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. Amongst 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 best method to present application data. Screens can be tailored to the end users needs so that high-level control is always within one touch away.

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

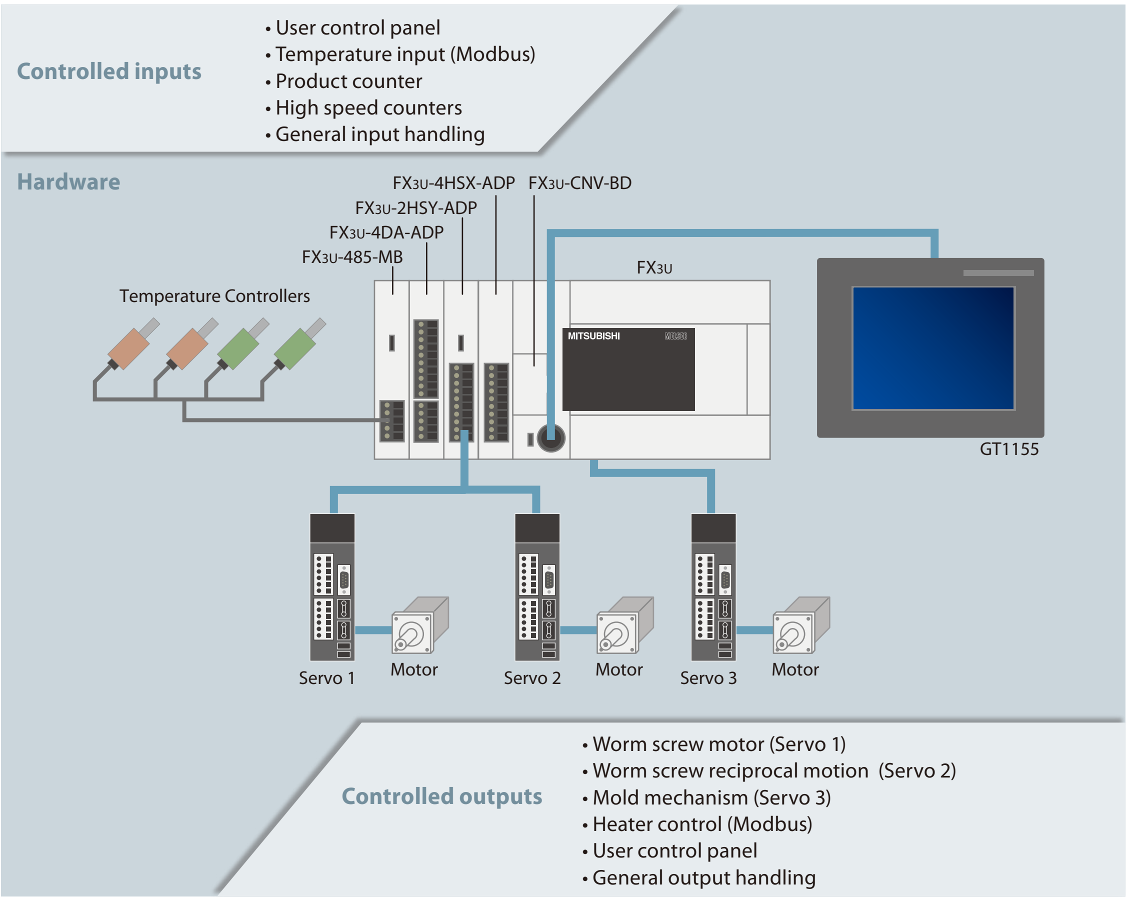
Direct Program Change & System Monitor



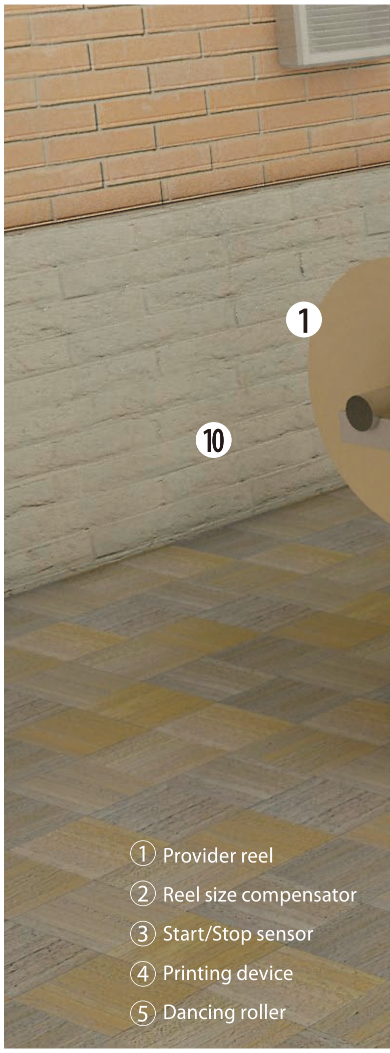
Furthermore embedded to the GT11 is a List Editor that provides a convenient method for minor onsite program changes. Changes are carried out in instruction list format, removing the need for additional peripheral devices.

Using System Monitor within the GT11, Mitsubishi PLC devices can be monitored and changed. Monitoring can be performed by selecting individual devices to be monitored, or by specifying an initial device. Current values and set values of timers and counters devices can also be changed, along with the buffer memory of attached special function blocks.

SYSTEM CONFIGURATION



Printing Industry
– Label Printing Application



Features

-FX2N-10PG with up to 1MHz pulse output string

-Non-protocol communication for third party device connection

-GOT 1000 Series with language switching

-FX1N-BAT for trouble free export

Application Overview:

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 within the market.

Single-Axis Positioning Module

For the majority of applications the FX1N'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 array output of up to 1MHz. This highly accurate pulse output can be used to drive a single-axis stepping motor or a servo motor enabling advanced control within the application. To limit the affect of noise within the system, the FX2N-10PG is also equipped with a differential line driver. The differential line driver cancels out any white 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, 7 different operation functions, such as jog mode, zeroing and speed increase or decrease functionality, the FX2N-10PG provides an array of functionality for the customer to control the application with.

Control of 3rd party devices

For control of third party devices the FX range can also communicate via non-protocol communication, connecting to devices such as printers, barcode readers etc. Using Non-Protocol communication up to 4096 data points can be sent, and up to 4096 points data can be received and with a total extension distance of up to 15m via the FX1N-232-BD, this setup could also be used be used on larger applications.

Trouble Free Export

The FX1N-BAT has been designed for long-term data retention (up to 1 year), to avoid the loss of capacitor-backed data. This allows the machine builders to export their applications world wide, ensuring that the machine is in an operable state when first turned on by the end-customer. This reduces complications for the end-customers on recital of the application.

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 GOT series features language switching which allows a variety of languages to be loaded within the users program, allowing the user to switch the GOT language at a touch of a button. The GOT series is also compatible with Unicode 2.1 enabling a host of character sets to be chosen whatever the language.

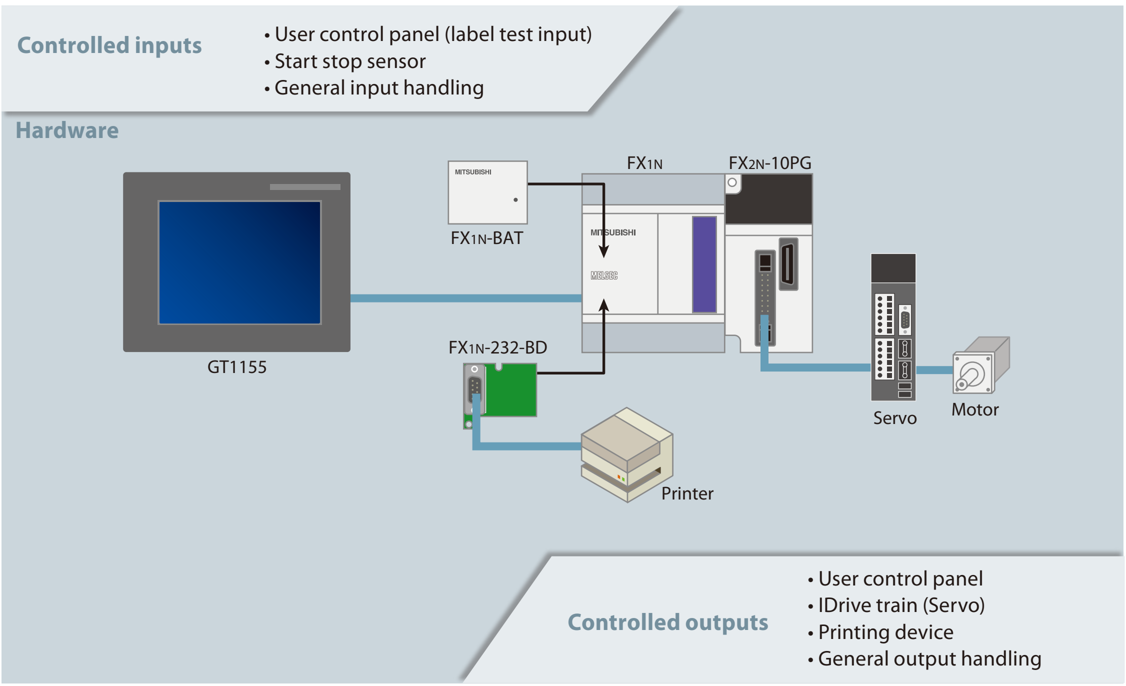
Using the GOTs text input feature, new ASCII strings can be created within the HMI and sent to the PLC. This feature allows the user to modify the alphanumeric strings that are printed to the labels without complications of additional hardware or software.

With a range of fonts, graphical charts and alternative startup strings the GOT range allows the user to create interface screens that display in-depth information about the application. Also by using the available graphical tools, machine

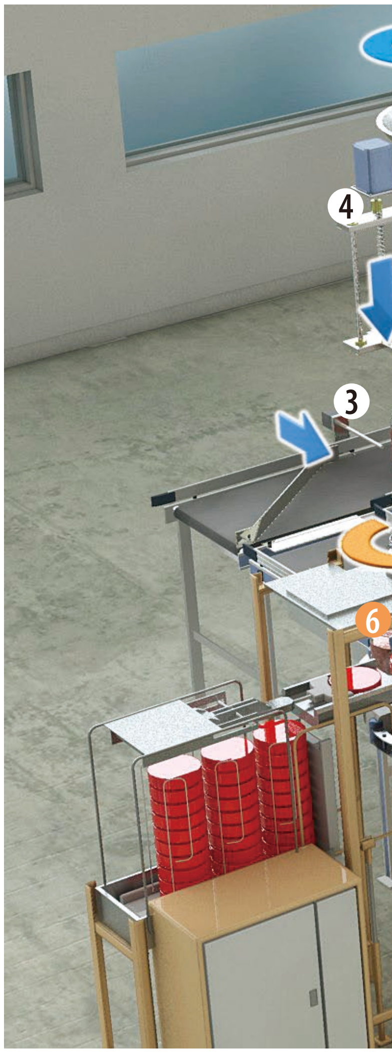
builders have a range of options to choose the most efficient method of representing data - thus making maximum use of the screen display area.

Finally with the front mounted USB port, service staff can quickly enter the PLC program, allowing the ladder code to be quickly monitored and changes made when necessary.
All of which simplifies the connection method thus reducing down time of the application.

SYSTEM CONFIGURATION



Packaging Industry
– Interconnected Applications



Features

- FX3U - Servo System Controller Network Advanced positioning control

- CC-Link connection - Effective data communication

- Backwards and Forwards Compatibility

Application Overview:

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 mold to the requirements of each solution. Whether it is filling, capping, sleeve placing, heat shrinking, foreign object detection or box placement - the chosen 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 customer's business' to stay competitive, it is important that control systems can be upgraded as the need arises. As new products feature in the market it is unreasonable for customers to bear the cost of upgrading their entire control system to accommodate new technologies. It is for this reason that the FX family of products have been developed with backwards forwards compatibility allowing users to upgrade parts of the control systems when the need arises.

SSCNET III
- Servo System Controller Network

Mitsubishi Electric's SSCNET fiber optic network provides new opportunities that were only previously available with advanced PLC platforms. The network is connected to the PLC via the FX3U-20SSC-H hardware block that permits a host of new functionality at the compact PLC range. As illustrated, features include torque control that ensures the maximum torque is not exceeded when placing caps on jars, manual pulsar connection functionality enables customers to quickly set up the position of the sleeve rolls, dual axis control functionality enables both linear and circulation interpolation providing quicker transition between points while reducing force loading on the product during positioning movements.

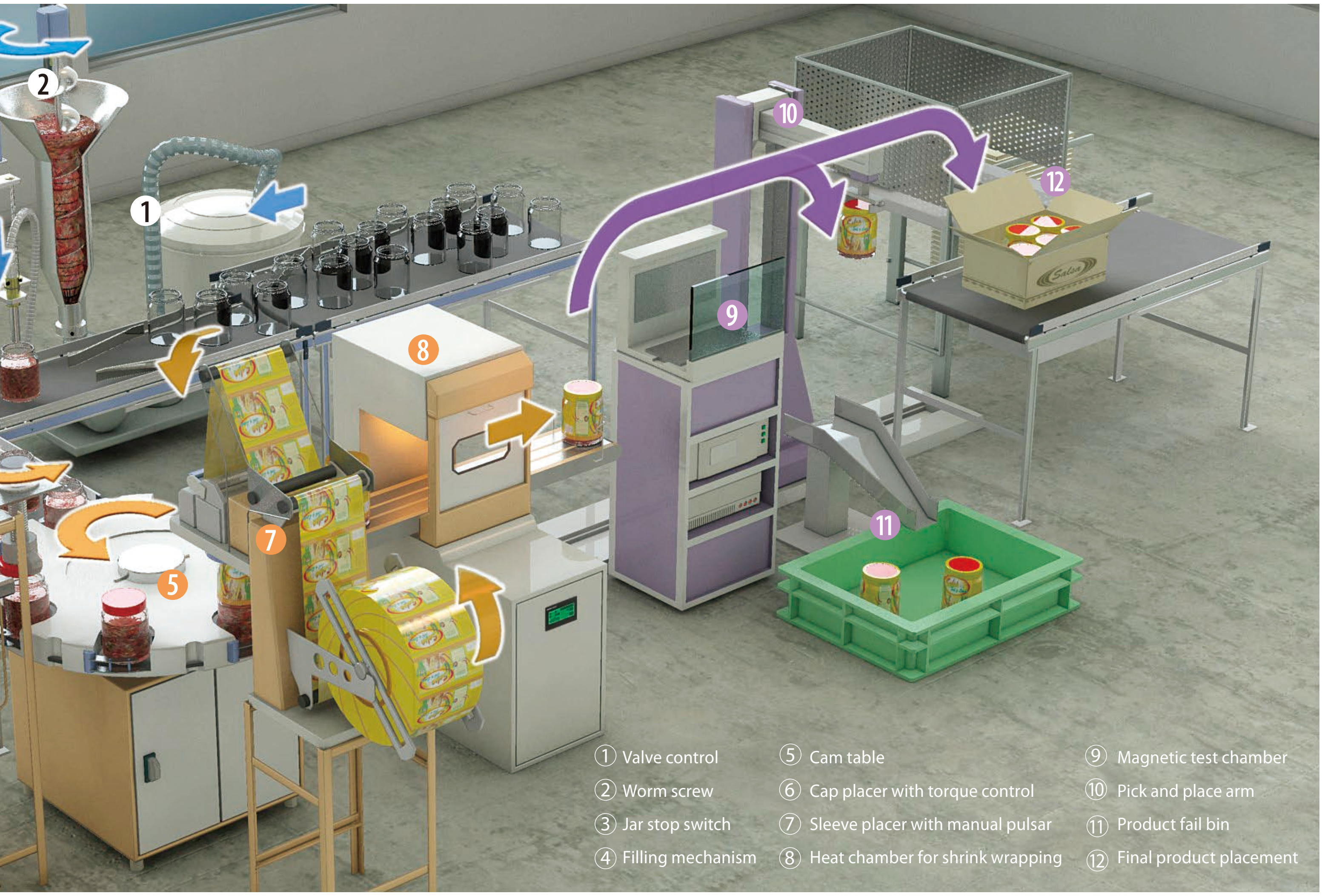
Another useful SSCNET feature is Target Address change, once the product is tested the PLC checks whether the jar is marked with a pass or fail status and is then moved to its new location. Using SSCNET, this process happens in one fluid movement – once the product status is identified the SSCNET module will automatically map the new path of the product without stopping, increasing the speed and efficiency of the process.

To enable flexibility when designing the application, SSCNET is equipped with fiber optic cabling to convey control signals between the servo motors and the PLC unit. Fiber optic cabling means the servos can be placed up to 50m from each node on the network whilst providing a communication speed of 50Mbps.

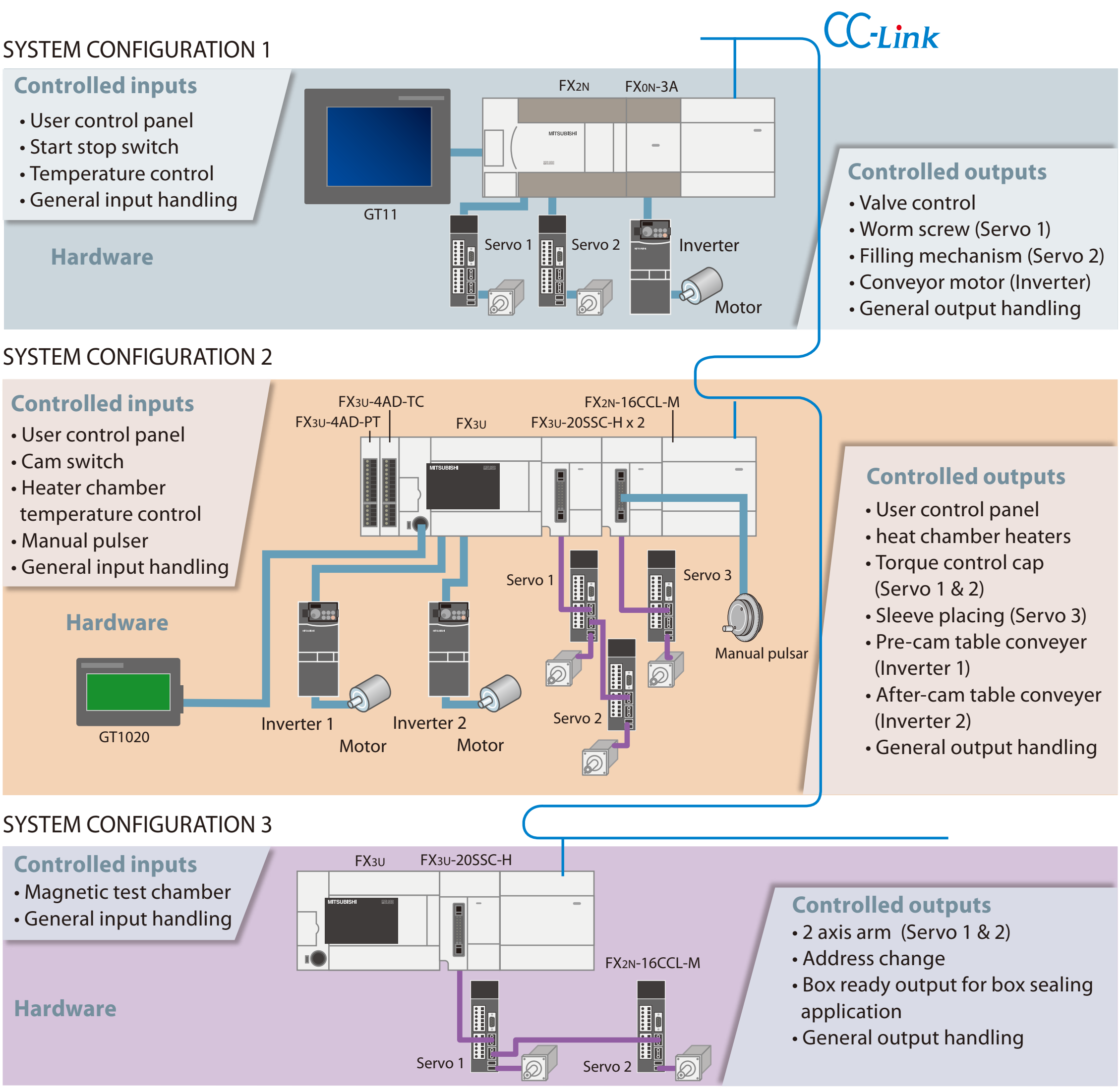
To simplify the setup procedure, the FX3U-20SSC-H also features its own programming software GX-Configuration-FP. This software integrates with GX-Developer and allows the users to set up positioning instructions via use of a table format enabling simple to advanced positioning control patterns to be quickly and easily created.

CC-Link
– Effective Data Communication

Often FX applications feature as part of a bigger application. In factory environments there may be many other processes happening simultaneously, to maintain synchronization and efficiency, application processes must be able



to communicate with each other continuously. To do this CC:Link has evolved, providing an open field bus and control network for communication with intelligent devices such as display devices, bar code readers, and PLCs. CC:Link is also able to connect to a PC, allowing a Master station to be setup on the network, permitting the user to monitor and control the system away from the factory floor.



Hardware

Hardware

The setup of an FX system can comprise of a standalone base unit to more advanced systems that include increased I/O handling, as well as analog and digital control. To create a clear methodology to creating FX control system each product falls into a set of defined categories.

Base units

The unique range of base units makes FX PLCs suitable for a variety of applications. The range allows the customer to select the power supply, AC or DC, as well as the inputs and outputs used within the system. All base units include an integrated real time clock and can be programmed with GX Developer programming software, allowing flexibility to transfer programs between different PLC types.

Expansion boards

For small numbers of I/O (2 to 4) the extension adapter boards can be installed directly into the FX1S or FX1N controller. Interface adapter boards can also provide other communication interfaces for FX PLCs.

Expansion I/O Blocks and Units

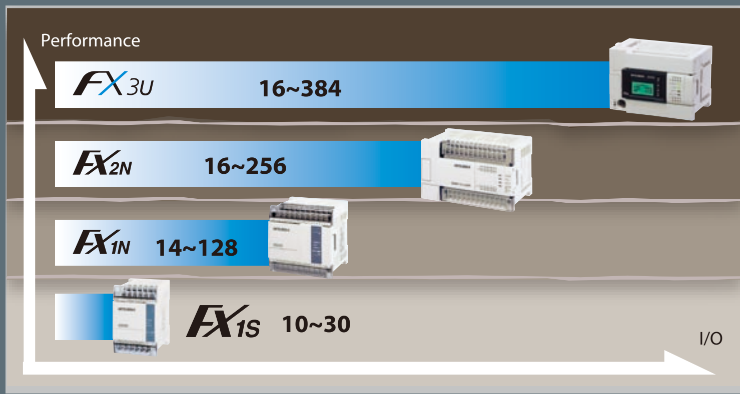
Both un-powered and powered expansion I/O can be added to the FX1N, FX2N and FX3U PLCs. This allows customers to create the systems that control the optimum amount of I/O to operate their application effectively.

Special Function Blocks and Special Adapters

A wide variety of special function modules are available for the FX1N, FX2N and FX3U PLCs, providing networking functionality, digital to analog control, analog to digital control, positioning control and temperature monitoring.

Accessories

To enhance the FX System performance the product range also features a host of EEPROMs, display modules and cables. This attention to detail allows customers to configure a system that can be fine tuned to meet the end customer's needs.



FX3U
Ultra high speed, maximum performance and a simplified design concept make this the ultimate micro PLC.

FX1N
This powerful micro brings the flexibility of the modular PLC design concept but, with the ease of use typical of FX Family PLCs.

FX2N
Advanced control, multiple communication possibilities and a wide range of options still make this PLC an industry leader.

FX1S
A compact micro controller for simple applications, supported by a strong communications capability.

A PLC right for you

The FX family of PLCs is highly flexible, enabling fast and efficient configuration for the application at hand. It is the ideal choice no matter whether you need a simple control system requiring up to 34 I/Os (FX1S), or a more complex system with up to 384* I/Os (FX3U). Each PLC within the FX family has been created with a different application profile in mind.

Model	FX1S	FX1N	FX2N	FX3U
Power supply	100-240V AC, 24V DC	100-240V AC, 12-24V DC	100-240V AC, 24V DC	100-240V AC
Maximum I/O	30	128	256	384*
Digital I/O	Relay/Transistor	Relay/Transistor	Relay/Transistor /Triac	Relay/Transistor
Cycle period/ logical instruction	0.55 µs	0.55 µs	0.08 µs	0.065 µs
PLC program memory	2k steps	8k steps	8k expandable to 16k steps	64k steps

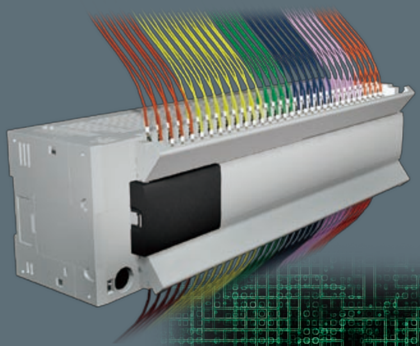
Your System

I/O Processing

Flexibility, speed, efficient configuration and ease of programming are often key features why customers choose FX products for their applications. The FX range is equipped with powerful processors that enable quicker responses and more accurate processing of tasks.

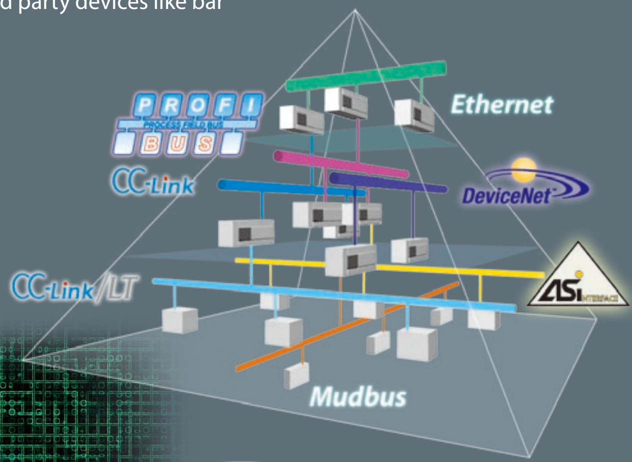
The use of instructions within the FX PLC range is designed with one common concept: to make the building of applications and program writing easier and quicker, whilst reducing the chance of errors.

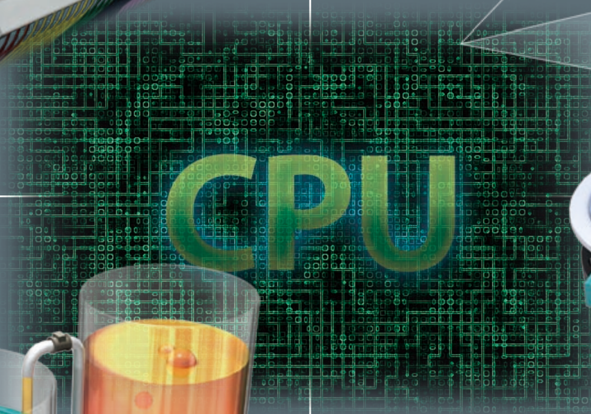
The FX base units' memory size comes in a range from 2K steps (FX1S) to 64K steps (FX3U). Larger memory means customers can write larger and more complex programs and store more data in file registers.

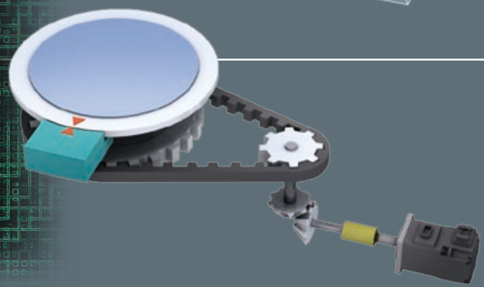


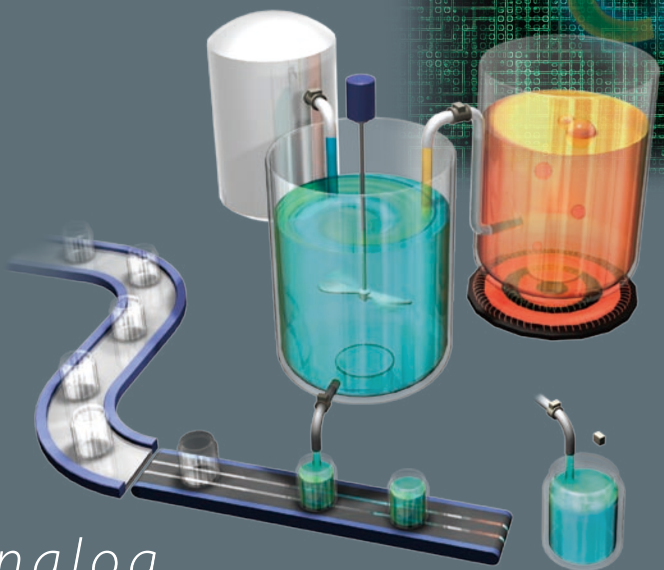
Communication

The FX Family of PLCs are equipped to 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 closed networks such as CC-Link, ASi, Profibus, Modbus and Ethernet.









Analog

The FX Family offers a wide range of analog solutions from 1 and 2 channel BD boards for FX1S and FX1N to the 4 high resolution independently configurable inputs and 1 output provided by a the FX2N-5A. FX analog blocks come in a range of resolutions from 8 bit up to 16 bit signal processing. Through use of the FX1S analog range of products control can be implemented for a wide range of devices be it speed control for an inverter, pressure levels in a pipe or temperature control.

Positioning

Simple

FX PLCs come with high speed counters and pulse train outputs as standard. The high speed counters can be configured as single or two phase inputs where as the high speed outputs can be configured as single pulse train outputs.

There are also Special Function Blocks and Adapters available for the FX range that offer improved positioning performance to meet the needs of the customer.

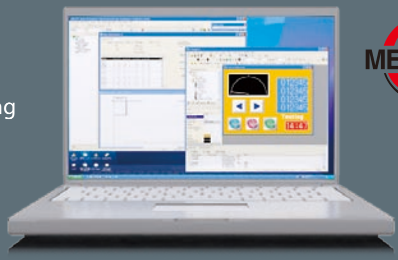
Advanced Solutions

Mitsubishi Electric's own Servo System Controller Network, SSCNET III, now includes a FX series connection via the FX3U-20SSC-H, bringing Modular platform technologies to the Micro PLC level.

Simple plug and play with dedicated cables reduce setup time and create an error free wiring scenario. Optical communication technology delivers high noise immunity and extended transmission distances enabling unconstrained servo placement.

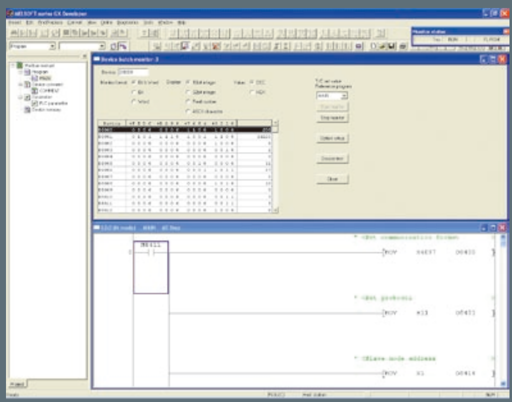
Software

In today's world, programming software for PLCs is a forever evolving process. Customers place more focus on reusable program code and function block concepts. This helps to reduce errors, reduce programming time and helps manage the programming process.



GX-Developer

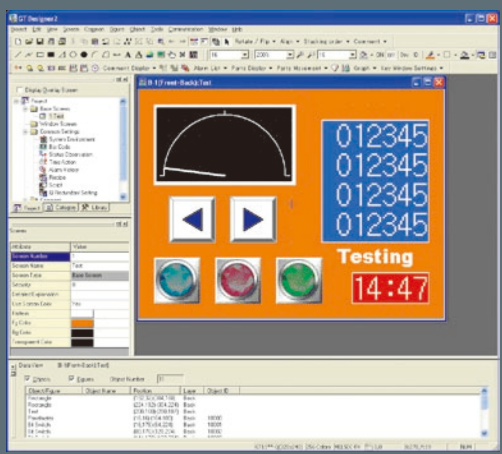
The key to any good software is that it is simple to use and intuitive. The GX Developer PLC programming package has achieved this by using design that is simple to understand yet has access to powerful functions and tools. It also features help functions and an advanced communications setup utilities, 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, allow customers to access different programs in a straightforward manner.

GT Designer 2

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

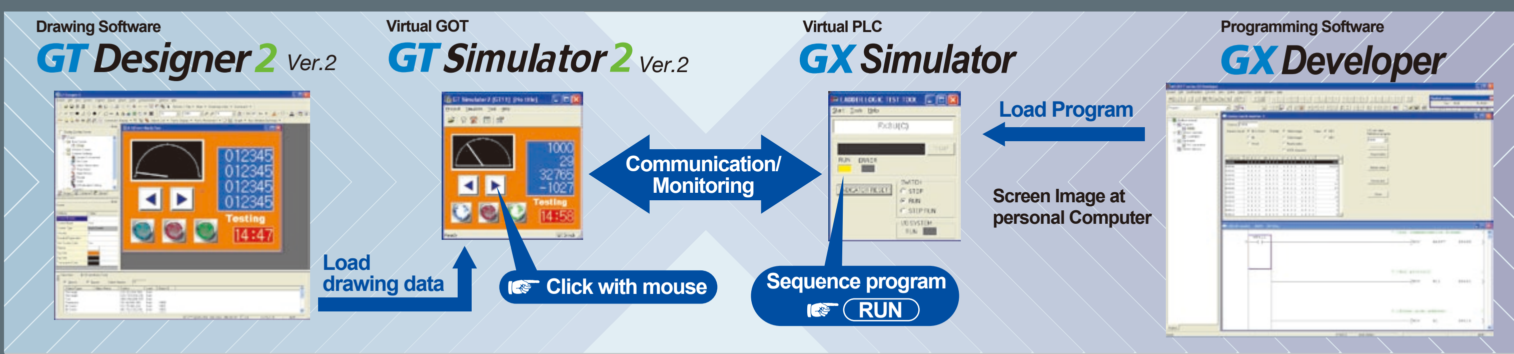


Simulation packages

GT Simulator 2 & GX Simulator

In today's time pressured world, application designers are often pressurized to reduce program development time. In order to save time, Mitsubishi Electric has created simulation packages to cut down on program development time.

GX-Simulator and GT-Simulator 2 allow the customer to create a virtual PLC or GOT respectively on a PC. PLC code and GOT programs can be tested and any errors debugged, without the need to wire to your PLC. GT Simulator 2 and GX Simulator have been developed so they can operate simultaneously allowing application environments to be created within the PLC.

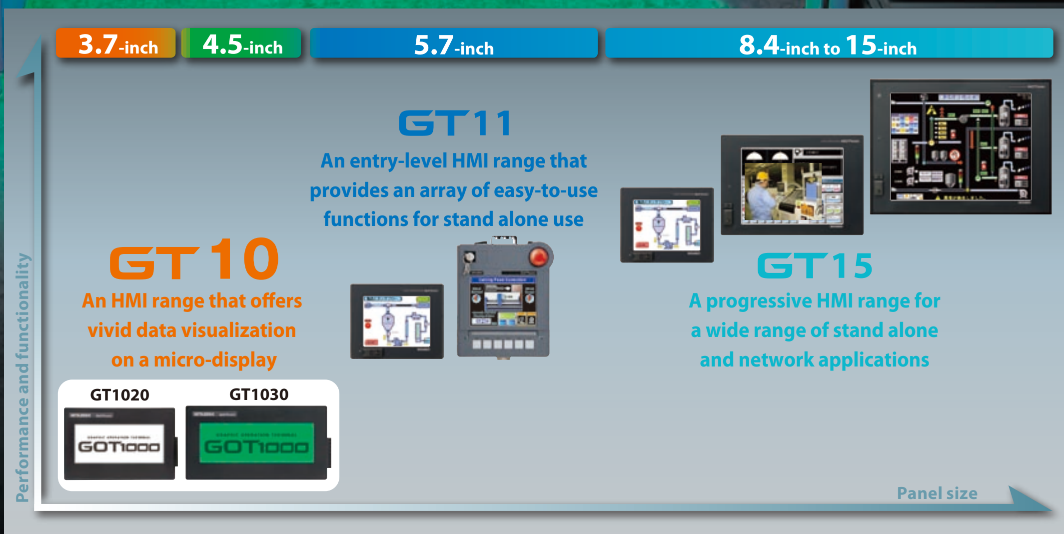


The Beauty of Functionality

GOT1000 Series

Mitsubishi Electric offers a comprehensive range of visualization solutions from simple data, advanced Graphic Operator Terminals like the GOT1000 Series, and a wide choice of software solutions from the MELSOFT software suite.

This powerful combination of hardware and software means there is a cost effective solution for most applications.



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⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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