

FOOD & BEVERAGE

Automation Solutions

**High performance solutions
for bakery production**



Increase yield /// Improve quality /// Increase profitability ///

Reduce costs, boost productivity



Modern bakery plant control systems built around Mitsubishi Electric control systems can help companies improve productivity and flexibility, reduce energy costs and boost operational efficiencies

Global strengths

Mitsubishi Electric is a global supplier of automation and productivity solutions in many industries and market sectors. Its position in the food sector has been built up over more than 25 years of experience working with end users and OEM machinery builders. In this document we focus on the bakery industry and our innovative solutions to the everyday business and production issues that all bakers face.

Our involvement in the bakery industry has led us to develop solutions for all parts of the bakery process using our wide range of automation products and software. Our experienced staff are able to assist in evaluation of your automation and business challenges and provide innovative ideas to help you reduce costs, improve productivity, maintain quality and consistency within your business.

During its own manufacturing process, Mitsubishi keeps a clear focus on maintaining the production of high quality affordable products. We are able to leverage the developments from our own manufacturing experiences to help our customers deliver high quality products to your supply chain.

For example the use of our data logging and MES/MES IT products were developed to monitor and report on our own production lines to identify non conformance, downtime and productivity rates, this forms part of our Lean Manufacturing process.

We recognise the significant competitive market pressures that bakeries face. As the market changes bakeries need flexible systems that allow them to accommodate changes in consumer tastes and food fashions. Combined with the external demands from regulation, environmental and nutritional factors your systems need to deliver information and maintain profit margins.



Bakery overview

The bakery industry is very much consumer lead with a constant requirement for new varieties of product, bakeries compete to gain shelf space and customer brand loyalty. Recent market trends have seen the rise of convenience foods and 'healthy options'. Being in synchronisation with the trends and fashions for new product can gain market share and increase profit margins.

Demands at the bakery production level need to reflect changing consumer requirements. Bakery equipment and processes need to be flexible enough to cope with a variety of modes of operation that match a continually changing marketplace, whilst balancing variables such as cost of raw ingredients, energy, minimising waste and conforming to the appropriate regulatory requirements.

Mitsubishi Electric is able to provide a wide variety of automation solutions to meet the varying demands from a modern bakery business. All encompassing product solutions are backed up by service, support, and most importantly industry knowhow to provide bakeries with the resource needed to produce consistently high quality products on time every time.

In the words of one industry commentator, "Volatility is the new normal". The food manufacturers who are successful in this fast paced, ever changing industry are the ones who can innovate more quickly, can capitalise on fast moving trends, can optimise their efficiency and productivity, who can best manage their supply chain and logistics, and who can minimise waste.

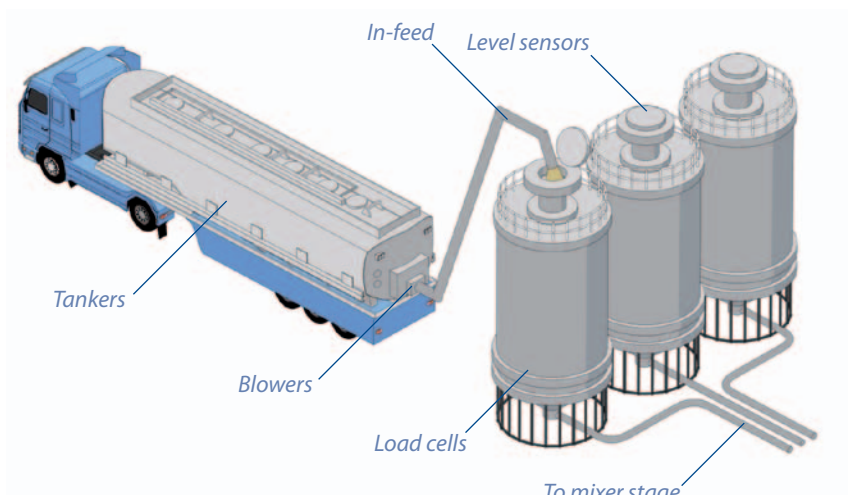


Control equipment from Mitsubishi Electric delivers reliable systems for Bakery automation, giving companies the potential to improve productivity and profitability, through adapting to constantly changing market demands

Flour plant



Because control needs to start from the raw materials stage



Accurate speed control enables precise delivery of the ingredients to the mixer stage

Key Issues:

- Moisture
- Stock rotation
- Track & Trace/batch weights
- Batch testing
- Re-ordering/supply chain
- Regulatory reporting

Dough consistency

The baking process begins with the flour plant, it is a critical input into the business. Creating and maintaining the correct environment at this stage of the process ensures consistency of the dough and hence quality of the final product. Accurate batching of the raw ingredients into the mixer stage also maintains consistency and quality from the beginning and leads to improvements in yield.

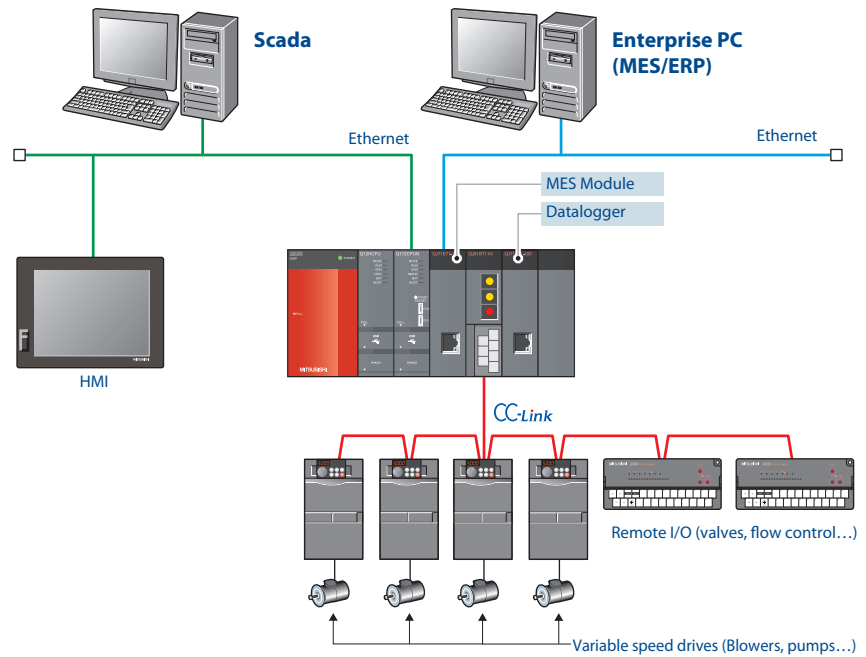
Process signals are collected from devices such as ultrasonic level sensors, flow meters, bar codes and load cells/weigh scales, which are fed into the control system. Interfacing to these signals is made easy using Mitsubishi's wide range of input and remote networking solutions. Full diagnostic and error detection of the network and signals leads to easy maintenance and accurate secure knowledge of stock levels.

Delivery of the flour into the plant is handled using variable speed drive technology, leading to energy saving and reduced stress on the mechanical components of the plant. Accurate speed control enables precise delivery of the ingredients to the mixer stage.

Equipment Used:

- Ultrasonic level measurement
- Pumps & Fans – Variable speed drive control
- HMI/SCADA Visualisation
- Load cell measurement
- Flow meters
- Modular PLC control
- Networks – I/O & MES
- RFID/barcode traceability

Inventory control of raw ingredients requires the process to alert when stock levels demand it. Utilising Mitsubishi’s non PC based secure IT connectivity technology ensures timely re-ordering and reporting is managed automatically through the control system which links to the inventory management system.



Typical control structure enabling transparency from flour plant to enterprise level

Meeting regulatory demands

Our IT technology has also enabled bakeries to meet regulatory demands that have forced bakers to produce documented Track and Trace information. Our control systems are able to report this information to higher level systems and give connectivity to ERP and management systems such as SAP™.

Mitsubishi’s ERP (Enterprise Resource Planning) tools integrate information from across an entire organisation, including manufacturing, stock levels, sales, etc, with external information. This ensures everybody involved in the business is fully informed of all relevant information, enabling appropriate decision making and ensuring efficiency and productivity.

Mitsubishi Automation System Solutions:

- Open connectivity to third party devices, weigh scales etc
- Seamless connection to business systems for Track & Trace
- Energy optimisation
- Eliminate Hand written reporting
- Automated inventory



Create and maintain the correct environment right from the start

Mixers



Control of mixer speeds and energy directly relates to the dough structure properties.

Key Issues:

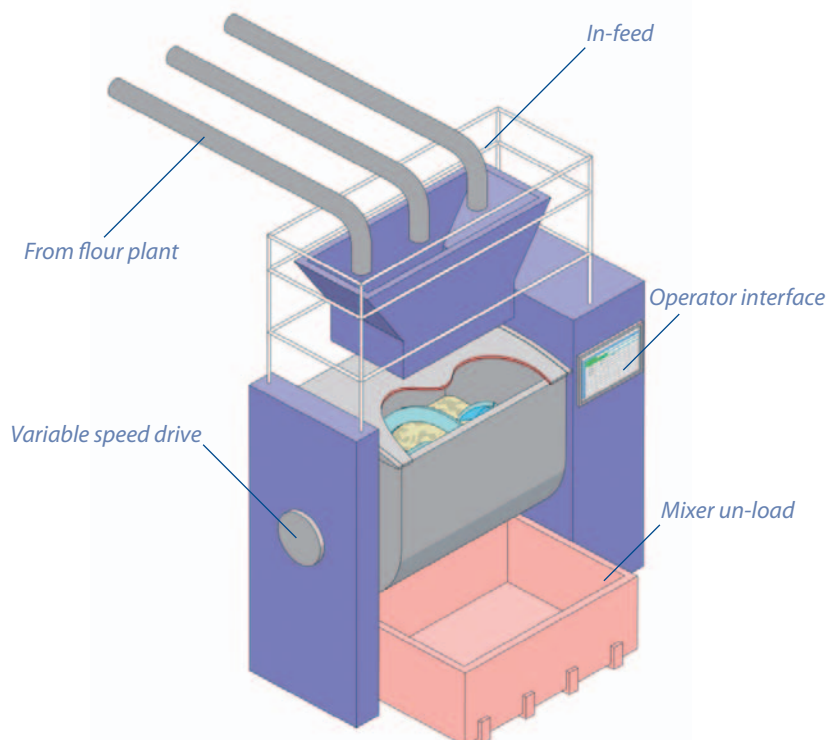
- Mixer Torque control
- Energy – kW/kg feedback per mix
- Dough consistency and repeatability
- Variable time mix
- Recipe control

Improving dough quality

Mixing of the dough is probably the most important event in the bakery, it is where the creative process begins, and is where the quality of the final product is significantly affected by the mixing methodology. Control of mixer speeds and energy directly relates to the dough structure properties.

Utilising Mitsubishi's advanced variable speed drives has had proven results in improving the quality of the dough from the mixer. Energy during the mixing process can be continuously monitored and fed back into the efficiency and quality metrics.

Recipe and batch control are used for reproducing consistent mixes. Accurate weighing and ingredient management are vital to repeatable product quality. Information such as mix time, energy used and time under vacuum (for Campden Process applications) are recorded as part of Mitsubishi's overall equipment effectiveness (OEE) reporting. Track and Trace techniques can also be applied at this stage to provide each batch with a unique ID which can be transferred to the downstream parts of production as it moves through the process.



Accurate weighing and energy management are vital to repeatable product quality

Equipment Used:

- Variable speed drives
- Modular PLC enables easy connectivity
- HMI visualisation and adjustment of mix
- Q-Safety integrated into the controller

The control system needs to be able to manage the above requirements whilst maintaining the flexibility of batch size and other adjustments of the mix. Mitsubishi's Human Machine Interface (HMI) and visualisation technologies allow local operator feedback and fine tune adjustment when needed.

Monitor energy usage

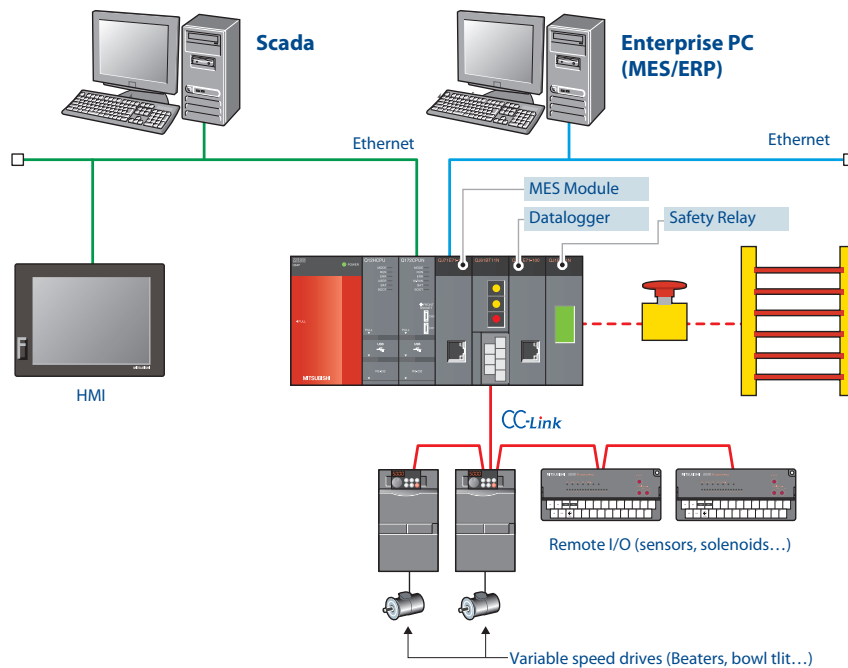
The profile of the mix is managed through the control system enabling it to be synchronised into the rest of the production process. It is often important to be able to delay the mix or hold it in a low speed mode before the unload, this requires energy monitoring so the dough is not over mixed and discarded as waste.

Due to the nature of the process, safety systems need to be integrated into the overall control strategy. This can be done by using Mitsubishi's innovative safety solutions.

Applications have included CC-Link and other open networks that form the basis of the main I/O control strategy as well as allowing direct control and monitoring of the motor drives. This has enabled energy usage to be easily monitored across the plant.

Mitsubishi Automation System Solutions:

- Accurate repeatability of the mix recipe
- Control of energy input to the mix via variable speed drives
- Profiling of the mix
- Waste reduction
- Reliable manufacturing



Typical control hierarchy for mixer applications



Dough mixing and handling are the critical processes for product quality. Good monitoring and management can also lead to significant energy savings

Dividers



Variable speed drives and servo control technologies provide accurate scaling of the dough

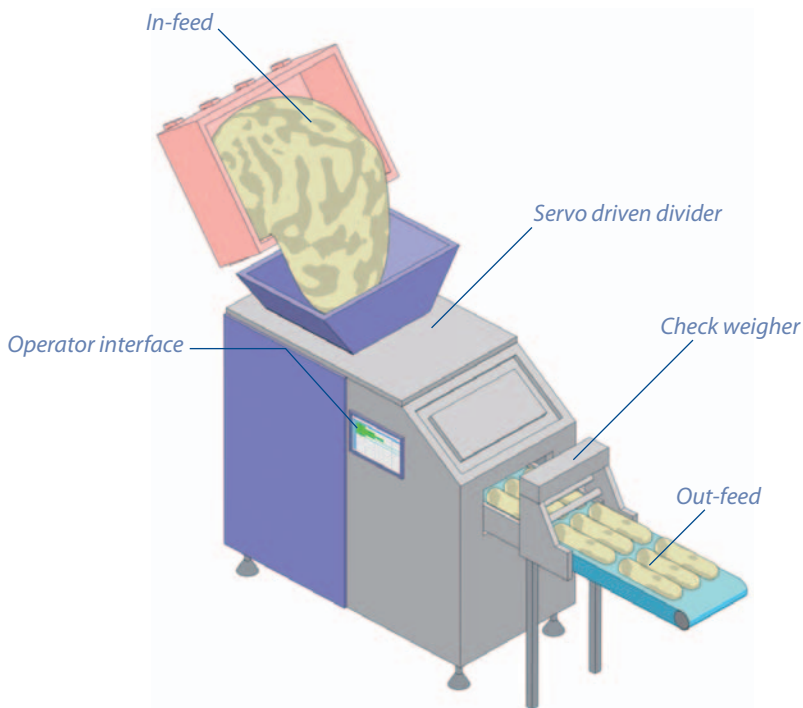
Key Issues:

- Variable product size
- Weight consistency
- Safety
- Gentle treatment of dough
- Recipe control
- Changeover time
- Simple maintenance
- Track & Trace

Total flexibility

Careful handling of the dough at the dividing stage is imperative so that there is no damage to the dough structure. Maintaining quality, whilst improving performance are key objectives at this stage of the process.

Variable speed drives and servo control technologies provide accurate scaling of the dough and the flexibility to adjust output weights during production. Accurate servo positioning provides easy repeatable product changeover capability, reducing changeover downtime and improving performance. Controlling the force exerted on the dough is extremely sensitive using servo systems and ensures the divider maintains the dough quality. This can also help with savings on ingredients such as yeast and flour improvers, thus reducing manufacturing costs and improving yield.



Variable speed drives and servo control technologies provide accurate scaling of the dough and the flexibility to adjust output weights during production

Equipment Used:

- Variable speed drives
- Servo systems
- HMI
- PLC/Motion controller

Track and Trace

Information such as dough weight per piece, variance trends from target weight, with weight totals are collected and passed to a secure database for management reporting and Overall Equipment Effectiveness (OEE). The information can then be used as part of a lean manufacturing or six sigma continual process improvement philosophy. The Key Performance Indicators (KPIs) of dough weight and variance can be monitored closely and the plant automatically adjusted to reduce waste.

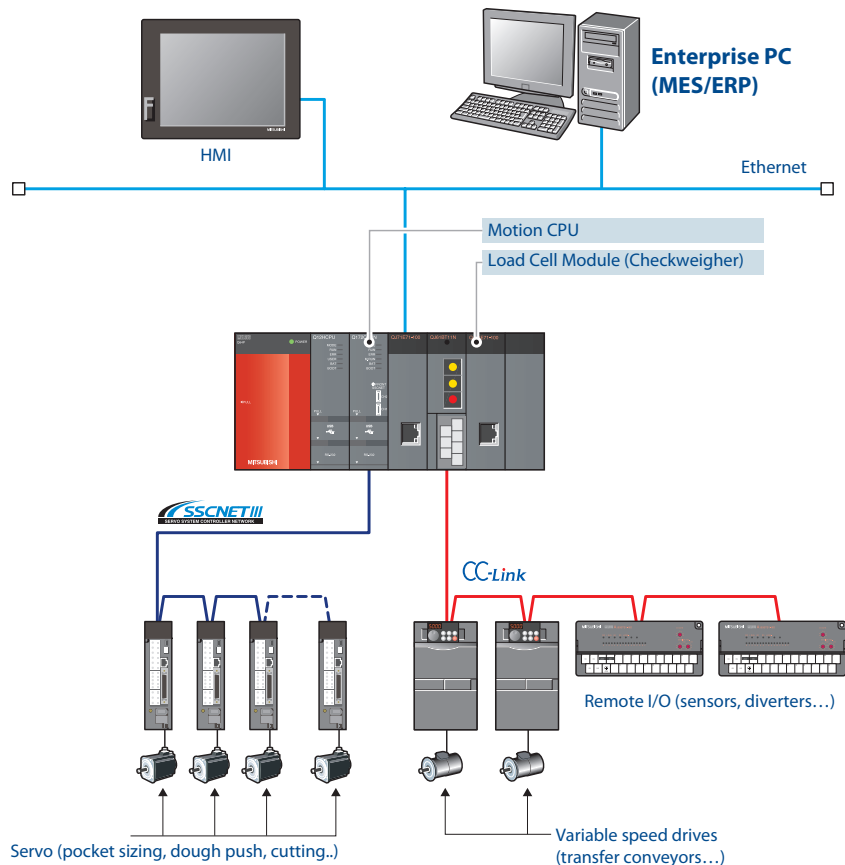
Open networking

Interfacing to check weighing systems can be done easily with the open networking connectivity of Mitsubishi controllers.

Mitsubishi has developed its core technology so that each device can communicate with other devices on the network including other manufacturers products. This overcomes the issue of integrating different manufacturers equipment between each part of the process.

Mitsubishi Automation System Solutions:

- Retaining dough quality
- High accuracy control
- Fast changeover enables good product flexibility
- Product weight variance detection and control
- Excellent repeatability
- Batch control/management
- OEE and Lean manufacturing
- Increased yield

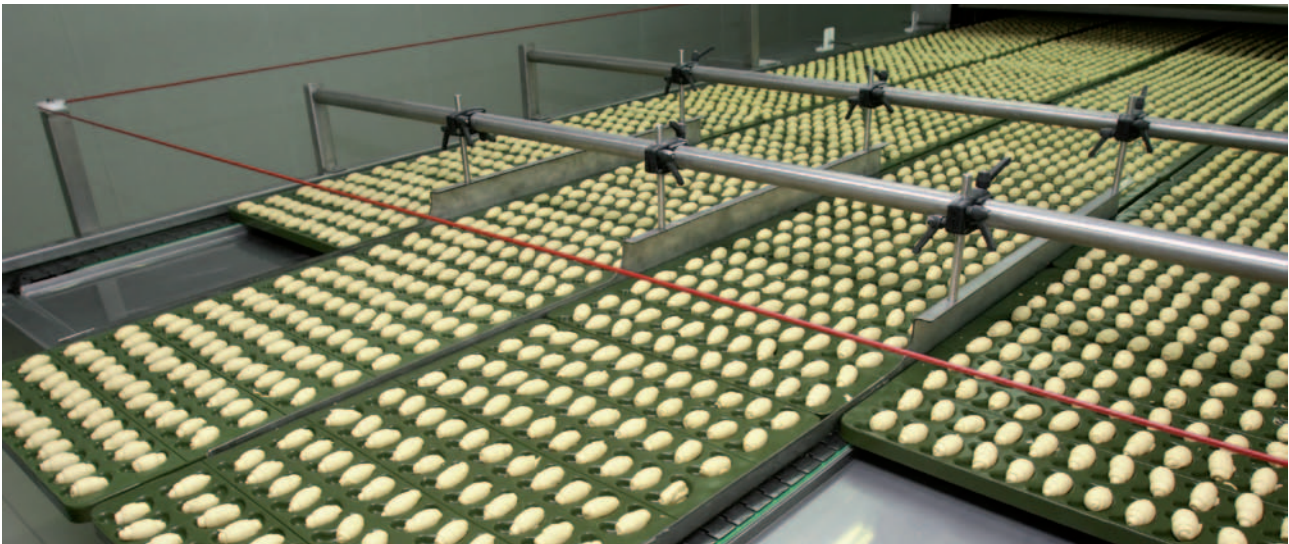


Typical control structure using servos. PLCs and drives in divider application

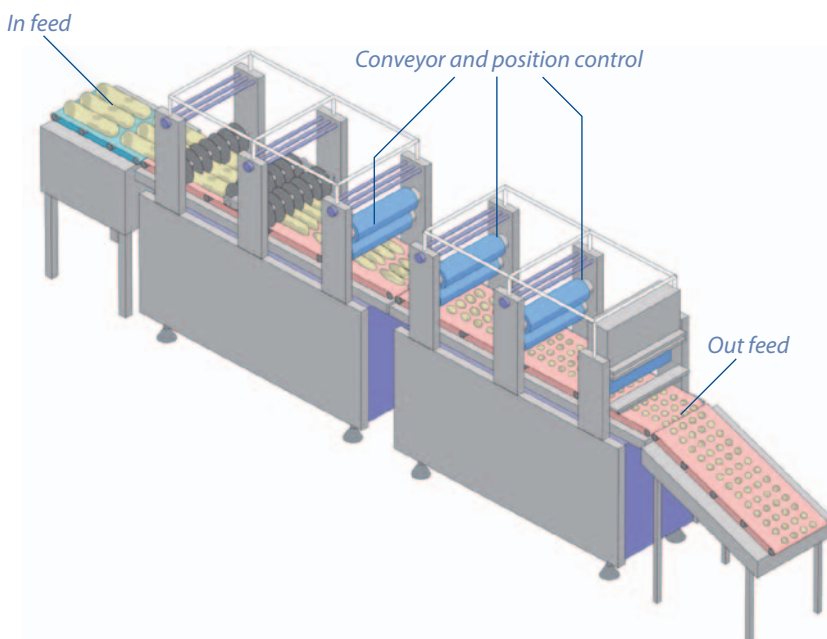


Retain dough quality and increase yield

Formers/Moulders/ Pan Setters



Maintain consistent placement of the dough into the tin



Accurate speed control and positioning

Key Issues:

- Speed control
- Separation
- Conveyors
- Tin positioning
- Variable tin size
- Recipe control
- Tin tracking
- Waste
- Double dough detection

Correct shape

Once the divided dough is taken into the forming and moulding part of the process, as in the divider stage, the product needs careful handling. Demands required from the control system are accurate speed control and positioning with minimum pressure exerted onto the dough. Once formed into the correct shape the dough is placed into the tin, where synchronised axes maintain consistent placement. Increased throughput is achieved by synchronising dough speed and tin speed.

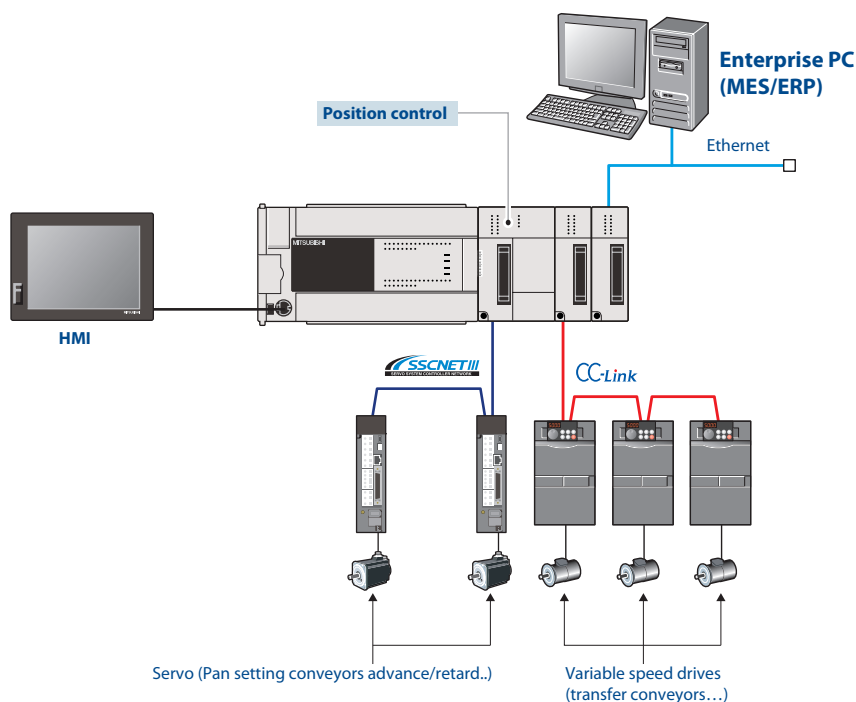
Equipment Used:

- Variable speed drives
- Servo systems
- PLC/Motion
- HMI
- RFID
- Sensors

Precision control

Precision synchronicity between the various steps in the process has to be achieved and maintained, even at high throughput speeds. Sensors, can monitor every element of the process and instantly feed data back to the controller so that speed matching of conveyors and other equipment is maintained to very tight tolerances.

Our multi axis drive control systems enable dough and pan speeds to be synchronised at high speeds. Issues such as double dough detection, variable tin size and tin tracking can be also accounted for. Additionally our automation solutions can enable feedback of error detection and fine adjustment back to both the local HMI and enterprise level.



Servo control enables precision control for pan setting

Data collection

To minimise downtime and identify errors, data has to be collected instantly for production analysis and also stored to meet track and trace requirements. This means problems such as double dough and wastage can be identified and corrected.

Mitsubishi Automation System Solutions:

- Fast accurate speed/position control
- Multi axis synchronisation
- Instant data for track & trace
- Accurate speed and position control, increased throughput
- Minimum downtime with error detection

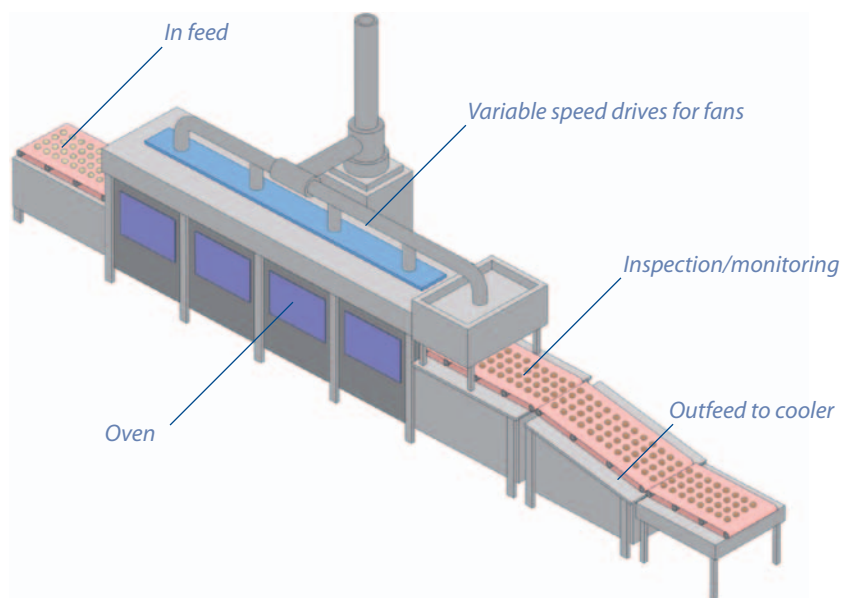


High speed data management is critical to reduce downtime

Provers and ovens



Constant temperatures are required across the prover



Variable speed drives reduce energy consumption to boost profitability

Key Issues:

- Humidity
- Ambient temperature compensation
- Temperature control
- Safety
- Colour monitoring
- Energy consumption
- Conveyor speed
- Heat exchanger
- Waste

Significant energy savings

The Prover retains the dough in a temperature and humidity controlled storage facility to enable the product to rise as the yeast activates. Constant temperatures are required across the prover to allow the dough to rise in an even uniformed manner, thus maintaining consistency and quality of the batch.

Critical areas of the prover require the speed and temperature to be maintained accurately and with relative compensation for ambient conditions. Significant energy saving is available with variable speed drives controlled fan and conveyor systems.

By utilisation of the advanced energy saving characteristics of the Mitsubishi variable speed drives range conveyor speeds are optimised to best speed and energy saving performance levels.



Control strategy can include management of the recipe

Oven solutions

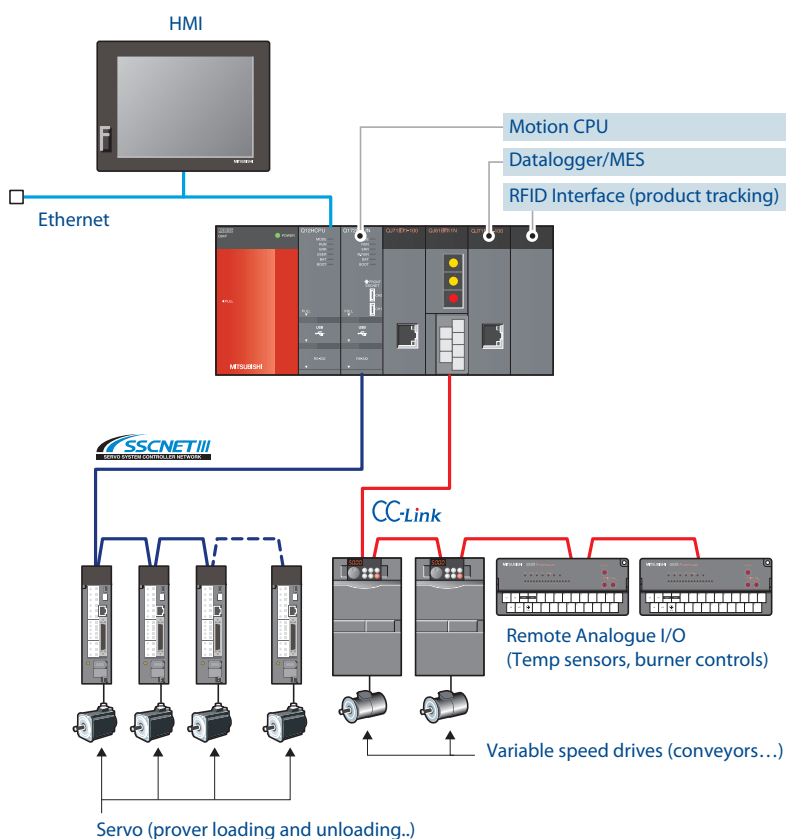
Most modern industrial ovens are of the tunnel type, they are generally available in modules so the length of the oven can be adjusted to suit the requirements of the bakery.

Control of the various aspects of the system include, bake times, loading and unloading, temperature settings, conveyor controls, fan optimisation, HMI display and track and trace.

Management of the recipe for the bake can also be included into the control strategy, with alarm and event annunciation and trending.

Interfacing to third party systems such as vision, burner controllers and RFID sensors is made easy using Mitsubishi's open network architecture.

The oven consumes the most energy in the bakery so any savings made can be very beneficial. Proven Mitsubishi variable speed drives technology used to optimise fan controls has consistently resulted in quick returns on investment and continued ongoing efficiencies.



Integrated control solutions result in quick ROI

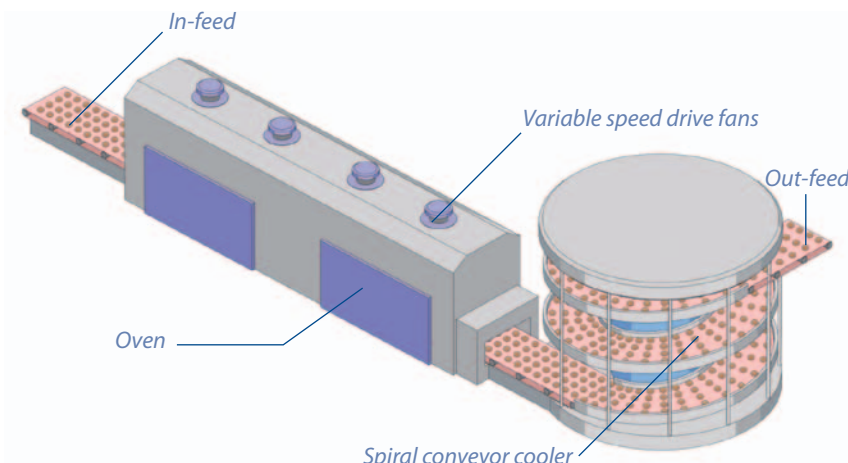
Mitsubishi Automation System Solutions:

- Accurate temp/humidity control
- High torque/accurate feedback due to loads on conveyor
- Speed control
- Energy saving – fan control
- Synchronised Drives
- Infrared and Vision systems interfacing
- Integrated safety

Coolers



Achieve the correct temperature whatever the product



Cooling to the optimum temperature is key for slicing and packaging

Key Issues:

- Humidity
- Spiral conveyor
- Weight loss of product
- Heat exchange > recovery

Optimum cooling

The cooling stage allows the freshly baked bread to cool to the optimum temperature for slicing and packing. The core temperature of the bread coming out of the oven is over 95oC and it has to be brought down to a maximum of 30oC. To do it too slowly would affect productivity, but to cool the bread too quickly would significantly affect its quality and its slicing characteristics as well as encouraging unnecessary weight loss.

Spiral coolers are commonly used in most large bakeries. Loaves are fed through them from the oven and cool by the time they reach the top. Typically, the control system monitors the temperature and humidity at a number of points in the spiral and adjusts the speed of the conveyor or the forced draught fans to maintain the optimum cooling profile.

Equipment Used:

- Variable speed drives
- PLC
- HMI

There is increasing interest from many parts of the bakery industry to reduce energy consumption, and the cooling process is a prime candidate for assessment. Heat, which traditionally simply vented to atmosphere can be recovered and used elsewhere in the plant, perhaps to pre-warm the provers or the hot water supply to the washrooms.

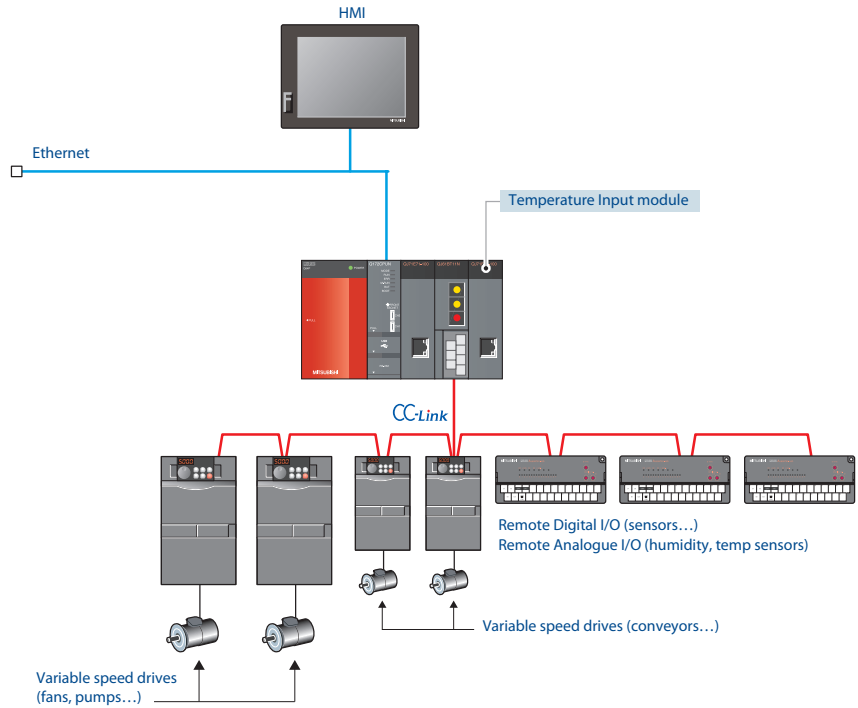
Heat recovery

The theory of heat recovery is simple: run the hot air through a heat exchanger to transfer the thermal energy to glycol flowing through pipe work or a radiator. This is then pumped to another exchanger where the heat is given up to another process. In practice however considerable control is required to optimise the process, this is achieved using sensors, thermocouples, solid state controllers and local graphic operator interfaces.

Only a few years ago cooling was an uncontrolled process. Now it can be optimised to maintain product quality and weight, enhance slicing and packing, and by recovering heat that would otherwise be wasted, help reduce the overall cost of production.

Mitsubishi Automation System Solutions:

- General control
- Energy saving
- Optimum cooling conditions
- Cooling profiles



The control system monitors temperature and humidity



Create the optimum cooling conditions

Slicing and packaging



High speed production needs high speed packaging solutions

Key Issues:

- High speed
- Slicing
- Waste/crumb/damage
- Traceability
- Lines in slice
- End of line
- Sell by date/label/barcode
- Tray handling
- Safety
- Palletising

Reduce waste

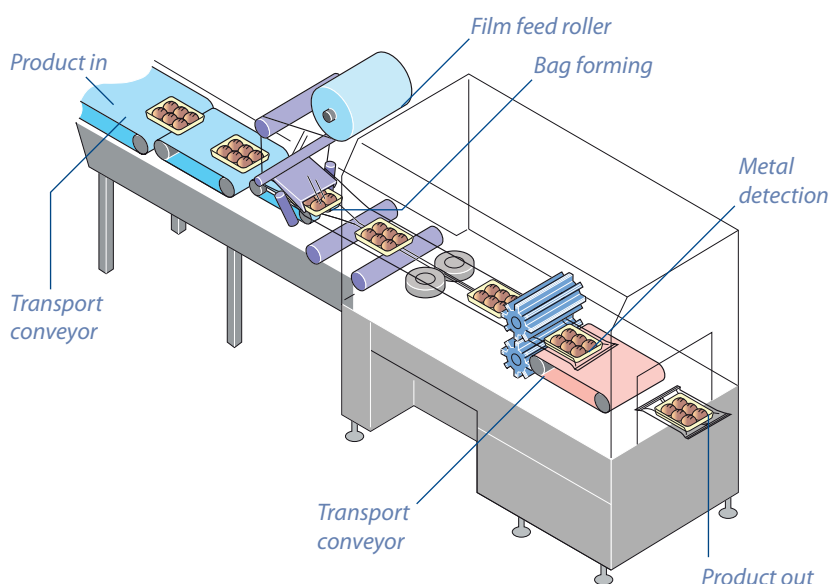
The final part of the process before shipping is the Slicing and Packaging section. The requirement for high speed operation is desired for maximum throughput.

The product now has reached its maximum value to the manufacturer so waste reduction at this stage is critical, reduction due to crumb waste and deformation of bread slice is handled using servo control based systems.

Labelling for the product track and trace and sell by date requirements need to be managed by the control system, with records and reports for regulatory compliance.

Palletising for order make up and final despatch is the last physical activity. For these, safety is paramount. People are likely to be working in close proximity with complex high speed machinery, active safety control systems ensure the most secure possible working environment.

Further information on Mitsubishi packaging solutions can be found in our packaging brochure.



Packaging a host of bakery products such as bread, pizza etc

Solutions from plant to business



Integrated solutions for total plant control

MX4-Business

The MX4-Business solution has been specifically designed to provide a cost effective system for tracking and reporting plant level production Operational Equipment Efficiency (OEE), Key Performance Indicators with concise and easy to use real time and historical reports for all personnel from the plant level to the boardroom.

MX4-Business is key to implementing Six Sigma projects or Lean Manufacturing techniques.

MX4 Energy

The MX4 Energy solution is an integrated monitoring and tariff management system. It deals with the specific requirements of energy management, can monitor a wide range of commodities which include; electricity, water and gas and provides an environment where energy managers can create reports and produce billing data.

MX4 Energy is fundamental in the process of energy management and allows the user to determine where energy is being used in the plant or process.

From analysis of the detailed information produced by MX4 Energy, control

strategies for energy saving can be developed. These strategies can then be implemented by the control system.

MAPS

The Mitsubishi Adroit Process Suite (MAPS) is a life cycle software solution that offers value along the entire value chain. It addresses the short comings of most PLC SCADA integration tools in that it offers value to the engineering and integration phases. It also extends the integrity of the "as delivered" solution and offers customers the ability to handle the normal modifications and maintenance of any automation solution.

The single integrated package takes users through all the phases of process design, installation, commissioning, acceptance testing and ongoing maintenance helping to maintain consistency and integrity, improving quality and reducing costs.

MES-IT

The MES-IT interface is a non pc based solution and can be used to capture data from many different devices including third party PLCs and send it directly to MES inventory management applications. This solution allows companies to track each

product manufactured.

By implementing MES-IT at line side, it can report information directly back to the database management solution such as Oracle, SQL or IBM DB2 for interrogation by ERP and MES analysis tools.

ROI can be achieved very quickly as the location of a defective product and the moment of deviation can be found quickly.

C Connector

The C Connector is a non pc based solution which greatly simplifies the cross platform vertical integration from field level to MES and ERP systems such as SAP, facilitating bi-directional data exchange between the PLC system and the ERP system.

The C Connector offers traceability, machine monitoring, maintenance provision and quality control.

C Batch

The C Batch non pc based solution provides a complete batch control solution that delivers PAC recipe based control in an ISA S88.01 compliant format.

C batch provides features such as recipe creation and management, creation of batches and control of their execution, automatic execution of recipes and simultaneous execution of multiple recipes.

The ISA S88.01 standard provides a path to significant productivity improvements allowing the same equipment to be used to make multiple products.

A wide support network



Technical support hotline

A customer telephone hotline service, supporting both current and past product lines, is located at Mitsubishi UK's Customer Technology Centre (CTC).

Local engineers at our regional centres and key partners provide telephone support during office hours. These expert engineers have a comprehensive knowledge of both the products and automation applications.

Technical Support Hotline
01707 288790

Email :
automation.support@meuk.mee.com

With this mix of local and centralised support you can always be sure there is somebody available to take your call.

First time is the right time

When your production line is down or you are trying to carry out essential maintenance between shifts and time pressure is mounting you need answers to your questions quickly and efficiently.

Using our technical support hotline you get to talk directly to expert engineers who on average solve 85% of problems within the first call and 99% of the problems within 24 hours.

24 hour support

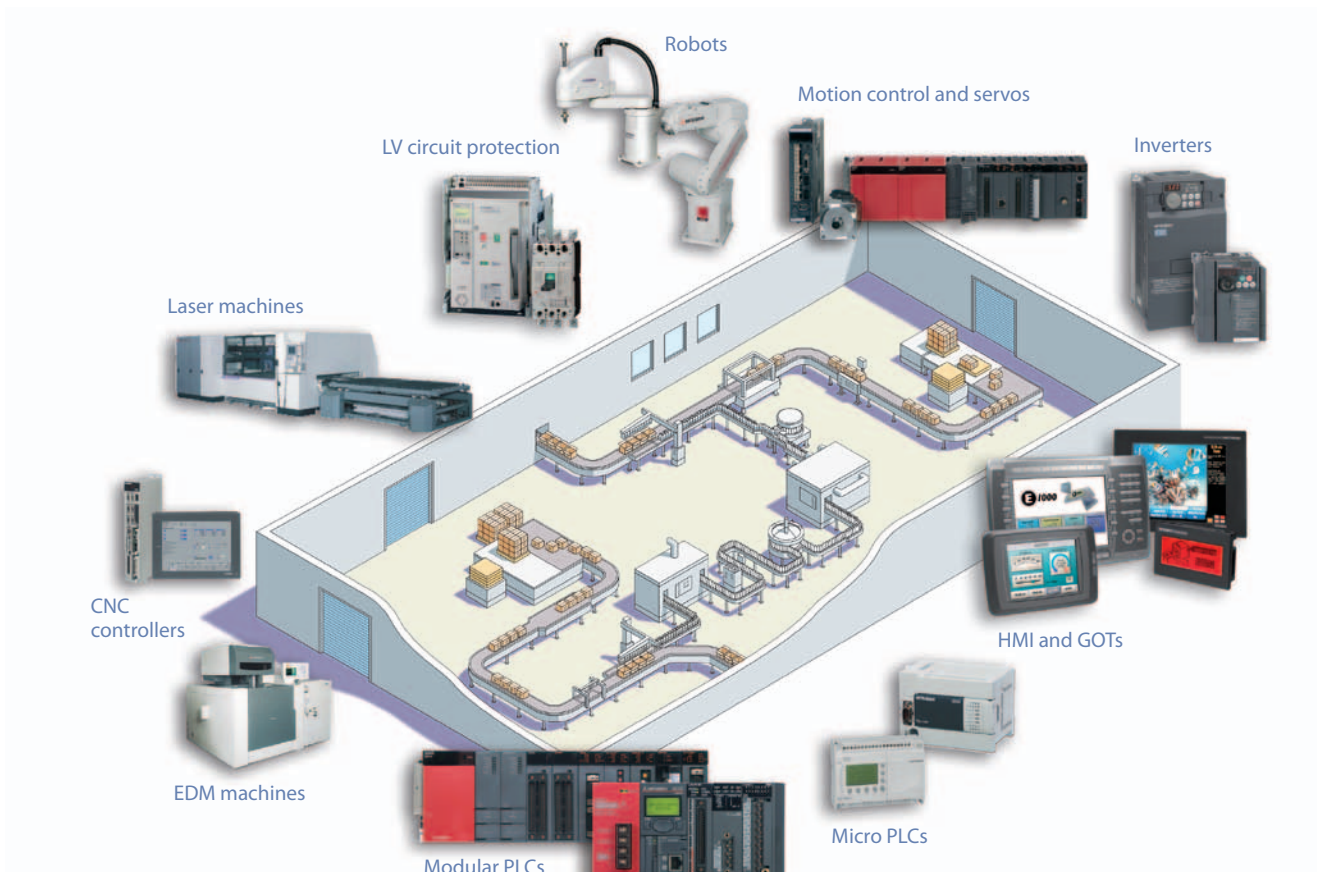
We also offer a range of extended customer services.

Twenty-four hour support is a natural extension of the Technical Support Hotline. This subscription service offers 24-5 (24 hours, 5 days) and 24-7 (24 hours, 7 days) coverage depending upon the support package you need.

CTC can make sure that your staff are trained and prepared by keeping up to date with the latest advanced technology. We offer targeted training for Developers, Programmers and Maintenance Staff at the beginning, middle and end of the project.



A world of automation solutions



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

A name to trust

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

The Mitsubishi brand name is recognized around the world as a symbol of premium quality.

Mitsubishi Electric Corporation is active in space development, transportation, semiconductors, energy systems, communications and information processing, audio visual equipment, home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

This is why you can rely on a Mitsubishi automation solution – because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

As one of the world's leading companies with a global turnover of over 4 trillion Yen (over \$40 billion), employing over 100,000 people, Mitsubishi Electric has the resource and the commitment to deliver the ultimate in service and support as well as the best products.

Global partner. Local friend.



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