Elecon Engineering Company Limited
Vallabh Vidyanagar, Gujarat, India

Manufacturer of gears and gear boxes

Elecon Engineering Company's Worm Gear Division develops and produces a wide range of worm reduction gears including Universal Mounting NU-Gears, Agitator Stirrer Gears, Cooling Tower Gears and Double Reduction Gears.

With 1998 sales of close to $18 million, Elecon Engineering Company's Worm Gear Division employs more than 2,000 people. The company is ISO-9001 certified for the design, development, production, installation and service of mechanical transmission equipment, helical, worm and special gearboxes, fluid and geared couplings and accessories.

Elecon Engineering's (EE) Gear Division, one of the largest gear manufacturers in India, is known for its quality products. The company's Worm Gear Division manufactures specialized gearboxes for some of the largest and most influential companies throughout the region. The company's products range in size from 1 5/8" to 17", with speed reduction ratios of 5:1 to 70:1. The Division also produces double-reduction gears with the speed reduction ratio reaching up to 4900:1. They produce standard designs, as well as engineered to order gearboxes for diverse applications in industries such as fertilizer, heavy engineering, cement, steel, mining, shipping, sugar, power sector, and chemical.
TOMER
F I L E

THE CHALLENGE
Established in 1951, Elecon Engineering Company Ltd. consistently sets the pace for manufacturing companies throughout India and its surrounding region. The company publicly states that its mission is to reach new frontiers of technical excellence. The company’s Gear Divisions are no exception. Continually a step ahead of its competition, Elecon was the first to introduce casehardened and ground gear technology with modular design concepts to India.

Staying a step ahead means that every aspect of Elecon’s Worm Gear Division must operate as smoothly as the gearboxes they produce. In particular, the company’s manufacturing organization must pay strict attention to its processes to ensure that the Elecon’s high standards of product quality and customer satisfaction are maintained.

COMPLEXITY DEMANDS EXCELLENCE
With a product offering that includes more than 200 varieties of standard and custom gearboxes, Elecon Worm Gear Division faces a wide range of manufacturing challenges.

Gearboxes consist of numerous manufactured and purchased parts. They are quite complex and require precision engineering and manufacturing. Due to the number of parts and processes that go into a finished product, gear manufacturing is inherently complicated.

To meet market demand for its products, the Elecon Worm Gear Division manufacturing facility has more than 100 machines that process thousands of parts. Each part undergoes several operations before it is considered a finished component and ready for use in a gearbox. Material flow is complicated. Purchasing must deal with multiple suppliers to ensure materials are available when needed. The lack of just one component can lead to the unavailability of the entire range of that size product.

Tasked with the challenge of maintaining continuous flow of product to the marketplace, P.R. Dave, Assistant General Manager of the Elecon Worm Gear Division soon realized that he needed more than just an ERP system. His search for a solution led him to the library, where he found and read a number of texts written by Dr. Eliyahy Goldratt, including The Goal, The Race and The Haystack Syndrome.

From that point forward, the solution was clear. “The information we found in Goldratt’s books excited many of us,” recalls Dave. “Following our study of his work, it was obvious that planning and scheduling using traditional methods such as MRP, would not be enough, due to the erroneous assumptions made by MRP, such as infinite capacity, fixed lead times, etc. We understood that we had to implement the Drum-Buffer-Rope (DBR) methodology. Doing this would allow us to identify our organizational constraints, exploit them to make the operation stable—in spite of an
existing MRP system—and finally, subordinate other resources to the constraints. The only ques-
tion that remained at that point was how we were going to go about practicing TOC and DBR.”

Dave and his colleagues at Elecon determined that they needed a was an advanced planning
and scheduling (APS) system that could help them implement put in place the DBF method-
ologies that embody TOC. They found the solution with Thru-Put Manufacturing™ from Thru-Put
Technologies®.

THE SOLUTION

“From the beginning it was obvious that Thru-Put Manufacturing would be a good fit for our
manufacturing facility at Elecon Worm Gear Division,” recalls Dave. “First and foremost, Thru-Put
Manufacturing is functionality designed to handle complex operations; and accommodates
material release and First-In First-Out (FIFO). Second, the software provides a simple and
practical solution with an easy and fast implementation. But even more important we had faith
in the people on the Thru-Put team and felt that they clearly understood the nature of our oper-
ations along with our problems.

“It was a good thing we felt comfortable with the Thru-Put team,” he adds. “We spent a
considerable amount of time with them as we sifted through the complex nature of our
business and developed solutions together. It was almost like they were consultants, rather
than a sales team.”

YESTERDAY’S PROBLEMS BECOME TODAY’S OPPORTUNITIES

According to Dave, many of the issues that led him to Thru-Put are very common to manu-
facturers of complex products like Worm Gears. Thus, the fact that Elecon Worm Division has
conquered these problems gives them a competitive advantage over their competition.

For example, Thru-Put Manufacturing allows Dave and his team to furnish all materials—both
purchased and manufactured parts—to assembly at the right time. “Before the implementa-
tion of Thru-Put,” Dave recounts, “the absence of synchronization caused shortage lists and
changing priorities. These shortages cause classic ‘fire fighting’ problems, as well as disrupting
schedules, which affects on-time delivery and stock levels.”

Among Dave’s other objectives were the reduction of Work In Progress (WIP) and reduction
of cycle times that cause materials to wait in queues in front of work centers and at those
assembly points waiting for mating parts. “Our story read like so many other companies,”
says Dave. “Although inventory levels of finished product and finished components were usually
very high, we would still run short of required materials. High WIP inventory levels means long
queues in front of work centers. Priorities in these queues were decided daily depending on the "urgency." Additionally, high raw material inventory levels can frequently cause a mismatch between requirements and availability.

"Today our operation is altogether different," he continues. "With the production synchronized to the needs of our constraints, WIP has decreased significantly. We are managing our WIP rather than it managing us, and produce only what we need. Cycle times are also down, and material no longer sits in queues in front of work centers and assembly points waiting for mating parts. We are more efficient and our operation is more cost effective."

Additionally, Dave cites improvements in Elecon's ability to manage resources, a problem that is common to complex manufacturing operations. "Overall, complex manufacturing facilities have capacity, but on a day-to-day basis there are resource scheduling issues that require struggle. Before we implemented Thru-Put Manufacturing, we expended a great deal of extra effort stretching resources to meet deadlines and targets. Today, shop-floor reports produced by Thru-Put Manufacturing, such as Shop Floor Schedule, Drum Schedule or Buffer Management reports, makes this a simple process.

"FIRST AND FOREMOST, THRU-PUT MANUFACTURING IS FUNCTIONALITY DESIGNED TO HANDLE COMPLEX OPERATIONS; AND ACCOMMODATES MATERIAL RELEASE AND FIRST-IN FIRST-OUT (FIFO). SECOND, THE SOFTWARE PROVIDES A SIMPLE AND PRACTICAL SOLUTION WITH AN EASY AND FAST IMPLEMENTATION. BUT EVEN MORE IMPORTANT WE HAD FAITH IN THE PEOPLE ON THE THRU-PUT TEAM AND FELT THAT THEY CLEARLY UNDERSTOOD THE NATURE OF OUR OPERATIONS ALONG WITH OUR PROBLEMS."

— P.R. Dave, Assistant General Manager of the Elecon Worm Gear Division
Implementing Thru-Put Manufacturing highlighted discontinuities in Elecon Worm Gear Division’s operations and directed Dave and his colleagues to focus on ways for determining important areas in their future. They developed a clear path for continuous improvement and have tangible evidence of their ability to reach their goals:

• At an overall level, Elecon Worm Gear Division has experienced a 33 percent reduction in manufacturing cycle-time for the longest lead time component. Additionally, the cycle-time including assembly has been reduced by 50 percent.

• Prior to implementing Thru-Put Manufacturing, Worm Gear was sending gearboxes, of any one size, to a subcontractor for a 14-day assembly turnaround. The Thru-Put team highlighted this as being a major hurdle in meeting market demands. After a brainstorming session with the Thru-Put team, Worm Gear reduced the time from 14 days to 3 days.

• Worm Gear reduced total inventory stock by 26.38% in just four months.

• During the first four months of implementation Elecon reduced finished parts store inventory by 17.4%.

• During the first five months of implementation, Elecon’s WIP was reduced by 27.25%. This figure includes material lying with sub-contractors.

• Raw material inventory dropped 8.0% in just three months. Production is now inline with market demand and the company has generated approximately 20% extra capacity in terms of producing the right order at the right time. Additionally, raw material shortages have decreased and subcontractors are better positioned to plan resources in a more effective manner.

• Subcontracting costs have been reduced due to efficient use of in-house resources. Today, subcontractors are used only in cases where extra capacity is required to meet additional requirements, or when in-house facilities can be used more profitably for producing product.

In addition to these tangible benefits, Thru-Put Manufacturing has also helped develop a sense of faith and confidence that was previously lacking at Elecon Worm Gear Division. “Before Thru-Put came on the scene, ERP transactions, such as stock positions, were incomplete or not in the system at all. Therefore, individuals had very little faith in the system and developed parallel systems, some of which were manually maintained. Today, we have one system that synchronizes our throughput and in general makes our lives easier. Our confidence and ability to meet our goals have been restored.”
ELECON ENGINEERING WORM GEAR DIVISION: THRU-PUT MANUFACTURING UTILIZATION SNAPSHOT

ELECON ENGINEERING WORM DIVISION FORMED CORE TEAMS THAT WORKED TOGETHER THROUGHOUT A STEP-BY-STEP IMPLEMENTATION OF THRU-PUT MANUFACTURING.

EDUCATION
Since the TOC methodology was new to Elecon employees, the company took proactive measures to educate people about DBR and Thru-Put Manufacturing. All employees were encouraged to read Dr. Goldratt's book and Thru-Put conducted sessions at a supervisor level. Formal and informal sessions continued the education process throughout the implementation.

DATA SYSTEMS
Although an ERP implementation had been completed, data accuracy was poor. The main areas of concern were the shop floor transaction system and the inventory system. The implementation team focused on these areas in two ways. First, they began requiring individuals to enter transactions into the system, and secondly, they cleared their huge transaction backlog. To hasten the process, they utilized the MIS department to develop programs to automate several transactions. Both tasks were daunting, primarily because they involved constant hard work, in conjunction with a shift in cultural change for using computers in day-to-day activities.

INTEGRATION AND MODELING
Elecon's MIS department created interfaces for extracting data from its ERP System and download of the information into Thru-Put Manufacturing, which helped identify the Drums and the bottleneck resources. Elecon Electronics Worm Gear Division also went through a process of setting Buffers. This included validating Rope lengths and thoroughly checking whether production could meet schedules provided by the software.

PURCHASING
The Resonance New Purchase Orders report was used to raise purchase requisition (PRs) for conversion into purchase orders (POs).

SCHEDULE EXECUTION
Material Release: Based on the Planned Work Orders report produced by Thru-Put Manufacturing, production managers opened work orders in the ERP system and allocated the material. The material (along with the work order) was released on the date specified by the software.

FIFO: Operators numbered material as soon as it reached a machine and loaded it in the same sequence. Upon completion, the material was transferred to the next machine. Supervisors updated shop floor transactions in the ERP system before the shift's end, maintaining WIP tracking.

Expediting Actions: Immediately after scheduling, management surveyed the production control module and noted the components that required urgent handling.

BUSINESS PROCESSES
One key factor in implementation was aligning business processes to support the DBR methodology. Some of the key areas Worm Gear focused on were Demand Management and Shop Floor Management.

Shop Floor Management: New shop floor management processes were developed for Materials Release and Batching.

Demand Management: The concept of market demand became paramount at Elecon. In other words, Worm Gear began to manufacture only those items that they could sell. The practice of quoting deadlines in "weeks" was replaced by the concept of a specific due date.

Material Releases: Worm Gear discarded traditional methods of "churning" available material and replaced it with a newer philosophy of releasing only required materials—never releasing materials before the required time. Prior to implementing Thru-Put Manufacturing, available material was released to keep machines busy. While releasing the material would keep the resource busy, important parts would often wait in the queue, increasing cycle-times.

Under TOC, this practice was stopped and replaced by FIFO, which was a major change from randomly deciding daily "priorities." With FIFO, operators would mark jobs as they arrived at the machine and load the machine in the same sequence.

Batching: The batch concept was removed completely. Prior to implementing Thru-Put Manufacturing, cycle times were higher than the quoted delivery periods, so Elecon Engineering Worm Gear Division would manufacture standard components in batches and stock them in large numbers. With Thru-Put Manufacturing, the company expected a major reduction in cycle-time so there was no longer a need to manufacture the components in batches, saving on materials and inventory.