

The customer magazine of the LTI Group

LTI | INNOVATION

www.lt-i.com

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Skills

... the key of success!

Skills

With some 100 electrical and mechanical engineers and mechatronics engineers working in their development functions and a further 20 engineers working in product management and applications consulting, the drive engineering specialists within the LTI Group of companies have a wealth of expertise when it comes to identifying and developing innovative new products. This pool of skills enables us also to develop highly complex and technologically challenging systems such as complete automation solutions for high-end machine tools – from the CNC control, through the drive units, to magnetic bearing supported machining spindles. But technical skills alone are by no means a guarantee of success.

In a mature market such as the automation field, it is becoming ever more difficult to make products stand out from the competition. Consequently, the overall performance capability of a company is becoming increasingly important in determining its commercial success.

Every contact between LTI and its customers or potential sales leads helps underscore the professional competence and competitiveness of our business. This begins right from the first sales approach, continues through the consultations during the design-in phase, incorporates innovative and ever reliable logistical support once an order has been won, and extends well beyond the absolute reliability and durability of the products.

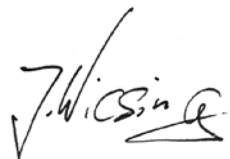
This illustrates the point that not only the technical competence of the engineering functions but the skills and efforts of each individual member of LTI staff are vital to the company's success. Those skills are born only in part from education and early professional training. Rather, it is the knowledge based on years of practical experience and, in particular, a critical attitude to one's own conduct and personal performance, combined with a commitment to continuous im-



provement, which are essential elements in attaining the necessary skills. The term „skill“ in this context should not be taken too narrowly however. Beyond mere technical competence, it also incorporates in particular a raft of social skills which are essential to efficient day-to-day working and good customer relations.

We at LTI have undertaken a range of measures in recent years in an effort to establish a culture based on the much-cited concept of „life-long learning“, backed by a comprehensive in-house training programme.

The decisive factor is not what measures we introduce however; it is that you appreciate the skills we bring to bear in everything we do. We are interested to hear how you perceive the overall skills of LTI in your dealings with us, and we would be pleased to receive your feedback in this respect.



Dr. Josef Wiesing

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LTi



Precise and highly dynamic – for machine tool business.

LTi is the new high-end system vendor to the machine tool business, bringing together four specialists in one: andron, LEViTEC, Fiege Spindles and LTi DRIVES. Comprehensive know-how, great flexibility and custom solutions make LTi your ideal partner.

LTi DRIVES **FS HEINZ FIEGE SPINDELTECHNIK** **andron** **LEViTEC**

LTi Group | Gewerbestraße 5-9 | 35633 Lahnau | Germany

facts



ANIMAL SKILLS

Apes, like many other animals, have very good numerical skills, enabling them to identify and differentiate quantities. Whereas actual arithmetic – adding or subtracting – and the use of complex mathematical formulas are cultural skills which require language, the sense of „more“ or „less“ does not.



COMPUTER SKILLS

Just under half of those who regularly work on a computer would call themselves „advanced“ users. So it is hardly surprising that, as recent surveys indicate, many users develop an emotional bond with their computers. While the revelation that, according to the study, 51.6 % of women „love“ their computer is good news for lonely PCs, the signs of increasing aggression demonstrated by many people in front of their monitors are a cause for concern. The most frequent victims of that aggression are mice being hurled against walls and monitors suffering torrents of verbal abuse.



COMIC SKILLS

An American scientist has discovered why it is that good jokes are so hard to remember: What makes a successful joke memorable is its punch-line – that is, the ending. What comes before – without which the joke does not in fact work – is all too easily forgotten. Consequently, bad jokes – which tend to have clichéd build-ups and be rather predictable – are easier to remember.



skills

The concept of skills is a very widely-used term in the modern-day world, and almost every scientific discipline has its own definition of what it means. Consequently, whatever the subject under discussion, everyone feels competent that they have the „skills“ to talk about it.

The concept of skills is particularly widespread in modern educational thinking, whereby the issue of what pupils actually learn is subjugated to the question of what skills students, and teachers, need to possess. Skills-oriented teaching curricula provide the basis for national comparative tests or final examinations as a means of measuring the acquired competencies. These tests nowadays seek to do more than merely find out what pupils know, but rather to test the skills and abilities of each individual.

The package of skills that pupils should have acquired by the time they quit their education is a mere precursor to what they will need to progress in their careers. Throughout his or her life, a thoroughly „skilled“ person ideally acquires methodical competencies and personal, social and communications skills, as well as emotional, intercultural and language skills, and of course computer and media skills.

Despite the widespread use of the umbrella term „skill“, a general distinction has been reached between purely technical or specialist skills, or competence, and the type of skills relating primarily to communication, personality and working techniques. These „soft skills“ are nowadays key elements in the portfolio of skills required by both employees and employers. Employers have learned from experience that purely technical or specialist competence is no guarantee of efficient output, but rather that social skills are just as important. These include, for example, the ability to work as part of a team and the flexibility to adapt to new ways of doing things.

Soft Skills: Essentials for workplace success

If someone fails to meet those challenges, the cause is most likely a lack of „skill“ in terms of their personal orientation.

(jg) ■







Energy efficiency = competence in power plant construction

COMPETENCE IN TERMS of energy efficiency demands extensive know-how in relation to energy generation processes, potential energy-saving models for industrial and domestic applications, and the development of previously unused energy potential. Examples of unused heat energy potential are to be found in the steel industry, in the casting of steel sheets, as well as in the heat insulation of buildings in conjunction with the use of solar energy.

LTi ADATURB GmbH specializes in developing such unused heat energy potential from industrial or motor processes. The unused heat, recoverable using distributed ORC technology, has the potential to deliver 70,000 to 125,000 MW_{th} of thermal energy output. Studies estimate that this can generate as much as 12,500 MW_{el} of electric power.

The recovery and conversion of heat into electric power requires the following competencies:

Design and construction:

- of largely maintenance-free exhaust gas heat exchangers
- of thermooil circuits to deliver the heat at the right temperature level for the turbine circuit
- of the turbine circuit, with heat exchangers, pumps, turbines and ancillaries
- of cooling circuits for the turbine circuit, with possible supply of usable thermal energy for local heating
- of suitable grid-synchronized or high-speed generators for power generation
- of the switch cabinet and PLCs required for process control

As LTi ADATURB is moving into new areas of operation involving the construction of small-scale ORC systems between 7.5 and 200 kW_{el}, existing standard industry products cannot be used. Instead, extensive in-house development work with the collaboration of competent partners is essential. This level of integration can only be achieved on the basis of comprehensive system and plant expertise.

Contracts carried out by LTi ADATURB GmbH to date have involved the use of waste heat from motors and industrial processes. The first standard products will have reached production maturity by Summer 2010.

(kpp) ■

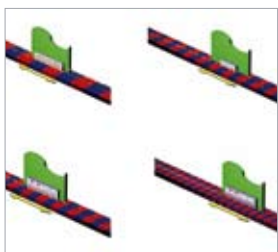
Intelligence based on competence

Flexible incremental encoders with state-of-the-art AMR and GMR sensor technology

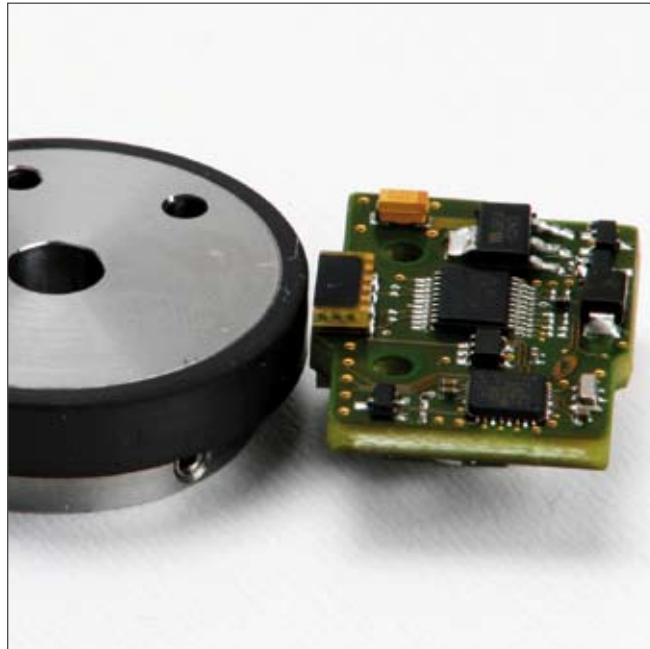
DEVELOPERS IN THE modern-day machinery manufacturing business are continually being challenged to optimize their designs in terms of fabrication, assembly and installation complexity so as to save time. Moreover, rotary encoders are being deployed in ever more demanding environments, where they have to reliably and permanently withstand extreme conditions of temperature, humidity or vibration. Last but not least, customers are looking to implement multiple requirements with a single encoder design concept based on variable interfaces.

In response to those demands, rotary encoder manufacturer 'Pepperl + Fuchs Drehgeber', based in Tuttlingen, is expanding its product portfolio to incorporate a built-on magnetic incremental encoder. Alongside the novelty of being a magnetically based built-on encoder, the object of the new development was to provide users with an assistance function during installation and operation of the encoder and a means of signalling its error-free operation. To meet those requirements, Sensitec has developed the intelligent encoder kit EBR7911. The different component mounting and programming options of its modular circuit design concept enhance flexibility and enable a wide variety of sensor modules to be used, which can in turn be combined with a wide variety of scales to create a wide range of sensor kits. The EBR7911 sensor modules thus offer customers a broad selection of solutions for their specific applications.

For the first time on this project, Sensitec developed a spin valve-based GMR sensor which is used as the sensor for the reference signal in the circuit design. A PurePitch sensor based on the familiar AMR technology, with a pole adjustment to 2 mm, is used as the sensor for the incremental track. This involves another new feature of this sensor module: the two sensors are each housed in their own SMD-solderable enclosure. This offers protection against mechanical damage to the sensor chips without significant-



↑ In the PurePitch design the MR resistors are distributed across multiple poles



↑ New encoder kit EBR7911 with assistance function

ly impairing the working clearance between the sensor and the scale, as the sensors are located right at the edge in the housing.

This produces an averaging which helps to minimize the effects of scaling errors with no additional signal propagation times. As the averaging is between the north and south poles, homogeneous interference fields are also more effectively suppressed. These improvements are reflected in higher control quality.

(rb) ■



Concerted engineering skills delivering higher yield

The utopian idea of getting more out than we put in – the apparently simplest solution to our energy problems – is likely to remain a pipe-dream. The search for an inexhaustible source of energy will continue to obsess humanity for generations to come. Yet the increasing use of renewables such as photovoltaic (PV) energy in recent years does certainly mark a step in the right direction.

At first glance, it can be seen that a cost-effective PV plant comprises three variables: high levels of sunlight; high-performance photovoltaic modules; and efficient inverters to convert the recovered energy into electric power and feed it into the grid. On closer analysis, however, it becomes clear that simply combining these high-performance variables does not necessarily deliver the best possible result. In fact, a wide variety of factors determine the overall efficiency of a PV plant, including its location and orientation, the type of cabling used and, not least, the topology of the inverter.

Everyone can put a lot of effort in. Only the best get the most out of it

With its PVmaster series of large-scale inverters for medium and large scale PV plants, LTi provides the basis for efficient conversion of generator power. Another key factor is the support we provide to our customers during the project planning phase, aimed at optimizing the efficiency of their PV plant.

Cost-effective and eco-friendly: a former ammunition bunker is turned into a large-scale solar power project

In Radelstetten, in the Schwäbische Alb hill range of southern Germany, our customer Krannich Solar last year constructed a 1.1 MW output PV plant on the site of a former German Army ammunition dump. Up until the year 2000, the site was a restricted military zone. Now the sun is shining down on the bunker installation, turning it into a model of both ecological progress and profitability.

A total of 6,012 crystalline high-performance modules have been installed across the 21 bunkers of the decommissioned site, mounted on automatic trackers. The trackers with an output of 54 kW or 37 kW are connected to a total of ten 100 kW AC rated output LTI PVmaster inverters. The tracking system, following the sun through a broad arc of 340° from sunrise to sunset, enables the plant to attain up to 25 % higher efficiency.

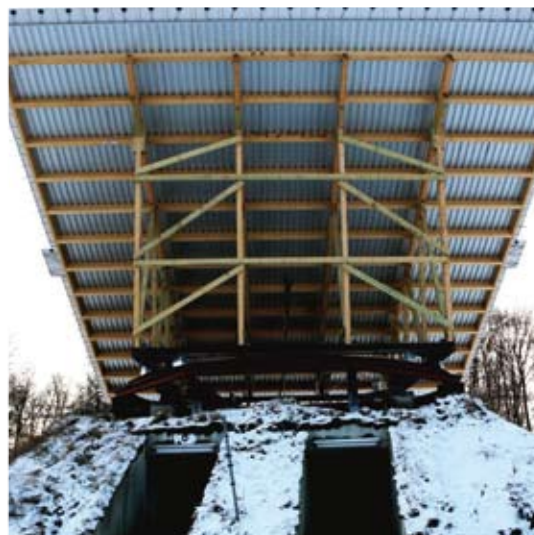
efficiency. Each of the PVmaster units is fitted with an independent MPP (Maximum Power Point) tracker, providing for autonomous optimized management of the individual inverters. In this way, the system can respond optimally to varying sunlight conditions across the PV park and so maximize yield. LTI handled the complete project planning for the PVmaster units, the low and medium voltage switchgear and the medium voltage transformer.

The Solar Park Radelstetten – a model installation in terms of environmentally friendly technology and solar energy recovery –, and has since then been generating enough power to cover the demand of some 300 households.

(abu) ■

PVmaster offers high efficiency

Based on the module type and the other technical conditions to which the PV plant is subject, we recommended installing the PVmaster OT variant. These PVmaster variants have no built-in transformers, but rather are connected to a central voltage transformer along with other PVmaster units. The advantage of the OT topology lies in the reduced loss, resulting in increased inverter



◆ The tracking system, following the sun through a broad arc of 340° from sunrise to sunset, enables the plant to attain up to 25% higher efficiency. The 1.1 MW output PV plant, commissioned in operation in November 2009, was constructed on the site of a former German Army ammunition dump

„Safety first“ with LTi

THE INTRODUCTION OF new safety standards has aroused a great deal of attention in the machinery manufacturing industry over the last two years. In the current climate especially, many manufacturers simply do not have the necessary resources to give due consideration to the new standards and the opportunities they entail. It is then all the more important for them to have a partner who has the ability to deliver optimum solutions based on expertise in dynamic drive engineering and in leading-edge safety engineering.

With its ServoOne and c-line Drives series and its SMC safety control system, LTi DRIVES offers the right components to meet any challenge – from simple retrofitting through to fully integrated machine safety solutions.

This all-embracing approach also incorporates the deployment of safe motor feedback solutions in the LSH and LST motor series, enabling the complete safety chain – from the motion sensors, through the evaluation system, to the shut-off – to deliver a single certified system.

Thanks to safe evaluation of movement information, new solutions with „functional safety“ in the drive controller and in the safety control system provide safeguarded access to the process. As a complete machine safety solution, this offers savings potential by comparison to conventional safety solutions in terms of machine assembly and of production availability.

With its young, expert team, LTi DRIVES offers customers active support in developing creative and intelligent safety solutions as well as advice on safety assess-

ment with the Systema calculation tool. In this way we are able to safeguard our customers' technology and know-how lead – a benefit which we will be continually enhancing after implementation of the new safety standards too.

(jbo) ■



◀TheLTIsafetyproductportfolio

Efficient, cost-effective and competent

TRUMPF CO₂ LASER deliver maximum process safety for welding and cutting applications. Despite the major technological advances in solid-state laser welding, CO₂ laser remain the universal standard tool for cutting sheet metal. The lasers of the TruFlow series are ideal for welding and cutting applications. They combine high process safety with maximum performance capability. The TruFlow 8000, for example, with its 8 Kilowatt output, is the most powerful laser in the compact TruFlow series, and can be integrated very easily into machinery.

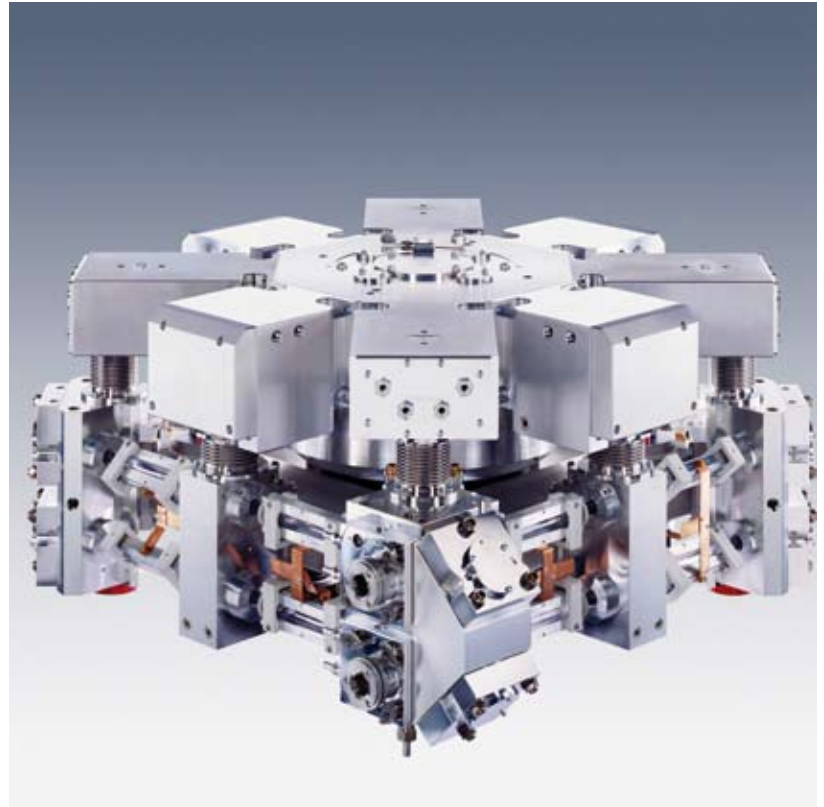
Characteristic features of all TruFlow lasers are their smooth, efficient high-frequency excitation, their compact and robust square design, and their maintenance-free magnetic bearing-supported radial turbo-blowers. The radial turbo-blower component ensures high-efficiency gas cooling and so optimum efficiency of laser beam excitation. The TruFlow lasers, featuring power outputs up to 8 KW, are the core components of high-productivity laser systems for high-speed cutting of thin sheet as well as for process-assured cutting of thick sheet. They are also deployed in five-axis machining centres for laser machining of three-dimensional units and in laser welding systems for pipes, profiles and gearbox or bodywork components.

LTi DRIVES systems complement the technical expertise of Trumpf

The drive section of the radial turbo-blower, comprising a synchronous stator and the drive controller CDS44.072,



was optimized for the TruFlow 8000 by components from LTi DRIVES. In order to achieve higher gas circulation rates, in addition to an increase in drive power the blower is operated at a rotating field frequency of up to 1000 Hz. The key factor in this is that the heat-up in the rotor is minimized even at higher speeds, thereby avoiding damage to the permanently magnetic material and so ensuring high system availability in line with the quality demands imposed by TRUMPF. With the three-level topology of the CDS44.072 in the



↑ TruFlow Resonator

LC (Liquid Cooling) variant and a small sine filter, Trumpf is able to operate a highly compact drive system. The harmonic components generating losses in the rotor are reduced to the permissible levels. The speed-controlled drive system means that all operation modes are safely controllable, including a power failure bridging feature which maintains power to the magnetic bearing control in the event of a power failure by way of the DC link and safely controls the speed of the radial turbo-blower down to a standstill.

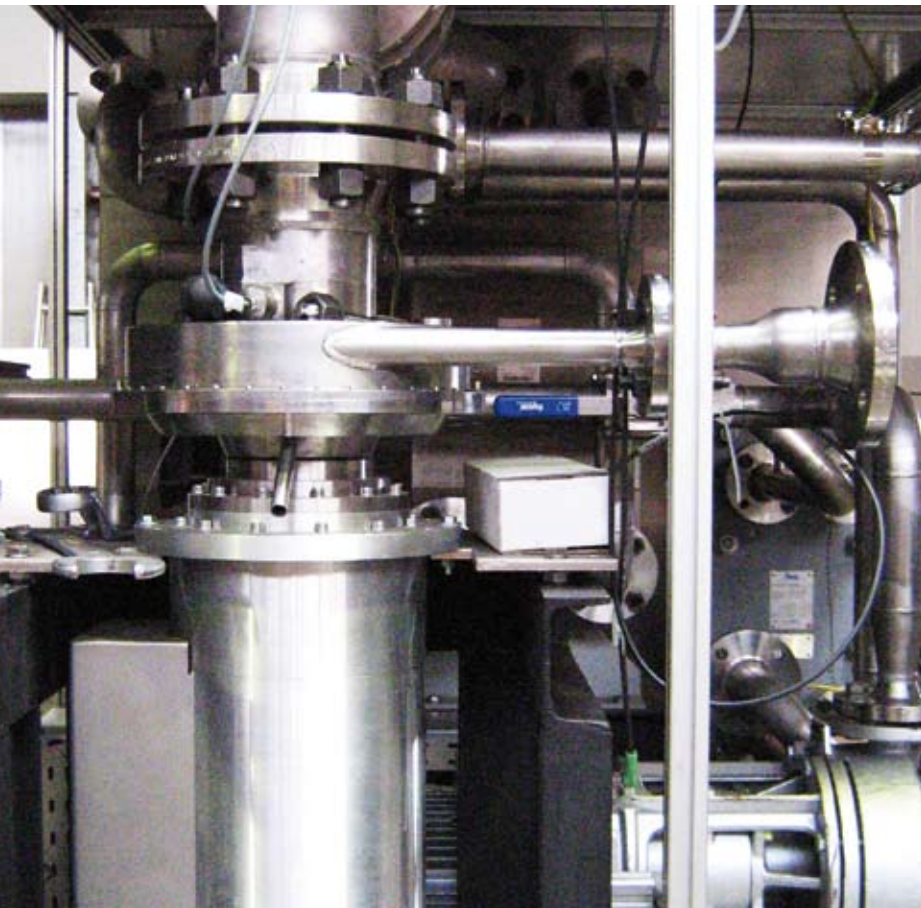
With the kind assistance of TRUMPF Laser- und Systemtechnik GmbH, www.de.trumpf.com

(pb) ■

Levitec turbo-generators ensure maximum efficiency in ORC systems

THERE ARE currently very large supplies of waste heat available all over the world which remain as yet unused. This surplus energy could be converted into electric power for example.

↓ Turbo-generator in an ORC system



The generator output is calculated as the product of the torque and speed. The key characteristic determining the size of the machine is the torque. A high speed and a low torque, with the same power output, produces a compact machine. Lower machine volume and weight are the main advantages to the customer of such a combination. At higher speeds – and in combination with the process – higher efficiency can usually be attained and so, in the present application, higher revenues can also be generated. The high efficiency also enables the ancillary components such as the cooling units to be smaller in scale, so helping to cut the cost of the overall system. In the ORC application the process parameters are favourable enough, in conjunction with the mechanical setup, to specify the turbine wheel for high speeds.

The generator was also designed and manufactured with a view to ensuring reusability of components for different power classes.

The use of magnetic bearings from Levitec provides ADATURB with highly efficient, maintenance-free turbo-generator units in the 30 kW and 60 kW power classes. Based on the measurement and testing results, the prospects for future developments are highly promising. There is additional potential to be exploited in further component integration to reduce complexity and expense while at the same time improving overall efficiency. Furthermore, adjustment of output opens up the opportunity to adapt the system to other energy sources.

LTi ADATURB develops and manufactures ORC (Organic Rankine Cycle) systems for the generation of electricity from the heat produced by sources such as biogas plants, CHP power stations or industrial facilities. A key element of ORC systems, alongside the process components, is the turbo-generator, which relieves the thermal energy by way of a turbine wheel and drives a shaft, thereby converting the rotational energy into electric power. To ensure this process of energy conversion is highly efficient, high speeds – in this instance in excess of 20,000 rpm – are required.

(cr) ■

The manufacture of puzzles demands extreme contouring accuracy

THE EXACT REPRODUCTION of delicate designs is a key quality characteristic in the fabrication of punching cylinders. To ensure all the puzzle pieces fit together exactly, rotary punching tools are used in their manufacture. In fabricating these punching cylinders, precision-angled cutting is an essential prerequisite to produce the exact contours of the end-product. For this precision work, LANG GmbH & Co. KG based in Hüttenberg has developed the RM milling machine series for the machining of embossing cylinders or rotary punching tools.

The andronic 2060 L CNC controller used in the process ensures fast block processing times and so high contouring accuracy of cuts or reliefs.

Rotary embossing or punching is deployed wherever a product is being manufactured in high volumes, because compared to flat machining it enables such high-volume production to be carried out in a shorter time. As punching or embossing cylinders are used wherever delicate and detailed precision machining is required, the primary demands placed on the milling machines are consistency of cutting speed and precision implementation. That is why they are also used for the manufacture of puzzles, in which the sharp edges of the tool have to cut out

the individual pieces. Key factors in terms of these punching cylinders are that the cutting roller has sharp inner and outer edges and that the blades are always the same width.

The andronic 2060 CNC controller used is designed as a dual-processor system, enabling fully isolated processing of the NC data which is transmitted directly

to the drives to deliver the path and speed information. The special method of data preparation and the continuous data feed into a buffer on the NC computer permits infinitely large volumes of data to be processed without the data buffer ever emptying, even at high machining speeds. The openness of the andronic control system also offers the facility to use a custom developed user interface.



▲ Punching cylinders of a folding box
(Source: LANG GmbH & Co. KG)

(ap) ■



◆ Punching cylinders for the manufacturing of puzzles
(Source: LANG GmbH & Co. KG)

How the ServoOne Safety is influencing weather forecasting

The „Safety“ weather forecast of the future

WE ALL WATCH the weather forecast after our evening news programmes, but few of us know how they are produced or how accurate they are. Weather data is gathered by a global network of weather radar dishes. The way those weather radar systems operate is essentially simple: The antenna emits an electromagnetic signal which is reflected by raindrops, snowflakes or hailstones. The range of the encroaching weather system can then be calculated from the delay between the emitted signal and the return. Differing reflections provide indications of the amount and type of precipitation. In this way, very accurate information can be obtained as to the expected intensity of the precipitation.

One weather radar system is able to monitor a radius of some 200 km. However, the more accurate the forecast needs to be, the more data is required and the more close-knit the network of radar systems must be.

The importance of accurate weather forecasting is highlighted by major events such as Formula 1 grand-prix races. All the teams rely on their own weather radar dishes covering just the area around the race circuit in question. This enables them to decide quickly when they need to fit rain tyres or when to schedule pit-stops.

The use of such weather radar systems entails a number of special demands. They must not only guarantee continuous operational safety, particularly in terms of „safe reduced speed“ and „safe positioning“ of the dishes, they also have to take into account the specific operating conditions. Conditions such as extreme temperature ranges from -40 to + 50 degrees, or installation at altitudes of up to 5000 metres above sea level, impose stern demands on both motors and controllers.



The control properties of the ServoOne deliver outstanding results in safeguarding precise continuous rotation and accurate tracking of the dish inclination. A significant improvement in control performance has been achieved in particular based on exact tracking of cloud banks.

The SELEX Gematronik corporation is a customer of LTI DRIVES, and the world market leader in the manufacture of weather radar systems. Its radar systems are among the most state-of-the-art systems in the world. The compact design of the ServoOne ‚Safety‘ variant is a key factor in the market success of SELEX. Special synchronous motors from our production round off the system package.



On the move with Mobile Power

IN VIEW OF RISING fuel prices and more stringent environmental standards aimed at reducing pollution emissions, the electrification of the drive train in electric-powered and hybrid vehicles is becoming an increasingly important issue. These applications entail a range of new technical challenges: tough ambient conditions; high stability demands; unusual geometries; compact installation; and cost pressures.

LTI DRIVES has for years been delivering custom solutions for high-voltage (250-700 V) drive components for use in materials handling equipment, and so has the experience and expertise to develop specialist and complex drive solutions and turn them into top-quality products.

In response to rising market demand, such as for inverters for hybrid solutions, LTI DRIVES has established a new dedicated division of its business named Mobile Power. The object of the new business arm is to develop solutions in conjunction with customers which can be incorporated within the available confines of existing commercial vehicle, construction and agricultural machinery platforms while withstanding the high ambient temperatures and vibrations encountered in such applications. Alongside a high protection rating, this also demands the integration of established vehicle bus technologies and protocols in order to continue using existing tools in the development, production and service fields.

In the low-voltage range (24-80 V) there is already a range of solutions on the market, originating from the materials handling equipment sector for example. In the high-voltage range (250-700 V), on the other hand, the situation is much more difficult, owing to insufficient standardization, unclear charging infrastructures and a lack of long-term experience – though here, too, there are signs of solutions in the pipeline. The demand for custom developments is particularly high in this sector.

Ultimately it is the economic factors which will determine the success or otherwise of a hybrid or electric drive system: Its cost must have been amortized after just a few years based on fuel savings or lower system costs. In view of rising fuel prices and more stringent environmental standards, however, that is a goal which is not only becoming ever more worthwhile to pursue, but which is also likely to become increasingly easy to attain.

(bh) ■



Source: STILL GmbH ▶

Always on the safe side

SAFE PROCESSES are becoming ever more widely incorporated into manufacturer operations. Such processes must be fully traceable not only in production itself, but all the way through to the packed product. As no steps can be omitted, but all have to be optimized, modern-day solutions are based on automation, with operationally safe and reliable systems.

DiaMed GmbH, based in Cressier, near Murten in Switzerland, is the world's leading vendor of products and services in the field of immunohaematology. As the originator of the gel column agglutination technique, now in global use in blood group identification and antibody detection in particular, DiaMed GmbH has played a major role in ensuring that blood transfusion analysis has today been made much safer.

As part of its co-operation agreement with the Swiss company, the task faced by LTI DRIVES Switzerland was to stack the finished product in a buffer storage location by way of a regulated conveyor system before transmitting it under control to the packing line. The LTI positioning controller CDE3000, with LSH servomotors, was deployed to handle the positioning tasks.



To ensure user-friendly operation, the complete system incorporates a cabinet-installed touch panel displaying the production speed, throughput rate and the safety functions. The entire system can in fact be controlled from the panel using simple commands.

As the system has to run 24 hours a day, the use of operationally safe inverters from LTI, guaranteeing increased production throughput and consistent quality, has proved invaluable.

(wk) ■



◀ Buffer storage location for the finished product

LTi servocontrollers – right on the Pick&Place machine

PET PERFORMED BOTTLE picking and placing is a highly involved and time-consuming process. A programmable Pick&Place machine has been developed for the purpose in China which is able to process PET preformed bottles from 48 to 72 pieces.

Strokes of the manipulator are positioned at a maximum speed of 1.43 metres per second and rotated through 90 degrees per second by the servocontrollers. This demands precise dynamic positioning by the servocontrollers.

The target position is transmitted to the servocontrollers from a PLC over the RS485 bus system – the rest is handled by the drive. It positions precisely with a synchronization belt drive. The drives signal back the status over RS485 to the PLC, which holds the data records covering all strokes of the manipulator and enables them to be retrieved at a press of a touch-screen, with no lengthy setup times.

In conjunction with LTi, the customer has been able to optimize the machine and improve its effectiveness. The machine is now in steady production.

(sz) ■



← Pick&Place machine

books

Konstruieren sicherheitsgerechter Produkte: Methoden und systematische Lösungssammlungen zur EG-Maschinenrichtlinie [Designing safe products: Methods and systematic solutions relating to the EC Machinery Directive]

Alfred Neudörfer, Springer Verlag, Berlin 2005
ISBN 3-540-2121-83

The subject of this book is the integration of the design of safe – that is to say, people-oriented – products into the methodical design process. Systematically structured collections of solutions set out numerous practical examples of direct safety measures and protective devices which can be incorporated into designs.

Payback: Warum wir im Informationszeitalter gezwungen sind zu tun, was wir nicht wollen, und wie wir die Kontrolle über unser Denken zurückgewinnen [Payback: Why we are forced to do things we don't want to do in the information age, and how we can regain control of our thinking].

Frank Schirmmacher, Karl Blessing Verlag, Munich 2009
ISBN 3-896-6733-6X

Schirmmacher sees the means of escaping the predictability of life and the threatened strangulation of free will not in a retreat from technology, but rather in enhancing creativity, tolerance and the (regained) ability to deal with the unpredictable.

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fair

FAIR	DATE/LOCATION	EXHIBITOR
GrindTec 201 International Fair for Grinding Technology	17.-20.03.2010 Augsburg, Germany	Fiege
energissima Swiss Trade Fair for Renewable Energies	15.-18.04.2010 Fribourg, Switzerland	LTi DRIVES, Switzerland
Hannover Messe International Industrial Fair	19.-23.04.2010 Hannover, Germany	LTi DRIVES, Levitec Sensitec
SIAMS Fair for Automation and Machine Tools	04.-08.05.2010 Moutier, Switzerland	LTi DRIVES, Switzerland
SOLAREXPO International Exhibition for Renewable Energies	05.-07.05.2010 Verona, Italy	LTi REEnergy
Sensor+Test 2010 The Measurement Fair	18.-20.05.2010 Nürnberg, Germany	Sensitec
IPVSEE 2010 Solar-Exhibition	27.-29.09.2010 Beijing, China	LTi REEnergy, China
SPS/IPC/DRIVES Italia International Fair for Automation	19.-21.10.2010 Parma, Italy	LTi ITALIA