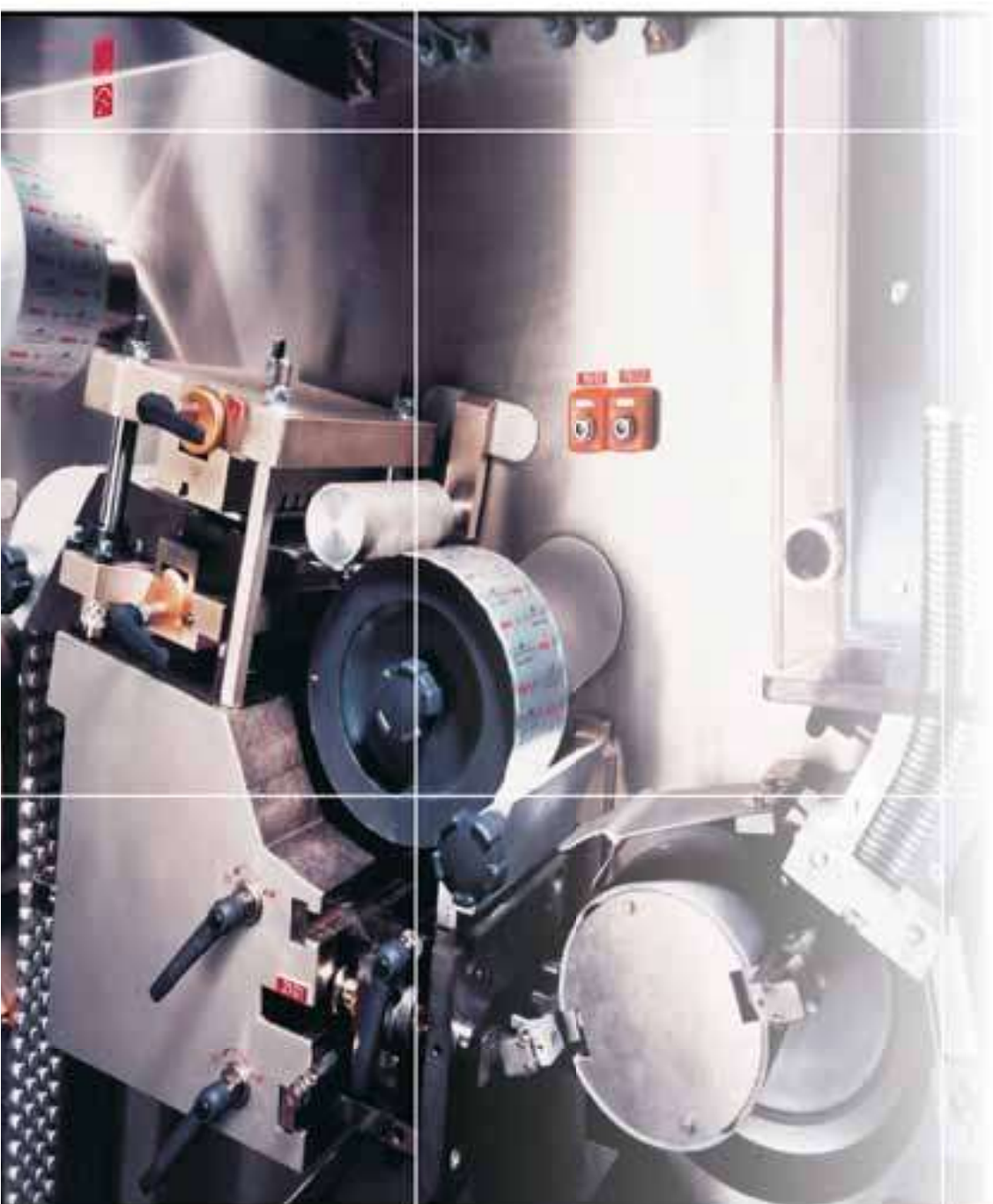
Getting Automated!



Automation improves efficiency, ensures higher output, repeatability and reliability of the process, and reduces wastages and manpower. Thus, it is gaining wider acceptance day by day in the packaging industry.

Usually, automation requires deep pockets, and exorbitant price tag proves to be a powerful deterrent for many organisations in developing countries like India, especially those, which are small or medium in size. But, 'low cost automation' or LCA solves this problem. It is a practical, safe, economical, and rewarding strategy for the small scale or medium scale business. Read on to know about ' automation in packaging' with special reference to LCA…

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Automation began with the use of mechanised devices employing hydraulic, pneumatic, electrical and/or electronics, hydro-pneumatics, or robotics systems to control various activities in the process like manufacturing, inspection and quality control, material handling activity to control industrial processes, replacing human operators.

Next came the controls systems, which were taken over by the computers or programmable logic controllers (PLCs). Use of computers in automation is a step beyond mechanisation, where operators are provided with machinery to help them in their jobs. The most visible part of automation can be said to be industrial robotics. Advantages of the robotics are repeatability, tighter quality control, and waste reduction, integration with business systems, increased productivity and reduction of labour. Some disadvantages of the system are high initial costs and increased dependence on maintenance.

By the middle of the 20th century, automation existed for many years on a small scale, using mechanised devices to automate the production of simple activities. However, the concept of automation became truly practical with the addition of the computer, whose flexibility allowed it to drive almost any sort of task. Computers with the required combination of power, price, and size first started to appear in the 1960s, and since then have taken over the vast majority of assembly line and manufacturing line tasks.

In most cases, PLCs are used to synchronise the flow of inputs from sensors and events with the flow of outputs to actuators and events. This leads to precisely controlled actions that permit a tight control of the process or machine.

Human-machine interfaces (HMI) are usually employed to communicate with the PLCs. For instance, to enter and monitor the process parameters that are to be maintained.

Another form of automation that involves computers is test automation, where computers are programmed to mimic what quality checker do when testing manually.

Automated handling of PET bottles

Motion Controls Robotics, a leading manufacturer of fully integrated robotic systems, introduces SUBTA (Stand up Bottle Take Away). SUBTA is a pre-engineered automation system designed for PET blow-moulded bottle handling.

The SUBTA system enables in-line automated PET bottle handling and unloading for coating, leak checking, case packing and bulk palletising. The SUBTA system grabs and sets the bottles on a conveyor standing up, acting as a takeaway unit.

SUBTA system is easy to use since it is portable and rolls away from moulding machine to allow for mould changes. It can be operated intuitively with easy-to-use joystick pattern teaching. The system includes an operator panel for recipe adjustments and error reporting.

It is easy to make in-process modifications due to the operator interface. Motion Controls Robotics develops technology that helps to keep customers' competitive.

The system provides increased throughput due to high reliability and uptime and cycle times faster than most mould machine rates. SUBTA also provides labour savings of up to two people per shift and the automated machine helps to reduce labour costs.

The SUBTA system is also flexible and precise since it handles any mould configuration (single or double row) and provides quick changeover using quick change tooling and stored recipes. The system is also programmable with a built-in joystick and operator panel with stored recipes, menu selection for patterns and on-the-fly adjustments.

The benefits

Some of the benefits of automation are:

- Improved operating efficiency and profits
- Minimised cost
- Simple installations and compact size
- Enable real time data collection for improved efficiency, controls and manufacturing benefits.

Automation meets two of the biggest needs when it comes to packaging equipment - flexibility and ease of use. Flexibility is being delivered by robots through the reduction of change parts required.

Automation in packaging

Automated case packages require zero change parts, where as a traditional machine needs a mechanical change. On addition of the new sizes into the mix, the robots can be reprogrammed or reconfigured, where as in conventional system a new size requires whole new set of change parts. This adds up in the more down time for changeover, additional inventory cost, and requirement of skilled personnel to effect the changeover.

Synchronised fast-paced bottle making

Installing MICRO MASTER(r) variable speed AC drives to control the transport of plastic bottles along an extensive conveyor system helps Johnson Controls focus on critical synchronising. With a production capacity of 1.5 million blow moulded polyethylene terephthalate (PET) bottles per day, the Plastic Container Division (PCD) of Johnson Controls produces containers that include soft drink bottles from 20 ounces to 2 litres.

At a speed of up to 18,000 bottles/hr, conveyance of empty PET bottles downstream from machines can create service disruptions in production if there is any kind of hold up. Yet, because the plant is equipped with different types of blow-moulding machines, the method of bottle discharge varies with each machine. The challenge for Johnson Controls becomes one of synchronising and harmonising the rates of different sections of the conveyor system with the production rates of different machines to avoid bottle tippage at points along the line.

Avoiding the Domino effect

With only three weeks to answer this challenge, the production team responded by installing 72 SIMOVERT MICRO MASTER variable speed AC drives from Siemens Energy and Automation, Inc. MICRO MASTER is the only micro invert on the market with flux current control (FCC). FCC gives the MICRO MASTER automatic load adaptation capability for precise control of AC motors with output ratings of 250 W to 2,200 W (1/8-2 hp). No voltage or HP characteristics need to be set under most circumstances, allowing motors to operate at optimum efficiency. Using the Siemens micro inverters and working with Siemens engineers, the solution involved complex variance of speeds in different sections of the conveyors in such a manner that the bottles move along right next to one another, adding support to bottles both immediately in front of, or behind, one another.

Each 1/2 hp MICRO MASTER AC drive controls a 4-1/2". wide section on a conveyor 60 ft long. These sections are tied into chain-to-chain parallel transfers, over which the bottles travel in single file. The conveyor has a speed range of anywhere from 12 ft/min up to 150 ft/min. These speed rates vary from one section to another, either to regain a gap or take up a gap between bottles.

The entire conveyor is equipped with sensors that are interlocked with the blow moulding equipment. The sensors keep track of production speeds, which are then relayed to a SIMATIC 555 PLC. The PLC then calculates a new conveyor speed, which matches the production rate of specific blow moulding machines. In addition, photo eyes along the conveyor system make fine setting speed adjustments based on the necessity to create a little back pressure between contiguous bottles.

Without such tight speed controls, bottles can tip over, creating a Domino Effect. This, in turn, jams up the line and shuts off the blow moulders, resulting in downtime.

A SICOMP(r)PC-32F industrial computer from Siemens displays the status of the drives, including current, voltage, time and nature of any faults, along with historical trending that can pinpoint any problems that might arise. The unit provides control of the 72 MICRO MASTER drives through two serial communication links from the HMI to the PLC. Through a RS-232 port, the HMI runs US Data Factory Link software and communicates constantly with the PLC.

The line supervisors can view a graphical representation of the line, which depicts the photo sensors, inputs and outputs, and the status of the motors. Programming through the PC-32F allows supervisors to make adjustments in the drives. A statistical screen shows the number of bottles being packed or being sent down the line.

With this level of automation, Johnson Controls is poised to dramatically increase production as a major source of PET bottles to the packaging world of food, liquor, pharmaceuticals, chemicals, and household and personal care products.

Robotics also adds intuitiveness to packaging equipment, with up-to-date touch screens for human interface.

The PLC control machines have graphic capabilities, so the operator can actually see a graphical image on the screen and find in which direction the process is going. In case of eventual shift, the corrective action can be taken immediately to over come the danger of process going out of control limits. This reduces the rejection/rework levels to almost zero level. Most of the machines also displays text messages describing what the fault may be, or where the process is leading. Along with process control it gives audiovisual signals in case of breakdowns, or a reminder for maintenance, etc.

Automation, due to its advantages of improved efficiency, higher output, repeatability and reliability of the process, waste reduction, reduction in manpower, and integration with process, is gaining wider acceptance day by day in the industry. Automation is applied in all industries like pharmaceutical, process industries manufacturing chemicals, oils, engineering, etc, to get the benefits.

The mode and efficiency of downstream operations like packaging, printing, and labelling of any product can be improved considerably by adopting low cost automation (LCA).

Many operations in food processing industries, which need to be carried out

under totally hygienic conditions, can also be rendered easy through LCA systems.

Need to automate

Under the present condition of globalisation and liberalisation, it has become a necessity for manufacturing organisations to become competitive, by achieving high productivity and quality. Large multinational corporations with huge financial strength, technical leadership and vast worldwide market are better equipped to remain competitive through the use of cutting edge technologies.

But this solution is exorbitantly expensive for many organisations in developing countries like India, especially those, which are small or medium in size. Majority of the small scale industries run by individuals or professionals, and the medium size industry often have finance constraints and often lack the best technical leadership. In addition, they have to operate on a smaller market, and also contend with relatively low labour productivity.

The low cost option

One of the very practical, safe, economical, and rewarding strategies for the small scale or medium scale business is the application of LCA. This is an effective tool for organisations of varied nature and size. That is, from enterprises employing only a few people to big manufacturing units employing thousands of people.

Due to the proven benefits of the LCA many large, well-known, organisations like Tata motors, Bajaj Auto, Mahindra & Mahindra, L&T, Siemens, etc., have established separate cells for in-house development of low cost automation.

LCA is a technology that creates some degree of mechanisation on the existing equipment, tools, methods, and people, using standard systems and components available. LCA as indicated by name allows low investment so that the pay back period is short.

Advantages of LCA

LCA is done on the existing capital equipment without altering the process, hence, the investments required are lower and payback periods are short. The labour productivity can be improved substantially using LCA. Expensive automation requires sufficiently large production volumes to be cost-effective. Where as small to medium scale industries with lower batch/production sizes can be made viable using LCA.

Over a period raw material costs have been rising steadily. With increased cost and depreciating purchasing power of rupee, increased competition, manufacturers' profit margins are shrinking day by day. This made it essential for better utilisation of material and resources, minimised work in progress (WIP) and minimum rejection levels. LCA helps to minimise such wastage.

Since the people involved in the production activities are participants of the LCA systems development, the additional skills necessary for maintenance and operation activities are also developed internally. This reduces the breakdown cost and time.

LCA systems involve a step-by-step approach; as such the attendant risks are low.

The risks associated with huge investments or an inappropriate selection of technology, or market uncertainties are minimised.

Limitations of LCA

LCA system has some limitations, which need to be considered prior to implementing the system.

- LCA is a custom built, tailor made system, takes longer time to develop
- CNC/PLC technology needs very little time to change over; however LCA is mostly manual process and takes more time for changeover.

Despite its limitations, LCA is used extensively in developed countries as well, as it is proven to be most attractive solution for small-scale industry.

Applications of LCA

Any manufacturing activity is a potential beneficiary of LCA. It is useful in all activities related to discrete manufacturing, irrespective of the product. A wide range of activities such as loading and unloading from machining centre, feeding, clamping, machining, welding, forming, gauging, assembly and packing can be subjected to LCA systems adoption.

Prior to defining an LCA requirement and devising a system following points should be considered:

- Defining the packaging needs to plan and design the most appropriate packaging system.
- Providing integrated hardware solutions with automation.
- Complete project implementation support with cost and time management.
- Guidance for process optimisation.
- Technology up gradation on a continuous basis.

The author is a consultant for packaging projects, PET projects, thin walled PP containers, hot runner mould design & development, waste management, moulding solutions, material handling and LCA.