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IN THIS ISSUE:

4 Interview with Dr. Michael Poellmann, Executive Director Global Sales, Messe Muenchen

6 Interview with Dr. Till Truckenmueller, President of Automotive Cluster Bulgaria

8 How to complete a low-cost design and analysis using a single-phase AC induction motors and an 8bit microcontroller

10 Electrical engineering and electronics sector in Bulgaria

14 The Greek biennale Syskevasia will demonstrate the newest packaging solutions in 2016

14 Leading innovations in the field of electric automation were showcased at SPS IPC Drives 2015

15 SEE Business

16 Automotive manufacturing and R&D sector in Slovenia and Romania

20 SEE Energy

24 Metallurgy and metalworking industry in Croatia

27 Strong international presence expected at Via Expo's exhibitions in April 2016

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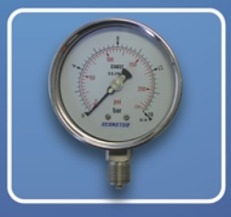







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SEE NEWS

Siemens to build factory for trams in Turkey



Siemens announced an upcoming investment in the growth market for urban public transport. The company will build an assembly factory for trams in the Turkish city of Gebze, near Istanbul, and begin production of its first vehicles in 2018. Around EUR 30m will be invested in the localizing of manufacturing and supply chain in Turkey, which will provide the company with better chances for winning tenders as well as substantial cost advantages for international orders.

Siemens is already cooperating with local manufacturing partners in Turkey on a project basis and intends to secure its competitiveness in the tram market following the recent growth of urban rail transportation business. The rail industry as a whole is increasingly depending on international production networks, noted company speakers.

"Our Avenio series trams have already proven themselves in some countries. We are now aiming at building on this success in the global market. We have the best chances of succeeding here with a factory in Turkey," said Jochen Eickholt, head of Siemens' rail business.

Dutch company invests in the Romanian hemp business



Dutch company HempFlax, active in the processing of hemp, announced that it has invested EUR 5 million in the Romanian hemp business and has opened its first factory in Alba country. HempFlax designs, develops and patents specialized equipment for hemp cultivation, which manages to combine the harvesting of the hemp seeds, stems and leaves at the same time.

Romania was the fourth largest exporter of hemp in the world before 1989, but the volume fell to only a few hectares in 2000. The investment made by HempFlax indicates a possible return of interest for the market. The company's cultivated area in 2015 is approximately 500 hectares, with investors expecting an increase by approximately 300 hectares year by year.

"Through innovation and vigour, HempFlax contributes to the concept of agrification in Romania. Providing renewable resources, synthetic fibers made from fossil resources - such as nylon, fiberglass and plastics - can be replaced by fibers from these natural resources such as hemp," said HempFlax general director Oana Suciu.

Together with the German-Bulgarian Chamber of Industry and Commerce, Messe Muenchen mirrors the Bulgarian market at its shows

Dr. Michael Poellmann,
Executive Director Global Sales,
Messe Muenchen,
for the South-East European Industrial Market magazine



Dear Mr. Poellmann, this year Messe Muenchen and the German-Bulgarian Chamber of Industry and Commerce celebrate 20 years of successful partnership. Which are the most important goals that you accomplished together for this period?

The first goal was to provide all Bulgarian exhibitors and visitors to our representative office a professional service with regards to necessary participation information. The second goal was to mirror the Bulgarian market at our shows. As Bulgaria has been able to multiply the visitors by 6 times and the exhibitors by 7 times since 1995, we have been able to realize a very good visibility of the Bulgarian industry at our international exhibitions.

What opportunities for the German-Bulgarian business do Messe Muenchen's exhibitions provide?

Messe Muenchen's portfolio includes 14 worldwide leading tradeshows like bauma, BAU, electronica, Expo Real, ISPO, transport logistic, drinktec and many more. These shows are able to provide a window for Bulgarian enterprises to the international demand of the various industries. An average of more than 2 million business visitors represent more than 2 million business opportunities. To use these melting pots of offer and demand creates real business contacts, visibility and media coverage. All of our shows are supported by a great range of services and media opportunities to increase the participation's impact. That means that with our shows everything is prepared for giving Bulgarian companies the best stage to show their strengths.

How do fairs influence the development of the exhibitor and guest companies and the global business climate?

Messe Muenchen is a gateway to the world. Several leading trade fairs bring together the international "Who's Who" of their respective industries and serve as a springboard that gives exhibitor and guest companies access to growth markets around the world. A leading international trade fair with the newest products can communicate to the visitor what current state-of-the-art is around the globe, where trends are leading, and if there are exciting innovators or niche suppliers available within just a few days.

Which of Messe Muenchen's events have proven as most successful through the years? How does the Fair adapt to the ever-changing trends in the exhibition business?

We are lucky to have a long row of events established since decades, including BAU, electronica, IFAT, ISPO and of course bauma, our flagship to this day. A further very successful trade fair is Expo Real, Europe's largest real estate and investment trade fair.

Critical for the future success is further internationalization, it's the only way to strengthen our position in dynamically growing markets around the world. We export our key trade fairs to the most important growth regions in the world.

Messe Muenchen is also consistently following the path of digitalization. For example, it offers a number of ways to improve fair-related services. This is why Messe Muenchen is creating platforms for its customers that will make it accessible to them 365 days a year. It enables us as trade show organizer to bring exhibitors together with existing as well as potential new business partners.

What are your impressions of the Bulgarian industry and commerce based on the performance of the Bulgarian companies participating in Messe Muenchen's exhibitions?

What I have seen at our shows is that Bulgarian enterprises exhibit very professionally and are able to compete internationally. The open minded and reliable mentality supports the increasing visibility of the Bulgarian industry at our exhibitions.

Which will be the highlights in your activities in 2016? What should local companies willing to participate in the upcoming industrial events know?

2016 is "year of bauma". The biggest trade fair of the world takes up 605.000 square meters, is sold up and has a long waiting list again. Spin-offs in China and India in the second half of the year will strengthen again its leading position in the global sector. bauma China is the second largest trade fair in our entire portfolio and pilots at the same time more and more exhibitors and visitors to the Number 1 in Munich.

In January ISPO fills again all halls. The same goes for IFAT in May/June, the world's leading trade fair for water, sewage, waste and raw materials management. In June we celebrate the groundbreaking of two new halls. We need the new capacities to supply the demand, to improve our service and our position in international competition. As you can see, we will have a lot of exciting highlights in 2016.

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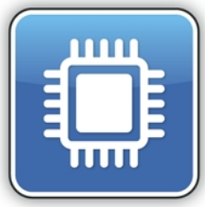

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The automotive industry is among the most prospective sectors in Bulgaria

Dr. Till Truckenmueller, President of Automotive Cluster Bulgaria, for the South-East European Industrial Market magazine



Dear Mr. Truckenmueller, which are the highlights in the activities of Automotive Cluster Bulgaria? Please, tell us more about the structure and the main goals of the organization.

Automotive Cluster Bulgaria is an organization founded in 2012 by eight companies to support the automotive industry in Bulgaria in two key areas: attracting investors from the industry and assisting companies in the country operating in the sector on issues of prime importance. We actively work towards improving the qualification of staff by offering practical training to improve the managerial skills of the staff of the middle management, training in methodologies such as Lean, Six Sigma, SPC, FMEA, VDA and other specific sectors. Together with our member companies FESTO and SMC we also offer technical courses as pneumatics, hydraulics, energy saving. Part of our goals in this direction is to set up classes in the dual education for the automotive industry. We also work towards branding the sector. We wish to provoke among the public, especially among young people interest in the sector, in the companies that operate in it and create long-term and attractive jobs. Recently we started issuing a newsletter that informs about innovations and opportunities in the industry. Currently, Automotive Cluster Bulgaria has 32 members. Companies outside the automotive industry are also interested in our activities.

What is your assessment of the current state of the automotive industry in Bulgaria? How would you estimate the level in the country compared to other European countries?

The automotive industry is one of the most promising and fastest growing industries in Bulgaria. This is a sector that creates high added value, creates jobs for low qualified staff as well as for highly educated people with good prospects for career growth and accumulation of valuable experience. The fact is that over the past few years, the companies in the industry grow rapidly, build new factories and plan future ones which is a sign that the economic conditions in which they operate are favorable and competitive. The more difficult point is to persuade new companies to invest in Bulgaria because of the relatively bad image of the country abroad.

What are the rates of development of the automotive manufacturing in Bulgaria in the recent years and which are its leading divisions? What are the most significant achievements in terms of technology and innovation?

Along with the IT and BPO sectors, the OEM sector is among the most dynamically developing ones. The boom, on its part, leads to an increase in demand for qualified personnel. Therefore in February 2015 Automotive Cluster Bulgaria, together with the companies FESTO and SMC, initiated the setup of a training center to increase personnel qualification. Moreover, the cluster plans to participate in the creation of classes for dual education in professions such as mechatronics, electronics, etc.

Is the qualified staff in the sector enough currently? What are the opportunities for training and enhancing the competencies in this field?

The automotive industry requires specific knowledge and skills. Currently, due to the rapid growth in this sector there is a shortage of specialists that we as an organization and each company in the sector try to compensate with trainings. Therefore we launched an initiative with the support of the Austrian chamber to form classes in the dual training for the automotive industry. The aim is that business in partnership with vocational schools produces and provides the qualified professionals needed.

Which local conditions attract foreign investors in the country and what is the significance of these investments for the sector and the economy as a whole?

Very often in conversations with investors the main focus is the low level of salaries as a major advantage. However it attracts fewer companies. Other advantages are necessary. What Bulgaria can offer and that is very important for companies lately it is the political and economic stability of the country. Bulgaria is among the countries with the lowest debt in the EU. For the potential investors it is also very important that the lev is pegged to the euro because they cannot afford large currency deviations. The EU membership is a priority for Bulgaria. Lower taxes are of prime importance, especially for the average business. Agreements to avoid double taxation which Bulgaria has concluded with most countries of Western Europe and the world are also taken into account.

An indisputable factor is the strategic location of Bulgaria. The pan-European Transport Corridor No.4 passes through the country (passes through Vidin). It is important for our members, especially after the construction of the bridge Vidin-Calafat.

What is essential for manufacturers and suppliers of automobiles and automobile parts is that they be able to reach all the important production bases that Bulgaria offers within 24 hours. That is why many suppliers withdrew from North Africa and China. In China parts are produced only for the market in the country or in Asia but not for Europe. In the future components for the market in Europe will be produced mostly in Eastern Europe from which Bulgaria also could benefit.

Specialists are of great importance. Bulgaria is the country with the most German-speaking graduates in Eastern Europe. Bulgarian students are one of the biggest groups in Germany.

Thanks to its well-qualified specialists Bulgaria gains popularity as a software center.

What are the specifics of the market in the country and the region? What opportunities on local and global scale are available to the companies in the branch and what are the most significant challenges facing them?

Typical of the automotive industry in Bulgaria is that there are but very few Bulgarian companies involved in the supply chain. These most often are companies of Tier 3 and Tier 4 or a lower level of supply. In order for a company to become a Tier 1 or Tier 2 provider the main challenge is to meet numerous criteria and requirements.

What is your forecast for the future development of the automotive industry in Bulgaria? Do you expect a new boom of interest in the local labor market by international companies?

Currently most of the possible big Tier 1 investors evaluate Bulgaria as one of the possible investment locations. Additionally we notice that some of the big companies move their production from China to Eastern Europe because of the better total cost relation.

The most important factors to win new investors is the improvement of the labour market, especially to push the dual education system, to shorten the administrative processes, to avoid all kind of corruption around the settlement of an investor and to improve the environment for the people to prevent that only few locations in Bulgaria will be selected as possible investment locations.

In total we are optimistic that the boom in the automotive sector will continue and of course a highlight will be the settlement of an automobile manufacturer. We try hard to win one of the worldwide OEM`s.

Could you tell us more about some of the most interesting and significant projects of the Cluster to improve the conditions in the sector? What similar initiatives are you planning from here on?

Automotive Cluster Bulgaria continually strives based on feedback from the business to improve conditions in the sector. Our main activities are associated with trainings of the personnel in the sector by organizing specific industry trainings and creating a closer relationship between students and teachers with businesses. That's why we arrange plant visits, presentations of key professions and opportunities for development for students and students from vocational schools. We plan on creating dual education classes for the sector from next year. A video clip for the automotive industry in Bulgaria is also in the process of creation. Next year there will be special career days with representatives of the automotive industry. We are preparing several projects with the financial support from the European Union for technology transfer to develop new supply chains among the automotive, logistics and mobile technologies sectors. We also participate as a partner in several consortia and work closely with organizations and companies from Italy, Spain, Finland, Hungary, Austria, etc. We plan the development of a project for setting up laboratories for the automotive industry. We have started many initiatives and hope to bring them to a successful end in next year.

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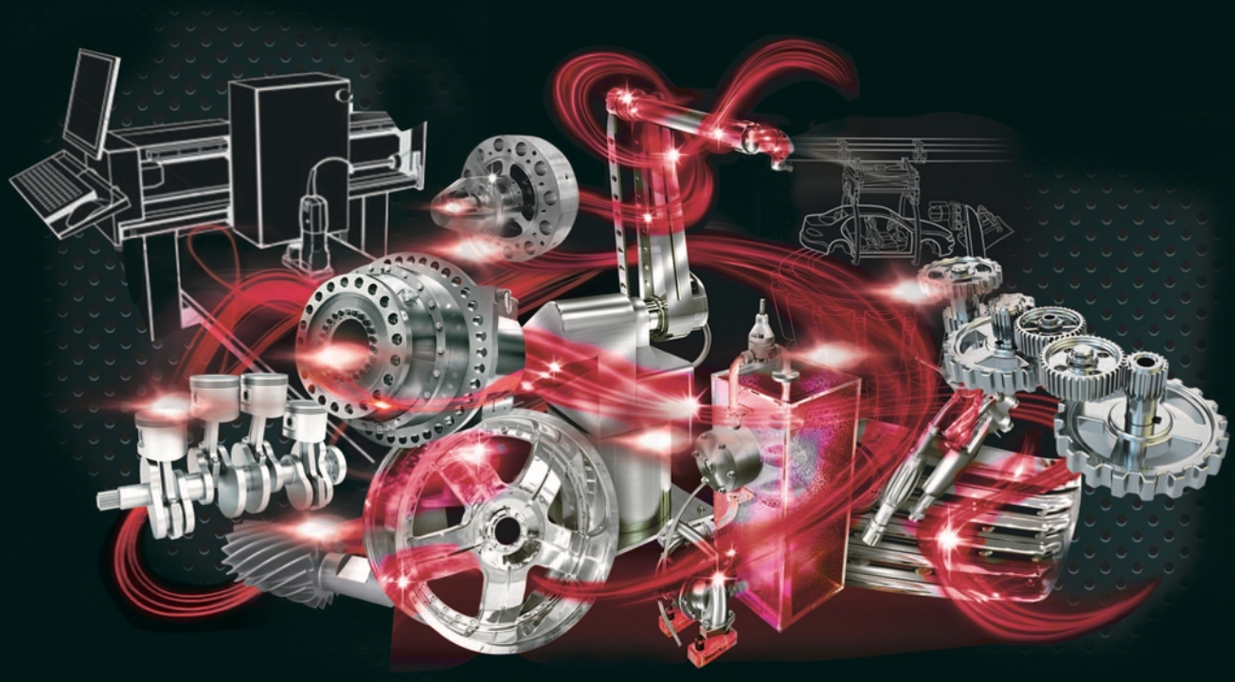

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How to complete a low-cost design and analysis using a single-phase AC induction motors and an 8bit microcontroller

Justin Bauer

Small AC induction motors, say for opening garage doors, can have speed control and soft start added with little cost using a three-phase inverter circuit. These permanent split capacitor (PSC) motors are among the simplest and widest used for this type of application. They have low starting torque and current, but can be inefficient due to the non-polarised run capacitor, which often fails before the rest of the motor.

These single-phase motors are often referred to as two-phase motors because they cannot run without sufficient phase shift between the two windings. The capacitor is placed between the input signal and winding to produce an approximate 90° phase shift. The switch is often replaced with a relay that can control the direction by swapping which phase leads or lags the other. The value of the capacitor is typically specified by the motor manufacturer and is sometimes in the range of 5 to 50 uF for motors that are less than 0.75kW of the type being looked at here. The capacitor should be carefully chosen to correct the power factor for maximum power efficiency. Fig. 1 shows the topology of a traditional AC induction motor.

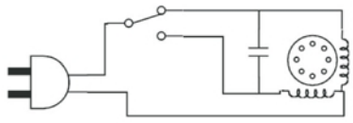

Fig. 1: Topology of a traditional AC induction motor; the capacitor provides the necessary phase shift to produce a rotating magnetic field

The voltage rating is typically high at around 220 to 450V, depending on the input voltage. The capacitor must not be polarised, since it is across an alternating voltage. If this capacitor fails, the motor will cease to turn. The importance of selecting the correct capacitor is therefore critical. A practical capacitor has resistance and radiates heat as it consumes the RMS AC ripple current within its equivalent series resistance. The permanently installed capacitor trades off starting torque capability at standstill with ripple torque reduction at running speed. Because of the high VA rating of the capacitor, it is often selected to meet the minimum starting performance requirements, resulting in poor running efficiency.

For motors that do not have identical windings, it is necessary to feed the two phases with different voltages. This asymmetry is due to the presence of the capacitor, which forms a resonant circuit with the motor's inductance. Consequently, this raises the voltage across one of the windings and causes uneven current flow.

However, a three-phase inverter can be used to replace the permanent capacitor, as shown in Fig. 2. This allows the speed of the motor to be adjusted with the appropriate amount of voltage applied to each winding so that weaker windings are not overdriven.

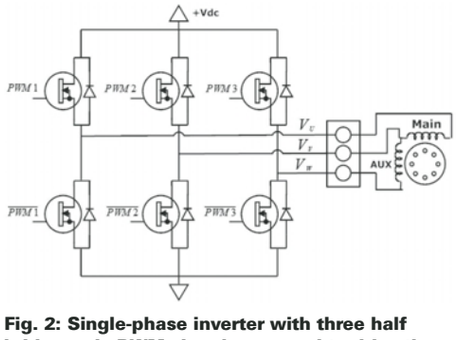

Fig. 2: Single-phase inverter with three half bridges; six PWM signals are used to drive the connected squirrel-cage PSC motor

The motor will still spin without the capacitor if the coils are driven out of phase from one another. This can be achieved by creating three phases in software. These three-phase voltages can then be referenced from one another to create two resultant waveforms across the two motor windings. One of the phases is taken as the reference, or neutral, to create the two waveforms. The three phases can be created in software using PWM techniques.

Comparison

Three tests can be run to compare the PSC run method with the inverter method with no run capacitor. These are: torque to characterise the effects of variable frequency drive on the motor; acceleration and speed to identify which method turns the motor shaft the fastest and how quickly the load will accelerate; and efficiency to compare the real component of the output power to the input power and to measure the power factor and other inefficiencies.

These three tests cover the largest design considerations in motor control. None of the tests require a special setup from the other tests. Each analysis in the three separate tests can use the same subset of data. The test set up is shown in Fig. 3.

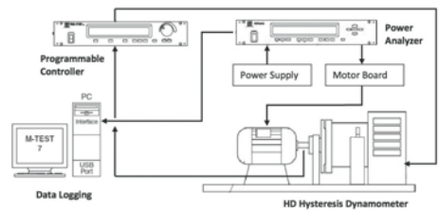

Fig. 3: Test set-up on the dynamometer

This test used a 0.19kW single-phase motor with a balanced wiring configuration. Both windings had identical resistance and inductance. A Hall-effect sensor was used to measure the shaft speed. The input was a single-phase, two-wire 220V at 60Hz. The output was fed into the two terminals on the inverter.

The PC interface ran Magtrol's M-Test 7 software. The programmable controller applied the test set-up from this software to the dynamometer and read the applied torque. The power analyser performed and logged all the other readings.

Starting with the torque test, it was apparent that the motor had the highest starting torque of around 0.75Nm between 50 and 60Hz in line with the motor design. Frequencies above and below 60Hz had lower torque profiles. However, the low frequency readings did not produce a constant torque curve. Frequencies lower than 60Hz required a fine tuning of the voltage-frequency ratio because of losses in the motor and inaccuracies in the motor drive. Frequencies below 60Hz were kept at maximum voltage.

A low frequency causes a decrease in an inductor's impedance. The high voltage applied to this lowered impedance raises the current in the stator, which produces higher torque. The fine tuning is needed to make the torque curve linear.

The shapes of the curves between the two methods differ greatly. The capacitor method shows a slightly larger starting torque and will accelerate faster than the inverter board at 60Hz. The inverter board produces a curve similar to that of a class D design motor, while the PSC run topology produces a similar class A torque curve. An unequal voltage magnitude caused by the permanent capacitor creates an unequal magnitude of magnetising flux within the stator. The inverter board attempts to create an equal amount of current in each winding, since this particular motor has identical impedance in each. The shape of the torque curves are not similar because of these discrepancies in the driving topologies.

Looking at the starting torque when the rotor is locked, the inverter would be unable to lift the same-sized load as the PSC method if the inverter were programmed to simply turn the motor at a 60Hz modulation frequency. However, the inverter board can use variable frequency drive to lift an even larger-sized load. The designer must also take into consideration the trade-offs of large starting torque versus efficiency and speed.

The most obvious benefit of controlling the voltage and frequency is that the designer can control the speed at which the motor shaft spins. The faster it spins, the sooner the load can be pushed or pulled to its destination. This can be a critical design win in a garage door or gating system application.

Inverter board

So, the inverter board allows the motor to out-pace a replica motor that is driven by the PSC method. The PSC method can only be driven at one frequency and, hence, it cannot exceed its synchronous speed.

The inverter board can be constructed as an application-specific platform rather than a general-purpose demo board. However, it does provide numerous inputs and outputs (I/O) for the user to interact with and modify. The inverter is engineered to drive a single-phase or three-phase AC induction motor. An overview of the board is shown in Fig. 4 using a PIC16F1509 microcontroller from Microchip.

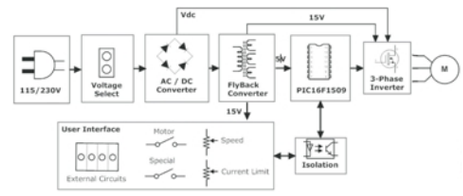

Fig. 4: Top level overview of the overall system

The board was designed with flexibility in mind, so some of its features can be used or not to achieve optimisation. Most of the I/O are used by the default code but there is still plenty of space for the developer to use custom modifications. The I2C lines are also free for any added slave devices. Some of the I/O are multiplexed onto one pin to increase the number of I/O that can be used. All user interface requirements are isolated via two four-channel optocouplers and a one-channel optocoupler. The board provides two switch buttons and two potentiometers. There are also headers that provide connections for external I/O, such as garage door trip sensors. The two potentiometers have their transistor in the optocoupler circuitry biased in its amplifying region. The output is therefore approximately linear, since the optocoupler LED does not have a linear I-V curve. Large currents in the 30mA range are consumed for each potentiometer.

The digital push buttons and auxiliary inputs are biased to cause an interrupt-on-change (IoC) when either is used. This alleviates the CPU from constantly checking the voltage level on the pins. Whenever an IoC is detected, an ADC reading must be taken to determine which input caused the interrupt.

Operation

The motor is in its idle state when the PIC16F1509 microcontroller initialises pins and stops the motor. When the start button is pressed, the motor starts using a soft-start method where the frequency and voltage are adjusted in a linear fashion to bring the motor up slowly to its operating speed. The motor then moves to its on state when the soft-start operation is completed.

The motor speed and current trip points are constantly polled in the main loop. If an over-current is detected, the motor is stopped and the status LEDs blink to indicate a fault. The motor is normally stopped by push-button using braking or soft-stop to return it to its idle state.

Conclusion

AC induction motors such as used in garage door applications can be driven using an inverter board rather than a traditional capacitor. This allows speed control and soft-start capabilities to be added to the motor at relatively low cost. The inverter board is based around a PIC16F1509 8bit microcontroller from Microchip.

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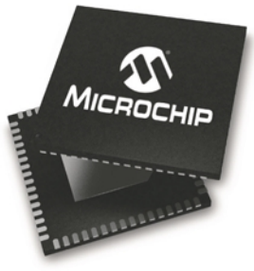

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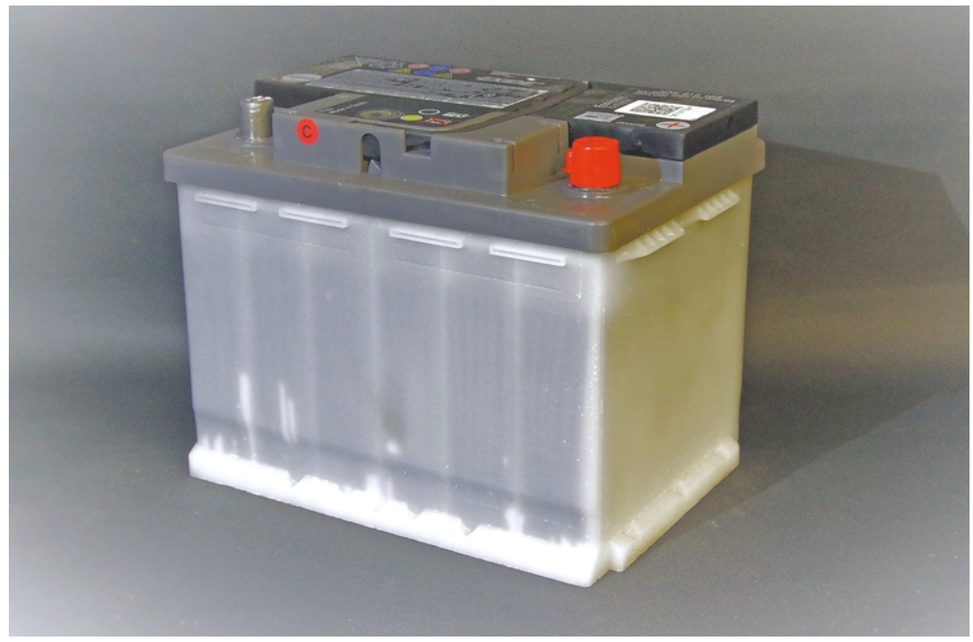
Electrical engineering and electronics sector in Bulgaria

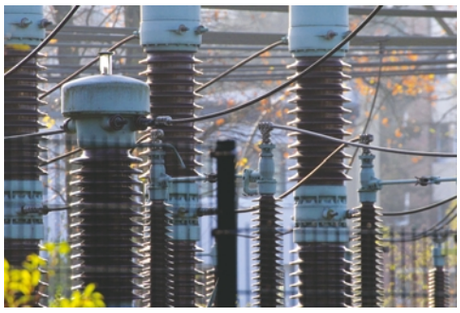
Electrical engineering an electronics manufacturing are among the key industrial sectors in Bulgaria. According to a recent research by Invest Bulgaria Agency, among the major product groups in this field in the country are: batteries for submarines, yachts, trains, airplanes, helicopters, military applications; high-performance transformers for the needs of the electric power industry; energy saving sensors for various applications in different industries ranging from automotive through food and beverage production to agriculture equipment; amplifiers and high frequency power products used in the radio communication sector.

Local and foreign producers situated in the country are also manufacturing: a wide range of capacitors and capacitor banks used by electrical distribution utilities and large industrial power users; HVAC and climate control equipment; semiconductors and semiconductor products used in medical, machine building and automotive manufacturing; wire harnesses and cables for the automotive industry; household and commercial refrigerators and freezers; printed Circuit Boards (PCBs) and microelectronic components for industrial applications; LED chips and LED lighting equipment, etc.



Strong traditions and favorable environment for sector development

Bulgaria has strong traditions in the electrical engineering and electronics sector. In the 1970s and 1980s Bulgaria was among the leaders of electronics manufacturing in Eastern Europe. In the 1980s the country supplied more than 40% of the mainframe and personal computers in the region. During that period more than 130 000 people were employed in the sector which comprised more than 25% of total Bulgarian manufacturing at the time. In addition, in the 1980s Bulgarian companies launched a number of joint projects with leading international electronic manufacturing companies like Varta, AEG, Toshiba, etc.



Invest Bulgaria Agency reports that today the country provides an overall compelling proposition for electrical engineering, electronics manufacturing and R&D. Bulgaria is characterized by availability of experienced engineers, qualified assembly workforce at affordable cost and established traditions in the electrical engineering and electronics sector. The country's infrastructure is well suited for the needs of electronics manufacturing. There are many international and local companies from the electronics sector with successful operations in Bulgaria. In addition, the country provides easy access to the EU, Russian/CIS and Middle East markets.

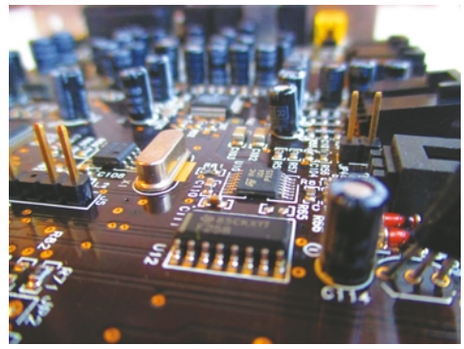
Diverse market of multinational and local companies

The electrical engineering an electronics sector in Bulgaria has been developed on the basis of an ecosystem of multinational and local firms. A number of large international companies like Siemens, Schneider Electric, Hyundai Heavy Industries, Liebherr, ABB have discovered the country as the best destination for their business in Eastern Europe. Many successful Bulgarian owned companies operate in the sector, offering competitive products worldwide. Today the combination of local and multinational companies is creating a unique environment where productivity, ingenuity and innovation in electronics manufacturing are thriving, Invest Bulgaria Agency points out.

The Bulgarian economy had a constant growth of above 6% in the period 2000-2008. The economy stabilized in 2011 with GDP growth of 1.8% for 2011 and 0.8 % in 2012. The budget deficit in Bulgaria is one of the lowest in Europe for 2012: -0.5 e%. There are no currency fluctuations due to a currency board introduced in 1997. Bulgaria has the lowest government debt to GDP ratio in the EU27 in 2012.

Strategic location and stability

Bulgaria is located at the cross-roads of Europe and Asia. Bulgaria is in the middle of the high growth market of South East Europe. The country is a suitable export base for serving the region, the EU, Russia and CIS, and Middle East and Africa. Physical infrastructure plays an important role in the access to international markets. Bulgaria provides the lowest cost access to a market of 500 million consumers (Russia/CIS, Middle East and North Africa). The country has the lowest tax rate and one of the lowest labour costs in the EU coupled with special incentives for investors. Besides, Bulgaria is a location with significant access to EU funding - more than EUR 10 bln in EU funds. It offers a combination of political and macroeconomic stability and incentives for doing business: stable parliamentary democracy, EU, NATO and WTO member, Invest Bulgaria Agency remarks.



With a strong macroeconomic and financial performance the country has competitive advantages in the region. There are 14 functioning industrial zones and 26 more under development, all of them suitable for manufacturing companies.

Developed cluster zones

There a number of established cluster zones in the electronics and electrical engineering sector in Bulgaria. Botevgrad is the electronics manufacturing center of Bulgaria. The city, located only 60 km from Sofia, has strong historic traditions in the industry and is home of the manufacturing facilities of IMI, Incotex, Sensata Technologies and other companies.

Sofia - the capital of Bulgaria, is the center of executive, legislative and judiciary power and also the financial hub of the country. The city is home of Siemens Bulgaria, Schneider Electric, Hyundai Heavy Industries , Festo Bulgaria, Sensornite, etc.

One of the oldest settlements in Bulgaria, Yambol, is strategically located in the heart of the country. The regional administrative center is also home of Yazaki Bulgaria. Plovdiv - the second largest city in the country, is a major administrative, industrial, transport and tourist destination. It is the home of the manufacturing facilities of Liebherr, Schneider Electric, BTL industriel, etc.

Electronics and electrical engineering in Bulgaria have rich history and established traditions

1890 - Siemens participated in building the telegraph network in Bulgaria
1928 - First telegraphic and telephone factory opens in Sofia
1947 - The state electronic manufacturing enterprises "Radioprom" and "Elprom" are established
1965 - The first European electronic calculator ELKA 6521 was invented in Bulgaria
1971 - Beginning of manufacturing of computing electronics. Transition to mass production of memory, processors, etc.
1972 - The first Bulgarian-made space equipment was launched into space
1985 - The peak of the industry - manufacturing of modern computers. Electronics comprises 25% of Bulgarian manufacturing. 130 000 people are engaged in the industry
1988 - Bulgaria manufactures more than 40% of the mainframes and personal computers in Eastern Europe
1990 - Beginning of privatization of state owned electronics and electrical engineering enterprises

Source: Invest Bulgaria Agency

Highly-skilled and affordable HR resources

Because of the traditions in the sector, Bulgaria offers qualified, experienced and skilled workforce for the needs of the electrical engineering and electronics industry - from assembly workers to highly qualified engineers. There are experienced assembly workers available at very affordable and the most competitive in Europe labor cost. The overall quality/cost ratio of the workforce is very good.

Bulgarian technical high schools and universities are working together with the companies in the sector to create future qualified workforce. There are five technical universities in Bulgaria offering majors in electronics and electrical engineering. About 30 000 university students are enrolled in majors related to the Electrical Engineering and Electronics manufacturing. In addition, many Bulgarian students study engineering in Universities in Europe, USA and the rest of the world and could be considered by sector companies as potential employees

A broad network of professional high schools

The country has a network of technical and professional high schools with established traditions in the Bulgarian education system which are preparing specialists for the electronics sector. More than 90 professional schools all over the country educate young people in electronics and other technical studies. Recent sector research data shows that high schools of electronics are among the most sought after institutions for secondary education in the country. There are more than 150 000 students enrolled in these high schools, many of them potential employees of the electronics industry.

After 1990s many international companies established operations in Bulgaria

1991 - Schneider Electric and Siemens open offices in Bulgaria
1993 - Festo AG & Co.KG establishes sensor manufacturing facility in Sofia
1993 - EPIQ starts manufacturing operations in Bulgaria
1997 - Hyundai Heavy Industries privatized the largest Bulgarian manufacturer of power transformers and tap changers
2000 - Liebherr opens its refrigerator manufacturing facility in the Marica industrial zone near Plovdiv
2000 - Melexis establishes their Bulgarian operations for microelectronic components
2002 - Sensor-Nite opens manufacturing facility for the production of sensors and high value added electronic and electro-mechanical products
2007 - Yazaki builds its plant for wire harnesses in Yambol
2011 - IMI purchases the facility of EPIQ Bulgaria in Botevgrad
2015 - Sensata technologies is building its second plant in the country near Plovdiv

Source: Invest Bulgaria Agency

According to Invest Bulgaria Agency's report, Bulgarian secondary education is among the best in the world with the country ranking 5th in the world in sciences and 11th in mathematics in 2013. Bulgarian high-school algorithm writers have been among the medalists at International Olympiads in informatics for 17 years now.

Steady growth since 2000

In 2013 the manufacture of electrical equipment in Bulgaria covers about 4.1% of the industrial production in the country and contributes about 4.3% of value added in industry. Production from enterprises in the sector for that year is 19.9 billion leva. The manufacture of computer, electronic and optical products covers about 1.2%



of industrial production in the country and also contributes 2.4% of value added in industry. Production from enterprises in the sector is 0.6 billion leva.

In 2013 there are about 45 000 people employed in about 2 300 companies in the electrical engineering and electronics sector. More than 75% of the production of electronics manufactured in Bulgaria is exported. Key markets are the EU countries, Russia and CIS, USA.

Conductors and cables represent 25% of the total sector exports, followed by industrial batteries with 11% of the exported production and electrical apparatuses with 8% of the export. The export mix has been changing in the recent years towards products with higher added value requiring more engineering skills, Invest Bulgaria Agency reports.

International companies in the sector

The company presentations contain information provided by Invest Bulgaria Agency, the companies themselves or based on their corporate websites.

ABB

ABB is among the global leaders in power and automation technologies and electrical equipment. ABB operates in Bulgaria through three companies: ABB Bulgaria, ABB Avangard and ABB Automation.



Its Bulgarian subsidiaries provide engineering services and manufacture electrical equipment: circuit breakers, disconnectors and generating sets. In Bulgaria the company was established in 1996.

It develops and manufactures high and medium voltage electrical equipment, automation parts, engineering solutions. ABB companies in Bulgaria export their products in Russia, Iraq, Romania, Mexico, Brazil, Sweden, Norway, China, Germany, France.

ABB operates in Bulgaria through a main office in Sofia, manufacturing facilities in Petrich, Sevlievo, two plants in Rakovski and office and turbochargers service station in Varna.

ABB Bulgaria EOOD focuses on providing engineering solutions and electrical equipment for high, medium and low voltage, as well as automation systems and products for the technological processes, both in the power and industrial sectors.

ABB Avangard in the Sevlievo production unit focuses on engineering and assembly for high and medium voltage equipment and related services. At the end of 2011 the factory in Sevlievo delivered the first Metal Enclosed Capacitor Banks (MECB) products.

ABB Automation is an internal supplier of automation parts for ABB factories mainly in Italy, as well as for other factories within the ABB Group in countries such as France, Germany and China.

Festo

Festo is specialized in manufacturing of sensors and sensor applications. It was established in1993.

The Bulgarian manufacturing is one of the biggest that the company operates.

The company is active in the production of magnetic sensors and automation applications. Since 1997 Festo Bulgaria has been specializing in the manufacturing of sensors and sensor applications. It operates manufacturing facilities in Sofia and Smolyan.

Among Festo's key products manufactured in Bulgaria are: production of fluid and magnetic sensors with various applications in automotive, machine building and other industries; cable applications for sensors and valves.

In September 2015 Festo Production inaugurated its new manufacturing facilities in Sofia.

The investment in expanded production amounts to 19.2 million leva. The company announced its plans for a significant new extension the next three years opening more new jobs, investment in machinery and equipment



for new products and automation of production amounting to 25 million leva. The planned investment program is already underway with the purchase of land for the construction of the new capacities. Festo also plans in-



creasing the level of automation of its production process. The newly built production facilities in Sofia are located on 8700 square meters. At present, the overall production base of Festo Production, including the extension, occupies a total area of 20 000 sq. m.

Hyundai Heavy Industries Co. Bulgaria

The company was established in1997. It manufactures heavy industry transformers, tap changers and solar systems. Hyundai Heavy Industries Bulgaria serves clients all over the world and exports its transformers and tap changers to more than 50 countries in Europe, Asia, America, Africa. It produces power and distribution transformers, high voltage apparatuses, tap changers, solar power systems.

The manufacturing range of the company includes oil-filled power transformers for power substations, hydroelectric and thermal power plants, and industrial enterprises. All power and special transformers are equipped with tap changers developed and manufactured in Bulgaria. Tap Changers manufactured in Hyundai Heavy Industries Co. Bulgaria are installed in a wide range of transformers and are currently in operation in Russia, South Korea, Romania, United States and many other countries in Asia, Europe, South and North America.

Among the key activities of the company and the products manufactured in Bulgaria are: power Transformers for the energy industry; high voltage apparatuses; tap changers used in power transformers manufacturing; solar power systems for clean energy generation.

IMI

Integrated Microelectronics (IMI) was established in Bulgaria in 1993 as EPIQ. It started activities in the field of electronic assembly, module assembly, development and manufacture of plastic injection moulds and factory automation equipment. In July 2011 the Belgian EPIQ group sold EPIQ Electronic Assembly EOOD to Integrated Microelectronics, Inc (IMI), a Philippines based company.



IMI subcontracts for well-known names in the automotive sector, including Valeo, Denso, Brose and EF. The company produces components for famous brands in consumer electronics like Tefal, Rowenta, De Longi. IMI manufactures more than 230 types of products and exports them mostly to the European markets.

IMI Bulgaria is located in Botevgrad, 60 km from Sofia. Its main activity includes PCB assembly and testing, system product integration, tooling and plastic injection. The Bulgarian operations are among the leading international suppliers to the automotive, consumer electronics and industrial appliance markets.

Liebherr

Liebherr was established in Bulgaria in 2000 . The company has capacity to manufacture 600 000 refrigerators annually and delivers its products to most EU countries. Liebherr's activities include manufacturing of refrigerators and freezers for domestic and commercial use, railway vehicle equipment, etc.

Liebherr Hausgerate Ochsenhausen GmbH-Germany employs a workforce of approx. 22 000 in more than 100 companies on all continents.



Liebherr Hausgeraete Marica EOOD and Liebherr Transportation Systems Marica EOOD are located in Marica Industrial Zone in the Plovdiv region. Lienherr Hausgerate manufactures refrigerators and freezers for residential and industrial use. In 2010 the company realized more than 140 million euro in revenues.

Liebherr Transportation Systems develops and manufactures air conditioning, power supply and hydraulic actuation systems for all the segments of the rail vehicle industry. Total investment in the company's Bulgarian operations is approximately EUR 86 mln. Liebherr's facilities are built on 200 000 sq. m., of which 65 000 manufacturing facilities and warehouses.

Melexis

Melexis is a Belgian company, leading manufacturer of advanced mixed signal semiconductors, sensor ICs, and programmable sensor IC systems. It is present in 12 countries worldwide. Melexis Bulgaria was established in 2000. The company's scope of activities includes microelectronic component manufacturing, sensors, IC's for the automotive industry. Melexis Bulgaria IC's are used in the vehicles of companies like Mercedes-Benz, BMW, Audi, VW, Suzuki, Toyota, GM and Ford.

The Bulgarian production is based in Sofia in a 7 800 sq. m facility containing office space, R&D, test areas, and over 1 000 m2 clean rooms for handling semiconductors. In 2006 and 2007 Melexis invested over 13 mln euro to improve its Bulgarian operations.

Melexis Bulgaria is involved in component manufacturing, R&D and testing activities. In 2007 Melexis was granted the famous French Electron d'Or Award for its infrared thermometer developed in the R&D facility in Sofia.

Schneider Electric

Schneider Electric is among the world leaders in electric distribution products and industrial automation. It was established in Bulgaria in 1999, today operating two manufacturing facilities.

The company's activities include: manufacturing of electric distribution products, renewable energy, industrial automation.



The French multinational company Schneider Electric - leader in energy savings, electric distribution products and industrial automation, employs more than 100 000 people in 130 countries. In 2010 the revenues of the Bulgarian operations of the company are in excess of 50 million euro. The Bulgarian operation was the first in the world to manufacture the company's energy saving timers and switches. The first manufacturing facility in Bulgaria started in 1999 but the company had commercial presence in Bulgaria since 1990. Currently Schneider Electric Bulgaria operates manufacturing facilities in Perushtitsa and Plovdiv. The Plovdiv facility was built in 2007 and expanded in 2008.

Schneider Electric has sales and service offices in Varna, Burgas and Ruse. 60% of the components used in the Bulgarian manufacturing are supplied by local companies.

Among the key products manufactured in Bulgaria are: energy saving electric switches used in the energy sector and manufacturing industry PLCs, buttons, sensors with application in manufacturing , energy and transport industries, energy saving timers.

Sensata Technologies

Sensata Technologies is a leading manufacturer and supplier of high-temperature sensors for the automotive industry. The company is part of the international holding company Sensata Technologies - a global manufacturing and technology company active in the development, manufacture and sale of sensors and control systems.The technical solutions that the company offers are widely used in the automotive sector, aircraft constructions, shipbuilding, military, trucks, HVAC, telecom industry and others.

On the territory of Bulgaria Sensata has two factories - in Botevgrad and Plovdiv. The plant in Botevgrad has existed since 2002. Currently in the facility there are two manufacturing buildings and a test laboratory. The new plant near Plovdiv is situated on 12,000 sq. m area, including a manufacturing and an administrative zone. Production there is scheduled to begin in April 2016.

The current company's production equipment includes a new generation of machines with a high degree of automation and complete control of technological processes. Basic technologies and equipment used in the manufacturing activities are related to the automated assembly of components, size monitoring, pressing, laser welding and testing stages.

Siemens

Siemens Bulgaria is a leading provider of innovative products, technologies and solutions in the industry, energy, healthcare and infrastructure. Its business activities are focused on the areas of electrification, automation and digitalization. The company currently has 500 employees in the country.



Siemens is represented in Bulgaria since the end of the 19th century. In early 1991, Siemens restored its tradition to be directly presented in the country and created its own representative office in Sofia, which presented the main directions of the company. In October 1998, a subsidiary company of the Siemens concern in Bulgaria was registered - Siemens EOOD.

The company's activity includes: manufacturing of equipment for transformers, energy engineering, industrial engineering and medical engineering solutions.

Siemens is a multinational conglomerate, the largest European based electronics and electrical engineering company. It chose Bulgaria for the home of its engineering outsourcing centers for house automation systems and conventional energy sources, servicing 12 countries. The key activities and products manufactured in Bulgaria include: ingredients for high tension measure transformers used in the energy sector, high voltage electrical engineering components for the electric industry, automation and control devices used in manufacturing industry, engineering solutions, etc.

Yazaki

Yazaki was established in Bulgaria in 2007. It operates a manufacturing facility in the cities of Yambol and

Sliven. The Bulgarian branch is the main supplier of wire harnesses for the automotive industry in Spain and France.

The company's activities are focused on the manufacture of electrical wire harnesses for the automotive industry. Yazaki is 100% owned by the Japanese Yazaki Corporation. It is present in 50 countries and employs more than 170 000 people worldwide. The company holds 35% market share of the world wire harnesses for the automotive industry.



Yazaki Bulgaria's main customers are automotive manufacturers in Europe, mainly France and Spain. The company's production is located in the Yambol industrial zone - an investment of more than 30 mln euro. The Bulgarian facility spreads on 50 000 m2, with 24 250 m2 of the area dedicated to manufacturing. Yazaki Bulgaria has not only an assembly department, but also an engineering division providing wire harnesses for the automotive industry.

Bulgarian firms established in the sector

Acom

Acom designs, manufactures high quality High Frequency (HF) equipment, HF antennas and antenna crank-up masts. Its products are sold in 110 countries around the world.

The company was established in 1989. Its activities include: design, manufacture and sale worldwide of audio and radio amplifying technology. Acom was the first company from Bulgaria to supply electronics for the most competitive markets in the world simultaneously - USA, Germany, Japan. 100% of the company`s production is exported.

Acom is working closely with a young engineers program at the Sofia Technical University. The company registers growth in sales for existing products and is developing a large portfolio of new innovation technologies which can be used in a variety of industries with higher organic growth rates.

In 2011, Acom started a joint venture with a large global private equity fund for development of other innovative products outside the pure amplification technology. Among the company's key products are: high frequency (HF) equipment used in radio communication industry, HF antennas for commercial, government and amateur markets, antenna crank-up masts, systems for short range network radio communications, etc.

Datecs

Datecs Ltd. marks its beginning in the early months of 1990 when a group of researchers from the Institute of Applied Cybernetics at the Bulgarian Academy of Science got together.



In 1994 Datecs entered the ECR market by collaborating with Samsung. In 1996 Datecs presented to the world its first electronic cash register (ECR), the MP500. In just a few years, over 100,000 devices were sold in 11 countries in Central and Eastern Europe.

The company is among the leading manufacturers and developers of innovative POS solutions. Its product lines include mobile payment systems, printers, cash registers, barcode readers, and peripheral devices, digital scales. The company is working with companies from 94 countries and 6 continents.

In 2001 Datecs introduced a Total Quality Management System certified on ISO 9001:2000 and by the end of 2001 it fulfilled all requirements on the standard ISO 9001:2000 and successfully passed the certification. Ever since, TQM has been an integral role in the development and manufacturing of the company's products.

Deltacom Electronics

Deltacom Electronics designs and implements complete hardware and software solutions. It is a consortium of companies with main activities in the area of design, manufacturing, sales and servicing of electronic devices. The company exports 90% of its products in Central and Eastern Europe, Russia, Africa and Asia. The comprehensive manufacturing and R&D at Deltacom are preformed by 85 employees within a modern 1500 square meters facility at present.



Established in 1997, as a sub-contract assembly company offering PCB assembly and finished product design and manufacturing for the broadband communications industry, Deltacom quickly developed on the Bulgarian market.

Being active in a diverse range of markets and products the company has grown steadily over the last several years providing the resource for Deltacom to continue investing in the latest equipment and techniques. This and the partnership approach of the company enable it to offer increasing capacity and range of services demanded by what is a technologically fast moving industry.

Electrostart

Electrostart manufactures ballasts for fluorescent, sodium, mercury and HID lamps, ballasts, capacitors.

The company was established in 1967 in the city of Varshets with the opening of a factory for electromagnetic ballasts production. The factory was equipped with German machinery, using a German technology, manufacturing a great variety of lighting industry components.

Since 2000 the company is a private venture with 100% Bulgarian capital. The plant was additionally renovated and modernized, again using German technology and equipment for its automatic processes. Currently Electrostart JSCo produces electromagnetic and electric ballasts, transformers, ignition devices and other components for luminescent, metal-halide, sodium, mercury and gas-discharge lighting units.

Electrostart is a registered trademark in the European Union, along with a number of countries in the Middle East, Northern Africa and South America. The company has a consistent representation on the markets in over 40 countries around the world, spreading over 4 continents.

Incotex Group

Incotex is a consortium of companies with main activities in the area of design, manufacturing, sales and servicing of electronic devices. The company exports 90% of its products in Central and Eastern Europe, Russia, Africa and Asia.

It was established in Bulgaria in 2008. The company's activities include: design, production and maintenance of energy meters, tachographs, fiscal and non-fiscal trade equipment, LED lighting.

The headquarters of Incotex are in Sofia and a purpose-built manufacturing facility is located in Botevgrad.

The consortium holds many international standards: ISO 9001:2008 by TUV Rheinland, AERO CERT and others. Incotex exports over 90% of its products in over



20 countries in Central and Eastern Europe, Russia, Africa and Asia. Among the key products of the company are: cash registers, fiscal printers, electronic scales, POS terminal systems, energy meters, LED lights.

In August 2011 Incotex opened a brand new production facility for LED chips and lamps, situated in the industrial zone "Microelectronica" in Botevgrad Bulgaria.

Monbat

Monbat is a Bulgarian company with almost 60 year history and traditions in the manufacturing of batteries. It manufactures lead acid batteries for various applications. It was established in 1959. The company exports around 85% of its products all over the world, mostly EU and Eastern Europe.

Monbat's activity includes: manufacture of starter batteries, stationary batteries, solar batteries, batteries for military applications, locomotive batteries, LED production, recycling.

Monbat is reported to be one of the fastest growing battery companies in SEE with 2010 revenues in excess of 80 million euro. The company operates two battery manufacturing facilities in Bulgaria located in the towns of Montana and Dobrich. It owns two recycling facilities in Romania and Serbia. Monbat maintains intensive R&D activities in cooperation with the Bulgarian Academy of Science. It works in cooperation with many large international companies such as Vodafone, Ericsson, Huawei. 24% of the sales are realized on the German market.

Teletek

High-tech manufacturer of full range of intruder and alarm systems, Teletek Electronics JSC has already established itself in the field of intruder and fire alarm system solutions. The company's products are well known in more than 65 countries all over the world.



Teletek Electronics JSC is a subsidiary of Teletek Group Holding, Bulgaria. Today, 24 years after its establishment, the company continues to create, research and realize new ideas for better intruder and fire security products.

In order to meet its clients' contemporary and growing needs, Teletek started researching and introducing not just separate products, but complete security and fire alarm system solutions, suitable for large range of applications - residential homes and small offices, houses, country houses, medium to large trade buildings (including storehouses, supermarkets, etc).

Source: Invest Bulgaria Agency

The Greek biennale Syskevasia will demonstrate the newest packaging solutions in 2016

The fifteenth edition of the international packaging, machines, printing and logistics exhibition Syskevasia 2016 is taking place in Athens, Greece, from 8-11 October 2016. It will traditionally present the latest novelties in the products, technologies and solutions for this fast growing sector.

Exhibition profile

After 28 years of presence in the market, pioneers in the packaging sector and in continuation of 14 successful shows, Syskevasia constitutes a reference point for exhibitors and visitors and is going to be held traditionally at the modern and functional exhibition center of Greece, Metropolitan Expo, the organizers note.

The four exhibition days will provide an opportunity forum for guests, exhibitor companies and for the promoted products and services concerning the latest developments and innovations in technological packaging machines and automation, packaging materials and printing, storage and logistics.



What can be seen?

The year of the tradeshow's foundation is 1988. Syskevasia all these years is oriented to the main production and trade visitors categories such as food, drinks, catering, cosmetics, pharmaceuticals, agricultural goods, printing, plastic, paper, glass, wooden, metal packaging, automations, electronics, wholesale, retail, exports and several other.

The exhibitors' profile include: packaging machinery, printing machinery, equipment and accessories, packing materials, storage and distribution systems, automation, services.

Parallel events

The rich program of Syskevasia will be continued in 2016 as it will include parallel speeches and conferences in the Conference Halls of Metropolitan Expo that will be announced in the process in the Exhibition's website.





It is held concurrently with FoodDrinks Tech - a specialized trade fair for machines, materials and services for sorting, standardization, processing and conservation of agricultural products, food and beverages.

Leading innovations in the field of electric automation were showcased at SPS IPC Drives 2015

The newest products, trends and innovations in the field of electric automation were presented at this year's edition of the leading international exhibition SPS IPC Drives from 24 to 26 of November in Nuremberg, Germany. The event, organized by Messe Frankfurt, once again gathered manufacturers, suppliers and users of electric automation technology from around the world. The trade fair offered the visitors a broad platform to search the right solutions for their automation tasks. The event has become the most important international exhibition location for comprehensive information on products, innovations and current trends within the electric automation industry, giving an overview of the entire market.

Highlights and exhibition topics

From 24 to 26 November the Nuremberg exhibition center opened its doors for the SPS IPC Drives which attracted more than 1,600 exhibitors. They demonstrated the latest novelties in the industry in spacious 14 trade fair halls. This year's edition of SPS IPC Drives again covered all components down to complete systems and integrated automation solutions in the field of electric automation.

From 24 to 26 of November 2015 in Nuremberg the exhibitors presented products and services from the following sectors: control technology; IPCs; electric drive systems and components; human-machine-interface devices; industrial communication; industrial software; interface technology; mechanical infrastructure; sensor technology.

SPS IPC Drives 2015: for the first time with Industry 4.0 area

For the first time at this year's edition of SPS IPC Drives there was a separate hall dedicated to the leading topic - Industry 4.0 - hall 3A.

"Industry 4.0 changes the world of industrial production. The intelligent networking of machines, systems and products along the value chain creates new potentials. Extensive information about the topic, products, solutions, innovations and trends in the field which act as a trailblazer for Industry 4.0 were presented at SPS IPC Drives 2015", the organizers pointed out.

In hall 3A of the Nuremberg exhibition center there were special on-topic exhibition areas, joint stands as well as interesting presentations at the exhibition forum "Automation meets IT".

The forum "Automation meets IT" took place in hall 3A, booth 3A-630 / 3A-530. Exhibitors gave visionary impulses and presented IT-based solutions in the field of automation technology on the way to the digital production of the future as well as databased business models. Interesting lectures and podia dealing with the topic Industry 4.0 were run concurrently at the exhibition forum.

Among the participants in the specialized Industry 4.0 area were: Baumueller Nuernberg; Bosch Rexroth; EPLAN Software & Service; MyOmega System Technologies; ORmatiC BU phiMatic;

Pepperl+Fuchs; Phoenix Contact; Rhebo; Siemens; steute Schaltgerate; znt Zentren fur Neue Technologien.

"MES goes Automation" and Smart Factory

In hall 3A, booth 3A-740, MES (Manufacturing Execution Systems) were presented as a central element of Industry 4.0. "Manufacturing Execution Systems connect the automation level with the organizational level. With the use of MES, order processing and production processes are optimized. Visitors could get comprehensive information on the subject at the MES joint stand "MES goes Automation" of VDE publishing house", Messe Frankfurt representatives added.



In hall 3A, booth 3A-440 of the Nuremberg exhibition center the special "DFKI-SmartFactoryKL" presentation was held. "The event answered the question how shorter production cycles and the increasing individualization of products will be handled due to the growing cost pressure. SmartFactoryKL delivers answers to the challenges and automation tasks of tomorrow. The cross-manufacturer Industry 4.0 plant which was realized by SmartFactoryKL together with renowned industrial companies presents a highly flexible automated production with standardized interfaces and modern information technology", the organizers stated.

SPS IPC Drives Forum

The complementary program of this year's event was diverse and comprehensive. It included interesting panel discussions about up-to-date automation issues directed by publishing houses and associations. The exhibitors presented their most innovative technologies and solutions for every automation task within the scope of product and company presentations.

During the seminar program different topics regarding electric automation were discussed, and the participants were provided with the opportunity to gain deeper insights on the presented subjects and use this broad international platform to exchange experiences.

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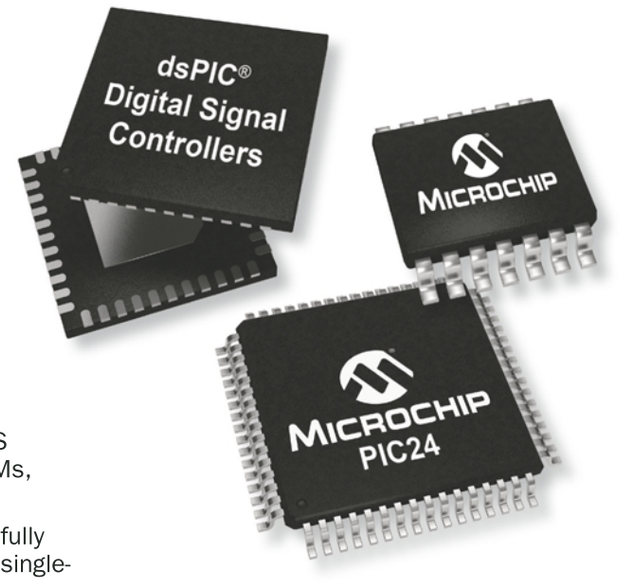
The top challenges facing today's embedded system designer are attaining product specification and performance goals, achieving on-time market launch and meeting cost targets. Microchip's 16-bit microcontroller and digital signal controller families deliver the performance, peripherals, software and hardware development tools to meet these objectives



The 16-bit family is comprised of several subfamilies ranging from 4 KB to 512 KB of Flash in 14 to 144 pins, with packages as small as 4 × 4 mm. The PIC24F family offers a cost-effective, low-power step up in performance, memory and peripherals for many applications that are pushing the envelope of 8-bit microcontroller capabilities. The PIC24F family features devices with eXtreme Low Power (XLP) technology, 16 MIPS performance, rich analog integration and drivers for segmented or graphical displays. For more demanding applications, the PIC24E family offers up to 70 MIPS performance and includes a robust peripheral set including PWMs, timers, CAN and op amps.

The dsPIC® family of Digital Signal Controllers (DSCs) include a fully implemented Digital Signal Processor (DSP) engine, including a single-cycle 16 × 16 MAC and 40-bit accumulators, for enhanced math capabilities to execute and control high-speed precision digital control loops with the simplicity of a traditional microcontroller. Microchip's dsPIC DSCs achieve up to 70 MIPS performance and include features for high-efficiency motor control, platinum-rated digital power supplies and other embedded control applications, including operation up to 150°C and support for both 3V and 5V applications. All 16-bit families have the same instruction set, basic peripherals and common pinouts and share the same development tool ecosystem for easy migration.

Performance

- PIC24 MCUs with XLP technology provide the lowest power and longest battery life
- dsPIC33 DSCs offer real-time response and highest performance
- Perform in harsh environment up to 150°C
- Deterministic interrupt response for real-time control
- Single-cycle bit manipulation and multiply
- High-endurance, flexible and secure Flash
- Fast DMA without cycle stealing

Software

- USB, graphics, crypto, smart card, file I/O and Wi-Fi® stacks
- Motor control software, models and tuning guides
- PMBus™ software and digital power compensator library
- DSP math function library and digital filter design tools
- Class B safety peripherals and library for IEC 60730
- Hundreds of code examples to setup peripherals and functions

Peripherals

- Rich analog integration – Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs) and op amps
- Communications – UART, IrDA, SPI, I²S™, I²C, USB, CAN, LIN and SENT
- Fast and flexible PWMs and timers
- Motor control PWM, precision ADC and QEI
- Digital power peripherals for low-latency control loops
- Optimized peripherals for real-time response
- Drivers for segmented or graphical displays
- Crypto engine for data security

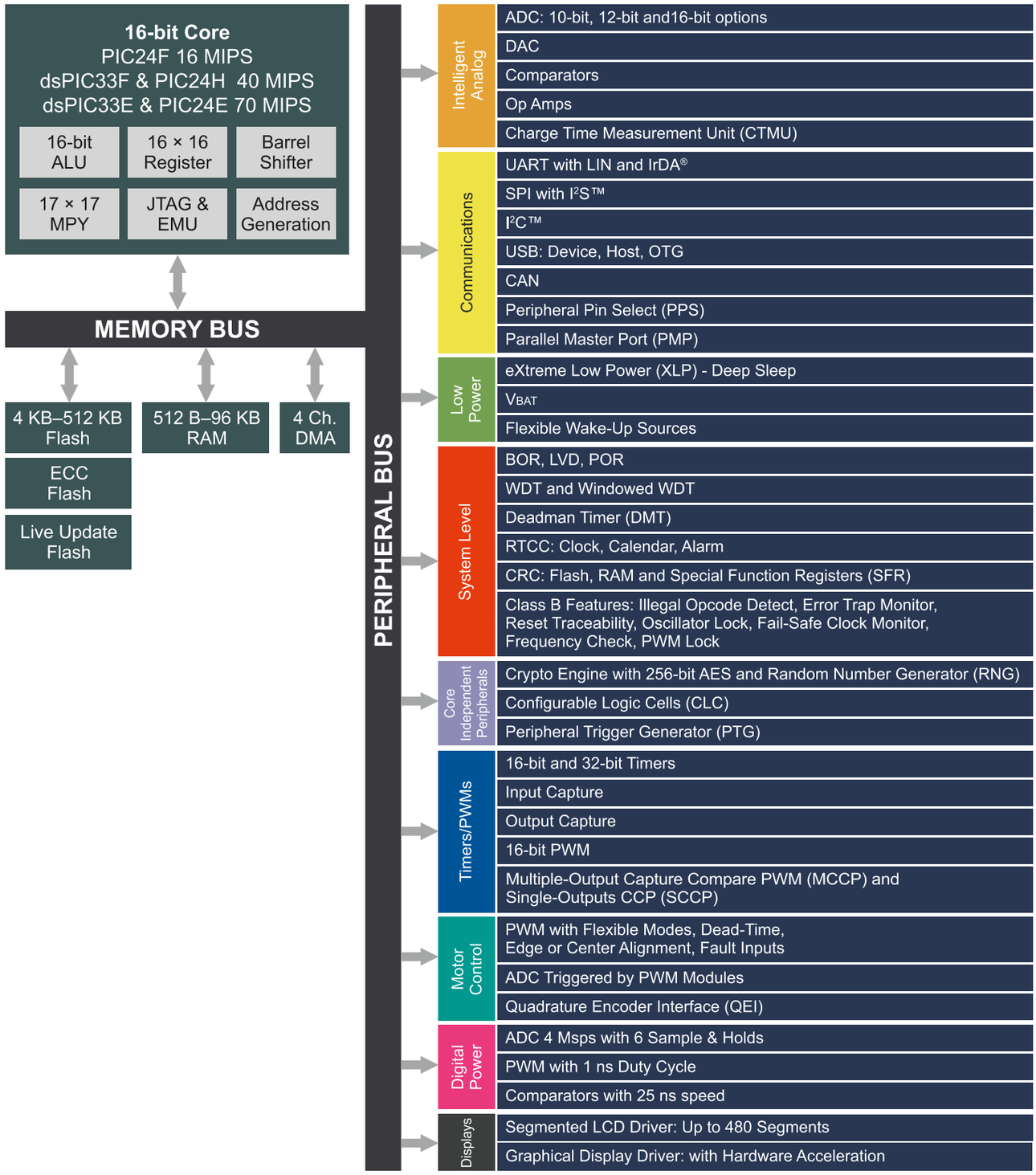
Tools

- Supported by MPLAB® X IDE and XC16 compliers
- MPLAB Code Configurator for easy setup and configuration of peripherals and I/O
- Starter kits and low-cost Microstick boards
- Flexible Explorer 16 Development Board
- Reference designs for digital power conversion and lighting

Flexible Integrated Peripherals

Microchip offers a rich set of high-performance peripherals that integrate seamlessly with customer application and enable solution with reduced costs and time. The 16-bit family offers key communication and control peripherals like SPI, UART, CAN, PWM, Timers and I²C, as well as specialized peripherals for USB, graphics, motor control and digital power. With intelligent analog peripherals, you can integrate analog functions such as high-performance ADCs, DACs and op amps into your applications providing simple-to-use interfaces that ease analog design. In addition, core independent peripherals such as CLC, PTG and crypto enable higher levels of integration and flexibility.

PIC24 and dsPIC33 Family Block Diagram



16-bit Embedded Control Solutions

eXtreme Low Power (XLP) Solutions



Microchip's XLP devices bring together the design and process technologies needed to address today's low-power applications. With sleep currents down to 10 nA and industry-leading integration including USB, touch, crypto and LCD drivers, XLP products can help extend the life of your battery-powered application.
www.microchip.com/XLP

Intelligent Analog Integration



By integrating high-precision analog peripherals into the PIC® MCU, you can achieve simplified design cycles, board size reduction, faster throughput and improved signal integrity. Products include 16-bit Delta-Sigma ADC, 10 Msps ADC, DACs, and op amps to make it easy to interface to a wide variety of sensors including portable medical equipment and industrial sensors.
www.microchip.com/intelligentanalog

Secure Data



Embedded applications in the internet-connected world demand secure data and long battery life. PIC MCUs ensure data integrity without sacrificing power consumption through an integrated hardware crypto engine, random number generator for unique key creation and secure key storage for applications such as IoT sensor nodes and access control systems.
www.microchip.com/lowpowercrypto

Driving Displays and Touch



For applications that need compelling and intuitive user interfaces, our portfolio includes devices with integrated low-power segmented LCD drivers or colorful graphical display drivers with hardware acceleration. Additionally, Microchip offers a broad portfolio of touch solutions for resistive and projected capacitive applications that make it easy for you to integrate touch-sensing interfaces. These hardware peripherals are supported by free software libraries to quickly integrate the touch and display functions into your application with a single microcontroller.
www.microchip.com/graphics
www.microchip.com/LCD
www.microchip.com/touch

Easy Connectivity



Whether you are considering adding wired or wireless connectivity to your application, Microchip supports a wide variety of communication protocols. It's easy to couple the PIC24 or dsPIC33 devices with Microchip's certified Bluetooth® or Wi-Fi® modules. Peripherals for CAN, LIN, SENT and USB are integrated onto our 16-bit devices with supporting free software libraries.
www.microchip.com/connectivity

Advanced Motor Control



The dsPIC33 motor control families feature a high-performance core with specialized motor control peripherals. The devices are supported with free software libraries and motor control algorithms. Our flexible motor control development boards support a wide variety of motors and help reduce development time.
www.microchip.com/motor

Efficiency for Digital Power and Lighting



The dsPIC33 "GS" DSC family is optimized for high performance on advanced algorithms for improved efficiency over widely varying load conditions. These devices feature dedicated peripherals such as fast ADCs and PWMs for digital power conversion and LED or HID lighting applications.
www.microchip.com/power

System Level Integration



PIC24 MCUs and dsPIC33 DSCs perform under pressure, with options that operate up to 5V for increased noise immunity and robustness. Additionally, many devices are rated for operation up to 125°C or 150°C ambient temperature for the most extreme automotive and industrial applications, including AEC-Q100 Grade 0 qualification. For safety-critical applications, the products include memory integrity check and error correction, backup oscillators and fault detection. The certified Class B software stack helps to simplify regulatory compliance.
www.microchip.com/hightemp
www.microchip.com/classb

www.microchip.com/16bit

PIC24 MCUs with eXtreme Low Power



eXtreme Low Power (XLP) Technology

Energy conservation is becoming essential for the growing number of electronic applications. Products with Microchip's XLP technology offer the industry's lowest sleep currents, where most applications spend 90–99% of their time. These devices are ideal for a variety of applications including portable medical devices, wearables/fitness monitors, remote controls, wireless sensors, asset tracking, thermostats, energy monitoring, security systems and IoT sensor nodes.

- Low sleep currents with flexible wake-up sources
  - Sleep current down to 9 nA
  - Brown-Out Reset (BOR) down to 45 nA
  - Real-time clock down to 400 nA
- Battery-friendly features
  - Enable battery lifetime greater than 20 years
  - Low-power supervisors for safe operation (BOR, WDT)
- VBAT battery back-up
  - Automatic switch-over upon loss of VDD
  - Maintains Real-Time Clock/Calendar (RTCC) and two user registers
  - Powered separately from 1.8–3.6V source (coin cell)
- Efficient instruction set; 90% single-cycle instruction
  - Active mode currents as low as 150 µA/MHz

XLP Battery Life Estimator

The XLP Battery Life Estimator is a free software utility to aid you in developing low-power applications. The tool estimates average current consumption and battery life. The utility allows you to select the target device, battery type, the application's operating conditions (such as voltage and temperature) and model the active and power-down times for their application. The tool comes preloaded with specifications of Microchip's PIC® microcontrollers featuring nanoWatt XLP technology and commonly used batteries in embedded applications.

Development Tools

16-bit XLP Development Board (DM240311)



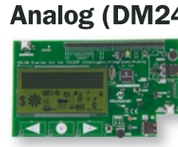
This board is designed as true platform for low-power development with flexible power sources including AAA, CR2032, energy harvesting, USB or 9V power supply. It includes current measurement terminals and ships with PIC24F16KA102 and can be used with other 28-pin XLP devices.

LCD Explorer Development Board (DM240314)



This board showcases the PIC24FJ128GA310 family with segmented LCD driver. The board operates from two AAA batteries and includes circuitry for VBAT battery back-up from a coin cell battery.

MPLAB® Starter Kit for PIC24F Intelligent Integrated Analog (DM240015)



Featuring the PIC24FJ128GC010 family, this kit is ideal for designing low-power sensor networks. It includes on-board sensors for light, temperature and touch. The analog header makes it easy to add your custom sensors for a complete prototype.

MPLAB REAL ICE™ In-Circuit Emulator Power Monitor (AC244008)



This add-on board enables low-power monitoring and debugging. Breakpoints indicate when current exceeds a specified threshold and provides a graph of current, voltage and time versus code execution.

Application Notes

- **AN1861:** *Bluetooth Smart Communication Using Microchip's RN4020 Module and 16-bit PIC MCU*
- **AN1556:** *Blood Pressure Meter Design Using Microchip's PIC24F Microcontroller and Analog Devices*
- **AN1416:** *Low Power Design Guide: A Single Source for Low Power Consumption from the Viewpoint of the MCU*
- **AN1267:** *nanoWatt XLP Technology: An Introduction to Microchip's Low-Power Devices*

Featured XLP Products

Product	Flash (KB)	Pin Count	Sleep (nA)	Deep Sleep (nA)	WDT (nA)	32 kHz SOSC/RTCC (nA)	Active µA/MHz	Features
PIC24F16KL402	4–16	14/20/28	30	–	210	690	150	MSSP
PIC24FJ64GB004	32–64	28/44	200	20	200	500	250	USB
PIC24FJ128GB204	64–128	28/44	380	18	240	300	178	Crypto, USB, VBAT
PIC24FJ128GA310	64–128	64/100	330	10	270	400	150	LCD, VBAT
PIC24FJ128GC010	64–128	64/100	330	10	270	400	150	Adv. Analog, LCD, USB, VBAT

www.microchip.com/xlp

Intelligent Analog



PIC® MCUs with Intelligent Analog

Analog design is difficult and consumes precious development time. Microchip's intelligent PIC MCUs integrate analog functions such as high-performance ADCs, DACs and op amps, providing simple-to-use interfaces that ease analog design. This single-chip solution enables reduced system noise and provides higher throughput, while dramatically reducing design time and cost.

Benefits of Analog Integration

- Eliminates the complicated task of debugging the noise sources that reduce analog signal integrity
- Removes the bottleneck of communicating to the microcontroller from analog
- Provides consistent analog performance that can be leveraged from design to design, eliminating analog design rework
- Through intelligent connections made inside the chip, the analog is fully controlled by software
- Benefits include a simplified design cycle, board space savings, faster throughput and better signal integrity
- Intelligent analog leads to lower-cost designs that are brought to market faster

Target Applications

- Environmental quality sensors
- Portable medical equipment (glucose meters, portable ECGs, pulse oximeters, blood pressure meters)
- Industrial equipment (gas sensors, handheld multi-meters, lab instrumentation, e-meters, sensor arrays)

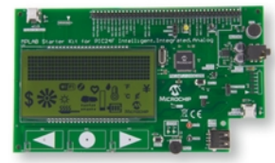
Featuring the PIC24FJ128GC010 Family with Intelligent Analog

The PIC24 "GC" family integrates a precision 16-bit ADC, high-speed 12-bit ADC, DAC and op amps with interconnect fabric providing the most analog integration available in a PIC MCU. With on-chip USB and segmented LCD driver, this family is ideal for portable devices with user interfaces.

- 16-bit Delta-Sigma ADC
- 12-bit 10 MSPS Pipeline ADC
- 10-bit 1 MSPS DAC
- Dual op amps
- eXtreme Low Power: 18 nA deep sleep, 180 µA/MHz Run

Development Tools

MPLAB® Starter Kit for PIC24F Intelligent Integrated Analog (DM240015)



This kit includes an analog header for clean analog signals and plugs into breadboards. The board includes connections for microphone, headphones as well as on-board light and temperature sensors. The segmented display showcases custom icons and a scrolling banner. The board also includes cap touch buttons, USB connection and easy connection for RF modules.

Featured Intelligent Analog PIC MCU Families

Product Family	Pin Count	Flash (KB)	ADC	DAC	Op Amp	Other
PIC24F16KM204	20–44	8–16	22 × 12-bit (100 ksps)	2 × 8-bit	2	Internal voltage reference, CLC, MCCP, SCCP (16-bit PWM), CTMU, three comparators, 3V and 5V operation
PIC24FJ128GC010	64–100	64–128	2 × 16-bit Delta-Sigma ADC 50 × 12-bit ADC (10 Msps)	2 × 10-bit	2	Analog interconnect switch matrix, internal voltage reference, CTMU, PWM, USB, LCD, mTouch® technology
dsPIC33EP64GS506	28–64	16–64	22 × 12-bit with 5 S/H (3.25 Msps)	2 × 12-bit	2	1.04 ns PWM resolution, four rail-to-rail comparators with dedicated DACs for each analog comparator, two oversampling filters for increased resolution
dsPIC33EP256GP506	28–64	32–256	1.1 Msps 10-bit with 4 S/H or 500 ksps 12-bit with 1 S/H (configurable)	–	3	Flexible ADC trigger sources, CTMU for temperature or touch, CAN, Peripheral Trigger Generator (PTG), four comparators

www.microchip.com/intelligentanalog

Hardware Crypto Engine for Secure Data



Hardware Crypto Engine

With the Internet of Things growing at a rapid rate, protecting embedded data and extending battery life are not an option, but a necessity. Devices in Microchip's PIC24F "GB2" family are the first PIC® MCUs to offer an integrated hardware crypto engine along with eXtreme low power performance. This new family also features a True Random Number Generator (RNG) and One-Time-Programmable (OTP) key storage for protecting data in embedded applications. For connectivity, the "GB2" family integrates USB for device or host connections as well as a UART with ISO7816 support, which is helpful for smart card applications.

Key Features

Cryptographic Engine

- AES engine with 128, 192 or 256-bit key
- DES/Triple DES (TDES) engine
- Encryption, decryption and authentication
- True Random Number Generator (RNG)
- Achieve a higher level of data security with unique key
- One-Time-Programmable (OTP) memory for secure key storage
- Once written, keys cannot be read or overwritten by software
- Core Independent Peripheral – offloads CPU to save power and headroom

eXtreme Low Power Features

- 18 nA sleep, 180 µA/MHz Run
- Enables integrity of data without sacrificing power consumption
- VBAT allows the device to transition to a backup battery

Connection to USB or Wireless Protocols

- Integrated USB 2.0 device, host, OTG
- Easy connection to certified modules for Wi-Fi® , ZigBee®, Sub-GHz and Bluetooth® Low Energy

Alternatively, you can add crypto functions in software to any PIC24 or dsPIC33 device using the free software found in the Microchip Libraries for Applications (MLA) download at www.microchip.com/MLA.

Target Applications

Industrial

- Security door locks
- Access control systems
- Security cameras
- POS terminals
- Smart card readers
- Heat/gas meters
- IoT sensor nodes

Computer

- PC peripherals
- Printers
- Portable accessories

Medical/Fitness

- Pedometers
- Wearable fitness
- Handheld devices

Application Note

AN1861: *Bluetooth Smart Communication Using Microchip's RN4020 Module and 16-bit PIC Microcontroller*

Learn how low-power Bluetooth connectivity is an ideal match with the XLP PIC24 microcontrollers, especially those with integrated crypto engine for adding another layer of data protection for internet-connected applications. Bluetooth Low Energy or Bluetooth Smart has evolved to support applications that need simple command and control or quick status from a sensor. This low-power protocol is ideal for connecting local embedded applications to the cloud through a smartphone or tablet.

Development Tools

The PIC24FJ128GB204 Plug-In Module (MA240037) plugs into the Explorer 16 Development Board (DM240001). To add low-power Bluetooth Smart connection, simply add the RN4020 Bluetooth Low Energy PICtail™/PICtail Plus Daughter Card (RN-4020-PICTAIL). This flexible development system makes it easy to customize for various other wired or wireless connectivity options including USB, Wi-Fi or ZigBee.

Featured Products

Product	Flash (KB)	Pins	Package
PIC24FJ128GB204	128	44	TQFP, QFN
PIC24FJ128GB202	128	28	SOIC, SSOP, QFN, SPDIP
PIC24FJ64GB204	64	44	TQFP, QFN
PIC24FJ64GB202	64	28	SOIC, SSOP, QFN, SPDIP

www.microchip.com/lowpowercrypto

Display and Touch



Display and Touch

Many 16-bit designs incorporate modern user interfaces to increase the usability, functionality and look of end products. More sophisticated displays and touch interfaces create higher impact designs, yet they must be cost effective and easy to integrate. Microchip's solutions allow for driving segmented or graphical displays with a single chip and offer integrated peripherals for touch buttons.

Segmented LCD Displays

The PIC24FJ128GA310 and PIC24FJ128GC010 families feature integrated segmented display drivers with up to 480 segments. Key advantages include:

- Direct drive of inexpensive, low-power displays
- Integrated analog for sensor applications like temperature sensing in thermostats
- Integrated touch sensing function for buttons or sliders

Graphical Displays

The PIC24FJ256DA210 family features integrated graphics acceleration and a display controller to directly drive displays up to 4.3" WQVGA with 480 × 272 resolution. This "DA" family includes:

- Dedicated graphics clock for a continuous, flicker-free display
- On-chip display controller provides direct interface to TFT, STN and OLED displays
- Easy to use graphics processing units for hardware acceleration allow for moving and copying rectangles, decompressing images and rendering text without CPU intervention
- Integrated color look-up table and 96 KB frame buffer support up to 8 bpp QVGA with internal memory

Touch Buttons: Keys and Sliders

Many PIC24 MCUs and dsPIC® DSC products include touch sensing capability for implementing keys or sliders as an alternative to traditional push button switches using CVD or CTMU technology. This enables more modern and stylish designs, lower manufacturing costs and increased reliability.

- Longer battery life with eXtreme Low Power MCUs
- Sensing through metal, plastic or glass
- High noise immunity and low emissions
- Free mTouch sensing solutions software library is available as part of MLA Software Legacy Version

Development Tools

LCD Explorer Development Board (DM240314)



The LCD Explorer Development Board provides an ideal platform to evaluate a MCU with a ×8 Common LCD Driver on a 38 segment ×8 common LCD display.

PIC24FJ256DA210 Development Kit (DV164039)



This kit bundles the PIC24FJ256DA210 Development Board (DM240312), a 3.2" Truly 240 × 320 TFT Display Board (AC164127-4), three Graphics Display Prototype Boards (AC164139), the MPLAB ICD 3 Debugger (DV164035) and also includes a USB Cable and accessories.

Remote Control Demo Board (DM240315-2)



This board integrates graphics, mTouch® technology, USB and RF4CE into a single demo. It features the PIC24FJ256DA210 MCU, a 3.5" Graphical TFT LCD with resistive touch screen, capacitive touch keys with plastic overlay, an MRF24J40 2.4 GHz transceiver and a ZENA™ wireless adapter.

Software and Application Notes

FREE Microchip Graphics Library

The Microchip Graphics Library is highly modular, easy to use and has an open documented interface for driver or controller support. The library supports the following features:

- Pre-made graphics objects
- Multiple fonts and languages
- User interface for mTouch sensing
- Buttons, charts, check boxes, scroll bars, list boxes, images and basic animation
- Download as part of the MLA software at www.microchip.com/MLA

Visual Graphics Display Designer by VirtualFab (SW500190)

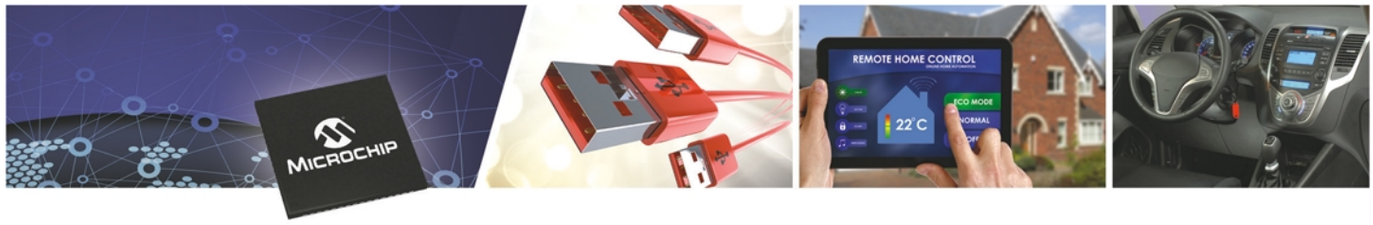
Visual Graphics Display Designer (VGDD) is a powerful visual design tool that provides a quick and easy way of creating Graphic User Interface (GUI) screens for graphical interface applications on Microchip MCUs. This development environment, developed by our partner VirtualFab, fully utilizes the Microchip graphics library in MLA as well as Microchip's graphics development boards.

Application Notes

- **AN1428:** *Segmented LCD Biasing & Contrast Control Methods*
- **AN1368:** *Developing Graphics Applications Using an MCU with Integrated Graphics Controllers*
- **AN1478:** *mTouch Sensing Solutions Acquisition Methods Capacitive Voltage Divider*

www.microchip.com/graphics

Connectivity for PIC24 MCU and dsPIC® DSC Families



Connectivity

The PIC24 MCUs and dsPIC33 DSC products include a wide range of integrated connectivity peripherals as well as support for many wired and wireless communication protocols. Many of these communication libraries, such as USB and Wi-Fi, are integrated into the Microchip Libraries for Applications (MLA) which can be downloaded at www.microchip.com/MLA.

CAN, LIN and SENT

Many of the dsPIC® DSCs and PIC24 MCUs include an integrated CAN peripheral which is ideal for applications requiring robust communications with a high-speed, reliable industry standard protocol. Vector CANbedded™ and osCAN™ development solutions support PIC24 MCU and dsPIC DSC products with embedded CAN controllers.

LIN support is integrated into many products for low-cost, single-wire serial communication for automotive applications.

The new dsPIC33EV family also includes SENT for automotive sensing. The dsPIC33EV 5V CAN-LIN Starter Kit (DM330018) contains data ports for CAN, LIN and SENT, a self-contained USB programming/debug interface, and an expansion footprint for flexibility in application hardware development.

A CAN/LIN PICtail™ Plus Daughter Board (AC164130-2) is available to plug into the Explorer 16 (DM240001) for developing embedded CAN or LIN applications. This must be used with a processor Plug-In Module (PIM) for a compatible PIC24 MCU or dsPIC DSC product.

IrDA®

The IrDA standard is an inexpensive method for providing wireless point-to-point communication. Through Application Note AN1071, Microchip's free IrDA stack is available to support 16-bit MCUs with integrated IrDA support, enabling a cost-effective wireless connection with plenty of computing power left for other tasks.

PMBus

The PMBus protocol standard operations over an I²C physical layer and was developed to enable easy digital management of power supplies. The protocol allows for reading values from a power supply such as measured voltage and current parameters, temperatures and fan speeds as well as writing commands to control the operation of the power supply. The dsPIC "GS" family of DSCs supports the PMBus protocol along with many other dsPIC DSCs and PIC24 MCUs. A PMBus stack is available free from Microchip for use with the dsPIC "GS" family of DSCs.

Wireless

Microchip offers a wide range of wireless modules ranging from Wi-Fi®, Bluetooth, Bluetooth Smart and various Personal Area Networks. These fully certified surface-mount modules allow you to quickly and seamlessly add wireless connectivity to your applications. The wireless modules allow you to bypass costly and timely RF design, Bluetooth certification and governmental certifications to get your designs to market faster.

For wireless sensors and other battery-operated applications, the eXtreme Low Power PIC24 MCUs are ideal companions to Microchip's RN4020 Bluetooth Low Energy Wireless Module, creating low-power wireless networks. Together these devices allow for connection to Bluetooth-enabled devices, making it easy to add internet connection to your embedded application for remote command and control. Application Note AN1861 describes the hardware and software needed to pair an XLP PIC24 to the RN4020 Bluetooth Low Energy Module.

USB

There are many PIC24 MCU and dsPIC DSC families with integrated USB which include support for device, host and On-The-Go (OTG) functionality. These products are supported by the dsPIC DSC USB Starter Kit (DM330012) as well as the Explorer 16 Development Board (DM240001) with USB PICtail Plus Daughter Card (AC164131) and one of the USB Processor Plug-In Modules (PIMs).

Microchip's free USB framework includes USB software libraries as well as a comprehensive set of host and device drivers including Human Interface Device (HID) class for user interfaces, and Mass Storage Device (MSD) class for memory devices as well as CDC, PHDC, custom, audio, printer and demo code including thumb drive bootloader, and printer host. The USB libraries, drivers and demo code are all available with the Microchip Libraries for Applications download.

www.microchip.com/connectivity

Motor Control



16-bit Motor Control Products

- High-performance dsPIC® DSC core with DSP instructions for precise control
  - Variable speed with constant torque using PI controllers
  - Field oriented control (FOC) for greater efficiency
- 5V 70 MIPS dsPIC DSC core for harsh environments
- High-performance on-chip op amps
- Intelligent, high-speed ADC
- Algorithms and application notes for
  - BLDC, PMSM, ACIM
  - Sensorless control
  - Field-oriented control
  - Certified class B safety software
- Dual motor control with FOC control for each motor
- Multiple package options, ranging from 28 to 144 pins
- Scalable motor control tools with low- and high-voltage options
- Motor control PWM: up to 14 outputs
  - Up to seven duty cycle generators
  - Independent or complementary mode
  - Programmable dead time settings
  - Edge- or center-aligned PWMs
  - Manual output override control, up to 10 fault inputs
  - ADC samples triggered by PWM module
- Quadrature encoder interface module
  - Up to two modules
  - Phase A, Phase B and index pulse input
- High current sink/source

Software and Application Notes

Motor Type	Algorithm	App Note
Stepper Motor	Closed-Loop Microstepping	AN1307
BLDC and PMSM	Sensored	AN957
	Sensored Sinusoidal	AN1017
	Sensorless BEMF	AN901 AN992
	Sensorless Filtered BEMF with Majority Detect	AN1160
	Sensorless Dual-Shunt FOC with SMO Estimator and Field Weakening	AN1078
	Sensorless Dual-Shunt FOC with SMO and PFC	AN1208
	Sensorless Dual-Shunt FOC with PLL Estimator and Field Weakening	AN1292
	Sensorless Single-Shunt FOC with SMO Estimator and Field Weakening	AN1299
AC Induction Motor	Open-Loop V/F	AN984
	Closed-Loop Vector Control	AN980
	Sensorless Dual-Shunt FOC with PLL Estimator	AN1162
	Sensorless Dual-Shunt FOC with PLL Estimator and Field Weakening	AN1206
Other	PFC	AN1106
	Class B Safety Software (IEC 60730)	AN1229
	Motor Control Sensor Feedback Circuits	AN894
	MOSFET Driver Selection	AN898
	Current Sensing Circuit Concepts and Fundamentals	AN1332

Featured Motor Control Products

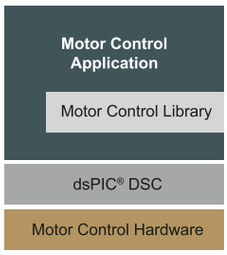
Product	Operating Voltage (V)	MIPS	Pins	Flash (KB)	RAM (KB)	DMA Ch.	Input Capture	Output Compare/ Std. PWM	MC PWM	QEI	Internal Op Amps	ADC 10/ 12-bit 1.1/ 0.5 MSPS	UART
dsPIC33EP512GM710	3.3	70	100/121	128–512	16–48	4	8	8	12 Ch	2	4	2/49 Ch	4
dsPIC33EP512GM706	3.3	70	64	128–512	16–48	4	8	8	12 Ch	2	4	2/30 Ch	4
dsPIC33EP512GM604	3.3	70	44	128–512	16–48	4	8	8	12 Ch	2	4	2/18 Ch	4
dsPIC33EP512MC506	3.3	70	64	32–512	4–48	4	4	4	6 Ch	1	3	1/16 Ch	2
dsPIC33EP512MC504	3.3	70	44	32–512	4–48	4	4	4	6 Ch	1	3	1/9 Ch	2
dsPIC33EP512MC502	3.3	70	28	32–512	4–48	4	4	4	6 Ch	1	3	1/6 Ch	2
dsPIC33EV256MC106	5	70	64	32–256	4–16	4	4	4	6 Ch	0	4	1/36 Ch	2
dsPIC33EV256MC104	5	70	44	32–256	4–16	4	4	4	6 Ch	0	4	1/24 Ch	2
dsPIC33EV256MC102	5	70	28	32–256	4–16	4	4	4	6 Ch	0	3	1/11 Ch	2

www.microchip.com/motor

Motor Control Development Solutions

Development Tools

Motor Control Library for dsPIC33F/dsPIC33E



The Motor Control Library contains function blocks that are optimized for the dsPIC33F and dsPIC33E DSC families. All functions in this Motor Control Library have input(s) and output(s), but do not access any of the DSC peripherals. The library functions are designed to be used within an application framework for realizing an efficient and flexible way of implementing a motor control application.

Motor Control Starter Kit (MCSK) (DM330015)



This starter kit with mTouch sensing is a complete, integrated development platform based on the dsPIC33FJ16MC102. It includes a USB interfaced debugger/programmer, a complete drive circuit, an on-board BLDC motor, a user-configurable switch and an mTouch sensing slider with LED indicators for speed control.

dsPICDEM™ MCLV-2 Development Board (DM330021-2)



This low-voltage development board provides a cost-effective method of evaluating and developing sensored or sensorless Brushless DC (BLDC) motor and Permanent Magnet Synchronous Motor (PMSM) control applications. The board supports Microchip's 100-pin PIM with dsPIC33E or dsPIC33F DSCs. This board supports the use of the internal, on-chip op amps found on certain dsPIC® DSCs or the external op amps found on the MCLV-2 board. A dsPIC33EP256MC506 Internal Op Amp PIM (MA330031) is included. The board is capable of controlling motors rated up to 48V and 15 A, with multiple communication channels such as USB, CAN, LIN and RS-232.

dsPICDEM Motor Control Stepper Motor (MCSM) Development Board/Kit (DM330022/DV330021)





This board is targeted to control both unipolar and bipolar stepper motors in open-loop or closed-loop (current control) mode. The hardware is designed in such a way that no hardware changes are necessary for 8-, 6- or 4-wire stepper motors in either bipolar or unipolar configurations. Software to run motors in open-loop or closed-loop with full or variable micro-stepping is provided. A GUI for controlling step commands, motor parameter input, and operation modes is included. This flexible and cost-effective board can be configured in different ways for use with dsPIC33F motor control DSCs.

Microchip Motor Control Library Blockset

The Microchip Motor Control Library Blockset contains a number of basic Simulink® blocks that can be used to jump start model-based design of motor control applications using Microchip's dsPIC33F and dsPIC33E DSC families. These blocks include reference frame transforms, a proportional-integral controller and trigonometric functions, all of which can be used with Embedded Coder® to generate efficient code on the dsPIC DSC that utilizes the Microchip Motor Control Library.

dsPICDEM MCHV-2 Development System (DM330023-2)



This high-voltage system is intended to aid the user in the rapid evaluation and development of a wide variety of motor control applications using a dsPIC DSC. This development system is targeted to control BLDC motors, PMSM and AC Induction Motors (ACIM) in sensor or sensorless operation. The rated continuous output current from the inverter is 6.5 A (RMS). This allows up to approximately 2 kVA output when running from a 208V to 230V single-phase input voltage.

Low-Voltage Motor Control Development Bundle (Single Board and Drive Board) (DV330100)



Provides a cost-effective method of evaluating and developing dual/single motor control to drive BLDC motors or PMSMs concurrently or one of each. The dsPIC DSC Signal Board supports both 3.3V and 5V operated devices for various applications and frequently used human interface features along with the communication ports. The Motor Control 10–24V Driver Board (Dual/Single) supports currents up to 10 A.

Motors

You can provide your own motor or purchase one of the motors used in our Application Notes which are guaranteed to run right out of the box:

- AC300024: 2-phase, 8-wire Stepper Motor
- AC300020: 24V BLDC Motor
- AC300022: 24V BLDC Motor with Shaft Encoder
- AC300023: 220V, AC Induction Motor



www.microchip.com/motor

Digital Power and Lighting



16-bit Digital Power and Lighting Products

- Streamlined interoperation between PWM, ADC and CPU
- High-performance core with DSP instructions
  - High-speed control loop execution for demanding power conversion applications
  - Fast and predictable interrupts
- High-resolution PWMs for digital power
  - 1 ns for duty cycle, phase shift, period and dead time
  - Flexibility to control numerous power topologies
- Live update features
  - Update all of the firmware in an operating power supply while maintaining continuous regulation
- Very fast ADCs optimized for digital power applications
- Complete reference designs and algorithms including:
  - AC/DC converter meeting platinum specification
  - LLC resonant DC/DC converter
  - Quarter brick DC/DC converter
  - Solar micro inverter
  - Interleaved power factor correction
  - Offline UPS
- Broad range of package sizes and types
  - 18–100 pins, as small as 4 × 4 mm
  - Robust packages to easy IPC-9592B qualification

Software and Application Notes

Application Solution	AN #	Description
Power Factor Correction in Power Conversion Applications Using the dsPIC® DSC	AN1106	This application note focuses primarily on the study, design and implementation of Power Factor Correction (PFC) using a Digital Signal Controller (DSC).
Switch Mode Power Supply (SMPS) Topologies (Part I)	AN1114	This application note explains the basics of different types of SMPS topologies and their applications. The pros and cons of different SMPS topologies are also explained to guide the user to select an appropriate topology for a given application, while providing useful information regarding selection of components for a given SMPS design.
Switch Mode Power Supply (SMPS) Topologies (Part II)	AN1207	This application note is the second of a two-part series on Switch Mode Power Supply (SMPS) topologies. This series expands on the previous material in Part I, and presents the basic tools needed to design a power converter.
Offline UPS Reference Design	AN1279	The application note describes the design of an Offline Uninterruptible Power Supply (UPS) using a Switch Mode Power Supply (SMPS) dsPIC Digital Signal Controller (DSC).
Digital Power Interleaved PFC Reference Design	AN1278	The application note describes the design of a Digital Power Interleaved PFC (IPFC) using a Switch Mode Power Supply (SMPS) dsPIC Digital Signal Controller (DSC).
Quarter Brick DC-DC Reference Design	AN1335	This application note describes the design of Quarter Brick DC-DC Reference Design using Switch Mode Power Supply (SMPS) dsPIC Digital Signal Controller (DSC)
DC-DC LLC Resonant Converter Reference Design	AN1336	This application note describes the design of DC-DC LLC Resonant Converter Reference Design using Switch Mode Power Supply (SMPS) dsPIC Digital Signal Controller (DSC)
Grid Connected Solar Microinverter	AN1338	This application note describes the design of Grid Connected Solar Microinverter Reference Design using Switch Mode Power Supply (SMPS) dsPIC Digital Signal Controller (DSC)
Platinum-rated AC/DC Reference Design Using the dsPIC DSC	AN1421	This application note presents a fully digital-controlled 720W AC-to-DC (AC/DC) power supply, which meets all CSCI Platinum Specifications, as well as provides a variety of additional, application-specific features and functions.

Featured Digital Power Products

Product	Pins	Flash (KB)	RAM (Bytes)	IC/OC	PS PWM	ADC	Analog Amps	Analog Compare	UART/I²C/SPI	CAN
dsPIC33FJ64GS610	100	64	9 K	4/4	18	24 × 10-bit, 6 S/H	0	4	2/2/2	1
dsPIC33EP64GS506	64	64	8 K	4/4	10	22 × 12-bit, 5 S/H	2	4	2/2/2	0
dsPIC33EP64GS505	48	64	8 K	4/4	10	19 × 12-bit, 5 S/H	2	4	2/2/2	0
dsPIC33FJ16GS504	44	16	2 K	2/2	8	12 × 10-bit, 6 S/H	0	4	1/1/1	0
dsPIC33EP32GS504	44	32	4 K	4/4	10	19 × 12-bit, 5 S/H	2	4	2/2/2	0
dsPIC33FJ09GS302	28/36	9	1 K	1/1	6	8 × 10-bit, 3 S/H	0	2	1/1/1	0
dsPIC33EP64GS502	28	64	8 K	4/4	10	12 × 12-bit, 5 S/H	2	4	2/2/2	0
dsPIC33EP32GS202	28	16	2 K	1/1	6	12 × 12-bit, 3 S/H	2	2	1/1/1	0
dsPIC33FJ06GS001	18/20	6	256	0/0	4	6 × 10-bit, 2 S/H	0	2	0/1/0	0

www.microchip.com/power

Digital Power and Lighting Reference Designs and Development Boards

Reference Designs

Platinum Rated 720 W AC/DC Reference Design



This reference design demonstrates the flexibility of dsPIC DSCs in Switch Mode Power Supplies. This reference design has a peak efficiency of 94.1% and achieves the ENERGY STAR® CSCI Platinum Level. It features a 2-phase interleaved power factor correction boost converter followed by a 2-phase interleaved two-switch forward converter with synchronous rectification.

Quarter Brick DC/DC Converter Reference Design



This reference design provides an easy method to evaluate the performance and features of SMPS DSCs in high-density quarter brick DC-DC converters.

DC/DC LLC Resonant Converter Reference Design



This reference design operates over a wide input voltage range (350–420V DC) with a nominal input of 400V, providing a 12V DC output while maintaining high-voltage isolation between the primary and secondary. This reference design is implemented using a single dsPIC33F “GS” digital power DSC that provides full digital control of the power conversion and system management functions.

Digital Power Interleaved PFC Reference Design



This reference design provides an easy method to evaluate the power and features of the SMPS dsPIC DSCs for IPFC applications. It features a universal input voltage range and produces a single high-voltage DC output up to 350 W with low Total Harmonic Distortion (THD) of the input current.

Digital Pure Sine Wave Uninterruptible Power Supply (UPS) Reference Design



This reference design demonstrates how digital power techniques applied to UPS applications enable easy modifications through software and allow for the use of smaller magnetics, higher efficiency and reduction in audible and electrical noise via a purer sine-wave output, USB communication and reduce cost.

Grid Connected Solar Micro Inverter Reference Design



This reference design demonstrates maximum power point tracking for PV panel voltages between 20–45V DC and has a maximum output power of 215 W. High efficiency is achieved by implementing a novel interleaved active-clamp flyback topology with Zero Voltage Switching (ZVS).

Development Boards

MPLAB® Starter Kit for Digital Power (DM330017-2)



This kit uses the dsPIC33EP64GS502 DSC to implement a buck converter and a boost converter. Each converter can drive its on-board MOSFET controlled resistive load or an external load. The board has an LCD display for voltage, current, temperature and fault conditions, and an integrated programmer/debugger, all powered by the included 9V power supply.

Digital LED Lighting Development Kit (DM330014)



The LED lighting development kit enables designers to quickly leverage the capabilities and performance of the dsPIC33 “GS” DSCs to create a 100% digitally controlled ballast function, while including advanced features such as dimming and color hue control. The dsPIC33 “GS” devices can support an entire system implementation for LED lighting products, including power-conversion circuits, such as AC-to-DC and DC-to-DC conversion, along with function such as Power Factor Corrections (PFC).

Tools and Libraries

Digital Compensator Design Tool (DCDT)

Use this free MPLAB® X IDE plug-in to calculate optimum compensator coefficients for maximum performance, with support for five common compensator types. Use this plug-in to analyze system response as well as stability.

SMPS Compensator Library

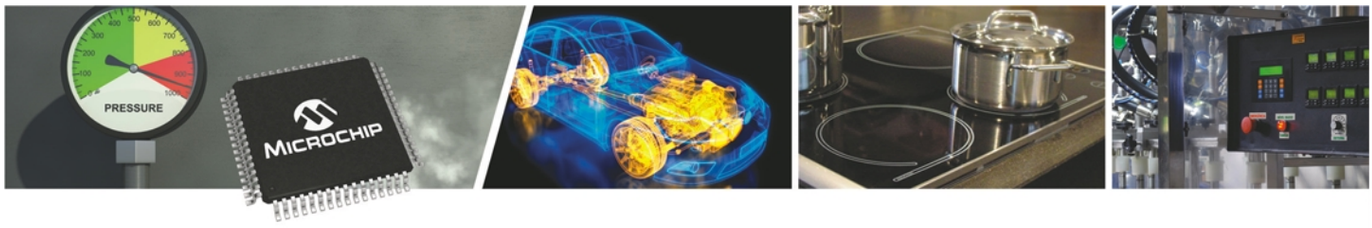
Optimized functions for the dsPIC33 family of DSCs implementing common compensator algorithms such as 2P2Z, 3P3Z and PID. These library functions are designed to be used within an application framework for realizing an efficient and flexible way of implementing the control of an SMPS application.

The above tools can be downloaded from www.microchip.com/dsPIC33EP-GS.

Additional information for all reference designs is available at www.microchip.com/power.

www.microchip.com/power

Easing System Level Integration



Robust 3V Operation

With operating voltages as low as 1.8V and up to 3.6V, PIC24 MCUs and dsPIC33 DSCs ensure robust operation such as:

- POR/BOR/Watchdog Timer (WDT)
- Support for temperatures up to 150°C
- AEC-Q100 Grade 0 qualification for automotive applications

Enhanced Robustness with 5V Operation

Microchip's PIC24 MCU and dsPIC33 DSC portfolios include some families that operate up to 5V for increased noise immunity and robustness. Devices with 5V operation provide more dynamic range for signals and improved sensitivity. The 5V devices include additional features to ensure robust operation such as:

- Backup system oscillator
- Windowed watchdog timer (WWDT)
- PWM with fault detection
- Support for temperatures up to 150°C
- AEC-Q100 Grade 0 qualification for automotive applications

Families with 5V Operation	Flash	Pins
dsPIC33 "EV" DSC Family	32–256 KB	28–64
PIC24F "KM" and "KA" MCU Family	8–32 KB	20–44

Extreme Temperatures and AEC-Q100 Qualification

Many devices are also rated for operation up to 125°C or 150°C ambient temperature for the most extreme automotive and industrial applications, including AEC-Q100 Grade 0 qualification.

Many target applications require operation in extreme environmental conditions. PIC24 MCUs and dsPIC33 DSCs have options for standard (85°C), extended temperature (125°C) and even high temperature up to 150°C.

For automotive applications, our products support AEC-Q100 Grade 0 level qualification for 150°C support, especially helpful for under-the-hood systems. Fore more information, visit www.microchip.com/hightemp.

Temperature Ranges	Range	Part Number Suffix
Standard	–40 to 85°C	-I
Extended	–40 to 125°C	-E
High	–40 to 150°C	-H

Safety Critical Applications and Class B Certification

PIC24 MCUs and dsPIC33 DSCs include integrated safety features to ease implementation of IEC 60830 compliance for Class B safety.

The CRC provides a memory integrity check and many devices also include memory error correction. For example, dsPIC33 devices with Error-Correcting Code (ECC) include 2-bit error detection and single-bit error correction for enhanced reliability, completely transparent and real-time implementation.

The memory also has read/write protection capability to protect sections of memory from code flow changes or interrupt vectors. You can establish zones that have different permissions, and you can define secure areas that should not be entered without the proper permissions.

Products include a backup system oscillator for system redundancy as well as clock-fail detection. Features such as a windowed watchdog timer will detect and reset the MCU in event of code execution error, with a dedicated clock source independent of they system clock. A Dead-Man Timer (DMT), clocked from the main system clock, detects out of sequence execution. The PWMs include fault detection features and the CPU includes trap instructions and illegal opcode detection.

The certified Class B software stack helps to simplify IEC 60830 regulatory compliance. This library routines integrate into the MCU application to test and verify the critical functionalities without affecting the end application. For more information, visit www.microchip.com/classb.

Robust Package Options for IPC-9592B

Some dsPIC33 "GS" devices are available with robust package options to help with operation in extremely noise environments. These packages make it easier to achieve IPC-9592B qualification. Options include a 28-pin µQFN (4 × 4 mm) or 28-pin µQFN (6 × 6 mm). These package options are designed to withstand temperature cycling as defined in IPC-9592B with over 700 cycles of –40°C/+125°C on thick high-layer count PCBs.

www.microchip.com/hightemp
www.microchip.com/classb

Development and Evaluation Tools

A variety of hardware development boards are available for the PIC24 and dsPIC33 products, enabling you to shorten your design cycle and quickly develop prototypes. These boards are designed to allow easy connectivity to an MPLAB® ICD 3 In-Circuit Debugger, MPLAB REAL ICE™ In-Circuit Emulator or MPLAB PM3 device programmer. Many also include integrated debugger and programmers. When combined with the MPLAB X IDE and the MPLAB XC16 Compiler, these development boards and starter kits allow you to quickly gain knowledge and experience using Microchip's 16-bit MCU and dsPIC® DSC products.

Photo	Tool	Part Number	Description
	**Explorer 16 Development Board**	DM240001 DM240002	This development board offers an flexible way to evaluate the PIC24 MCU and dsPIC33 DSC families with modular PIMs to support various product families and a wide range of application daughter cards. Features on the Explorer 16 Board include: ■ Processor PIMs • DM240001: Includes 100-pin PIMs PIC24FJ128GA010 and dsPIC33FJ256GP710 • DM240002: Includes 44-pin PIMs PIC24FJ64GA004 and dsPIC33FJ32GP204 • Many other processor PIMs available for easy device evaluation ■ PICtail Plus connector for expansion daughter boards • Provide expansion for application-specific hardware • Allow for the easy evaluation of software libraries • Including USB, CAN, IrDA®, speech playback, graphics, Ethernet, ZigBee®, Wi-Fi®, and Bluetooth® ■ Full documentation at www.microchip.com/explorer16
	**Microsticks**	DM330013-2 DM240013-1 DM240013-2	Microsticks are USB-powered and include an on-board debugger/programmer. The boards are fully supported by MPLAB® X IDE and provide easy plug in to a standard breadboard with access to device signals for prototyping. The Microstick II works with all 28-pin PIC24FJ and dsPIC33EP families Microstick for 3V PIC24F K-series works with the PIC24F "KA" and "KL" families. Microstick for 5V PIC24F K-series works with the PIC24F "KM" family.
	**Intelligent Analog PIC24 Starter Kit**	DM240015	This starter kit features the PIC24FJ128GC010 family with advanced integrated analog peripherals. The board includes an analog header, allowing clean signals to be accessed for easy prototyping The board also includes sensors for light, touch and temperature as well as USB, potentiometer, microphone and headphone interface. Comprehensive demos are included as well as integrated programmer and debugger.
	**XLP 16-bit Development Board**	DM240311	This board is designed as a true platform for low power development, featuring the PIC24F16KA102, supporting other PIC24 XLP devices in 20- or 28-pin packages. It includes current measurement terminals for board or device level measurements and PICtail interface for expansion boards such as low-power wireless, SD/MMC, speech playback and more. The board is powered from AAA batteries, CR2032, energy harvesting, USB or a 9V supply.
	**LCD Explorer Development Board**	DM240314	This development board supports 100-pin PIC® MCUs with eight common segmented LCD drivers. It ships with the PIC24FJ128GA310 and other families can be evaluated with different processor PIMs. In addition to the display, the board includes a PICtail Plus connector for daughter cards. It can be powered from USB, battery or 9V power supply, and includes VBAT battery back-up.
	**dsPIC33EV 5V CAN-LIN Starter Kit**	DM330018	This USB-powered starter kit features the dsPIC33EV256GM106 with connections for CAN, LIN and SENT, as well as integrated programmer and debugger.
	**dsPIC33E USB Starter Kit**	DM330012	This starter kit includes integrated programmer and debugger and expansion capability with the Multimedia Expansion Board or I/O Expansion Board. It comes with preloaded demonstration software to allow you to explore the features of the dsPIC33E DSC family including USB communication.
	**Motor Control Starter Kit**	DM330015	This board includes a small 3-phase BLDC motor driven by dsPIC33FJ16MC102 motor control device and integrated programmer and debugger, powered by 9V power supply. This is a low-cost way to evaluate the motor control features on the dsPIC33 family and comes with full source code based on Application Note AN1160: *Sensorless BLCD Control with Back-EMF Filtering Using a Majority Function*.
	**Digital Power Starter Kit**	DM330017-2	This board includes the dsPIC33EP64GS502 digital power conversion device to implement a DC/DC synchronous buck converter power stage and boost converter power stage. Each power stage includes a MOSFET controlled 5 W resistive load. The board includes a display for voltage, current, temperature and fault conditions and integrated programmer and debugger, all powered by 9V power supply.
	**Graphics PIC24FJ256DA210 Development Board**	DM240312	This graphics development board is for developing colorful graphics displays with the PIC24FJ256DA210 family. The board includes touch pads, USB and a PICtail Plus connector for daughter cards. Match this board with your desired display size; it easily connects to the 3.2" Truly TFT Display (AC164127-4) or 4.3" Powertip TFT Display (AC164127-6) or Display Prototype Board (AC164139).

www.microchip.com/lowpowercrypto

Software Libraries and Tools

Many software libraries, code examples and application notes are available to support the PIC24 MCUs and dsPIC33 DSCs. The table below includes some of the most popular software libraries and tools that help you jump start your application development.

Software	Description	Location
Microchip Libraries for Applications (MLA)	MLA includes source code, drivers, demos, documentation and utilities. All PIC24 MCUs and dsPIC33 DSCs are supported. ■ USB – including device, host and OTG support ■ Graphics – including pre-made graphics objects, fonts, languages, images and display drivers ■ File I/O Memory Disk Drive – transfer portable memory devices between and embedded system and a personal computer ■ Crypto Software – including AES, DES, 3DES, MD5, SHA-1, SHA-2 ■ Smart Card ■ MiWi™ Wireless Networking Protocol ■ TCP-IP for Wi-Fi® Legacy versions of MLA are achieved and also include support for TCP/IP with Ethernet, touch or accessory framework for Android™.	www.microchip.com/mla
16-bit CPU Self-Test Library	The 16-bit CPU Self-Test Library allows you to verify during run-time, that all CPU core features are functioning correctly.	www.microchip.com/libraries
Bootloaders	Several application notes and code examples exist to help with your bootloader applications. ■ AN1094 describes UART-based bootloader with command line interface for dsPIC30F, dsPIC33F and PIC24FJ and PIC24H ■ AN1157 describes PIC24F family and includes a GUI for quick programming ■ CE417 code example for dsPIC33EP with aux Flash ■ USB bootloader included in the MLA USB stack	AN1094 AN1157 CE417
Class B Safety Software Library	Microchip has developed a library of low-level software routines that simplify meeting IEC 60730 requirements for Class B safety. Includes CPU register test, program counter test, variable memory test, Flash memory test and clock test. Certified by VBE.	www.microchip.com/classB AN1778
Code Examples	Hundred of code examples are ready to help you set-up peripherals and functions, sorted by product family: ■ PIC24E and dsPIC33E code examples = CE4XX ■ PIC24F code examples = CE3XX ■ PIC24H code examples = CE2XX ■ dsPIC33F code examples = CE1XX ■ dsPIC30 code examples = CE0XX	www.microchip.com/codeexamples
Data EEPROM Emulation	For devices that do not have on-chip EEPROM, this algorithm increases endurance when emulating EEPROM with an on-chip Flash memory.	AN1095
Digital Filter Design	The Digital Filter Design Tool makes designing and analyzing FIR and IIR filters easy. When the user enters frequency specifications, the tool automatically generates the filter code and coefficients. Graphical output windows provide the desired filter's characteristics.	www.microchip.com/SW300001
Digital Power	Several software libraries and tools are available for digital power applications. ■ Includes Digital Power Compensator Libraries, optimized for use with dsPIC33 "GS" devices ■ Digital Compensator Design Tool helps calculate compensator coefficients for maximum performance ■ PMBus™ stack implements the PMBus protocol over I^2C communication interface	www.microchip.com/power
dsPICworks Data Analysis	dsPICworks Data Analysis allows you to evaluate and analyze DSP algorithms in both time and frequency domains. Includes signal generation and DSP functions such as FFT or DCT.	www.microchip.com/SW300021
Embedded Code Source	Embedded Code Source is a collection of code, tools and utilities from Microchip and third party developers to help speed your design.	www.embeddedcodesource.com
Fixed Point Math Library for PIC24 MCUs and dsPIC® DSCs	This software library provides a set of speed-optimized functions for the most common digital signal processing applications. The I/Q math library includes over 65 general-purpose functions composed of 28 functions support Q15 math and 37 functions supporting Q16 math.	www.microchip.com/libraries
Floating Point Math Library for PIC24 MCUs and dsPIC DSCs	The IEE-74-Compliant Floating Point Math Library is the compiled version of the math library that is distributed with the XC16 Compiler. It contains advanced single- and double-precision floating-point arithmetic and trigonometric functions from the standard C header file <math.h>.	www.microchip.com/libraries
Motor Control	This library includes the Motor Control Library for 3-phase control as well as MATLAB Simulink® Blockset and motor models, tuning guides, application notes and code examples.	www.microchip.com/motor
XLP Battery Life Estimator	This library estimates average current consumption and battery life. The utility allows users to select the target device, battery type, the application's operating conditions (such as voltage and temperature) and model the active and power-down times for their applications.	www.microchip.com/xlp

Microchip's Development Ecosystem

MPLAB® X Integrated Development Environment (IDE)

MPLAB® X IDE

Windows® Mac OS® Linux®

SCALABILITY, MEET FLEXIBILITY

Universal and Integrated Tool Set

MPLAB X IDE is a single, universal graphical user interface for Microchip and third party software and hardware development tools. It is the industry's only IDE to support an entire portfolio of 8-bit, 16-bit and 32-bit PIC® MCUs, dsPIC® DSCs and memory devices.

Powerful Yet User-Friendly Interface

With complete project management, visual call graphs, a configurable watch window and a feature-rich editor that includes code-completion, context menus and a task navigator, MPLAB X IDE is flexible and friendly enough for new users.

Open-Source Platform

Based on the NetBeans™ Platform, MPLAB X IDE supports a host of free software components and plug-ins from the NetBeans community for high-performance application development customized to your needs.

Cross-Platform

Using MPLAB X IDE, users can run their favorite toolset and develop their next embedded application on Windows®, Linux® or Mac OS® X.

MPLAB XC16 Compiler for PIC24 MCUs and dsPIC DSCs

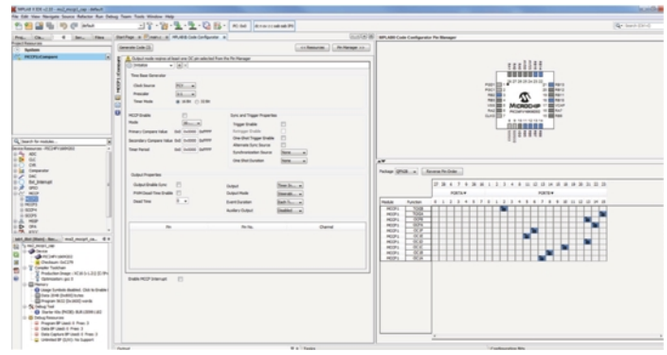
The MPLAB XC16 Compiler includes a complete ANSI C standard library, including string manipulation, dynamic memory allocation, data conversion, timekeeping and math libraries. The compiler has a powerful code optimizer. Other 16-bit MCU compilers generate as much as 165% larger code for the same application.

The assembler comes with the MPLAB XC Compiler and may be used with the compiler or as an assembler. It is a full-featured macro assembler. User defined macros, conditional assembly and a variety of assembler directives make the assembler a powerful code generation tool.

MPLAB Code Configurator (MCC)

MPLAB CODE CONFIGURATOR

DYNAMIC CODE GENERATION



MPLAB Code Configurator is a user-friendly plug-in that seamlessly integrates with your existing MPLAB X IDE to provide an easy setup and configuration experience with your chosen PIC MCU.

MPLAB Code Configurator offers a simple graphical representation of the selected PIC MCU and its on-chip peripherals and allows you to quickly arrange hardware peripherals into functional building blocks without an in-depth setup of registers or flags. The tool also displays package pins in both a graphical and tabular format, which makes pin and I/O configuration as easy as a mouse click.

MPLAB Code Configurator generates function and peripheral drivers in seamless, easy-to-understand C code for ultimate flexibility and portability. Its ease of use will help significantly reduce your software development time and get your product to market quicker.

Flexible

You can use it for simple configuration of your microcontroller in-system or to create complex functions with groups of integrated peripherals. Many PIC MCUs and their peripherals are supported, with new ones added regularly.

Intelligent

It can alert you of a potential pin or function conflict. It creates efficient code with a small memory footprint.

Easy to Use

Intuitive graphical user interface provides a visual representation of your selected PIC MCU, with an "aerial view" of the package. Pin selection and configuration is done via mouse click.

Saves Time

MPLAB Code Configurator generates simple, clearly documented APIs without the hassle of register-level setup. Its C code output can be easily modified for quick platform-level development. MCC is available as a plug-in for the free MPLAB X IDE. Learn more at www.microchip.com/MCC.

Compare 16-bit Families

Features	PIC24 Families			dsPIC® DSC Families		
	PIC24 “F”	PIC24 “H”	PIC24 “E”	dsPIC33 “F”	dsPIC33 “EP”	dsPIC33”EV”
Description	Low cost, lowest power, general purpose	High performance, general purpose	High performance, general purpose and motor control	16-bit DSCs: General Purpose	High performance and integrated op amps	5V operation, enhanced noise immunity and robustness in harsh environments
System Level						
MIPS	16 MIPS	40 MIPS	70 MIPS	50 MIPS	70 MIPS	70 MIPS
Pins	14–100	18–100	28–144	18–100	28–144	28–64
Flash Memory (KB)	4–256	12–256	32–512	6–256	16–512	64–256
SRAM (KB)	0.5–96	1–16	4–53	0.25–30	2.–53	8–16
DMA	✓	✓	✓	✓	✓	✓
BOR, LVD, POR, WDT	✓	✓	✓	✓	✓	✓
Windowed WDT	–	✓	✓	✓	✓	✓
Deadman Timer (DMT)	–	–	–	–	–	✓
RTCC - Clock, Calendar, Alarm	✓	–	✓	✓	–	–
CRC - Flash, RAM and SFR	✓	✓	✓	✓	✓	–
Class B Features	✓	✓	✓	✓	✓	✓
Timers/PWMs						
16-bit and 32-bit Timers	✓	✓	✓	✓	✓	✓
Input Capture	✓	✓	✓	✓	✓	✓
Output Compare	✓	✓	✓	✓	✓	✓
16-bit PWM	✓	✓	✓	✓	✓	✓
Multiple-Output Capture Compare PWM (MCCP) and Single-Outputs CCP (SCCP)	✓	–	–	–	–	–
Intelligent Analog						
ADC	10-bit @ 500 ksps 12-bit @ 200 ksps 16-bit Delta-Sigma 12-bit @ 10 Msps	10-bit @ 1100 ksps 12-bit @ 500 ksps	10-bit @ 1100 ksps 12-bit @ 500 ksps	10-bit @ 1100 ksps 12-bit @ 500 ksps 10-bit @ 2 Msps	10-bit @ 1100 ksps 12-bit @ 500 ksps 12-bit @ 3.25 Msps	10-bit @ 1100 ksps 12-bit @ 500 ksps
DAC	✓	✓	✓	✓	✓	✓
Comparators	✓	✓	✓	✓	✓	✓
Op Amps	✓	–	✓	–	✓	✓
Charge Time Measurement Unit (CTMU)	✓	–	✓	✓	✓	✓
Core Independent Peripherals (CIP)						
Crypto Engine with 256 b AES	✓	–	–	–	–	–
Configurable Logic Cells (CLC)	✓	–	–	–	–	–
Peripheral Trigger Generator (PTG)	–	–	✓	–	✓	–
Motor Control						
Motor Control PWM with Flexible Modes	✓	–	✓	✓	✓	✓
Quadrature Encoder Interface (QEI)	–	–	✓	✓	✓	–
Digital Power						
ADCs with Multi-Million Samples Per Second	–	–	–	✓	✓	–
Power Conversion PWM with 1 ns Resolution	–	–	–	✓	✓	–
Low Power						
eXtreme Low Power (XLP)	✓	–	–	–	–	–
V_{BAT}	✓	–	–	–	–	–
Communications						
UART with LIN and IrDA®	✓	✓	✓	✓	✓	✓
SPI	✓	✓	✓	✓	✓	✓
I^2C	✓	✓	✓	✓	✓	✓
USB - Device, Host, OTG	✓	–	✓	–	✓	–
CAN	–	✓	✓	✓	✓	✓
Peripheral Pin Select (PPS)	✓	✓	✓	✓	✓	✓
Parallel Master Port (PMP)	✓	✓	✓	✓	✓	–
Displays						
Segmented LCD Driver	✓	–	–	–	–	–
Graphical Display Driver	✓	–	–	–	–	–

16-bit Packages



20-lead QFN (MQ)
5 × 5 × 0.9 mm
(Lead Pitch: 0.65 mm)



28-lead QFN (MQ)
5 × 5 mm
(Lead Pitch: 0.65 mm)



28-lead QFN (MM & ML)
6 × 6 × 0.9 mm
(Lead Pitch: 0.65 mm)



44-lead QFN (ML)
8 × 8 × 0.65 mm
(Lead Pitch: 0.65 mm)



64-lead QFN (MR)
9 × 9 × 0.5 mm
(Lead Pitch: 0.5 mm)



28-lead UQFN (M6)
4 × 4 × 0.55 mm
(Lead Pitch: 0.4 mm)



28-lead UQFN (MX)
6 × 6 × 0.5 mm
(Lead Pitch: 0.4 mm)



48-lead UQFN (MV)
6 × 6 × 0.5 mm
(Lead Pitch: 0.4 mm)



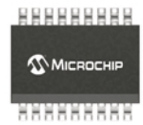
20-lead SSOP (SS)
7.2 × 5.3 × 1.85 mm
(Lead Pitch: 0.65 mm)



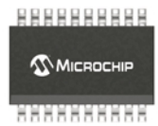
28-lead SSOP (SS)
10.2 × 5.3 × 2 mm
(Lead Pitch: 0.65 mm)



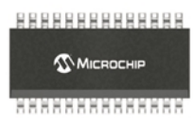
14-lead TSSOP (ST)
5.0 × 4.4 × 1.2 mm
(Lead Pitch: 0.65 mm)



18-lead SOIC (SO)
11.53 × 7.5 × 2.31 mm
(Lead Pitch: 1.27 mm)



20-lead SOIC (SO)
12.80 × 7.5 × 2.31 mm
(Lead Pitch: 1.27 mm)



28-lead SOIC (SO)
17.88 × 7.5 × 2.31 mm
(Lead Pitch: 1.27 mm)



44-lead TQFP (PT)
10 × 10 × 1 mm
(Lead Pitch: 0.8 mm)



48-lead TQFP (PT)
7 × 7 × 0.12 mm
(Lead Pitch: 0.5 mm)



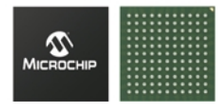
64-lead TQFP (PT)
10 × 10 × 1 mm
(Lead Pitch: 0.5 mm)



80-lead TQFP (PT)
12 × 12 × 1 mm
(Lead Pitch: 0.5 mm)



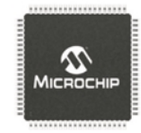
100-lead TQFP (PT)
12 × 12 × 1 mm
(Lead Pitch: 0.4 mm)



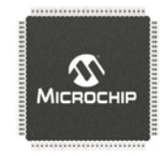
121-ball BGA (BG)
10 × 10 × 0.8 mm
(Lead Pitch: 0.8 mm)



64-lead TQFP (PF)
14 × 14 × 1 mm
(Lead Pitch: 0.8 mm)



80-lead TQFP (PF)
14 × 14 × 1 mm
(Lead Pitch: 0.65 mm)



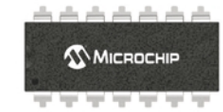
100-lead TQFP (PF)
14 × 14 × 1 mm
(Lead Pitch: 0.5 mm)



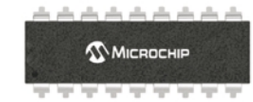
144-lead TQFP (PH)
16 × 16 × 1 mm
(Lead Pitch: 0.4 mm)



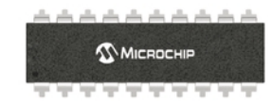
144-lead LQFP (PL)
20 × 20 × 1.4 mm
(Lead Pitch: 0.5 mm)



14-lead PDIP (P)
19 × 6.35 × 3.3 mm
(Lead Pitch: 0.1 inches)



18-lead PDIP (P)
22.81 × 7.95 × 3.3 mm
(Lead Pitch: 0.1 inches)



20-lead PDIP (P)
26.24 × 7.87 × 3.3 mm
(Lead Pitch: 0.1 inches)



28-lead SPDIP (SP)
34.67 × 7.87 × 3.3 mm
(Lead Pitch: 0.1 inches)



40-lead PDIP (P)
52.27 × 15.24 × 3.81 mm
(Lead Pitch: 0.1 inches)

Die/Wafer
(WLCSP)

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SEE Business

The Bulgarian metallurgical industry celebrated its traditional holiday in Aurubis Bulgaria

On November 5, 2015, in the Bulgarian town of Pirdop more than 200 representatives of the local metallurgical community, the central and local authorities, diplomats and media gathered to celebrate the professional holiday "The Metallurgical day" in Bulgaria. This year the event was hosted by the largest copper producer for Southeastern Europe, Aurubis Bulgaria. "The celebration of the Metallurgical day goes back to 1963, when the 5th of November was declared a professional day of the Bulgarian metallurgists", the company added.

Among the hosts of the event were the Chairman of the Executive Board of the Bulgarian Association of the Metallurgical Industry (BAMI) Anton Petrov and the Executive Director of Aurubis Bulgaria Tim Kurth. The celebration was also attended by the Vice-Minister of the Energy Zhecho Stankov, the adviser of economic affairs of the Ambassador of Germany Johannes Behrens, the Vice-President of the Bulgarian Industrial Association Kamen Kolev.



"The Metallurgical industry has a sustainable place in the Bulgarian economy, is a leading sector in the industry and the export, with a 12% of the total produced industrial production in the country and 15% of the export of goods. A main priority for the companies from the branch is to improve the competitiveness of their production through investments in modern equipment and technologies, to increase the productivity and the quality of the production, the energy efficiency, the safe environment and good working conditions", said Anton Petrov, Chairman of the Executive Board of the Bulgarian Association of the Metallurgical Industry, at the event.

At "The Metallurgical day" with a symbolic ceremony - planting a tree, was given the start of the new investment program of Aurubis Bulgaria "Spectrum 2018", which amounts to 180 million euro.



"Today it is an honor for us to host this respected holiday and here to announce the successful completion of the investment program "Aurubis Bulgaria 2014", which started in 2011 for more improving of the environment and increasing the productivity. Today we announce its continuation with the new long-term investment program that proves our sustainable presence in the country", said Tim Kurth, Executive Director of Aurubis Bulgaria.

During the event the traditional awarding ceremony of students with excellent grades from the University of Chemical Technology and Metallurgy and the Technical University in Sofia was held. Veterans from the metallurgical branch - Prof. Diliana Chavdarova, Prof. Boris Drakaliyski, and Prof. Petar Bakardzhiev, were awarded with a sign of an honored metallurgist.

Turkey is 16th in global automobile production

Turkey ranks sixteenth in global automobile production according to research, conducted by the International Organization of Motor Vehicle Manufacturers (OICA), that was released on October 26 this year.

In the half-year period, Turkey has manufactured 667,592 cars - an increase of 18,4% as opposed to the same period during 2014. Global vehicle production also rose during the first six months of 2015 and was up 0,5% compared to the previous year, the report states.



The world auto production from January to June reached 45,6 million cars, up from 45,4 million in 2014. China still occupies the first place of the list of 20 biggest automobile producing countries with about 12 million motor vehicles produced. The second-largest economy in the world manufactured more than one out of every four motor vehicles worldwide, which is an increase of 2,6% compared to last year. It was followed by the U.S., with about 6 million, and Japan, with about 4,5 million vehicles.

Greece is testing a driverless bus in real traffic conditions

A driverless bus is being tested in real traffic conditions for the first time in the town of Trikala, Greece, local media reported. The French-built CityMobil2 buses are guided by GPS, lasers and wireless cameras, and their rides are free. As part of the European project to revolutionize mass transport and wean cities off oil dependency over the next 30 years, the testing will continue until late February 2016.



Over the past year, CityMobil2 has been tested in controlled conditions near its base in La Rochelle in western France, on a campus in Lausanne, Switzerland, and near Helsinki, Finland, and has produced no accidents. The buses can seat up to 10 people and send live data collected via GPS and supplementary sensors to a control center. For safety precautions, each vehicle's data is monitored by a driver in the control center who can override the systems.

Trikala has previously tested EU-funded pilot medical programs, including schemes to relay heart test data from home to the doctor's office and use tracker devices for Alzheimer patients. The Greek government had to amend some of its laws to allow testing of the buses and in addition to that, the city had to build a dedicated bus lane that deprived residents of downtown parking spaces.

Over 9.2 million euro will be invested in waterworks in Croatia

Improvements to the wastewater network in the Croatian city of Sisak and neighboring municipalities will be supported by the European Bank for Reconstruction and Development (EBRD) with a 9.2 million euro loan. The funds will be provided to the local water supply and wastewater company - Sisacki vodovod, for the financ-



ing of the construction of a new wastewater treatment plant and upgrades and extensions to the municipal wastewater network.

"Sisak is located south-east of the capital Zagreb and has a population of around 47,000. It used to be a leading industrial city known for its steel production, among other things. In March 2013 the EBRD provided a 20 million euro loan for the restructuring and modernization of the famous Sisak Ironworks", EBRD informs.

The bank has been active in Croatia as an investor since the country's independence and has invested some 3.2 billion euro in more than 170 projects to date. The Bank's activities cover all areas of the economy but are especially strong in the infrastructure, corporate, financial institutions and energy sectors.



The EBRD has also worked with the municipality in the past, financing the acquisition of new buses and providing a first loan for upgrades of the wastewater network. Further development of both water supply and wastewater collection and treatment services, which will help preserve the city's three rivers Kupa, Sava and Odra, is a clear priority for the City of Sisak.

"We are pleased to sign this loan agreement with Sisak Water Company as it underlines our commitment to this important Croatian city. Decent water supplies and well-functioning sewage disposal are preconditions for the sound development of any municipality. In our strategy for Croatia we emphasize our readiness to work with the authorities and the European Union to modernize the country's infrastructure", Vedrana Jelusic Kasic, EBRD Director for Croatia, stated.

"I am pleased that we managed to secure EBRD financing, especially funding for the project design and extension of the wastewater collection network in more remote areas of our municipality, such as Pogorelec, Galdovo Kaptolska and parts of Zeleni brijeg", Kristina Ikic Banicek, the Mayor of Sisak, added.

Source: Aurubis Bulgaria, EBRD, OICA

Automotive manufacturing and R&D sector in Slovenia and Romania

Automotive industry is a key industrial sector of the European economy, including the South-East European region. The development of the industry includes intensive R&D activities, growing innovations and strong focus on education. R&D is more and more among the high competitive advantages for industrial firms. According to the study "Innovation Trends and Challenges and Cooperation. Possibilities with R&D in Automotive Industry" by the international cooperative network of educational and research institution with subcontractors and other bodies active in the automotive industry ACSEE Autoclusters, the automotive sector in Europe is the most important employer in comparison with other industrial sectors. High automotive R&D expenditure per year (app. 20 bln. eur) is observed in the region. ACSEE Autoclusters reports that there are more than 300 automotive production and assembly plants in Europe. The companies in the SEE automotive manufacturing and R&D sector may be divided into three main groups: global world car producers, which establish productions and research and development centers in the SEE countries, local national car producers and special car producers.

R&D capacities in SEE

According to ACSEE's data there are over 200 R&D organizations in South-East Europe. The most numerous and developed among them are in Slovenia, followed by Croatia. In Slovenia there are mainly technological development centres, followed by engineering services centres and university centres in the automotive field. Romania has 6 technological development centres. In Croatia and Serbia there are mostly university centres.

Divided by industry sector orientation, the research and development centres are focused on:

electronics and electrotechnical engineering, hydraulics and pneumatics, group manufacturing technologies, mechanical engineering and mechatronics, group material research and chemistry, centres in group vehicle design, product development and prototyping, etc.

In Romania for example, R&D activities are mostly dedicated to the following fields: electronics and electrotechnical engineering, hydraulics and pneumatics, vehicle development, product development and prototoyping.

In the current issue of South-East European Industrial Market we present an overview of the automotive manufacturing and R&D sector in Slovenia and Romania. The upcoming issue of the magazine (1/2016) will introduce you to the development of the sector in Croatia and Serbia.

Automotive traditions in Slovenia

Slovenia has a long industrial tradition. From the beginning of the automotive industry at the end of the 19 century, Slovenia has been following its development and has been providing technical and researchable contribution, ACSEE reports. Gradually Slovenia has strengthened the economic purpose of the automotive industry in the national economy.

The first industrial production of buses in Avtomontaza in Ljubljana started in 1936. This factory was one of the first in Europe that manufactured buses with steel body work. The upturn of production of industrial vehicles, first trucks, later also buses, followed after the end of the Second World War, in the early fifties in Maribor. TAM Factory of Automobiles Maribor manufactured vehicles and motors under licence and cooperational contract with Deutz from Germany. This production had a major influence on production of component parts or components, first in Maribor, then in Slovenia and other areas of former Yugoslavia.



Source: Slovenian President

The production of personal vehicles in 1959 started in Novo mesto with the establishment of IMV Industry ofmotor vehicles (already in 1954 the production of delivery vehicles started). The production of personal vehicles DKW started first, followed by the production of BLMC vehicles and from 1972, they have been producing vehicles Renault. Since 1960 at TOMOS in Koper personal vehicles Citroen were assembled.

After that extensive production of automotive parts began; first for Citroen and later for other global vehicle manufacturers and system suppliers. After Slovenia became independent in 1991 the production of commercial vehicles was significantly reduced after the loss of markets in former Yugoslavia and other eastern markets and due to transitional deindustrialisation. The production of automotive components, especially for personal vehicles, transferred most of its production to Western European markets, especially to Germany and France.

Modern industry

Today there are more than 220 companies in the Slovenian automotive manufacturing and R&D sector which employ approximately 16,000 workers, the local AJPES agency reports. The annual revenues of the branch (in EUR) are around 3.3 billion, and the exports (in EUR) amount to 2.9 billion. Among the key export markets: Austria, Croatia, Hungary, France, Germany, Italy, Mexico, Romania, Spain, Turkey, UK, USA, etc.



Source: Revoz

Key products and solutions for the automotive sector, developed and manufactured in Slovenia, are: seats and seat components; components and materials for interior furnishing; car body parts;

components for braking systems; mechanical and electric/electronic components for engines; exterior equipment and body lighting equipment, etc. Local and foreign companies situated in the country also produce: exhaust systems; engine and gearbox components; steering system components; drive components; other systems and components; manufacturing spot welding equipment; tooling for automotive industry and procure research, testing and other development activities.

The structure of the automotive industry in Slovenia

ACSEE reports that the Slovenian automotive suppliers industry includes about 100 producers that can be mainly defined as Tier 2 and Tier 3 suppliers. There are also Tier 1 system suppliers of pedal boxes, gear shift mechanisms, braking systems and other assemblies at CIMOS, auto-electric equipment at Iskra Avtoelektrika, ignition systems and electronics at AET, seats at TPV, bowden cables at TBP, headlights at Hella Lux. The buyers of components for the first implementation from Slovenia are VW, BMW, Audi, DC, MAN, Bosch, Ford in Germany, Renault, PSA, Brose in France, Lombardini, Landini, Fiat in Italy, Magna Steyr, Grammer in Austria and many others, also in England, the USA, Spain, Hungary and many other countries. These companies have an intensive development in introducing automatic systems into the production process and they are also flexible in adjustments to customers' needs.



Source: Revoz

The Slovenian automotive supply industry's annual turnover exceeds 3,7 billion Euros, 80% of which comes from the export of goods and services to the EU and rest of the world, Together with car production in Revoz it represents approx. 20% of the complete Slovenian export and 6% of DPH. In 2008 Slovenian suppliers spent over 3% of sales turnover for R&D and invested 12% of sales turnover into new technology equipment in average.

Buyers and export

The sector today is also represented by the production of personal vehicles Renault in company Revoz where 900 Clios Storia and Twigos are produced per day and a well developed automotive suppliers industry with about 100 big, medium-sized and small companies that are followed by over several 100s specialized small companies that they cooperate with. The production of commercial vehicles has been becoming more active and has been gradually spreading its suppliers' network. The production of personal vehicles represents about 9% of the overall value of goods and services export form Slovenia. The production of component parts or components for automotive industry (and accessories) reaches the value over 1,5 billion EUR, from that value around 80% is exported, which is close to 10% of Slovenian export of goods and services. Buyers are car producers and system suppliers in EU are Germany 40%, France 21%, Italy 8%, Austria 6%, England 6%, USA 4%, Spain 3%. Export of buses and other economy vehicles is around 30 million EUR. Over

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The super precision T250 CY RAIS CNC lathe is designed to perform a wide range of turning operations on medium-sized parts and components on a serial production basis.

Max swing over bed	Ø550 mm
Swing over carriage cover	Ø280 mm
Max turning diameter	Ø280 mm (with 12-station VDI 30)
X / Z axis travel	210 / 560 mm
Y axis travel	± 50 mm
Carriage inclination	45°
Y / X / Z axes rapid traverse	12 / 20 / 20 m/min
Spindle nose	A2-8
Spindle bore	Ø92 mm
Power chuck diameter	Ø245 mm (10")
Spindle motor (cont. / 30 min rating)	Fanuc βi IP18/6000 9 / 11 kW
Max spindle speed	3000 rpm
Number of tool posts	12
Number of rotating tools	12
Tool holder	VDI 30
Tailstock quill taper	MK45
Quill diameter / travel	Ø80 / 100 mm
CNC control	Fanuc 0i–TD, 0i–TF

An unique torque- rib structure provides high rigidity for heavy cutting and enlarge the tool life.

The 45° slant bed construction assures high accuracy and high rigidity for heavy duty cutting.

The spindle is mounted with high precision class P4 NN type roller bearings and trust bearings, providing outstanding radial and trust loads.

The machines were exhibited on EMO MILANO 2015

Transmission with low thermal, low preload ball screws provided higher rigidity control.

Hydraulic tailstock. Programmable positioning is available.

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Table face plate	Ø450 mm
Max axes travel X / Y / Z	600 / 560 / 510 mm
Max tilting axis travel	+125° to -10°
Max rotating on C- axis / torque	360° / 950 Nm
Table size, 4-th and 5-th axes	Ø350 mm
Max workpiece weight (A0°/A90°)	300 / 200 kg
Spindle nose to table	150 ... 510 mm
Spindle speed range	12000 rpm (opt.: 8000 / 10000 / 15000)
Main motor power	8 / 11 kW (option: 15 / 18.5 kW)
Spindle taper	ISO / BT40 (MAS403BT)
Tool capacity	24 tools (option: 32 / 40 / 60)
Max tool diameter × length	Ø80 mm × 350 mm
Rapid traverse X / Y / Z	30 / 30 / 30 m/min
Max cutting feedrate	10 m/min
X-, Y-, Z-, A-axis motors, standard	Fanuc αiS22 / 4000HV
Torque motor (rotary axis C)	Fanuc DiS 500 / 1000HV
CNC control	Fanuc 31i MB,31i MB5



C-axis turn continuously with speed up to 800 rpm as its torque is equal to 950 Nm.

Using specially developed from RAIS break for the main spindle, this 5-axes vertical machining center quickly and easily becomes modern CNC lathe.

Milling and turning with only one workpiece clamping!

140 million EUR represent the export of special tools and machines and investment and supporting services for the automotive industry in EU.

Economic impact and investments

According to ACSEE, the whole section of automotive industry, vehicles and production of automotive parts, has directly involved around 27,500 employees, it represents 19% of all export of goods and services of Slovenia and it creates 6% GDP (indirectly more than 100,000 employees). The automotive section is above average in the field of investments, especially in investments into new production technological equipment, which guarantees the quality of vehicles and components and also assures high productivity. The competition due to relatively high labor force price (salary and other obligations that employers have) in comparison with the competition in Central and Eastern Europe (Czech Republic, Hungary, Poland, Slovakia) is achieved by Slovenian automotive and automotive component parts' producers by using high technology, innovation and labor force quality. Investments into "soft factors", are particularly high especially investments into training and extra qualifications of the employees (learning companies), into motivation of the employees and into efficient organization and managing quality. Numerous producers of automotive components have already obtained global certificates ISO TS 16949 (3/4 of ACS members). Before that they already had, because of their export intensity, VDA 6.1, EAQF and QS 9000. Big investments are also meant for the welfare of the environment, in accordance with strict EU regulations that Slovenia obeys; therefore numerous companies in automotive section have already acquired environment certificates ISO 14001.

Automotive research and development

The planning and introduction of a new product is a time-consuming process that can take years and even decades, therefore the expenses connected to this process are extremely high and for this reason the realisation of such a project is only possible in cooperation with the researchers (developers) from the company with external research institutions that have the knowledge. In all this the "available technological" environment and available sources are of key importance. In the Slovenian automotive industry the research and development are directed towards the market requirements and the increase of profit. Slovenian automotive industry is doing business under pressure of fast changes and therefore it has limited resources for the research and development which is then supplemented by using the resources from universities. Currently more than 1,000 registered researchers are connected with the Slovenian automotive industry at faculties, independent R&D institutes and R&D centres in the companies.

Universities, research institutions and associations performing activities in the automotive field are: University of Ljubljana, Faculty of Electrical Engineering; University of Ljubljana, Faculty of Mechanical Engineering; University of Maribor, Faculty of Electrical Engineering and Computer Science; University of Maribor, Faculty of Mechanical Engineering; ACS - Automotive Cluster of Slovenia; TECOS - Slovenian tool and die development centre; Tool-making cluster of Slovenia; Car industry institution RTC; Slovenia Partner, Development Group for Vehicles, Transport & Logistics, etc.

Automotive industry in Romania

The beginnings of the automotive industry in Romania have their roots in the interdictions imposed to the Romanian aviation industry at the end of World War II. The new industry started at the beginning of the 1950s and has grown and diversified since the 1970s especially. It included manufacturers of tractors, trucks, buses, off-road vehicles and cars.

Romanian Automotive Industry in the last decade

Romania's automotive industry has grown rapidly since 2000, with sales of 180,927 units in 2004, up from 84,170 units in 2000. The passenger car industry is the most important segment of the market, with 80% of total sales in 2004. Vehicles manufactured in Romania accounted for 67.5% of total sales in 2004 (down from 92.9% in 2000).



Source: Dacia

Romania's top vehicle maker was Dacia, owned by Renault of France, with 44.2% share of total sales in 2004, followed by Daewoo Automobile Romania (15.1%), owned by Daewoo of the Republic of Korea. Relatively low labor costs, and unimpeded access to the European automotive market are some of the main reasons for the relatively high penetration of foreign firms into Romania's automotive subsector, including autoparts.

Overall market review

The auto industry employs 3.5% of workers in the manufacturing sector. Romania has different customs valuation rules for new and used motor vehicles, including cars, all-terrain vehicles, trucks, motorcycles,



Source: Dacia

and trailers. Romania has revitalized its automotive industry, mainly by attracting foreign direct investment, through inter alia, incentive schemes, including state aid granted to Dacia and lately Ford. Some other companies, such as Daewoo, became eligible for exemption of customs duties, and tax holidays on profits, producing with a Romanian content of at least 50%, and exporting a minimum 50% of annual production. These incentives were eliminated in 2002. In addition, Daimler is planning to establish a manufacturing venture in Romania, also in the mini- and small car segment. Given these developments, the Romanian car industry will witness a major boost over the next year, ACSEE reports.

Romania's role in the European automotive industry

As production was moving towards Eastern European countries Romania's role in automotive industry has steadily increased. This was possible based on the following factors: Romania had and still has one of the lowest production costs in Europe; investment in production facilities in Romania leads to a stronger market presence in Europe for non-European companies and presence in Eastern Europe and proximity of ex-Soviet countries for European and non-European companies. Opening car production and automotive parts in Romania increased competition and lead to continuous price reduction in the small and medium car segment. Renault continuous process of cutting costs (through Dacia models) increased the operation in Romania in order to stay competitive.

Research and development

A big amount of R&D is outsourced by foreign companies to local subsidiaries opened in Romania. Dacia has started to outsource some of its R&D activities to suppliers and many foreign suppliers have established R&D and production activities in Romania in order to meet Dacia's demand. In the commercial vehicle industry sector there was no globalization of the vehicle production though some attempts were made to sign strategic collaborations with important foreign companies.



Source: Dacia

The present Romanian production of commercial vehicles is low and strictly oriented to the local market. Increased competition from abroad has reduced significantly the sales of Romanian commercial vehicles. Large commercial vehicle producers were considering the possibility to open production facilities in Romania. Exploring the possibilities to find suppliers in Romania, these initiatives provide opportunities for T1 suppliers to start operations in the country.

Supplier sector

The Romanian car parts industry has experienced rapid expansion over the last five years as several large foreign parts producers established production plants in the country. The automotive industry in Romania had until recently two large foreign vehicle makers, Daewoo and Renault. Numerous parts production plants have opened in to support these facilities. 58% of the spare parts used by Daewoo were domestically produced and Daewoo co-operated with 226 Romanian producers who supply more than 1,000 parts. The Romanian automotive supplier sector has followed the evolution of the car producer in Romania.

The major car production facilities located in Pitesti, Craiova, Brasov and Bucuresti has concentrated most of the supplier companies. These companies had to face the changes car producer went through. Before 1990 all suppliers were producing for national car producers in Pitesti, Craiova, Brasov, Bucuresti, Campulung and Timisoara. When Romania started to open to foreign investors, a lot of Western European and international automotive suppliers have open subsidiaries in Romania based on the existence of a relatively skillful but cheap working force. The current situation provides excellent opportunities for suppliers of all tiers. Ford is partly looking for a new supplier network and Daimler will also be looking for low-cost but good quality suppliers to support their strategy. Currently, the Romanian automotive industry consists of a limited number of players (as compared for example with Poland).

Source: ACSEE

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SEE Energy

Nine outstanding projects from Croatia and the Western Balkans received recognition for energy efficiency

Nine outstanding projects financed under the Western Balkans Sustainable Energy Finance Facility II (WeBSEFF II) received recognition from the European Bank for Reconstruction and Development (EBRD) as part of an initiative for promoting renewable energy in Croatia's capital Zagreb.

The investments promoting energy efficiency and low carbon technologies in the commercial, residential, and municipal sectors were honored at the 2015 Sustainable Energy Excellence Awards ceremony hosted by the EBRD on 22 October 2016 at the Hotel Esplanade Zagreb. The event was attended by local authorities, international institutions, the diplomatic community as well as EBRD partner banks and local companies.



The prizes were awarded in nine categories with winners as follows:

Energy efficiency in the public sector - The awarded project was by the company Brod-plin, Croatia. The project was financed through WeBSEFF by Zagrebacka banka, Croatia;

Successful use of renewable energy in the public sector - The awarded project was by the company IEE, Bosnia and Herzegovina. The project was financed through WeBSEFF by UniCredit Bank, Bosnia and Herzegovina;

Utilisation of advanced technology in the production process for the improvement of energy efficiency - The awarded project was by the company Krupakabine, Bosnia and Herzegovina. The project was financed through WeBSEFF by Raiffeisen Bank, Bosnia and Herzegovina;

Improvement of energy efficiency in the production process for the better protection of the environment - The awarded project was by the company Kiro Dandaro, FYR Macedonia. The project was financed through WeBSEFF by Ohridska banka, FYR Macedonia;

Improvement of the production process to enable energy savings and scrap reduction - The awarded project was by the company FMB, Serbia. The project was financed through WeBSEFF by Banca Intesa,Serbia;

Improvement of energy efficiency in agricultural production - The awarded project was by the agricultural entity Radanov Miodrag, Serbia. The project was financed through WeBSEFF by Komercijalna banka,Serbia;

Energy efficiency refurbishment of business buildings - The awarded project was by the company Alkaloid, FYR Macedonia. The project was financed through WeBSEFF by NLB Tutunska banka, FYR Macedonia;

Energy efficiency refurbishment of the residential building - the awarded project was from the company Komuscak, Croatia. The project was financed through WeBSEFF by Provredna banka Zagreb, Croatia;

ESCO - the awarded project was from the company Sense Esco, Croatia. The project was financed through WeBSEFF by Erste Bank, Croatia.

These projects led to annual total equivalent primary energy savings of 386,7 GWh/y and of 205,028 tonnes of CO_2/y. This amount equals the buildings energy consumption of a city with about 25,000 citizens for an entire year, and the equivalent of taking 30,000 passenger cars off the roads for a year.

Under the new Green Economy Transition approach, the EBRD is aiming to increase its green financing to around 18 billion euro or 40 per cent of its total annual investment by 2020. This approach aims to scale up the Bank's financing to tackle the climate change over the next four years ahead the COP21 in Paris.

WeBSEFF II is part of the Regional Energy Efficiency Programme for the Western Balkans, a joint initiative of the Western Balkans Investment Framework (WBIF) and the EBRD. The European Union is supporting WeBSEFF II with EUR 11,5 million in grant funds under this umbrella, for technical assistance and investment incentives for the borrowers, who can benefit from consultation and advice such as free energy audits.

Romania's CEZ Distributie to improve network operation and improve efficiency with EUR 153,7 million loan

Romania's electricity distribution company CEZ Distributie will receive a syndicated loan from The European Bank for Reconstruction and Development (EBRD) worth of RON 675 million (EUR 153,7 million equivalent), aimed at supporting the projects of the distribution company. The projects refer to the 2015-16 investment programmes aimed at reducing technical and commercial losses, improving efficiency and installing smart meters, the restructuring of the company's balance sheet in order to optimise its capital structure, and the provision of working capital.

CEZ Distributie has 1,4 million customers in the region of Oltenia in southern Romania. The company is fully-owned by CEZ Group, an integrated electricity utility headquartered in the Czech Republic with operations in central and south-eastern Europe and Turkey.



The implementation of smart metering together with new communication equipment is expected to contribute to the overall improvement of the network operation. CEZ Distributie aims to replace 50 per cent of its current meters by 2020. Additionally, the investment programme will contribute to setting new standards for business conduct in Romania since the reduced technical and commercial losses will lead to CO_2 emission savings of up to 285,000 tons per year.

The provided funding is split into two parts - a RON 281,25 million (EUR 64 million equivalent) "A loan" for the EBRD's own account and a "B loan" portion of up to RON 393,75 million (EUR 89,7 million equivalent) for the account of syndication participants. It is the first long tenor local currency (RON) EBRD syndicated loan to a corporate in Romania.

Nandita Parshad, Director for Power and Energy at the EBRD, said: "We have supported the reform of the Romanian electricity sector for many years and we are pleased to continue our engagement with this loan. The introduction of smart meters and the creation of the basis for smart grids will be another major step forward and lead to higher efficiency for the benefit of the provider, the clients and, of course, the environment."

A state-of-the-art electricity network is another step towards unleashing the potential of Romania's economy, said Matteo Patrone, EBRD Director for Romania. He added that this loan is an excellent example of an infrastructure investment that will have a lasting impact and benefit commercial customers as well as private households by rewarding responsible and sensible consumption. The EBRD also expects the investment to become a successful model which will attract many successors, further elaborated Patrone.

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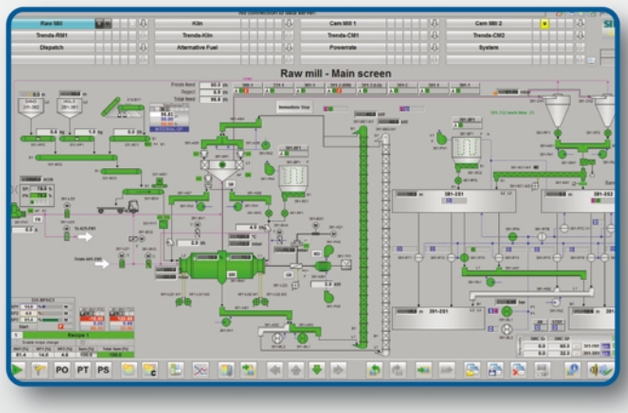



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Martin Zmelik, Country Manager and President of the Board, CEZ Romania, said: "Our collaboration with the EBRD is part of a long term partnership we have been developing, as well as our long term business vision for the Romanian market. We will continue to invest in the modernization of the distribution grid in our operation area, as we committed to 10 years ago when we first entered Romania, and to optimize our internal processes in order to provide a high quality distribution service to our clients."

Romania was the sixth country by volume of EBRD investments in 2014, with almost EUR 600 million invested. To date, the Bank has invested over EUR 7 billion in the country and has also mobilized more than EUR 14 billion for these ventures from other sources of financing.

EBRD supports Serbian reform programme for the power sector

The European Bank for Reconstruction and Development (EBRD) is supporting a comprehensive reform programme for the power sector in Serbia by extending a EUR 200 million restructuring line to the state-owned utility Elektroprivreda Srbije (EPS) that generates, distributes and supplies electricity across the country.



The restructuring loan is aimed at improving the power infrastructure within the country by helping EPS restructure its balance sheet and support its recovery after the devastating aftermath of the Balkan floods in 2014. Following those events, the power utility faced about EUR 86 million worth of losses and was forced to reduce its power output by one third due to damage on its coal-production plants. The EBRD reported that the floods also caused the Serbian economy to contract by 1,8% in 2014, but the combined effect of the coal extraction and power generation, as well as the re-launch of operations of a major steel plant is expected to expand the economy 0,5% this year.

The EBRD investment will also help the EPS reach long-term development objectives such as commercialization, raising standards of corporate governance and improving energy efficiency.

The EBRD's financing will support further reforms in Serbia's energy sector and will help achieve energy market liberalization, a significant condition for the country's admission to the European Union. Another positive impact will be the deepened regional integration in the Western Balkans as a result of the stimulated cross-border energy distribution and trade.

The programme will be implemented in close cooperation with the Government of Serbia, alongside support from the World Bank and the International Monetary Fund, and is a major part of a wider fiscal consolidation drive by the authorities of Serbia.

"We believe our financing will make EPS more efficient. We are pleased to be working on the modernization of the company, increasing environmental and social standards and corporate governance. We see a lot of potential to further develop EPS as a commercial company and it is important EPS continues to implement the reforms started over the past year or two," said Nandita Parshad, EBRD Director Power and Energy.

"EPS needed to respond urgently last year to the unprecedented and catastrophic floods which hit Serbia. This put huge strains on EPS and we commend the resilience demonstrated by the company and management at that time. This loan is hopefully the final step to help EPS recover from the damage and by refinancing liabilities taken at the time, management will be in a position to press forward with a vision for a more efficient company", added Daniel Berg, EBRD Director for Serbia.

"We're delighted to be working with our long-standing partner EBRD. A lot of hard work lies in front of us, but we are committed to making EPS a modern, efficient and competitive regional leader in the energy sector," said Aleksandar Obradovic, General Manager of EPS.

Aleksandar Antic, Serbia's Minister of Energy and Mining, said: "This is a very important step for Serbia. We are grateful to the EBRD for taking such active role in providing support to EPS, alongside the World Bank and the IMF."

Since the start of its operations in Serbia, the EBRD has invested over EUR 4 billion in over 190 projects across the country. The Bank invests in the financial sector, industry, commerce, agribusiness, energy and infrastructure.

Construction of Serbian biomass power station started

A biomass power plant will be constructed in Krusevac, Central Serbia. That was announced by Building Energy, multinational company operating as Global Integrated IPP in the Renewable Energy Industry, and the city of Krusevac, Serbia. The facility will be the first one in the country combining electric and thermal energy and will have an installed capacity of respectively 4.8 MWe and 20 MWt. The plant will generate 38.4 GWh of electric power and 86 GWh of thermal power per year.

The implementation of the project worth a 27-million euro investment is among the arrangements in a memorandum of understanding, which was signed between Building Energy and the city of Krusevac. The contract provides for a close collaboration for the creation of an electricity generation pole from renewable sources.

Building Energy has been present in the Balkans market since 2014 with company offices in Belgrade, from which it manages and coordinates the development of its projects in Serbia, Croatia, Republika Srpska, Romania, Montenegro, Poland, Ukraine, Belarus, Azerbaijan and Armenia.



"The biomass power plant will be fuelled by woodchips coming from the cleaning of Serbian woods. The sale of thermal energy, resulting from a ten-year agreement between Building Energy and the Krusevac thermal power plant, will largely contribute to satisfy the thermal needs of the city, which has about 110,000 inhabitants. The sale of electric power, instead, will be regulated by a contract with the national utility operator EPS, according to the Serbian feed-in-tariff rules", the company informs.

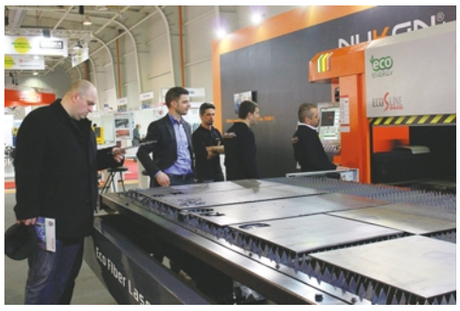
The project is expected to create 70 new job positions during the plant construction, and 40 more positions, between specialized staff and workers, for the plant management and maintenance activities. Additional jobs will be created from complementary activities, such as the woods cleaning and the biomass transportation to the plant. "In addition to this strong economic impact, the territory will also benefit in terms of CO_2 savings, around 38,400 tons per year, achieved through both a higher cycle efficiency and the reduction in the use of carbon as the energy source of the current teleheating", the company further explains. The construction works of the power plant and the beginning of electrical and thermal power production are expected from the winter of 2017-2018.

"We are happy to develop, with the support of the city of Krusevac, the country's biggest plant combining electrical and thermal power in the renewables sector. We believe that this project can contribute to help the Balkan countries to fully exploit the potential and the resources the territory is rich in. The high availability of woodchip biomass in Serbia, together with our know-how and experience in the use of diversified technology will allow a modernization process to begin, by substituting the current thermal power plants, fuelled by fossil fuel, contributing to align the country to the European standard of CO_2 emissions", said Paolo Rossi, Managing Director of Building Energy Eastern Europe.

Sources: EBRD, Building Energy

The MachTech & InnoTech exhibition to be held for the first time in April 2016

The sixth edition of MachTech & InnoTech - the B2B forum for industrial equipment, will be organized for the first time within 4 days, from 5 until 8 April 2016.



Besides the new dates in the calendar, any registration made before 20 November this year will bring the companies from the machinery sector a 20% discount from the price of exhibition space.

This year the forum has gone beyond the scale of the previous edition and the organizers expect in 2016 a growing share of the newly registered companies by more than 25%.

Along with MachTech & InnoTech there will also be held the 44th edition of Bulcontrola - the exhibition for measurement and analytical equipment, as well as Water Sofia, which is an unique business exhibition in the national water sector.



Time to make business in the machine-building sector

This year on March 12, the second day of MachTech & InnoTech, there were bilateral business meetings for commercial cooperation and technology transfer between Bulgarian and foreign companies - B2B MatchMaking. The meetings are organized for the third consecutive year in cooperation with the Enterprise Europe Network, the largest information network of the European Commission to support small and medium businesses.

The exhibition is the only business forum in the country, during which are held bilateral business meetings in the sector. This year, within just one day, the event allowed for more than 170 meetings between interested companies, and was attended by companies from the Netherlands, Belgium, Tunisia, Spain, Turkey, Serbia and others. The presentations by the participants were completed by a team of experts, which was available to the companies all the time.



SEE NEWS

Slovenia is shortlisted for possible Yaskawa production centre location

Slovenia's Ribnica is one of the possible locations for Japanese robotic manufacturer Yaskawa Electric Corporation's new production centre, revealed company executives and government officials. Slovenia is currently shortlisted alongside the Czech Republic and Poland for a possible location. The final decision, however, will be known in the beginning of 2016.

Yaskawa has two subsidiaries in Ribnica - Yaskawa Slovenija and Yaskawa Ristro, which earned revenue of EUR 25 million last year, while this year, the figure is expected to increase towards EUR 35 million.

At a celebration marking the company's 100th anniversary, the president of Yaskawa Robotics Europe Bruno Schnekenburger noted that Slovenia is a good candidate for the project, while president and executive director of Yaskawa Europe Manfred Stern said the country's dynamics offer good growth prospects.

"Japanese investments in Slovenia in 2013 amounted to EUR 44,4 million. I believe that there is still room for improvement. In the following months, the government will strive to create favourable business conditions for new investors as well as existing investors," said Slovenian Prime Minister Miro Cerar.

Serbian PKC Group commissioned a new production line



The Finnish manufacturer of electrical distribution systems for the vehicle industry PKC Group inaugurated a new technology line in its factory in the Serbian city of Smederevo. The start of its production is expected at the beginning of next year.

The opening ceremony was attended by the Serbian Prime Minister Aleksandar Vucic who remarked that Serbia has made progress in the economic front as well as on the road to the EU.

Vucic added that the company that initially had a brownfield investment in Smederevo currently employs 890 full-time workers. By the end of 2016 their number is expected to increase to 1,500.

Vice President of the Board of Directors of PKC Group from Helsinki Robert Remenar pointed out that the company had to choose the best and most competitive production location if it wanted to meet the expectations of its customers. "PKC Group found qualified, dedicated and technically skilled workforce in Serbia, as well as transport infrastructure which will enable the efficient flow of goods, technical university base and a progressive political environment focused on improving business conditions, he said", the company representative added.

"The negotiations on EU membership are in progress, which is probably the most important factor that gives confidence to companies that Serbia has a safe, secure and functional business environment", Ambassador of Finland to Serbia Pertti Ikonen said.

Metallurgy and Metalworking Industry in Croatia

The metal industry is one of the most important industries in Croatia. The Agency for Investments and Competitiveness, an agency of the Croatian Government (AIK), reports that businesses dealing in the metal industry are focused on exports, introduction of new technologies, training professional personnel, quality system certification, environmentally friendly production and connecting domestic and foreign producers. The production program of the metal industry in Croatia is very diverse and can meet the needs of potential customers and partners.

In Croatia the metal industry is mostly developed in the counties of Medjimurje, Bjelovar-Bilogora, Brod Posavina and Krapina-Zagorje. The businesses in the sector enjoys a continuous growth which is clearly shown by the increase of production capacity, new products and increased exports.

In Croatia more than 3,000 companies operate in the metal industry. The number of employees in the sector is over 27,000. The share of metal industry in total exports is 3.5%. Approximately 10% of the total added value and sales of the manufacturing industry is realized in the metal industry, AIK reports.

Traditions in the sector

The manufacturing of basic metals and fabricated metal goods has a long tradition in Croatia. The production of aluminium and Al-alloys started in 1937 in Sibenik while in 1950 the ironworks in Sisak commenced the production of seamless steel tubes and metal. Production development has been accompanied by the establishment of various institutions of higher education. The Faculty of Mechanical Engineering and Naval Architecture was founded in Zagreb in 1956 and four years later, in 1960, it was the Faculty of Metallurgy in Sisak. At the same time, if the situation in this sector is compared with the situation in 2006, we notice not only a growth in the number of employees by 10%, but also export growth by 28.4% and import growth by 26.4%.

Industry development

The Croatian metal industry includes the manufacture of welded and seamless steel tubes, reinforcing steel, rolled bars, wire fabric, aluminium processing and metal castings. Steel consumption in Croatia has substantially grown in the last six years, due to an increase in the construction and shipbuilding sector production, AIK reports. Many steel products, e.g. steel sheets, steel sections and similar, are not manufactured in Croatia, which is offset by imports. When compared with the same period in 2006, industrial manufacture in production of metals has slightly dropped in 2007 (index 99.7), which can be attributed to a lesser volume of steel tube manufacture as a consequence of the restructuring and privatisation processes of the ironworks in Sisak. At the same time, if the situation in this sector is compared with the situation in 2006, we notice not only a growth in the number of employees by 10%, but also export growth by 28.4% and import growth by 26.4%. Production of crude steel is estimated to have increased by about 51% in 2008 compared with production in 2007. The estimated 2008 production figures are based on production data released by Croatia's two steel producers. The reason for the large increase in production of crude steel in 2008 is unknown, although it could be the result of operational changes owing to the change of ownership of both Croatia's steel producers late 2007.



The sector today

Today the manufacture of fabricated metal products and the metal processing activities in Croatia can be divided into the manufacture of metal constructions, builder's carpentry of metal, containers, radiators, boilers, tools, packaging, bolt goods, furniture etc. Significant production growth has been achieved in the industrial manufacture of selected goods, which are part of fabricated metal products manufacture (index 115.8), according to AIK. In the fabricated metal products manufacture field, the number of employed has risen by 15%, exports by 35.2% and imports by 22.5%, when compared with 2006. Major efforts are being made to increase competitiveness in international markets. To achieve substantial growth of output in future, it is necessary to boost exports, penetrate new markets, introduce modern technology and launch new products, and also to connect with manufacturers of machinery and equipment both within the country and internationally.



Croatian Foundry Association

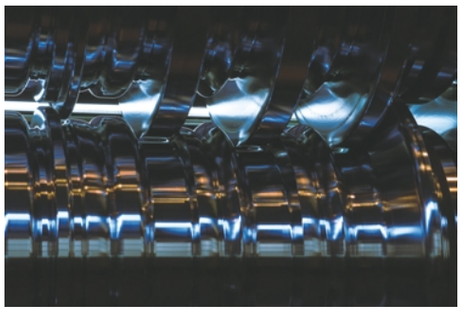
The Croatian Foundry Association was established in 1953. It is active in different fields, supporting the development of the companies in the branch. Among the organization's aims are: gathering information from the Croatian foundry industry; establishing cooperation between the companies; coordinating experience exchange between foundries; publishing technical foundry literature; organizing visits and exhibitions at the foundry industry trade shows; providing cooperation with different institutions which have the influence on the foundry technology (Croatian Chamber of Commerce, Ministry of the Economy, Environmental protection and energy efficiency fund etc.).

Association of production of metal and metal products

Inside the Industry of Croatian Chamber of Econo-

my, within the Department of production and processing of metals, the Association controls the production of metals and metal products.

Metal production is characterized by the production of welded and seamless steel tubes, steel wire rod, rebar network construction, aluminium processing, metal casting and production of ferroalloys. The Association performs its activities through discussion between companies and the association; collaboration with relevant ministries and institutions in order to improve business conditions members of the Association; connection with related companies and national associations abroad; presentation of and on specialized fairs abroad.



The purpose of the Association is to be efficient and facilitate monitoring the activities of production of metals and fabricated metal products, which gathers 201 companies, founded by the following groups: casting of metals; manufacture of tools.

Major foundries and companies in the metallurgy and metalworking

Duro Dakovic Trade

Duro Dakovic Trade was founded in 1991. Basic activity of foundry is production of grey and ductile iron metal casts and manufactoring of models.

The production of casts at the foundry started in 1922 with the production of railroad vaggons at the "Duro Dakovic" plant. At that time foundry produced engine blocks, cylinder heads and other important engine parts made of iron cast metal. Annual production amounts to 4.000 tons of iron cast metal. The weight of casts ranges from 50 up to 15.000 kg with the quality ranging from GG 10 to GG 35, GGG40 to GGG60 (weight from 15 kg up to 3.500 kg).



Apart from standard qualities, the foundry also produces casts matching customers' specific requirements. Casts manufactured at the plant are applied in: motor industry, industry of agricultural and construction machinery, chemical and railroad industry. The foundry's production program includes casts for tools, housings (reductor housings, engine housings, machine housings etc.), fly-wheel, casts for agricultural machines, castings for the process industry, acid industry, sugarmill industry, steam drum industry (grid-iron), coke industry, etc.

Ferro-Preis

Ferro-Preis was founded in the mid-20th century in the city of Cakovec, Croatia, under the original name Foundry Cakovec (Ljevaonica Cakovec). Since then there has been a long tradition of development and production of grey cast iron (EN GJL) products and castings - such as motor housings, pumps and other industry components. In the year 1991, Foundry Cakovec became part of Preis Group, based in Pernitz, Austria and the company name was changed to Ferro-Preis Cakovec.

The company manufactures a variety of castings made of grey cast iron according to customer specifications, such as housings of electric motors, pump parts, bearing housings, gear castings, components for diverse industries, manhole covers. With an annual production of approx. 10.000 tons and more than 180 employees, the company Ferro-Preis is one of leading grey cast iron foundries and producers in southeast Europe. More than 90% of the production is sold to the export markets, mainly customers from EU (Austria, Germany, Finland, Ireland, Italy, France, Sweden).

Ivanal

Ivanal's main products are AL-die-casting products for the automotive sector, the manufacture of home appliances and furniture. The company was established in 1937. In 1979 the foundry started production of secondary alloys, which was abandoned in 2005. Since 1989 Ivanal has been manufacturing AL-die castings. The annual output is 1200 - 2000 mt (metric tons), and the annual capacity - 3000 mt with present product range. The production is mainly supplied to ContiTech VC-Germany for end-users like Daimler Chrysler, MAN and Renault.

The basic capacity of the factory was built in the the interval 1936 - 1940 (the electrolysis in 1937; the hydrated alumina operating unit in 1939). In 1940 the establishment reached the installed capacity of 3000 t/y of hydrated alumina and 3000 t/y of aluminum.

The company's future development strategy is based on the increase of die casting production,

The development of machining aluminium die castings, the enhancement of the respective quality procedures - introduction of ISO TS 16949, etc.

Ljevaonica Bjelovar

The foundry was founded in the beginning of the 20th century. It started production of casting in gray (SL) and ductile (NL) cast as well as iron alloys with maximal annual capacity of 10 000 tons of casted products which made the foundry one of the bigger manufacturers in the country.

Ljevaonica, as it is today (founded in 1991.), is implementing new productional technologies, modernizing equipment and production lines, changing the production programmes and improving the product quality.

The company has introduced the quality system certificate ISO 9001:2000. It is active in the production of gray and ductile cast and casting alloys. The melt plant produces liquid metal on medium frequency electrofurnace. The finishing processes include annulating - stabilizing and recrystallizating heating process (500°C-1200°C) in annealing furnace 2 m^3.

LTH Metal Cast

LTH Metal Cast was founded in 1980 and joined the LTH Castings Group in 1999. After resuming the production in the early 90s, the company focus was predominantly raw part production. Today, using the advantages of a traditional industrial environment and the Group's synergies LTH Metal Cast offers a wide

SEE NEWS

A new rubber tire factory opened in Turkey



The USD 520 million Sumitomo Rubber tire factory in Turkey has been officially inaugurated by Turkey's President Recep Tayyip Erdogan. The plant in the central Anatolian province of Cankiri has been realized in partnership with Abdulkadir Ozcan A.S (AKO) and will be able to manufacture 10 million tires per year.

President Erdogan noted at the opening ceremony that Japanese investments into Turkey have been on the increase recently, reaching USD 1,6 billion in the last five years. During the first nine months of the year, Japanese companies have been part of seven merger and acquisition operations in the country, which is an important indicator of the country's investor interest in Turkey.

"We have high expectations from our Japanese friends. Turkey should have a share of at least 1 percent from Japan's outgoing investments, corresponding to USD 1 billion a year," the President said.

The Sumitomo Rubber AKO plant will employ 2,000 people and is expected to export about 80% of its product range, consisting of radial passenger and light truck tires, to the Middle East, North Africa, and Russia.

Romanian food supplements producer Alevia invests EUR 1 million in plant expansion



Romanian herbal teas and dietary supplements producer Alevia has invested EUR 1 million in expanding its factory and offices and acquiring new equipment for its production plant in Faltceni, northern Romania. Previously, the company had invested another EUR 1 million in setting up its factory.

The production unit covering 2000 sqm has an annual capacity of 4 million units and produces over 50 types of herbal tea and 120 types of dietary supplements. Currently, Alevia has 160 employees in the production and sales departments, but plans to exports its products to other Balkan countries in the near future. Last year, the company reported EUR 4,55 million in sales.

SEE NEWS

First two high power charging stations launched in Slovenia



The first two out of 26 power charging stations for electric cars were launched in Slovenia in October 2015. By the end of the year, Slovenia will have rapid charging stations every 50 kilometers along its motorway network. The initiative is part of the "Central European Green Corridors (CEGC)" project aimed at establishing a dense network of 115 interoperable fast charging stations in Slovakia, Austria, Germany, Slovenia and Croatia.

More than 10 strong partners, among them leading car manufacturers (BMW, Nissan, Renault and VW), OMV location partners, the Slovak energy supply company ZSE, the Slovenian Government and Slovenian electricity network operator SODO will fast track the tightening of the fast charging station network in order to make daily use of electric cars more comfortable. The EUR 2m project was awarded for funding by the European Commission, in line with the Trans-European Transport Network (TEN-T) programme call. A total of EUR 620,000 came from EU funds, while the rest was provided by Slovenian partners.

"It takes just over half an hour to charge up to some 80% empty batteries of cars performing at between 18 and 24 kilowatt hours," explained SODO boss Matjaz Vodusek before the launch of the first two charging stations.

DS Smith acquires Cukurova Group's corrugated packaging business in Greece

Recycled corrugated packaging company DS Smith has signed an agreement with Cukurova Group to acquire its corrugated packaging business in Greece and divest its minority stake in Cukurova Group's Turkish corrugated paper and packaging entities to the Cukurova Group. The acquisition is part of DS Smith's strategy to expand its presence in the growing region of South Eastern Europe.

Cukurova's Greek corrugated packaging unit produces packaging products for the FMCG sector in three production facilities. The company has reported close to 80 million euro in annual sales for their packaging business in Greece. Cukurova is based in Turkey and has operations in industry, construction, communication and information technology, media, financial services, energy, transportation, and service sectors.

"We are delighted to announce the acquisition of the Greek corrugated packaging activities of the Cukurova Group. It is a high quality and stable business that we have known and partnered with for a number of years", announced DS Smith CEO Miles Roberts.

range of machining and is the most "lean" site within the LTH Castings Group.

Using fully automated casting machines, machining centres and dedicated machines the facility typically manufactures aluminium anti-vibration and braking system components as well as water and vacuum pump housings for the automotive industry. Using lean structures, the site is particularly cost efficient with high volume production.

Core competences include die-casting and machining of aluminium parts and processing of aluminium alloys. Among the key products of the foundry are pumps housings and components, as well as braking components.

RS Metali

RS Metali operates two plants in Croatia - Samobormetal - Sveta Nedelja and Rapid - Virovitica. The foundry produces wide range of single and serial castings in completed technological process from drawing to semifinished or finished, machined product. Castings weigh from 0,10 kg up to 350 kg.

Among the main segments of the company's business are the production of castings and the production of patterns and tools.

The production of castings according to kind and qualitiy of material includes: grey cast iron in quality from GJL-100 to GJL-300; nodular graphite cast iron in quality from GJS-400 to GJS-700; non-ferrous castings in quality: Bronze RG-5 to RG-10, Bronze GBz-10 to GBz-20, Bronze CuAL9 to CuAl10Fe5Ni5, Brass CuZn15 to CuZn40Pb, Aluminium ALSi6Cu to ALSi12.

In two well equipped pattern shops RS Metali produces patterns and tools for single, small serial and serial production of castings. For pattern production it uses wood, for single castings, and for serial production, plastic combined with metal plates and tools for shalco production of cores.

Strojar

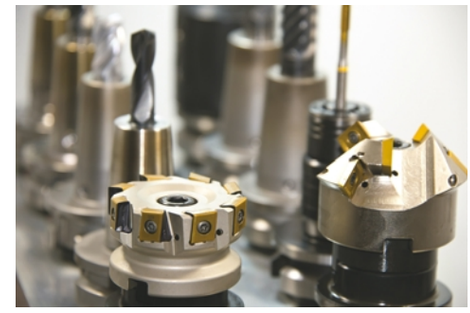
Strojar is a manufacturer of copper based alloys in Croatia. Founded 60 years ago today it is positioned as manufacturer of high value and high quality products thanks to internal chemical and mechanical laboratory. The enterprise has several hundreds of costumers from areas of naval engineering, engine and aggregate manufacturing, process industry and other industry branches. More then 50% of production is sold on European Union markets like Austria, Slovenia and Germany.

The manufacturing facility has 250.000 kg yearly production capacity of various products. The capacity of furnaces allows manufacturing of up to 3000 kg heavy casts, and machining can be made on rings up to 2400 mm in diameter. The enterprise can make over 30 different alloys of bronze and brass, including tin bronze, aluminum bronze, aluminum nickel bronze, led bronze, and other types of multi component bronzes, while brasses are most often made as alloys of copper and zinc with addition of led. Core products include: centrifugally cast plain bearings, bushings, rings, nuts and other machine parts, while smaller part of product selection is made by casting in metal and sand molds.

Trade fairs in the field

BIAM & WELDING

Owing to their long tradition and successful organization the fairs BIAM - WELDING have confirmed their status of the most important business event of this economic branch in Croatia, enjoying high reputation in the world. The fairs offer an overview of the latest technological achievements in the field of machine tools, welding and anticorrosion under a single roof. Therefore they have become an unavoidable venue for intensive business meetings of manufactures, experts and business people in the sector.

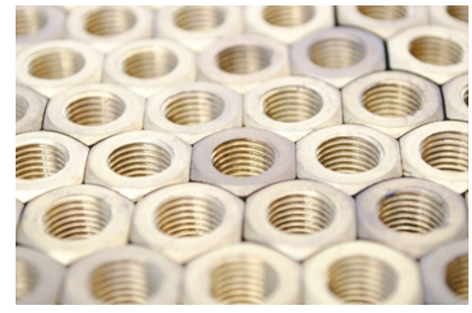


The exhibitions programme covers: flexible automatic products, systems and lines; cutting machine tools; bending machine tools; physic-chemical process machine- tools; machines for thermal treatment of metal; machines for machine tools; hand and cutting tools. The fairs also traditionally present the novelties in: accessories and components for machine tools; welding equipment and procedures; basic and supplementary welding materials; welded joints control equipment; welded constructions; means, equipment and procedures for anticorrosion protection.

SPLIT: The SASO fair

At the national level, SASO presents one of the most significant civil construction, wood and metal industry, tool and equipment, energy, electrical engineering, telecommunications and craft and small entrepreneurship fair. Fair SASO is an excellent opportunity to encounter business visitors, small and middle businesses, architects, engineers and investors: over 73% of all fair visitors are company owners or decision makers that have great impact on management judgement.

It combines the International Tool and Equipment fair and The International Metal industry fair.



The International Metal industry fair's product range includes: metal treatment machines and equipment; metal ware (screws, bolts, studs); metal structures, metal materials; metal packing, non-ferrous metals; welding equipment, protection at welding, anticorrosive protection, etc.

The International Tool and Equipment fair's programme covers: professional, clamping, measurement, manual, pneumatic and D.I.Y. tools; cutting and straining machine tools, processing lines, grindstones; bmetal and plastics testing machines and devices (sensors and diagnostics); tools and devices for thermal treatment of metal; transportation equipment, industrial robots, transportation lines; hydraulic machines and tools, pumps and motors for all purposes, etc.

Strong international presence expected at Via Expo's exhibitions in April 2016

The next year's editions of the international exhibitions EE & RE (energy efficiency and renewables), Smart Cities, Save the Planet (waste management and recycling), and LiftBalkans (elevators and escalators), organized by Via Expo, will be held on April 5-7, 2016 in Sofia, Bulgaria.

Being among the leading initiatives in South-East Europe, the specialized Exhibitions and Conferences of Via Expo will become again in 2016 a meeting point between global players and local partners in the clean-tech and sustainability sectors.

Focusing on energy saving, alternative energy sources, smart urban development, waste and recycling innovations, the Forum also plays a significant role for attracting foreign investments in these fields.

The 2016 Edition

At the upcoming editions of the events many up-to-dated products will be showcased. The organizers expect a strong international presence. For 7th year in a row Austria will be a long-term supporting partner. Austrian Pavilion and Italian Group Participation will be realized at the exhibitions.

Among the visitors to be invited are: CEOs, decision makers, investors, consultants and experts from different sectors. The thematic range of the events includes: practice-oriented topics, case studies and discussions on district heating, insulation innovations, geothermal energy, energy and mobility in smart cities, planning sustainable cities, circular economy package, the role of bio- and plastic waste for the achieving a resource-efficient society. The exhibitions are expected to be visited by many CEOs, decision makers, investors, consultants and experts from public authorities and different sectors.

The Events in 2015

In 2015 there were 120 exhibitors from 18 countries. 42% of the exhibitors came from abroad. There were also over 4100 visitors from 37 countries.

52 speakers from 15 countries and a total of 227 attendees from 23 countries participated in the conferences. The events got marketing & PR promotion support from: 110 associations from 21 countries and media partners: 84 magazines and websites from 24 countries.



"It can be definitely resumed that the SEE Exhibitions & Conferences assist for the environmental progress in the Bulgaria and the Region through presenting good practices and relevant know-how for their implementation. There are very good prerequisites for energy, environment,



transport and construction sectors, coming from the recently adopted OP "Environment", OP "Regions in Growth", OP "Transport and Transport Infrastructure" and OP "Innovations and Competitiveness" by the European Commission with 6.36 billion EUR. The programs envisage important investments which will make the local economy more sustainable and competitive", the organizers from Via Expo stated.

Highlights

The EE & RE Exhibition 2015 has put on display a great set of existing energy technologies as it was a starting point for the launch of innovative products. Its aim was to stimulate the development of energy market in South-East Europe through technology transfer.

The Smart Cities Exhibition & Conference 2015 presented new technologies which transformed today's cities into sustainable systems spending less energy and resources. The number of exhibitors was doubled. Distance street lighting management system, LED illuminators, Wi-Fi technologies, mobile ticketing service for public transport, ultra-compact electric vehicle, 'Smart House' software, etc. caught the visitors' interest.



The 2015 edition of Save the Planet proved its position as one of the business platforms in Bulgaria and South-East Europe. It presented new technologies covering the whole process of waste management: treatment, transport, collection, disposal, recovery and recycling.

LiftBalkans is a timely support of the vertical industry in South-East Europe. Its aim is to speed up the well-needed modernization of the stock of old lifts in the Region by presenting the latest products and services. As the only business event in this sector in Bulgaria, the biennial event LiftBalkans provides favorable opportunities for direct meetings between industry players.

Companies in this issue

Bulcontrola 23

Jaksa 2

LEM International 11

MachTech&Innotech 23

Microchip Technology 9

Prima 08 3

Rais 17

SAT ..... c. I, 21

Via Expo 28

WIN EURASIA Automation 19

WIN EURASIA Metalworking 7

Exhibitions & Conferences for South-East Europe
5-7 April 2016, Sofia, Bulgaria

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