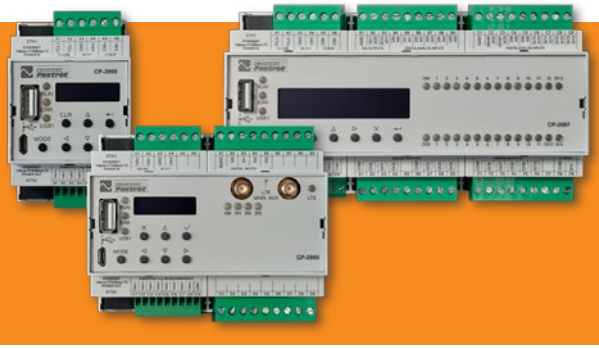
Newsletter for Teco system users

March 2019

40

TECO Info

Foxtrot 2 is coming



We are shifting into a second gear!

Foxtrot 2 is coming

and One hundred years in a new building

Two events which occurred this year are the dominant news in the fortieth anniversary issue of TecoInfo newsletter. We have stayed for one year in our new building and were able to confirm correctly that foxtrot systems are able to maintain high-quality environment inside the building both during scorching summer temperatures and during freezing weather. Our building is located on our own land and covers half of its energy demands from own renewable resources. In our new building we shall celebrate the hundredth anniversary since the first company, which manufactured electronic components, was established in the town of Kolín in the former Czechoslovakia. Thanks to Teco a.s. twenty-five years ago we were able to continue with this great tradition and are very proud of it. We were able to continue seamlessly and actively focus on the development of our new products, which have proven to be very successful, and hold a strong position in the front line and in a violent and highly competitive world of trends that dictate the direction and push high speed development of electronics, IT and telecommunication systems. As a product-oriented company would like to celebrate the hundredth anniversary with a new Foxtrot product completely innovated and simply called Foxtrot 2. This new product was genetically modified using DNA of its predecessor but surpasses its old friend significantly in almost every aspect. TecoInfo 40 newsletter wants to demonstrate again, using references and sample projects, the universal application and abilities of all our Tecomat systems to cover wide spectrum of uses and projects. We are walking this road with a great confidence and keep pursuing perfection.

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HUNDRED YEARS
IN A NEW BUILDING

The historical roots of Teco company gave us an overview of the company predecessors and how individual companies continued and seamlessly built on the tradition of the previous ones. These were already mentioned in our previous reports using dry data and describing the important milestones. However, this time we celebrate the hundredth anniversary of the establishment of the first electro-technical company in Bohemia by Bohuslav and Karel Prchal but this time let us browse through the history using graphic images as well. We were able to find several pictures thanks to Jaroslav Pejša who works for the Kolín city archive.

Fig. Another building where B.K.Prchalové & spol. worked. They built it and moved in around 1921. the photograph is from 1930. This building may still be seen today. It is located on Benešova street 245 and is known as the "Blue point".

Fig. the building located in Havlíčkova 260 street was purchased by the Prchal cousins through bankruptcy proceedings. This building used to be a shoe factory. They moved all their operations into this building in 1932. At that time the company was called Prchal, Ericsson & spol.

Fig. the company founder – Bohuslav Prchal. On his fiftieth birthday a magazine called "Polabská Stráž" published in 1933 in an article covering the entire page together with many interesting photographs. Bohuslav started in 1919 with his cousin Karel in a small shop in Tyršova Street.

Fig. By merging with L.M. Ericsson Telefonaktiebolaget in 1 January 1921, the Czech company bought the majority of shares which gave the company an option to manufacture "patented well-known systems and automatic telephonic apparatuses and switchboards following the Ericsson model". the add is from 1937.

Fig. After 1945 the company was nationalized and until 1993 the company was known as Tesla Kolín. The original building No. 260 was newly marked as M1 and underwent several reconstructions.

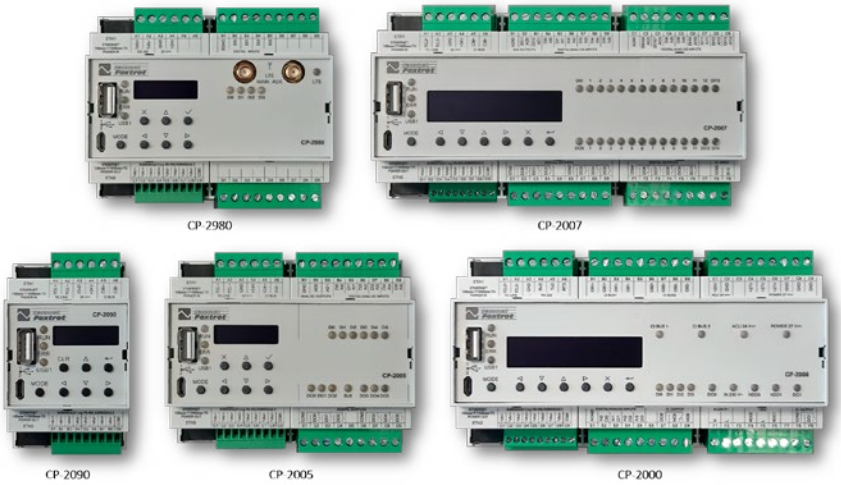
Fig. During the existence of Tesla Kolín the company on Havlíčkova 260 street expanded and two new buildings were built. In 1975 the new tall building M6 was completed (on the left side) where electronic products were assembled. During its most successful years the Tesla Kolín employed approximately 2, 500 employees in all their branches in Czech Republic.

Fig. Between 1993 and 2017 Teco a.s. resided in rented spaces (fist and fifth floor) in the M6 building and remained there for 25 years. the number of employees kept steady around 85 people.

Fig. the new building of Teco a.s. is approximately 1.4 km from the old one towards the east in the industrial zone called Šťáralka. the drone view shows that this factory was literally built on a green field and it took only 8 months. Even though the building looks like a silver technical piece, the building is actually green. This is because the building covers 50% of its energy needs for heating and cooling from renewable resources. There are twelve deep drilled wells on the land. Even the rain water collected by the building roof goes to reservoirs below and it is used to water greenery or to flash toilets. the building became fully operational at the end of November 2017, three weeks after the staff moved in.

Foxtrot 2 – We are shifting into a second gear!

In March at the Amper 2019 fair we have introduced a new generation of programmable systems from the Tecomat family. A new star of automation is rising and shall remain shining for the next decade. Many new programmable automats, which have been coming from Kolín since 1976, are already regarded as the eleventh generation. As for the Foxtrot family we only have the number 2. Why our new Foxtrot defers from its predecessor only by the number? Over the past twelve years of our existence and with almost forty thousand Foxtrot system installed all over the world Foxtrot name has become an icon and a standard of quality but it is mostly seen as a reliable and well-tested automation tool with an architecture which offers great future perspective. Foxtrot only reached a stage where we needed to increase its performance little bit, and that is all. Even though the media or professional lobbying try to assign to each term the number "4.0" to suggest that these products belong to the fourth Industrial Revolution as announced sometime before by the German government, we simply adding the number 2 to our Foxtrot family, which stands for a second generation. At the same time Foxtrot is an ideal standardized and basic building block for various solutions used by the "new movements" such as the Industry 4.0, Internet of things and the Smart trend, which includes smart houses smart cities and in particular smart grids.



The new Foxtrot 2 offers an elegant solution for problems that the new era presents and which need to be solved by electrical fitters, system integrators, project designers and programmers. These systems must communicate both with subordinate devices as well as over the Internet and they must be able to do so safely. the number of interconnected devices is increasing, for example voice controlled devices, and also the number of various models from different manufacturers is increasing as well. This also includes the number of used protocols and even creation of new ones, which are being quickly standardized. IT technologies and telecommunication are literally invading quickly and vehemently all electrical systems and devices.

Basic modules of the new line start with the number CP-2000 and the first "wave" offers five options. the basic feature of the new generation is full compatibility of application programs with the current first-generation of Foxtrot systems and full compatibility with all current expansion modules using TCL2 and CIB (Common Installation Bus™) buses. the new properties may be described briefly as follows:

- Completely redesigned and optimized firmware architecture
- New processor platform and operating system with performance scalability potential using multi-core processors
- Two Ethernet adapters
- Additional two USB ports
- New smaller sub-modules with optional communication interfaces
- Four-line text display available with seven keys (pushbuttons) in all models
- Models available with built-in Wi-Fi adapter
- Models with built in LTE modem allowing direct connection to wireless Internet
- Basic data storage of 128 MB with journaling file system implemented in the motherboard, micro SD card is optional feature for additional storage
- Increased number of variables on a single website
- PLC instruction processing speed has been increased ten times
- Memory for application program has been increased to 1 MB which represents three or fivefold increase
- New system websites
- Increased cyber security by increasing the number of used and secured IP protocols, mainly https
- Full communication compatibility with Teco Route service
- IoT protocols MQTT, REST API interface
- option to access the file system in PLC – as a network drive
- PLCComS, Avahi, Samba and FTP services integrated in firmware

And now let us explain individual improvements in more detail. We shall start with those that are visible immediately.

CP – 2090; the smallest Foxtrot 2 is half the size

The CP-2090 model has been "stripped-down". There are no integrated inputs and outputs. the reduction in the size of the new central unit allowed us to make Foxtrot smaller. the final module on the DIN bar take space of three modules

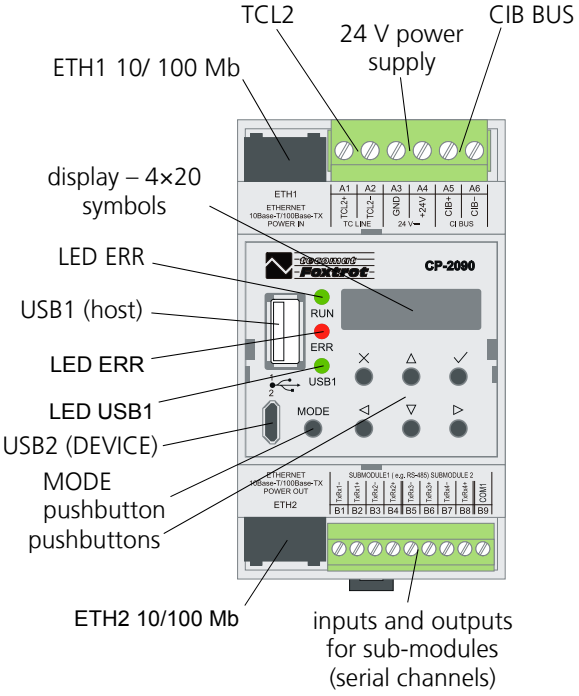


Fig. 1 Layout showing the distribution of elements on the smallest PLC in the new line Tecomat Foxtrot 2

only and it is the smallest PLC in this category. It may be used as a compact and universal communication node equipped with up to four serial and two Ethernet ports, but it may also serve as a central unit for a modularly built PLC because it also carries masters of both expansion system buses. the speed of TCL 2 dictates the speed of the installation – CIB (Common Installation Bus™). This small size of our system is also a response of the manufacturer to the ever increasing number of installed systems where Foxtrot is used mainly for its universal and unique programmability of communication channels. Therefore, Foxtrot becomes a programmable converter of communications occurring between the various devices and protocols where direct inputs and outputs are not needed.
The new feature offered by the smallest module is also available on all other larger central modules with integrated inputs/outputs (I/O).

2 Ethernet ports

When compared with the current Foxtrot the RJ45 connector for Ethernet is no longer part of the front panel. This connector is now available together with the other connectors arranged in the upper row all the way in the left. An important functional improvement is that another Ethernet port was added, which is located in the lower row of connectors. Foxtrot 2 can therefore be used on two different LAN networks. By moving the Ethernet port from the front panel to the row with other connectors we also eliminated the undesired bending of the network cable by the door of certain distribution cabinets.

2× USB – device and host

One Ethernet port was removed from the front panel of the Foxtrot 2 but another USB host connector (type A) was added. It is used for the connection of a typically external device – a flash memory or other miniature devices sharing this type of connection such as Wi-Fi or Bluetooth adapters. Also micro USB connector was added which shall be primarily used for direct and quick connection of Foxtrot via cable to a service computer running programming environment Mosaic. This eliminates the rather time-consuming process of setting the correct IP address and new Foxtrot may remain connected to LAN network even during the programming process.

OLED display and control buttons

Each basic module Foxtrot 2 is equipped with four-line display and with seven pushbuttons used for basic visual communication and user settings without the need to connect to a computer. Even though the display is rather small the resolution of 4 x 20 characters is sufficient and provides a clear and legible view which may be used to diagnose and configure the system or as typical user interface display used for configuration of the application program.

From SD card to micro SD card

Another visible modification is the absence of the SD card slot, which used to be on the left side. Thanks to the miniaturizing process, but mainly based on the trend which no longer fancies older external storage media, the new Foxtrot is fitted with a holder for microSD card (microSDHC and micro SCXC card), which is available for use when the cover is removed. the new system utilizes this card only as the extension of data storage. As for user websites, which had to be stored on the SD card in the first generation of Foxtrot systems, the second-generation has the memory directly in the chip which is available in each central model as a standard feature.

New sub-modules with interface

Thanks to the fast-progressing process of miniaturization a new generation of sub-modules was developed equipped with interfaces for serial channels. This smallest model has four of them. This made the base and the height of the module smaller and allows you now to install them on the other side of the circuit board of the programmable controller where the soldering connections are done (see the picture below). A single sub-module may be equipped with one or two interfaces allowing you to configure the basic module either without serial channel, or gradually using one, two, three or four serial channels. RS-232 and RS-485 interfaces are ready for the first phase.

CP-2005, CP-2080; Foxtrot 2, a six-module width equipped with built-in 4G /LTE modem.

Foxtrot has been fully integrated with the Internet since 2007 when also the world's first smart phone had its premiere. This integration proved to be a well thought decision as it gradually became a standard feature for system integrators and end-users, similarly as the smart phone has become an inseparable part of our everyday lives. Internet of things (IoT,) hugely supported and glorified by the media together with a massive development and availability of fast mobile Internet further supported the decision to equip PLC with Web servers and with freely programmable integrated websites used as the communication interface of the future. the new Foxtrot 2 reflects this new trend by integrating LTE modem into its basic model. Not into the smallest model where there is no room to install antenna connectors but for the six and nine module series. LTE modem is an optional feature which needs to be specified during the ordering phase and cannot be added to modules already ordered without the modem, because the layout of the front panel is different when used with antenna connectors. the first six-module option which may be ordered with LTE modem is the CP-2005 which is equipped with six universal digital/analogue inputs, six relay and two analogue outputs matches the current CP-1005 model and has been designed to fully replace it. Another model in this size category is the CP-2080 equipped with

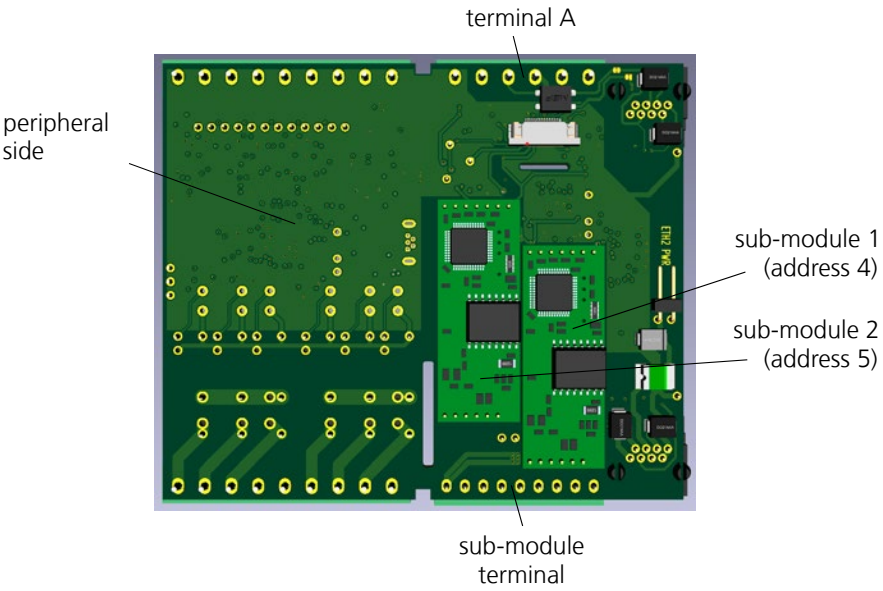


Fig. New sub-modules with interface showing serial channel ports (light green modules) which are installed on the back side (the "peripheral" side) by simply pushing the module into the circuit board.

a combination of four counter inputs, six relay and two transistor outputs with PWM modulation option.

CP-2000, CP-2007; Foxtrot 2, a nine-module width

The first group of five modules in the new Foxtrot line also offers nine-module variations of the CP-2000 unit with the same number of inputs and outputs and two master CIB with full power supply for both branches, which is the same as in the original CP-1000. CP-2007 is fitted with a new combination of I/O with 14 universal DI/AI inputs of which four may be used as quick counters, and one input which detects the presence of 230V AC. On the input side there are eleven relay outputs (3 A) and up to 2 analogue outputs, which may be switched to wide modulation PWM at 24 V level. There is also an option to use a jumper to turn two universal inputs into two analogue outputs to use applications which require the previous generation of CP-1008 unit which was equipped with four analogue outputs.

Conclusion

The first information about the new generation of control system Tecomat Foxtrot focuses on the hardware and on the "visible" changes. There are many more details in terms of software and firmware which will be most appreciated by programmers whose tasks today is not only write and debug the application program but also communication of the programmable controller with peripherals and with the Internet. Such functionalities could be described in several future articles. This information will be available to the public at the Roadshow event which is currently being prepared by Teco company and shall start in April and last until June 2019. Please keep checking our website www.tecomat.cz for additional info.

Ing. Jaromír Klaban,
Teco a.s.

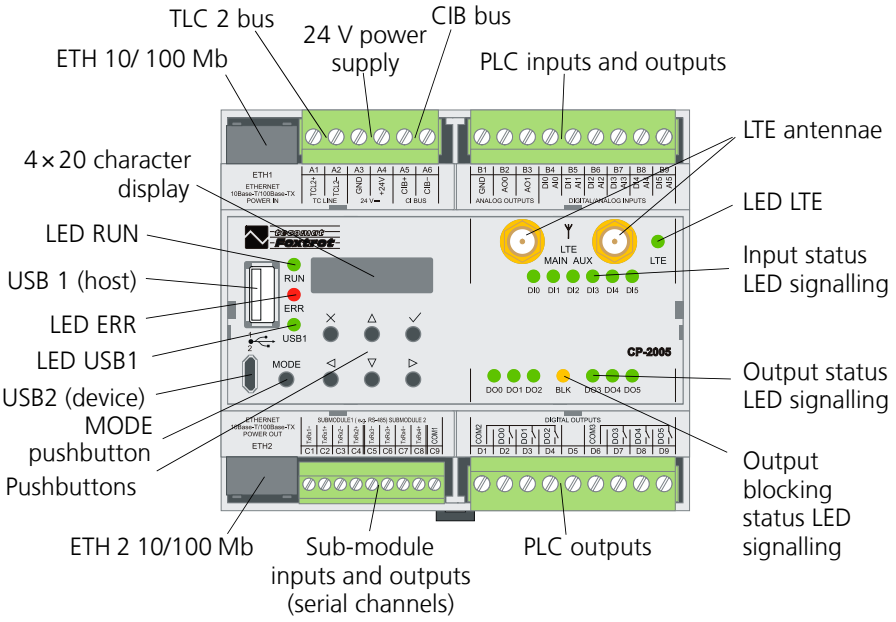


Fig. Layout of elements on PLC panel including LTE modem.

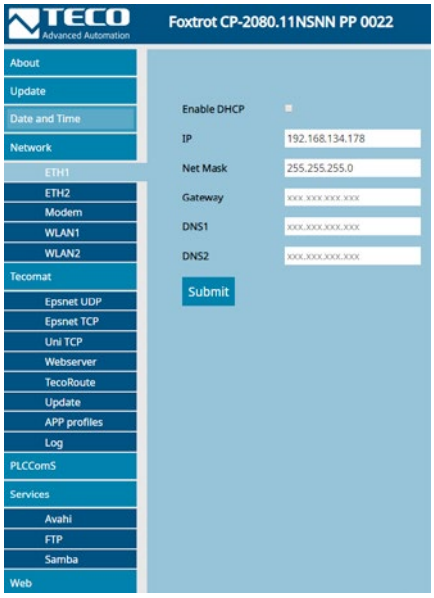


Fig. For experts we have prepared a "taste" of the drop down menu of the system website to demonstrate the wide range of functions supported by the new Foxtrot system.

RFox wireless modules

With the introduction of the new line of Foxtrot 2 we have decided to innovate the group of wireless modules of the RFox series as well. the current system was based on sub-deliveries of radio modules which are no longer available and their new versions does not allow full reverse compatibility of functions based on which the RFox is built. With the new RFox 2 line we have implemented an innovative feature to maintain the compatibility of the radio network for at least the next decade. Of course both systems, both generations may be combined in your installed applications where each network uses its own master on TCL 2 bus. You may even expand your system using the original RFox with new RF modules by simply adding the new RFox 2 master or modem on TCL 2 bus. Like the previous version also the new version works in unlicensed band of 868 MHz.

The picture shows the starting set of modules ready for new network.

SC-111-A is a communication module – modem which turns wireless protocol into TCL 2 system bus protocol so data may be processed in the main loop of the application program. R-JC-0201B-A is a module used to control blinds by means of AC motors using the so-called three-point control system: open – rest – close. It may also be used for three-point control of other devices, for example for valves. It is also suitable to control switching process of inductive loads. Permanent current in each output is 16 A and outputs use insulated wires 100 mm long. the module is equipped with two binary outputs and it is powered from regular 230 V AC power grid and it is designed to be fitted in an installation box.

R-LC-0202B-A is a module with two independently controlled relays each with switching contact used to control capacity loads, usually LED light bulbs and power sources for LED lighting systems with large inrush current up to 800 A for no longer than 200 µs. It is also suitable to switch inductive loads where the permanent current at each output is 16 A and outputs use insulated wires 100 mm long. the module is equipped with two binary outputs and it is powered from regular 230 V AC power grid and it is designed to be fitted in an installation box.

R-OR-0201B-A is a module with one relay and one switching contact. (NO, NC) for switching capacity loads such as LED light bulbs and power sources for LED lighting systems which short switching current of

SC-1111-A

R-SL-0201L-A

R-IT-0500S-A

R-OR-0201B


R-HF-0101F-A

R-JC-0201B

R-LC-0202B

80 A for no more than 20 ms. It is also suitable for switching inductive loads and for single phase socket switching; the permanent current through each output is 16 A and outputs use insulated wires 100 mm long. the module is equipped with two binary outputs and it is powered from regular 230 V AC power grid and it is designed to be fitted in an installation box.
R-SL-0201L-A is a module primary designed for wireless remote control of public lighting systems with LED dimmer ballasts. It may also be used to control the brightness of other similar LED lamp ballasts.
It is equipped with one relay with a switching contact. Permanent current through output is 16 A. the circuit is equipped with a current sensor which validates error statuses at the output of the ballast – the LED chips (interrupted circuit, short-circuit). To control brightness the module is equipped with PWM output which controls the relevant input of the ballast. the module also has two universal AI/DI inputs and it is powered directly from 230 V AC power grid. It is designed as a flat plastic unit to be attached to DIN bar. All terminals are designed as screw-less connections.
R-IT-0500S-A is a built-in module with a protection in a shrinking tube with no fault binary inputs (DI) and one temperature sensor. the temperature monitoring interval is activated with a jumper. This module is suitable for example for monitoring standard wall-mounted buttons or other devices with contact output. It is powered from a replaceable lithium battery CR2450. Outputs are designed as screwless terminals.
R-HC-010F-A is a motorized head for proportional/gradual (0–100%) control of heating units or similar valves. the module is powered by two standard AA 1.5 V batteries. the internal temperature sensor is in the cover.

We are currently preparing other modules
R-WS-0400R
R-WS-0200R – pushbutton controllers sharing the Logus design, battery powered unit R-RQ-0200R – Internet air quality sensor
R-DM-0201B-RLC – single channel dimmer with phase control 230 V AC
R-RC-0011R – interior controller – LCD display with touchscreen control and powered by battery

Grid Eye – matrix with 8×8 temperature sensors also available with CIB bus

Panasonic Electric Works has introduced a detection sensor called Grid-Eye. It is a product with parameters that significantly exceed the standard parameters of other presence detecting devices. It is equipped with 64 detection elements which are arranged into a square matrix (8×8), which may be used for wide variety of uses. Teco a.s. has integrated this innovative and universal sensor into C-IF -6400R module and therefore all data provided by the sensor are available through two-wire CIB bus.
For example, system integrators working with Foxtrot may now use a wider spectrum of sensors capable of performing contactless and static measurements of wall or ceiling temperatures at the same time while covering large areas. Grid-Eye is based on MEMS technology. Unlike regular conventional temperature sensors which measure the temperature of only one point, Grid-Eye is able to measure temperature individually in 64 measuring points. Thanks to silicon lenses it actively monitors 60° angle and is able to precisely detect not only presence but also movement, speech and direction of moving objects. It monitors the detection zone ten times in a single second. Grid-Eye is able to see objects within wide temperature range starting with – 20 all the way to 100°C.

Fig. C-IF-6400R module is supplied in a plastic casing allowing installation onto the ceiling for example. It monitors the presence of persons below the sensor. It uses the application program which deals with the point metrics allowing you to deduce a lot of information. For example, the presence of the person, direction where the person came from and where the person is going, the number of persons including the direction of their arrival or exit.

QR code will take you to YouTube page where the function of Grid-Eye sensor is explained.

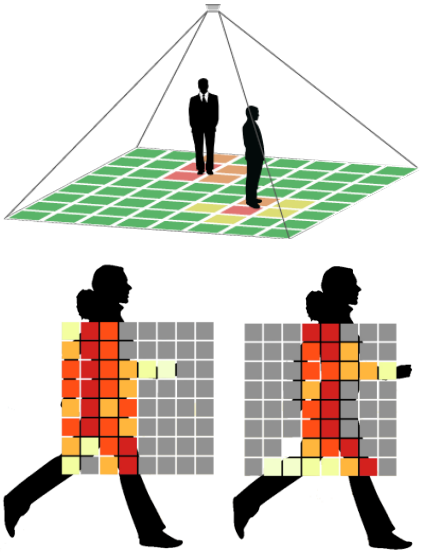


Fig. 60° angle of view of the new matrix sensor

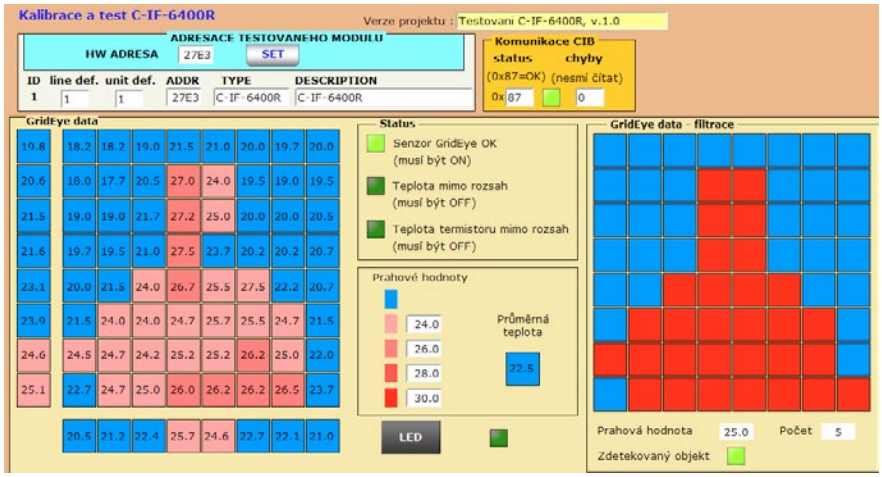
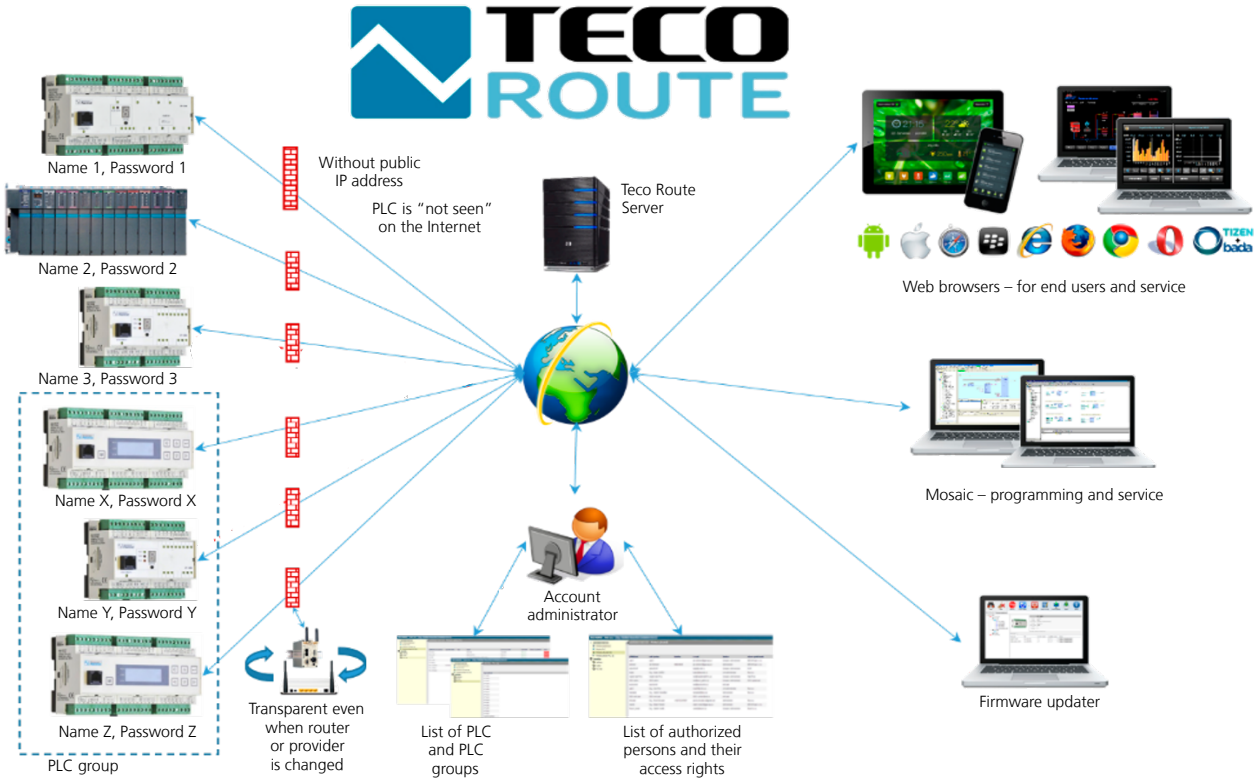


Fig. A sample project of the application program with thermal visualization at the Foxtrot website and configuration of basic threshold values that are used to create the final images which are then compared with samples. Obtained data are dynamically stored in a data field where they are available through the application program. the program is individually configured and debugged for the relevant task and scene.

TecoRoute in 2019

Teco has developed a unique communication service called TecoRoute which is used to access inner web server and user websites without IP address. This service is unique because it does not require any external device and uses SW to solve the problem – under its own PLC Tecomat firmware both in the Foxtrot and TC 700 series. To register each PLC Tecomat with the TecoRoute service you must open an .... an administrator account. It is usually opened under a company name but it may also be opened as an individual account of course. Users registered to this account on one side of PLC Tecomat are assigned with a unique name and password which is required for the authorization process and the same applies to the other side – users with assigned name and password need to pass the authorization as well. the account administrator then assigns access rights and roles of individual users to individual PLCs or to PLCs divided into groups. This allows the user to access Tecomat the user websites through an Internet browser. A programmer may be allowed to access through Mosaic programming environment or to administer firmware through Firmware updater. Connection without public IP address allows you to safely integrate Tecomat systems into local networks where net-



work administrators do not want to expose local servers through the Internet. This also ensures that Tecomat systems ... are not seen by all robots which go through all IP addresses in cycles and try to attack unprotected users inside the local network. TecoRoute runs on https server under a certificate.
During five years of real operations TecoRoute service has become a proven, common and the simplest way used to remotely connect various devices to Tecomat. It does not matter if it concerns a house, machine or measured data concentrator or a computer, tablet or today the most commonly used device – a smart phone owned by almost everyone. the service is permanently maintained and developed. Recently, we have upgraded encrypted connection through S-tunnel, which further improved the stability of the service for https connections. We are currently preparing implementation of authorization through OAuth2 service.

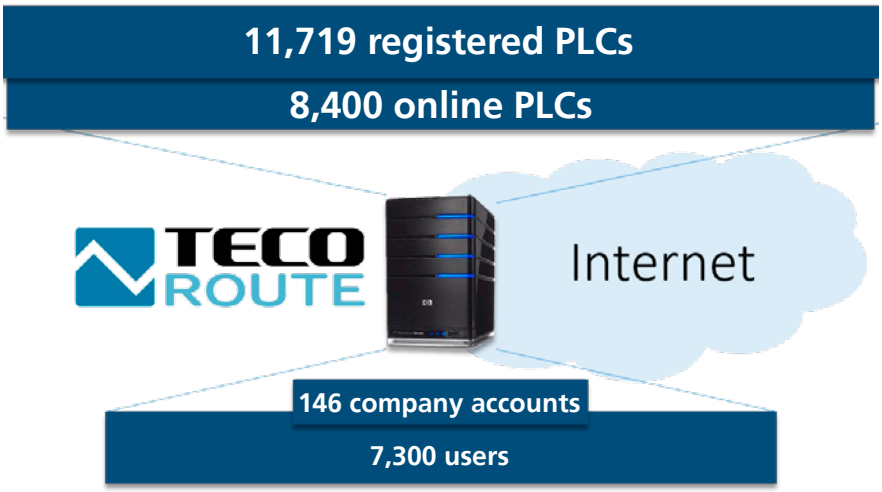


Fig. At the beginning of March 2019 TecoRoute service registered almost 12,000 systems/devices using Tecomats with access rights established for 7,3 thousand users.

Tecomat Foxtrot is available from Node RED programming tool

Node RED is "a visual tool used to connect Internet of things (IoT)". It builds on the Node.js platform originally developed by IBM. It is a very simple development environment used for creation of applications allowing interconnections between devices from the IoT world, API and online services. the Node RED tool may simply be run as a server on a regular PC, single board computer with ARM processor or in clouds. Editor opens directly in an Internet browser.
The principle of Node RED tool is based on data flow between functional nodes where each node performs a specific function. Thanks to the interned community gathered around Node RED a wide range of functional blocks is available through integrated palette. You may select from various blocks performing many functions necessary for the IoT world. Functions may also be defined directly through JavaScript. the increasing popularity of this tool helped Teco a.s. to develop its own set of functional blocks which will be available through official Node RED palette and which may be integrated into Foxtrot system. Just use the pallet search engine and enter the word "foxtrot" and the system will immediately offer a package ready for installation (the full name of the package is: node-red-contrib-foxtrotnode). the package offers two types of functional nodes – foxtrot input (provides data from PLC to Node-RED) and foxtrot output (allows you to write the data from Node RED to PLC).

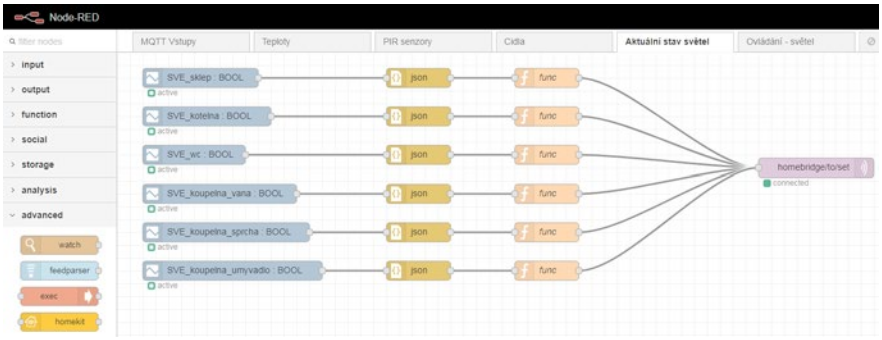


Fig. A sample showing how to use Node RED functional blocks to connect lamps controlled by Foxtrot into HomeKit platform made by Apple.

The principle of communication with PLC is based on the use of proven communication server PLCComS. As for Foxtrot of the first generation you need to have this PLCComS installed and running on external hardware, for example on the same hardware where the Node RED is running. the new Foxtrot 2 already has this server fully integrated in the firmware and therefore communication may go directly to PLC. the use of PLCComS server offers additional options such as the ability to see live pictures provided by Foxtrot inputs and outputs directly in Node-RED.

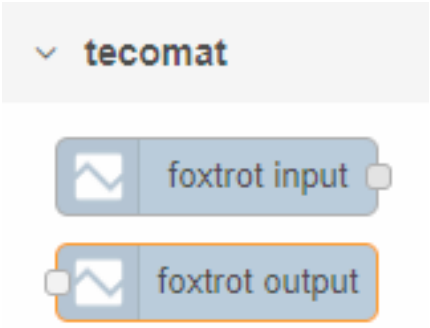


Fig. Input and output blocks are offered together with other options in the Node RED palette.

The use of signals provided by Foxtrot directly in Node RED is therefore very easy. Each time you install a functional block you specify the PLCComS server to which the system shall connect, and from the list of published PLC variables you select the one which shall represent the node.
The Node RED tool offers another option how to connect system Tecomat Foxtrot with technologies and devices which

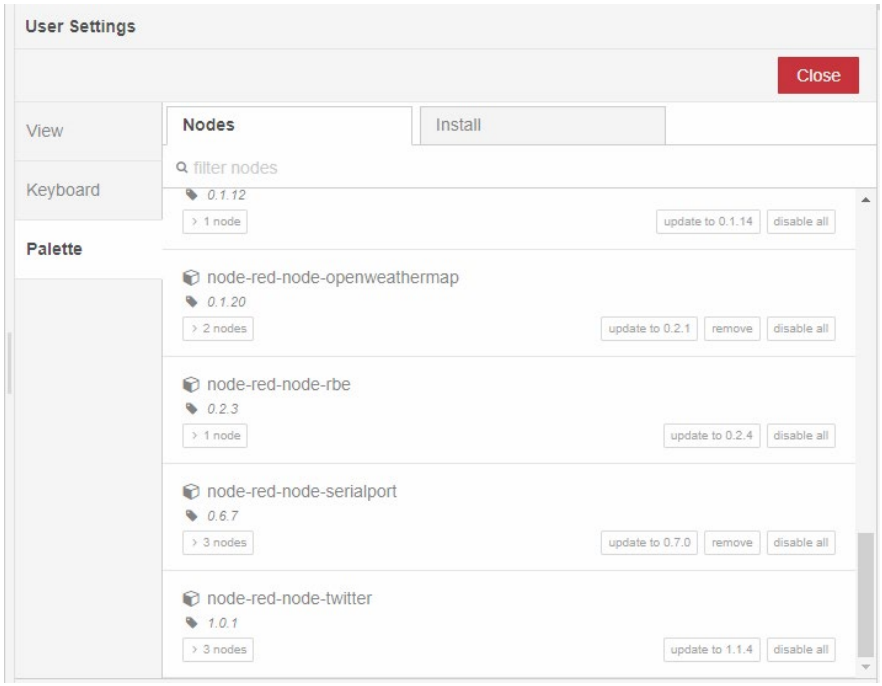


Fig. Integrated Node RED palette with complete functional blocks

would be rather difficult to implement using standard programming PLC tools.
Thanks to its simplicity and intuitiveness Node RED may also be used by beginners who are just making their first steps in the IoT world.
This integration is a great demonstration showing that Foxtrot does not stagnate and is not stuck in proven PLC standards but it is systematically maintained, upgraded and integrated with the intention to meet compatibility needs of new trends coming from the IT and IoT world, as well as from new telecommunication technologies.

Ing. Jan Martinec

Internet of things – Tecomat web server added with API

What is API? If you look in Wikipedia you will learn the following: "API – is an abbreviation for Application Programming Interface and, in the IT world, it refers to interface which is used to program applications. This term is used by software engineers. It represents a collection of procedures, functions, classes or protocols used by a certain library (but also by other program or by the core of an operating system), which may be used by the programmer." It is therefore a term and function which originated in the IT world and which solves or simplifies data exchange processes between applications which may run on PCs, servers or mobile devices. And because Tecomats, even though they come from the world of industrial automation and strictly observe IEC 61131 standards, are fully integrated into the Internet and follow compatibility requirements on IT technologies, and because of the implementation of MQTT protocol in 2017 Tecomat systems made another important step in 2019 which allowed them to support IoT. Web server of PLC systems Tecomat Foxtrot as well as TC700 starting with the firmware version 10.4 are also equipped with API interface TecoApi, which provides services allowing you to read and write data from/to PLC system using http protocol. Data are provided in the JSON format (Java Script Object Notation). JSON is a text format fully independent of the language and it is used for data exchanges. Additional information about the JSON format is available at http://www.json.org/json-cz.html.
Once you program Tecomat with this function you need Mosaic environment version 2018.1 or higher.
TecoApi interface is described together with samples in the TXV 005 37.01 documentation, which we used to provide a brief explanation of this principle:
Communication through TecoAPI is done through http protocol and it is based on the query/response principle. TecoAPI interface provides services which allow you to read and write objects from/to PLC system. the object which is available through the TecoAPI system may be any variable in the PLC program. All variables which are visible as objects through TecoAPI interface must be marked directly as {PUBLIC_API}. the PLC project must contain at least one website created in WebMaker and at least one access name + password for TecoApi service must be configured in WebMaker.

Even though there are faster transfers in the PLC and industrial automation world or rather in the IoT world, API interface is widely used and standardized also for communication with single-purpose devices such as meteo-stations, smart thermostats, smart light bulbs, various alarms, doorbells etc. where the volume of transferred data is rather small and delays in data transfer during processing are not critical.
Tecomat plays a similar role in the world of "Internet of Things", as it can use its own API interface to process any input or output signals from the controlled object, and based on the accepted data performs control activities which may be programmed by the user alone.
Thanks to this feature Tecomat units have become the first programmable controllers or units in the world with a natively built-in API interface and therefore have moved the imaginary border of traditional communication universality even further.
Tecomat has become an important player – node – in networks solutions used in Smart cities and Smart houses as well as for any application used by the Internet of things and in industrial automation which follows the Industry 4.0 trends and finally, everywhere where there is a need to interconnect several various devices and sensors, communicate with cloud databases while still maintaining their independence and autonomy – should the Internet connection be lost.

Library supporting the control of Xiaomi light bulbs

Xiaomi made a huge introduction not only with its mobile telephones but also with other devices such as LED light bulbs whose color shade or the temperature may be controlled through built-in Wi-Fi communication. Light bulb controlling is done directly from mobile phone application available both for Android and for IOS.

Motivated by a customer who installed Xiaomi light bulbs in his household and tried several available options and models from different manufacturers sold for different prices and who also verified the reliability and "controllability" has recommended LED light bulbs called Yeelight. We have streamlined his control functional block and converted it into a library called Yeelightledlib, which will be available for the next version in Mosaic. The library functional communication blog works above data structure and communicates through Ethernet IP protocol with up to 16 light bulbs on one Wi-Fi. the application program writes into this structure the following parameters:

- Turn on/off
- Brightness setting 0–100%
- Color temperature 1,700–6, 500 K

Fig. Yeelight light bulb has Wi-Fi built inside.

- RGB value – color adjustment in RGB environment
- HUE value – color adjustment in HUE environment from 0–259
- Saturation (0–100)
- Value entry method configuration (1 – RGB; 2 – colour temperature; 3 – HUE)
- Light bulb name which is stored inside the light bulb

Fig. Yeelight LED light bulbs may be controlled in parallel. You may either use the original application in your smart phone or you may now use Foxtrot and include your light bulbs into the logic control system of the entire house.

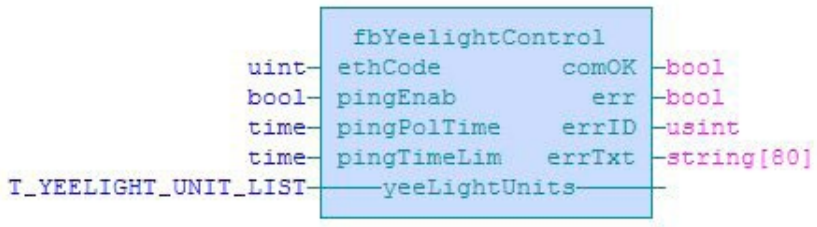
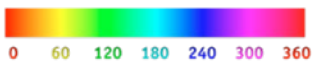


Fig. Functional block fb YeelightControl transfers the entire contents of data structure T_YEELIGHT_UNIT_LIST over Wi-Fi.

Color temperature control mode

HUE color control mode



Space color control mode RGB
0 -FFFFF (hex)

Fig. Yeelight light bulb may be controlled parametrically in three different modes

Measurements in a smart house with Tecomat Foxtrot

Assessment of energy consumption and operational economics

Measurements of various variables is an inseparable part of services and the actual control of a smart house. Sometimes people use the term (smart metering), which is not really accurate because the "smartness" does not lie in the actual measurement process but in the evaluation of the measured data obtained from the control system. Especially important is to measure energies in their various forms (consumed or produced electric energy, consumed gas and water). Also long-term measurements and assessment of temperatures and temperature curves is an important aspect of measurements done in individual rooms, including measurements of the outside temperature and domestic hot water temperature.

Measured data give the user information about the efficiency of the energy consumption as well as the cost needed for the operation of the building. These may be long-term data summarizing energy consumption over a certain time period (for example per day, per month, since the beginning of the heating season or for the completed heating season, or for the invoicing period set by energy providers) or providing information about the cost. Users may also be interested in the current consumption and what the current "money flow" looks like. This information is usually used for informative purposes only – it is not probable that the user will use this information to control the current consumption in the house, for example by closing windows, by lowering the heating system performance, by stopping shower, or by turning the light or TV set off etc. However, the measured data may help the user to control long-term activities and the behavioral patterns of people living in the household. These data may be used for example to modify the temperature settings in various rooms based on various times, to take a notice or realize that windows have been open for a long time etc. Summarized data are usually used to evaluate long-term status or as the essential information for "strategic" decisions, for example whether to replace the windows or install thermal sheathing around the house, or about changes or modifications in the building technical systems, boiler replacement, installation of solar panels, heat pump or accumulation reservoir for hot water, or to simply change the energy/utility provider.

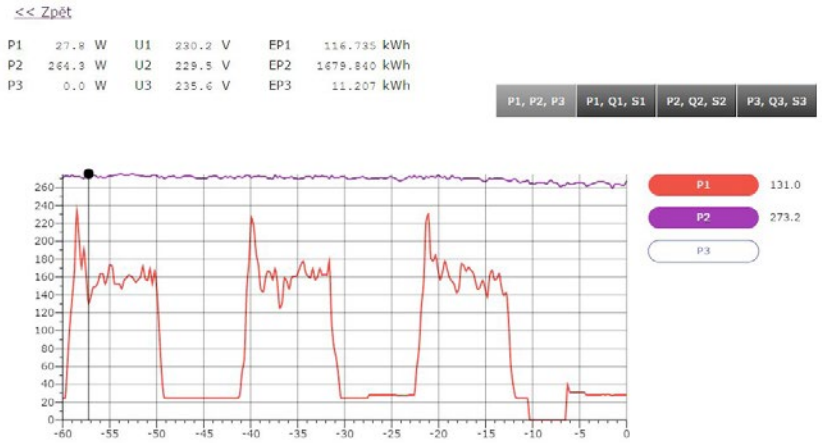


Fig. 1a Washing machine (red) shows the input of the washing machine, motor working for a short time when the machine is actually washing your clothes

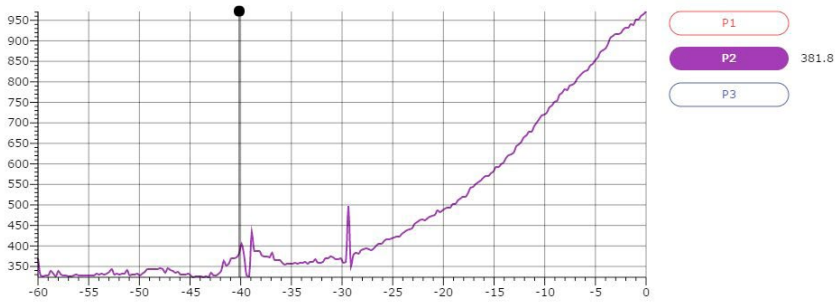


Fig. 1b Shows the start of the heat pump. Peaks between – 40 s and – 30 s correspond with the start of the compressor and the fan; then the heat pump starts smoothly and reaches a stable performance.

More sensors will give you more. Relationship between diagnostics and security

By performing a smart assessment of the obtained data in terms of the consumption and the status of the house you may get important information about your house and activities conducted by people living in the house but also information about the security/safety status of the house – alarms, warnings pointing to various risks or dangers etc. By monitoring the current consumption values in the house you may guess the occupancy level in the house or possibly how many people are in individual rooms. For example, nonstandard energy consumption in a house which was empty before may signal an unexpected return of some people living in the house, or it may signal a burglary or technical failure. Extremely high energy consumption may signal danger in the building or accident, for example broken piping, gas or water leak, shortcut or malfunction of a certain device or appliance. Unusually high values of consumption during night and during the monitored period (for example when the family is on vacation or during night), may also be seen as a warning. In addition, an increase in the temperature where there is no reason for the increase or constantly increasing temperature may warn you about a fire. On the other hand increased level of CO2 may just tell you that you need to open the windows. the value of CO2 or increasing amount of CO2 clearly indicates that the number of occupant in the house went up or that the number of people in certain room has increased or that the occupants perform certain activities.

More information makes data more credible and makes the final evaluation of data obtained through measurements of various and related variables more precise, or may point out to a certain change. For example, if you suspect a gas leak due to increased values in the gas consumption you may compare these findings with the increasing values provided by air-quality sensors. Similarly, you may evaluate the relation between unreasonably high temperature or the increase in the temperature in combination with data provided by smoke and CO2 sensors. Infrared sensor (PIR) is commonly used to control the lighting system. However, it may also tell you about the presence of persons in individual rooms and about the move-

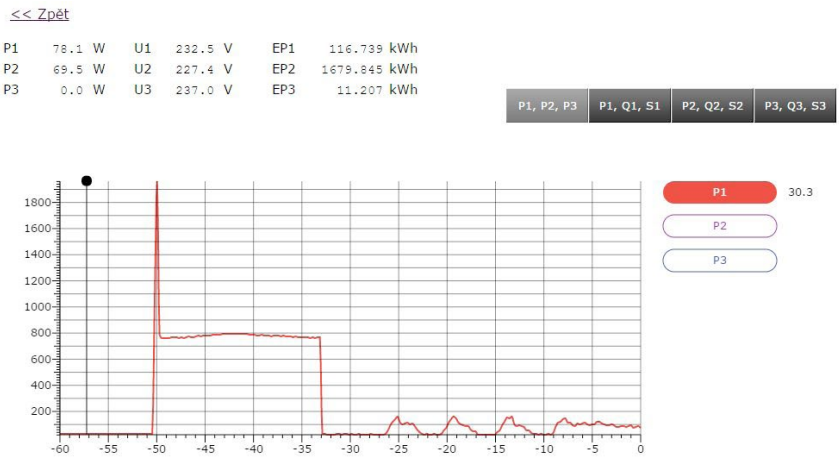


Fig. 1c Water treatment and the washing machine: the phase 1 shows that the start (peak) and then a stable run of the water treatment, small increases in time – 24 s correspond with the operation of the washing machine.

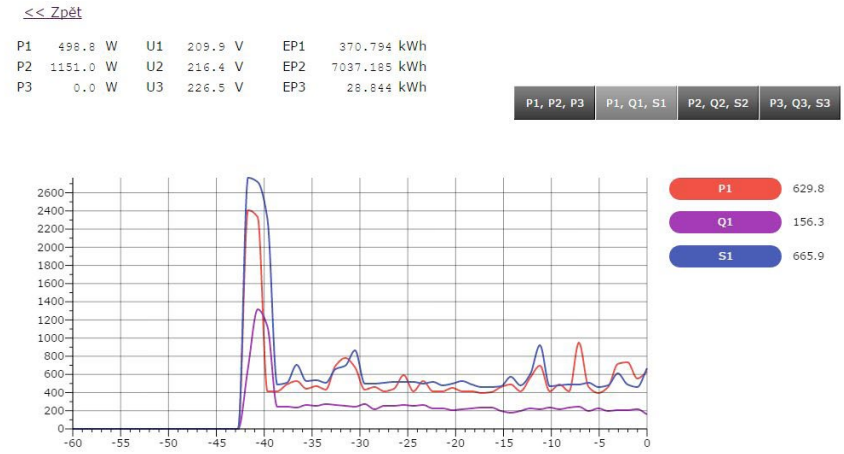


Fig. 1d Large lawnmower: start and then lawn mowing, active (P 1, orange), reactive (Q1, violet) and apparent (S1, blue) input of electrical lawnmower – start (peak) and then stable lawn mowing

ment around the building. Together with data provided by CO2 sensors you may guess the presence of people, the number of people or the activities they perform – even if the PIR sensor does not detect any motion. And finally, in combination with pictures provided by the camera you may even identify the relevant persons.

Also the electric power consumption may point out to the presence of people in the house. the summarized data provides only general information about the house status but it may be used to detect several information – in any case you may use the information pointing out to the fact that certain appliances are still active in the house and to make sure that you shut them down before you leave the house (for example still active baking oven or electric heater, active gas burner, running water). Using the consumption curve over a longer time you may deduce or guess the activities conducted by the house inhabitants – especially when you know the input of individual appliances (Fig. 1a – 1d). Measurement done at several locations (for example at various sections of electrical wiring, or possibly water or gas distribution piping), may reveal more detailed information which you may use to calculate and distribute cost among tenants and inhabitants of the house, or to simply quantify operational costs for various section of the building (for example for individual floors, separate sections of the building etc.).

Measurements and Tecomat Foxtrot

If the house or other building is controlled by Tecomat Foxtrot system made by Teco a.s. it may be used for applicable measurements, comprehensive evaluation of measured data and to create a graphic demonstration of the obtained results – not only in the form of text messages (for example alarm warning messages) but also in numerical form, but mostly for graphic representation of data. For example in the form of visualization diagrams demonstrating activities in the house and its rooms or in the form of diagrams showing relevant time curves. To do so Foxtrot system mainly uses tools offered by the Web server, which is part of each central unit. For more clarity of for more demanding presentations you may also use visualization tools and long-term archiving of SCADA data in the Reliance system. Communication features offered by Tecomat Foxtrot give you the option to remotely access data (for example through your mobile phone, tablet or PC), or you may even send data into a cloud and have them available for other calculation systems.

To conduct the actual measurements you may use sensors connected to inputs of the Foxtrot central unit and to expansion modules but also data from other modules (made by Teco or other manufacturers) which may be connected to the system using one of the standard buses. A suitable approach is to use modules communicating with Foxtrot central module over CAB bus (CFox system) or wireless radio communication (RFox system). Detailed descriptions of CFox system together with the recommended wiring and communication with the central module including its program is available in the following handbook: Peripheral modules on CIB – TXV 004 13.01, which is available for free download at www.tecomat.com. Using the same web address you may download another very useful handbook called CFox, RFox and Foxtrot – TXV 004 16 rev. 3d project guide. This is a very comprehensive handbook which provide descriptions of modules and measurements done in various fields and used in building/house systems and technologies such as heating, cooling and air conditioning systems, photovoltaic (solar) power plants, water heating, lighting systems and power socket systems, window blinds or window shad-

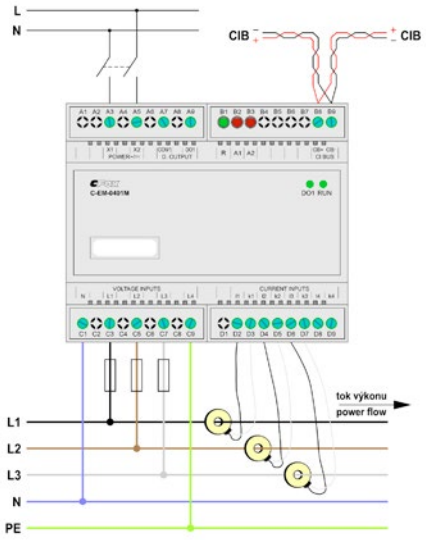


Fig. 2 Typical connection of the power meter module C-EM-0401M to measure three-phase circuit

ing systems, window and door monitoring, EZS and EPS (fire and safety systems), entry monitoring systems, communication/user interface systems and multimedia systems. Particularly important part is the description defining measurements of temperature, energy, non-electric values and monitoring of other values.

C-EM-0401M power meter module

To measure electric power you may use various modules and procedures described in the above handbooks. the assortment of the CFox bus series also offers power meter module and quality-meter module C-EM-0401M (Fig. 1). This module is used for remote monitoring of the electric consumption and the quality of electric power in the power grid. It is equipped with four inputs for voltage measurements, four current inputs and one relay output (protection relay). Current inputs are designed for connection of external current measuring transformers – solid core current transformers or split core transformers. the actual mechanical design corresponds with "distribution system" design 6M allowing installation to DIN bar. the basic module parameters are shown in Table 1, and the detailed description of all parameters is given in the handbook. Basic documentation for C-EM-0401M (TXV 133 22) is available at www.tecomat.com. Table 2 gives you an overview of data sent by power meter to the central module over CIB bus. the C-EM-0401M module was primarily designed for quick and accurate measurements of three-phase networks (generally, four single-phase measurements) – frequency, phase voltages, currents, active or reactive power outputs, efficiency factors, THD voltages and currents in low-voltage circuitry (LV). the measurement occurs within the range from 15 to 150 A, optionally also from 5 to 600 A. It is equipped with voltage and frequency protection used to control solar power plants (photovoltaic power plants and hybrid photovoltaic power plants) and cogeneration units. the power meter evaluates 128 samples for the period and sampling is governed by the frequency of the first phase. the measurement is done continuously without interruptions. the basic evaluation interval is 200 ms. During the same interval you may read via the bus the actual values of active power output for production and for consumption (under the source or appliance mode). If necessary, other values may be read by entering the relevant query commands. In addition to voltage, currents and active power outputs for each phase, the power meter also offers values of reactive, apparent, deformation and fundamentally active and reactive power output, efficiency factor, harmonic and total harmonic distortion (THD) voltages and currents up to the 63rd harmonic component.

Table 1. Basic parameters of C-EM-0401M module

Voltage inputs	
Number	4
(ULN) measuring range	6 ÷ 300 V AC
Measuring accuracy	±0,05 % of the value, or ±0,02 % of the range
Current inputs	
Number	4
Nominal INOM current	5 ÷ 250 A AC
Measuring range	0,0025 ÷ 1, 2× INOM
Measuring accuracy	±0,05 % of the value,or ±0,02 % of the range
Power supply from CIB	
Power supply and communication	24 V (27 V) from CIB bus
Maximum power draw	15 mA
Auxiliary power supply	
Range	based on type, 10÷275V AC/DC
Power input	3 VA/3 W

Table 2. Data sent by power meter C-EM-0401M to the Foxtrot central unit over CIB bus

Variable name	Format and range	Meaning
Frequency	32bit/real	frequency
ULN1	32bit/real	voltage 1
ULN2	32bit/real	voltage 2
ULN3	32bit/real	voltage 3
UN	32bit/real	voltage 4
I1	32bit/real	current 1
I2	32bit/real	current 2
I3	32bit/real	current 3
IN	32bit/real	current 4
cos(ϕ)1	32bit/real	phase efficiency factor 1
cos(ϕ)2	32bit/real	phase efficiency factor 2
cos(ϕ)3	32bit/real	phase efficiency factor 3
cos(ϕ)N	32bit/real	phase efficiency factor 4
P1	32bit/real	active power output 1
P2	32bit/real	active power output 2
P3	32bit/real	active power output 3
PN	32bit/real	active power output 4
Q1	32bit/real	reactive power output 1
Q2	32bit/real	reactive power output 2
Q3	32bit/real	reactive power output 3
QN	32bit/real	reactive power output 4
S1	32bit/real	apparent power output 1
S2	32bit/real	apparent power output 2
S3	32bit/real	apparent power output 3
SN	32bit/real	apparent power output 4

Several suggestions for the use of the power meter C-EM-0401M in a family house energy systems or in large buildings.

Single power meter module may be used to measure three-phase household network. the fourth input may be used for independent auxiliary measurement conducted on other single phase branch. However, this module may also be used to measure on four independent single-phase branches. If you need to measure several single-phase inlets you may use the CIB bus to connect several power meters to one central module Foxtrot.

The power meter C-EM-0401M shall not be used as a certified measuring instrument for cost invoicing. However, it may be used to divide the cost for electric energy consumption between tenants living in the building or to quantify consumptions used by several sections in a more complicated or larger building.

The speed of the measurement depends on the C-EM-0401M in terms of blocking the overflow going into the power grid. If the owner of the building is able to produce electric power (usually by solar panels) and does not possess a licence allowing supplies of electric power into the power grid, the owner cannot allow (not even short-time) overflows into the power grid. the power meter indicates the beginning of the overflow by changing the negative/positive mark before the measured output. the simplest (but the least suitable) solution is an immediate disconnection of the power source (solar panel converter). However, if we assume the use of a well-thought Foxtrot program which has the entire house under its control then the system may use the produced electric power properly for example, to supply the power to another appliance (for example a water heater, heat or cold energy reservoir), or to store the energy in batteries.

In buildings, where the price tariffs are dependent on the observance of the quarter-hour maximum (usually industrial buildings), the power meter C-EM-0401M may be used to regulate the quarter-hour maximum (for example by disconnecting suitable appliances or by using own resources, for example the batteries).

Similarly, you may reduce the input (power draw) of buildings (including family houses) to make sure that the tripping current of the main circuit breaker is not exceeded. To do so, it is usually sufficient to decide whether to allow or reject a request to start key appliances, or in exceptional cases, you may disconnect certain appliances or use your own resources.

Knowing the value of the immediate input allows you to optimize the price of electric power. At times when the electric power supplied by the power grid is cheap you may activate appliances able to conserve energy (heat accumulation heaters, electric boilers, water heaters, heat or cold energy reservoirs, swimming pools, washing machines), or you may store the energy directly in batteries. On the other hand when the energy from the power grid is expensive you may limit your power needs or consumption and supply the energy from your own sources back to the power grid. *Ladislav Šmejkal,*

Foxtrot controls the charging process for many electric vehicles

SThe number of increasing companies using a fleet of electric vehicles for short distance transportation purposes, up to 100 km, are seriously considering converting to the so-called electric mobility system, which of course, offers considerable fuel saving costs, simple maintenance while reducing service and expenses, easy management and operations and overview of the statuses of electric vehicles in the fleet. To operate such fleet of electric vehicles you need a robust and reliable charging network communicating with the control system and with individually coordinated recharging stations. But if you have a large number of recharging stations connected to one branch, then simple and insulated recharging stations will not do the trick. You need a technology which would allow you to safely charge large number of vehicles at the same time, and a technology which actively manages and controls priorities of each individual electric vehicle. You also need technology which oversees the amount of consumed energy used for vehicle recharging based

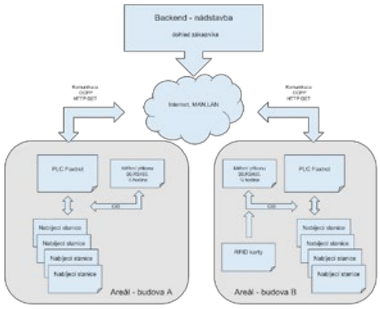


Fig. 1. A block diagram showing the recharging structure in 2 areas each separately invoiced and measured by a single power meter and supplied by a single branch which is restricted either based on the maximum current or based on the maximum reserved input expressed in the so-called quarter-hour maximum. Monitoring is achieved through online application.

on the actual need of the entire building or facility or based on the maximum capacity of the branch or possibly on other important criteria as well.
The request seems to be a simple one but if you consider the technical solution it does not appear so simple anymore. However, comprehensive and flexible system may be built on a uniform base offered by the Foxtrot system. Thanks to its modularity and flexibility of the interconnection topology and thanks to the variety of application programs, you may meet all requirements using one single system. You may start with a small arrangement and then extended it gradually and interconnect it with other systems, modify it and control it at several levels. For example, Figure 1 shows recharging stations in different areas or they may be in different towns where the first level of the recharging process is handled by our Foxtrot system alone.
Typically, this may be achieved by limiting the amount of charging current available for individual electric vehicles. This eliminates exceeding the maximum triggering current of the circuit breaker set by large power-drawing customers connected directly to the 22 kV power grid. the system provides electric vehicles with the maximum available electric power and controls it dynamically based on the actual power draw of the building or the entire facility. One may say that it smoothes out power peaks by suppressing the charging demands or rather the charging energy reserved for electric vehicles.
By installing Foxtrot system and RFID reader modules in each wall box you may achieve even higher level of control which will allow you to better prioritize charging needs among large number of electric vehicles or rather recharging stations. In addition,

Fig. 2 Each wall box is equipped not only with a circuit breaker system, but also with an power meter and with a module which communicates with the power meter, and with RFID reader connected directly to the Foxtrot central system.

users may use the RFID chip and identify themselves directly at the recharging station, connect the recharging cable to the vehicle and by doing so define priorities of each recharged vehicle. Identification data are sent immediately to the superior system for verification. the recharging process is either activated or not activated after the relevant access parameters are verified or the account number of the user is charged with a "priority recharging fee".

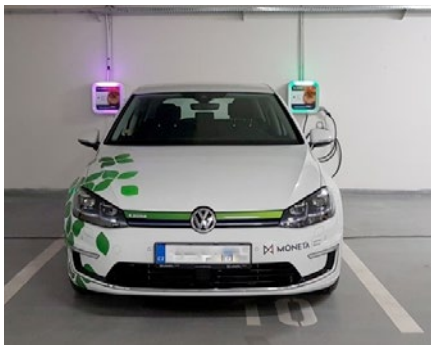


Fig. 3 Each parking space in the underground parking lot in Moneta bank is equipped with a recharging cable. the status of the recharging box is indicated by color LED indicator. All recharging stations are connected with two-wire CIB installation bus and are monitored online by Foxtrot using 150 ms clock tact. the current 36 parking spaces, each equipped with a recharging station, will be expanded in the near future to reach 100 spaces.

The first implementation of such robust recharging infrastructure built on Tecomat Foxtrot system was supplied by a company called PRE Měření during 2018 for the newly reconstructed headquarters of Moneta bank Prague. This bank not only publicly declares its intention to utilize green technologies but actually uses them in real life by a massive utilization of electric vehicles. This may be the most significant approach in the entire Europe. Teco together with Axomer have become the sub-supplier of the solution. Here, one basic Foxtrot module services all 36 underground parking spaces. Each parking space is equipped with a recharging cable and RFID reader. Foxtrot system is able to read (online) the immediate power consumption of the entire building right behind the distribution transformer, so the system knows at each moment how much power remains or is available for

Fig. 4 Parameters of each individual wall box in the interconnected arrangement are configured separately through online application.

the recharging process. This energy is then divided among individual electric vehicles and based on the current recharging needs and based on priorities of individual users / drivers . the installed infrastructure is based on two-level control structure. the basic level is controlled by Tecomat Foxtrot, that is by standard PLC which is independent of the higher control level and guarantees maximum recharging speed while making sure that the maximum limits are not exceeded.

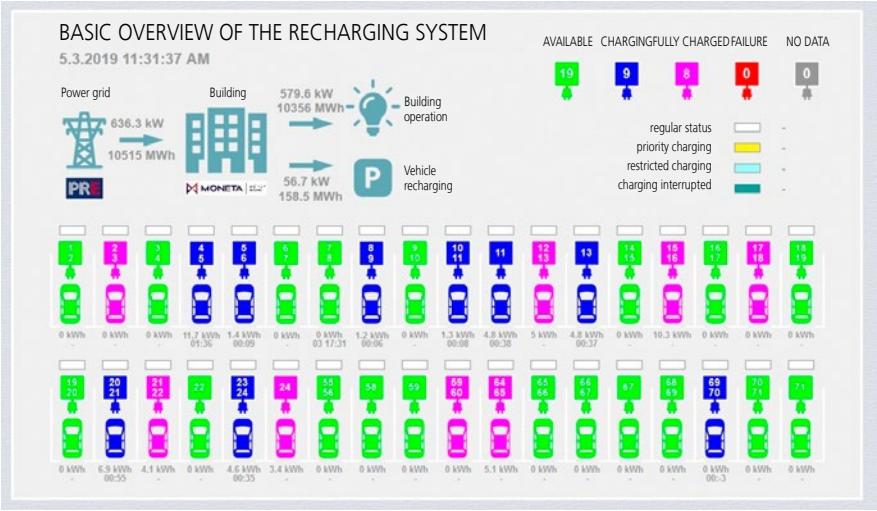


Fig. 5. the superior level of the recharging infrastructure controlled by Foxtrot represents a web application with a user interface providing an overall review about the current recharging. It also provides historical data and statistics of the use of individual parking spaces and may be used to manage individual users. It allows you to change relevant limits as required or based for example on the agreed and reserved input of the building.

Fig. 6. Parallel recharging process of the entire fleet of e-Golf vehicles is fully controlled by Foxtrot

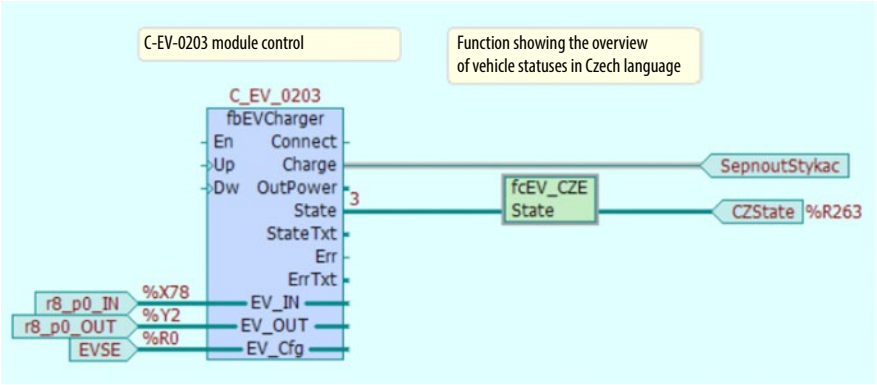
Each wall box has its own instance in the application program and its control loop, which is performed in parallel with all others. Each such wall box also has its own website on the integrated web inside the central PLC Foxtrot. There is a small interactive, configuration and overview menu available after successful login from any device running a web browser including a mobile phone of the servicing employee or the parking garage manager. All information about the recharging process is displayed together. Therefore, it is very easy for the monitoring staff to plan servicing interventions remotely for individual wall boxes or for the entire building. All data and changes are sent by Tecomat Foxtrot to the server. the web application serves as the second control level and works above these data and forms the basic user interface for the entire recharging infrastructure. the entire recharging infrastructure may be gradually expanded and connected with other local infrastructures built on Foxtrot system and installed in other building or even city. This will allow you to create a network of recharging stations which are automatically controlled/regulated to avoid penalties from the electric power distributor or to eliminate station failures and the customer may use this tool to save energy cost and to have an overview of all recharging processes at individual parking spaces, and finally, the customer may manage access rights to individual recharging stations.

Ing. Jaromír Klaban, Teco a.s.
Petr Postránecky, Axomer
Ing. Jindřich Nerad, PREměření

Electric vehicle recharging monitored by Foxtrot

With the fast development of the so-called "electro-mobility" there is a greater demand for infrastructures which is able to recharge electric vehicles. Thanks to the C-EV-0203 module connected via CIB bus you may control and integrate the recharging process into 22 kW /32A networks using Foxtrot system. When connected the module communicates with the vehicle charger. Therefore, you may read the statuses of the recharger installed in the vehicle from the module structure. To make the use of the module hardware easier we cooperated with Axomer s.r.o and prepared a functional recharging block for Mosaic which is a part of the EVcharger_lib library. Thanks to this functional block you may upload the program into the central unit C-EV-0203 (after translation) and use it immediately. the recharging process starts if it is required by the vehicle – after the charging cable is connected. As a standard, the initial recharging current has been set to 16 A (11 kW) but it may be changed or increased based on the installed system. In order to change the charging current during operation, that is to increase or decrease the value of the charging current, you may do so by using the Up or Dw inputs. the block displays information about the charging process and the State output which takes the value between 0 to 5 and by displaying a message using StateTxt interpretation.

This functional block further increases the functionality of the C-EV-0203 module and provides an easy solution for electric vehicle recharging stations running



Electro-mobility merges paths between Teco a.s. and Schrack Technik

We began cooperating with Teco twenty years ago by delivering basic components. These included mainly input relays for programming controllers (automats) belonging to the Tecomat series, but also safety components for distribution cabinets. the goal of Schrack Technik was to gradually move towards more complex projects and solutions. the first larger project occurred ten years ago when we cooperated on energy supply projects called Smart region Vrchlabí. Thanks to this cooperation we learned that Teco is our reliable partner even for additional sophisticated solutions. In 2019 we are increasing our cooperation even further. the so-called electro-mobility brought us even closer together, because this type of project require each recharging station to be equipped both with basic safety components (circuit breakers, protection elements, contactors), as well as with advanced control algorithms running on reliable hardware platform.

We have used OEM program offered by Teco where Teco included a recharging station PowerFox fitted with Schrack components. At the 2019 AMPER fair we shall together introduce recharging stations bearing the logo Schrack Technik. These are AC recharger built in a stand offering power output up to 22 kW/32A. This stand is designed to be included in an assembly of several recharging stations which are controlled together as an integrated part of a complex building wiring systems using Tecomat Foxtrot system. Tecomat Foxtrot handles dynamically controlled intelligent recharging process based on the currently available input/power at the relevant drawing point. This recharging station will also be introduced at our roadshow in April where we will visit various Czech cities.

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Public lightning and illumination system controlled by Tecomat Foxtrot designed for Smart Cities

Control system designed for public lightning structures using Tecomat Foxtrot is a modular solution allowing you to create any control structure and to reach the project objectives in a particular city or municipality or in industrial or commercial park. This system is suitable for new projects as well as for retrofit projects focusing on already built VO (PLS) (public lighting systems).

This system may also be implemented as an extension for existing wiring networks because it will establish remote communication and remote lamp control at individual light points (lamps) which are today commonly innovated by LED technology. It will also provide communication, control and monitoring using existing distribution boxes (RVO) which control the public lightning or illumination systems.

The system allows you to control the entire lighting system either

Centrally,

from your dispatch station consisting of individual PC stations or via LAN network. the actual control is done through an assembly of switching locations/points equipped with sub-stations Tecomat Foxtrot installed in distribution boxes of the public lightning system (RVO) with which the dispatch communicates either through the existing communication cables or wirelessly through private radio network, or through a network of a particular mobile operator. Sub-stations are equipped with a simple command interpreter to switch on the switching locations in RVO, either in the entire public lighting system at once or "branch by branch" or based on the "maximalist control version" where each lamp is handled separately. In such scenario, our Tecomat Foxtrot system is added with a cable or wireless communication module which communicates with each lighting pole.

Locally,

when sub-stations Tecomat Foxtrot are not connected to any superior dispatch system. These are installed in switching point in RVO and contain algorithms which are responsible for monitoring, switching as well as for the control of all subordinate light poles. the control is mainly done based on feedback provided by dusk sensors, which may be combined with other systems for example using astronomical clock or based on fixed mode or dynamic time programs. Under this concept no centralized dispatch is required. However, today it is beneficial connect sub-stations directly to the Internet and to be able to control each station remotely, for example for servicing purposes or when time synchronization with the network server is necessary. Under this concept, and again in the maximalist version, all light locations/light poles may be covered by this station and controlled wirelessly through RF.

Individually,

when the control of individual lamps under this concept is done using the Tecomat Foxtrot kit, and is actually identical with the maximalist local control system described above. This eliminates direct communication of each light location through paid public networks, which only offer access to each light location through a cloud. Tecomat Foxtrot serves here as a concentrator which is able to provide comprehensive control functions for each light location including archiving as well as presentation of all monitored data through a web interface. Each light location is equipped with R-SL-0201L module which monitors the current and the temperature of the LED ballast and also the temperature of the LED chip holder or the brightness at that location. To handle switching operation it is equipped with a relay for LED ballast switching and output for proportional control of light intensity from 0 to 100%. Variable design of the module may handle switching of static and dynamic control of two independents sets of LED chips – hot and cold temperature and therefore the color temperature as well.

The above specified individual control and monitoring works both in networks with where the power supply for the branch is disconnected during the day and also for permanent "all-day-long" power supply fed to all lightning poles constantly. In this situation the control works only when the power supply is connected.

However, today it is recommended that the all-day-long power supply is used for

Central monitoring:
Variants:
– SCADA visualization
– WEB applications
– City geoportal

Variants:
Data storage:
– Own server
– Cloud storage

Service:
Full direct access through a web browser

Simplified monitoring:
Full direct access through a web browser

Service may be divided between several authorized subjects

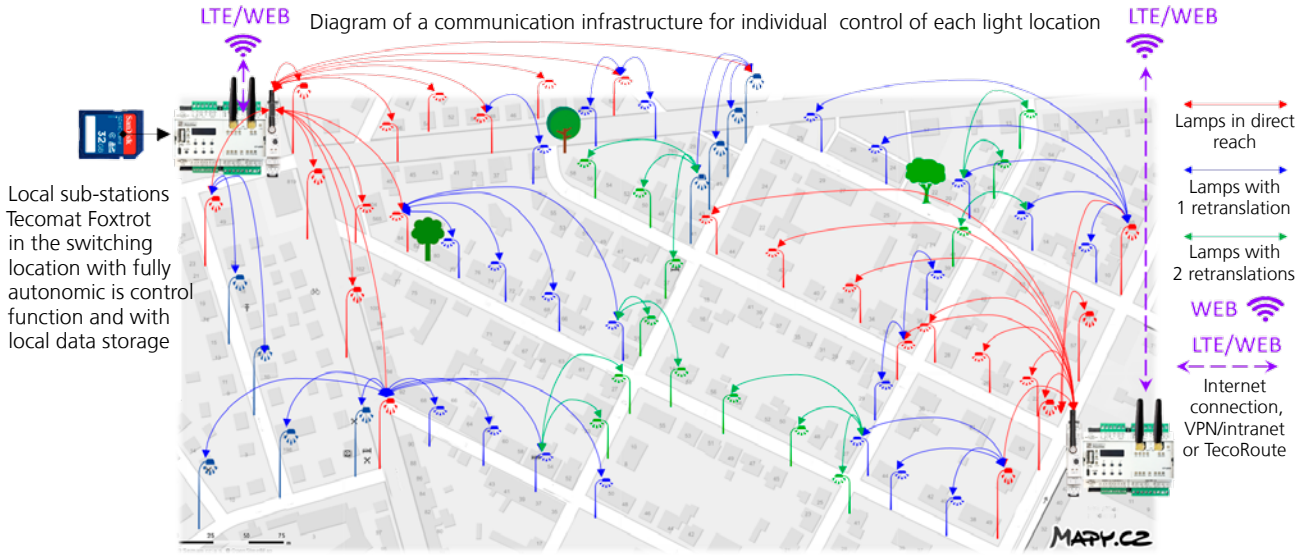

Fig. 1 Diagram showing connections and relationship between central, local and individual control of public lighting system based on Tecomat Foxtrot

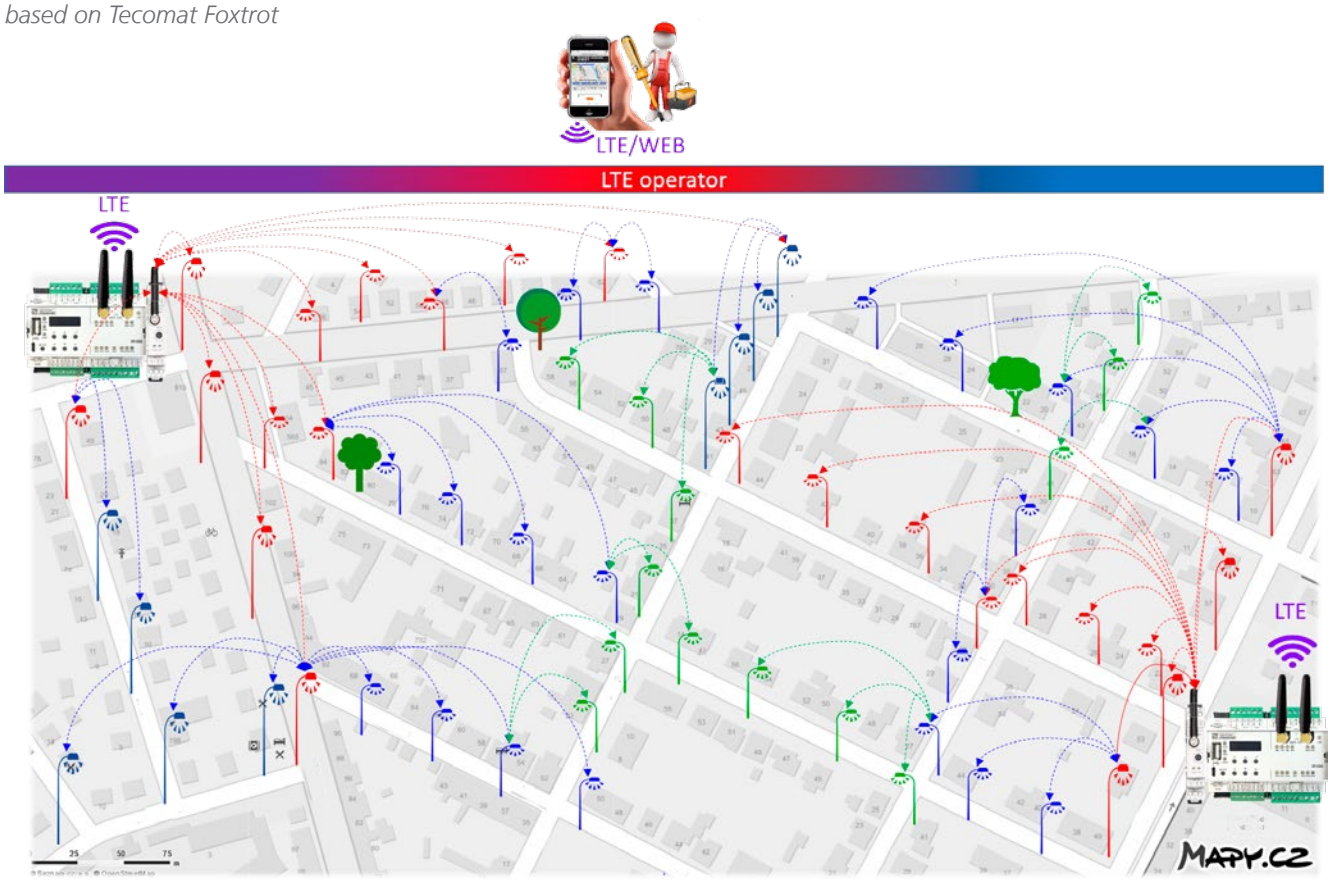

Fig. Diagram showing local control of public lighting system without central dispatch but connected to the Internet which allows remote service and access to each sub- station and to each light location / lamp.

Fig. the use of radio module R-SL-0201L with an external 868 MHz antenna installed on the lamp together with LED ballasts

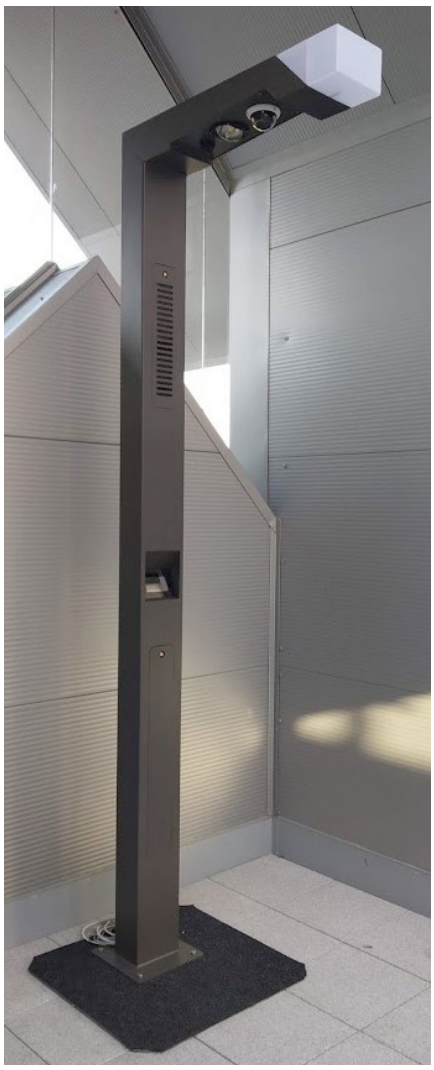

Fig. A sample showing integrated Smart lamp of the public illumination system with camera, electric vehicle charger and with air-quality sensors and with an integrated interactive display. the lamp is the result of cooperation between Kooperativa Q-EL PRO and Teco

each light location as this approach corresponds with the new Smart City trends when public lightning poles become natural carriers and supporters of other technologies offering all-day-long functions. In this regard sub-stations Tecomat Foxtrot are universal devices and these technologies may therefore be integrated and may communicate with superior levels and effectively utilize the already constructed an existing wireless or cable communication channels.

Technical properties of Tecomat Foxtrot control system designed for public lighting system:

1. **Individual monitoring and control of each light location – lamp separately.**
   - Wireless module R-SL-0201L has been designed for this function
   - To handle two-way communications with the central module it is equipped with a transceiver which communicates in the unlicensed bandwidth of 868 MHz approved in the EU. Each message is encoded for safety reasons.
   - The communication distance is several tens or even hundred meters based on the layout of the location. That means, the communication distance depends on how many buildings or trees are around, on the terrain profile, the actual weather, the density or rather on the number of additional users in the area utilizing the same bandwidth, etc.
   - If there is no direct "radio" visibility between the sub-station Tecomat Foxtrot and the light location you may introduce both-way retranslation using any other permanently powered R-SL-0201L module.
   - It is equipped with a relay output which switches or more precisely disconnects LED ballast and therefore eliminates so-called standby consumption during the time when the lamp is not on.
   - It is fitted with internal current measuring – passing through the primary LED ballast circuit and with two outputs for external resistance sensors monitoring the surrounding brightness or the temperature of LED ballast or LED chips. Based on this information the following statuses (as well as additional statuses) are detected:
     - regular operational status
     - error status – interrupted LED circuit
     - error status – shortcut LED circuit
     - error status – overheating of inner lamp circuitry
   - It is fitted with one control output 0 – 10 V (optionally with two outputs), used for proportional dimming of the LED ballast 0 – 100%.
2. **Advantages offered by this module and relevant situations the R-SL-0201L module handles:**
   - Today a common feature of the centralized activation approach (switching on and off) the entire line/street used for RVO (distribution box of public lighting system) is replaced by this module which offers individual switching process or rather by gradual control of each lamp which occurs right before the ballast. This individual control also works in systems which use the centralized activation (switching on) for the entire line. This feature works only when the line is on of course.
   - While permanent power supply of public lighting systems (VO) is rather a nonstandard feature today on the other hand the Smart City concept requires permanent "all-day" power supply because this concept allows you to use other technologies in the lamp which require constant power supply. For example a socket for electric bike or mobile phone recharging or even power supply needed to recharge electric vehicles.
   - When configuring the entire lighting system/line the intensity of the light provided by each lamp may be calibrated using a lux-meter and the value may be saved in the module. This setting is used until the next inspection/calibration is due. This way the LED lamp does not shine with 100% intensity. This represents energy cost savings and eliminates extreme over exposure to undesired light intensities at the given location (for example undesired illumination of certain floors in high buildings

found near the line of the public lighting system. It also gives you the option to adjust the light intensity or brightness later – back to the original value, as the brightness of the system goes down gradually over time. This is an extension of the function and an additional option offered by the ballast which is known as CLO (Constant Light Output).

– When dimmable LED lamp ballasts are used the lamps may be turned on or off slowly and gradually (dimming feature). the two-channel option, which is currently being prepared, also offers the so-called biodynamic control of the light color temperature, which allows you to eliminate the harmful impact of the blue part of the light spectrum emitted during night.

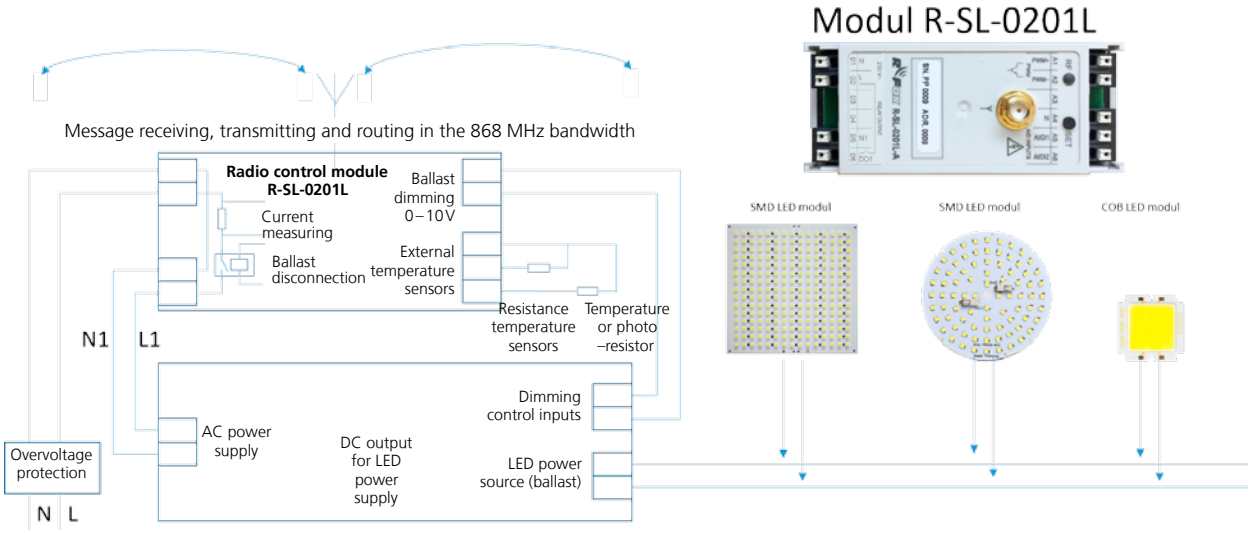

Fig. R-SL-0201L module wiring diagram installed inside a lamp

iCOOL – system solutions for hotels

We have already informed you about the iCOOL system operated by Tecomat Foxtrot in our previous newsletters. However, let us invite ICT Expert company and listen to their arguments this time focusing on integrated management of hotels and hotel rooms.

iCOOL is an intelligent system used for building automation processes which interconnects all technologies in the building and allows the user to control these technologies from one simple interface and takes care of your comfort, safety and economical operations. It may be used in family houses or apartments, commercial objects, schools or in facilities providing accomodation services.

Advantages

– It will massively simplify control of modern technologies,
– it will save you money thanks to energy savings and timely maintenance,
– the system will process and arrange data into a simple overview,
– effectively manages and stores energy produced by the system
– ... it will not take over your own intelligence because you may set the intelligence level as you see fit!

Solutions for hotels

An ideal hotel or facility deals with customers quickly and efficiently, utilizes a simple overview of vacant and used rooms and is also aware about customer requirements. Your hotel may become a perfect system as well thanks to the automatic system called iCOOL which simplifies the work performed by your staff, guards access to rooms and handles permanent comfort of your guests.

Interconnection of technologies offered by the iCOOL system will give you the option to automatically oversee and regulate heating and ventilation systems or even the actual use of individual appliances. Comfort of your staff and your guest will also increase thanks to the card or mobile device access system. Your customers will be able to send you requests via SMS or email and finally, the overall operation of your hotel will become much more cost-effective and safer.

What iCOOL offers to hotels

– comprehensive overview and pleasant and user-friendly interface – information about temperature, ventilation, illumination system status or even fire warnings at the front desk and quick navigation thanks to colorful control icons.
– communication with guests – your guests may send their requirements for hotel services (such as request for cleaning, do not disturb etc.) by email or by a SMS messaging.
– simple and intuitive control of systems installed in hotel rooms
– access system based on RFID technology or NFC chips – the front desk may allow access to rooms using selected

cards/ or devices only and during the selected time interval (for example from Friday 14:00 until Sunday 11:00),
– automatic temperature and ventilation adjustment – economical mode is activated in vacant rooms but before the guest arrives the system activates the standby mode
– elimination of undesired statuses – deactivation of the heating system or air-conditioning when windows in the room are open
– five prevention system – should smoke be detected the information demonstrating activation of the fire detector in the room is displayed on the main panel at the front desk and at the same time the siren at the front desk is activated
– event recording – all events are recorded into a log for further evaluation

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Hybrid solar (photovoltaic) power plants and heat pumps SunnyCold Airsun

SunnyCold has been using programmable controllers Foxtrot and various component from Teco for its products designed to utilize renewable resources and technologies in buildings for many years. Based on the development project of patented houses using direct current, which received the 2015 ČEEP award under the INNOVATION category, SunnyCold decided to use Airsun products after while.

Airsun is a unique solution which connects the heat pump air-water (HP) and hybrid solar/photovoltaic power plant (PPP) with a battery storage. These systems may be operated separately or as mutually interconnected solution. the unique feature of this system is the fact that it uses two different types of energies: energy from the air (HP) and energy from the sun (PPP). It is a well-established fact that a heat pump is able to use 1 kW of electric power and produce up to 3 kW of heat which is able to cover the input of the heat pump for a family house using reasonably large PPP located on the roof. Airsun received a product recognition award for the system at the For Arch product fair.

SunnyCold is the only company on the market which produces both systems (heat pumps and solar power plants), which allowed the company to become the leader in terms of the system integration, regulation and control. Systems are available in matching designs and equipped with a single, legible user-friendly environment compatible with any mobile device, so you may control the system from anywhere in the world. If you select Airsun system you can be sure that they will be compatible and that the various devices will be able to communicate between each other digitally and share the necessary control information. the system also features safety and backup components not offered by any competitors in their basic series. Further, SunnyCold guarantees free software updates for life. Easy program startup is achieved through TecoRoute. Thanks to this integration customers will be able to use a system which is ready to accommodate any additional trends which may become useful in the future. Decentralization of distribution networks, Smart Cities, virtual batteries, electro-mobility or changes in electric power purchase tariffs, etc. will not be an issue for this system.

The goal of the system designers was to place the maximum possible number of components inside the product. As for solar power plants equipped with battery storage, everything is inside one "device" and as such it is certified. Therefore, the final installation process does not require any installation of a converter, electric distribution boxes or batteries in any particular room – which is usually later declared as the "technical" room accessible by properly trained technicians only. Heat pumps produced by AirSun HW integrate within themselves the maximum number of components including hot water reservoir (water heater). the result is a clean and simple design shared by both products produced by AirSun, and which are ready for final installation and the much-needed assurance that your components were selected properly and that they are compatible.

Fig. the basic module may either contain the heat pump or battery storage

Fig. A pair representing heat pump and battery storage unit produced by SunnyCold is not only technically efficient but also a nicely designed product.

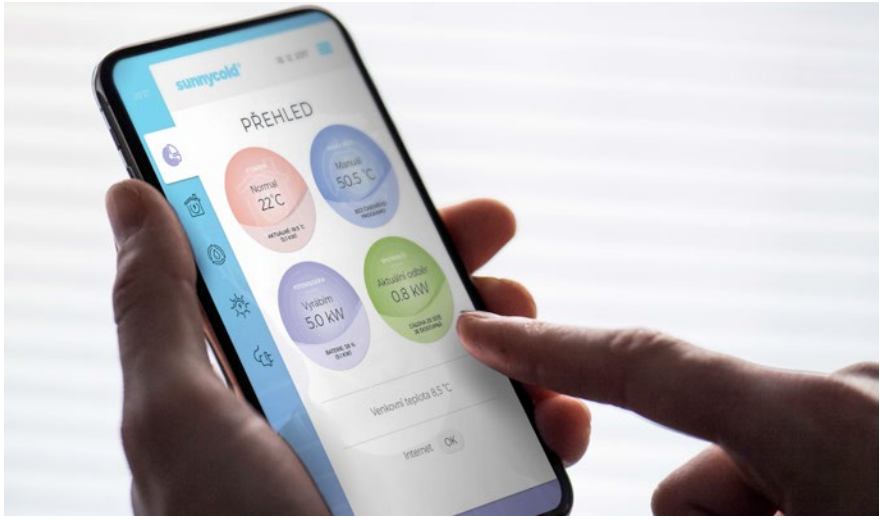

Fig. New interface TecoApi further helps with the creation of user-friendly applications which may be used for mobile devices and for online connection and access to the current data in Foxtrot. the picture shows Graphic user interface created by SunnyCold.

Fig. Foxtrot integrated in the Airsun system monitors the level of solar radiation using special sensor on CIB bus.

Tecomat products help SunnyCold to remain at the top and gain a certain advantage in terms of modern technologies. Thanks to modern interface based on TecoAPI, Airsun may be successfully integrated into household automation systems and connect with third-party devices. Thanks to detailed API and simple installation, Airsun products are the correct choice when integrating your projects into smart houses. Solar radiation sensor on CIB bus allows you to monitor solar power plant and detect possible overflows created by systems which do not offer the option to sell the electric power back to the power grid.

Thanks to the mentioned technologies and large customer demand, more than 90 Airsun systems have been installed in the Czech Republic and Slovakia during the last year. SunnyCold offers partners installing Airsun products assistance with the selection and application for grants for their clients, remote start up for newly connected system, access to Online monitoring, automatic optimization and system debugging based on historical data, the option to use database of inquiries, promotional materials, training and help with the installations of first projects or systems.

For more information please visit www.sunnycold.cz or www.facebook.com/sunnycoldsro/

Chef Tecomat Foxtrot?

At the gastronomical fare called HOST Milano 2017 a Czech company JIPA International introduced its new product to the entire world – multifunctional equipment JIPA International MKH. This equipment is a flexible worker and the heart of large and small culinary facilities starting with five star hotels through regular daily restaurants and ending with children meal facilities. the brain which controls each model (100, 150 and 200 l options) is of course Tecomat Foxtrot which is known to you from applications used for the control of smart houses or from power or transportation industries. However, here Tecomat Foxtrot controls everyday activities allowing the kitchen staff to focus on more important work activities. This year this equipment will be displayed in Prague at the fair called For Gastro & Hotel in October.

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Twenty-five years of experience of JIPA CZ, s.r.o owned by Jiří Pavlík and progressive approach, paying attention and implementing customer requirements and finally, observing trends existing in the culinary market helped the company to design the MKH – Multi-Kitchen Heart concept. the company has been developing this future "heart" of a modern kitchen for 3 years while focusing on the smallest details, functionality and user comfort with the intention to make sure that the equipment will make the work of the kitchen staff easier and at the same time will comply with the applicable and all safety standards, while preserving natural taste of food and providing savings. the company entrusted the control and management of all measurements and other functions to our Foxtrot system because our system meets high demands on long-term reliability, flexibility of inputs and outputs, offers large touchscreen panel necessary for the operators and lastly, also because our system offers remote access and management including online upgrades and services. This feature allows the manufacturer to provide permanent online support for customers – the kitchen staff working anywhere in the world.

Fig. MKH 101 D actually represents two units in one and offers better flexibility and may be used to prepare two meals at once.

Fig. 1 Multifunctional equipment for gastronomical facilities produced by JIPA International in several sizes. the largest model MKH 201 offers a useful volume of 200 L and the floor dimensions are 1,429 × 580 mm, maximum input is 58 kW.

Fig. 3 Foxtrot controls retractable frying baskets. This machine is also equipped with temperature sensors which measure temperature of sauces and even the temperature of meat.

The equipment manufactured by JIPA International MKH is able to replace single-purpose technologies /devices such as boilers, stoves, cooking or frying pans, grills etc. It is also able to handle all cooking regimes such as cooking, frying, steaming, grilling, toasting, baking, low-temperature cooking (slow cooking) and even preparations done in vacuum

(sous-vide). the design concept allows meals to be prepared several times quicker and with much more efficient use of energy and water.

The heating element of the machine is a system called SUPER BLOCK JPX 17 which allows you to reach temperature of 200 °C within no more than 4 minutes. Foxtrot measures the temperature in individual zones at the bottom of the cooking pan and based on the measured results controls the heating unit in each zone separately. This eliminates local overheating or burning and allows the system to reach even temperature around the entire bottom.

Another unique feature is an automatic frying basket lift. This feature will turn the equipment into an automatic frying pan which may be used to prepare food with the lid closed – night cooking – cooking without supervision. This feature will save you up to 60% of water consumption in comparison with regular cooking. the obvious thing we need to mention now is the fact that each device is equipped with Tecomat Foxtrot and may be connected to the Internet. Foxtrot is used here as the server, data storage and also controls the entire process in real time. So it goes without saying that the equipment automatically becomes a part of the so popular Internet of things (IoT) without the need for additional converters or cloud repositories. This is also true for the Multifunctional equipment JIPA International MKH. Further, the fact that Foxtrot is able to optimize the entire process and the consumption of energies and water, the equipment may be called a smart device in a smart building which is a part of a smart city. And what more we could wish for in today's era of "smartification"? Based on promotional materials of JIPA International prepared and compiled by

Ing. Jaromír Klaban,
Teco, a. s.
(Photo: JIPA International, Teco)

Fig. 2 the multifunctional equipment is also supplied with a function able to accomodate a pressurized system. Just connect it to the electric power and to water and waste pipes. the cook only introduces the ingredients and then takes out the finished meal; other routine activities such as the control of temperatures and energies is handled by Tecomat Foxtrot

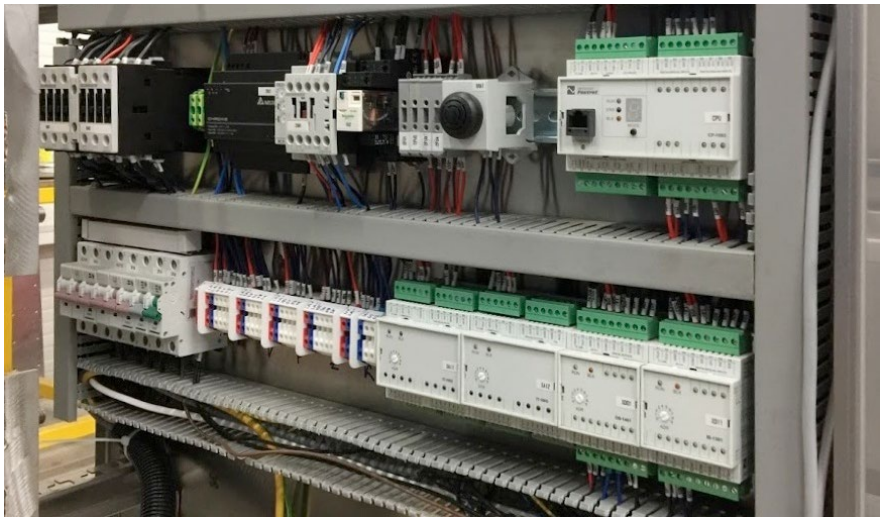


Fig. 4 the control center and heart of the gastronomical equipment is Tecomat Foxtrot system which is placed together with other electrical wiring systems on a retractable installation panel.

Fig. the equipment can also handle intensive cooking but also economic cooking. It may be used to grill, sauté, bake, fry or steam. It may also be used for low-temperature cooking and the so-called sous-vide cooking.

Tecomat systems are the core of cryo-saunas

sauna CRYOMED

A Slovakian company called Cryomed s.r.o. has been producing compact and easily transportable cryo-saunas for 15 years. During this time the company has become a world leader in the so-called entire body cryo-therapy. A few years ago Tecomat Foxtrot produced by Teco fitted with ID-31 or ID-36 display panel has become an inseparable part of their products. A cryo-sauna is comfortable and very efficient equipment which uses cryo-therapy to improve a large number of health problems but it can also enhance the performance of athletes. This product efficiently enhances health treatments but it is also used during convalescence procedures or as a fitness machine and even in the field of cosmetics.

The principle of the cryo-therapy method is very simple and very efficient. The body of the treated person is exposed to extremely low temperatures ranging from –110° C to –190° C for a short time (1–3 minutes). All humidity from the cryo-chamber is sucked out and the air is cooled by liquid nitrogen. This extreme cold acts only on the outer parts of your body – your skin, muscles, tissues under your skin, but not on your internal organs. Internal body organs retain their original temperature and functions. Exposure to such a low temperatures will create a stress in the neurosensory tissues and nerves which sends a signal to your brain that you have been exposed to an extreme situation and your body starts producing higher levels of corticoids, endorphins and also testosterone (applies to men). This results in increased blood flow into tendons, ligaments and tissues under your skin and muscles. When you leave cryo-sauna you blood, containing higher volume of active nutrients, will enter into your outer tissues and supply them with these nutrients. And what are the impacts and results demonstrated in real life of athletes? We

Fig. Cryo-sauna manufactured by Cryomed is a compact unit which may be easily moved anywhere you want. It is a typical device that represents the new Internet of things (IoT). Thanks to Tecomat foxtrot, which not only controls the entire unit but also seamlessly integrates it into the Internet, the unit is on-line and provides users with remote access and remote servicing.

displej CRYOMED

Fig. the user controls the cryo-sauna using the touchscreen display and the user interface created in Mosaic and in WebMaker. It may also be controlled directly from your smart phone application which is available for download both from APP store and Google Play.

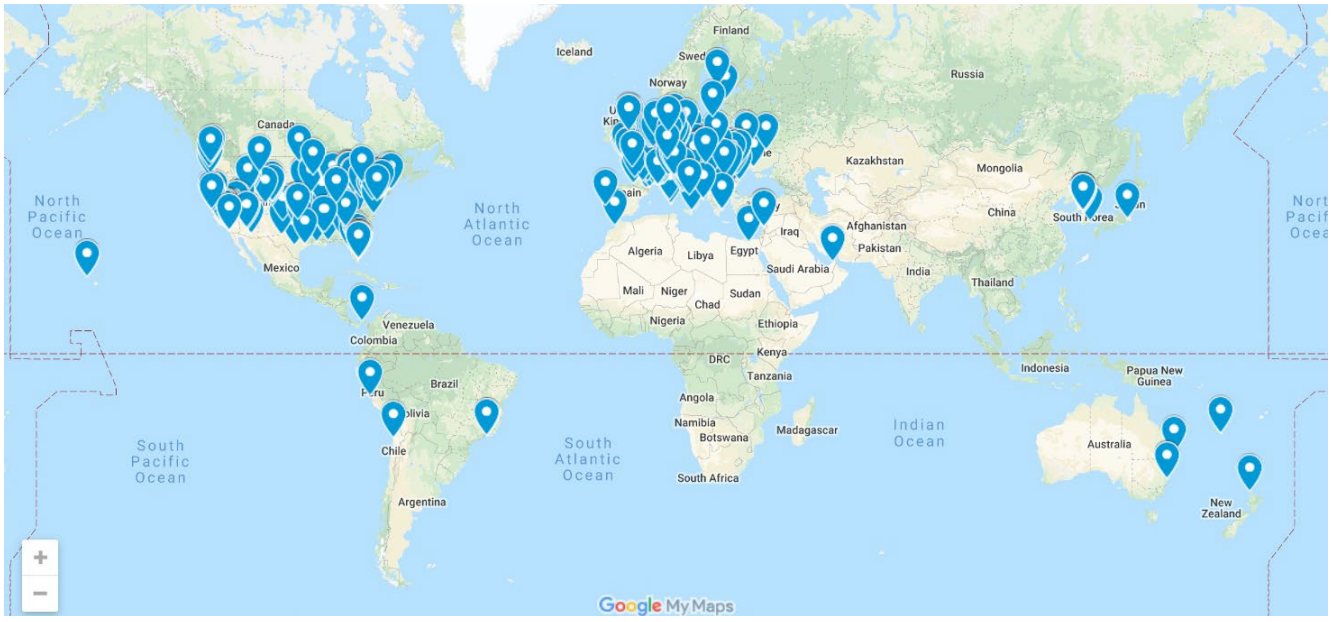


Fig. Cryo-saunas manufactured by Cryomed and controlled by Foxtrot systems are literally all over the world. the company has 1,320 customers in 62 countries all over the world and all of them rely on remote servicing and connection which is possible thanks to our Teco Route service controlled by Foxtrot system from the headquarters located in the town of Nové Zámky.

decided to give you a shortened version of an article published in a web portal called Sports24.ks.

The following technical description demonstrates what functions are handled by built-in Foxtrot control system.

A cryo-sauna is a unit equipped with 10" Teco touchscreen which is used to control the entire unit. It is also equipped with a safety system which prevents incidents This safety system includes for example an open door sensor, ultrasound sensor monitoring the position of the user in the cabin, safety shutdown system and efficient ventilation system. To maintain the highest possible comfort an intelligent multimedia system with full HD 10" tablet and USB port has been integrated into the unit featuring two 120 W speaker system. It also offers RGB illumination system which may be programmed in several zones.

And as you would expect, the entire system is connected via Wi-Fi or LAN to the Internet allowing the user to update and optimize all software functions easily. Remote control is achieved by using a regular desktop computer, tablet or smartphone. the unit also features an active messaging system which emails reports and actual data about the unit directly to the email address specified by the user.

Fig. Šamorin (15/6/2017) – During the football preparation camp which took place before the European championship, Slovakian football players still belonging to the "up to 21-year category" had a chance to try what a cryo-sauna is all about. This portable unit which offers quick regeneration and relaxation using freezing temperature enchanted them so much that they requested their management to bring the unit to the European championship in Poland.

Fig. For beauty and power. "This secret weapon is also used by Cristiano Ronaldo. This world famous football player had this unit installed in his luxurious mansion. Our football players could not get enough of this unit either. "We had a great experience with the use of cryo-sauna so we decided to take it with us to Poland" said the football team physician Zsolt Fegyveres for the portal administered by the Slovakian Football Association before leaving for Poland. (Author: Juraj Vnuk, photo: the author and SFZ)

Educational and training kit Foxee

Foxee represents the shortest and the most direct way of learning. From the first steps, focusing on the use of technical gadgets, all the way to professional engineers.

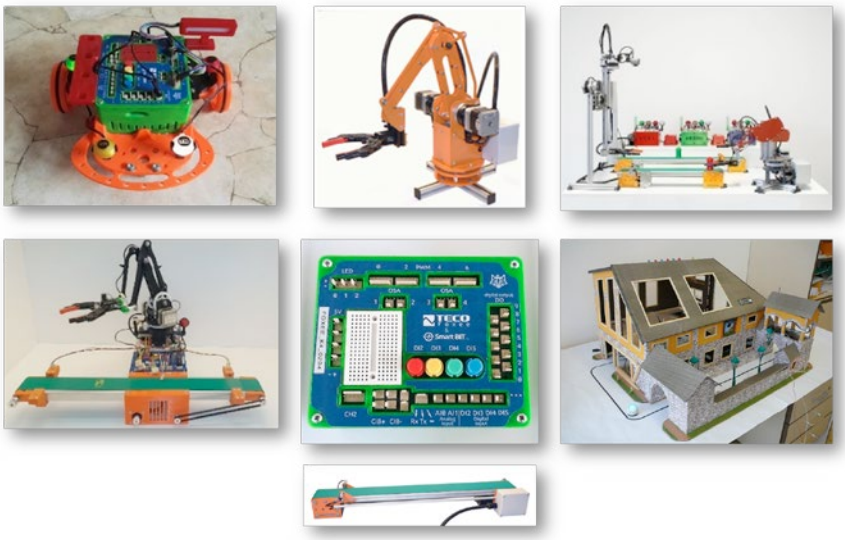
Teco a.s. continues expanding its educational kit called Foxee – an educational tool used to teach and improve technical knowledge and control principles used in real life specially in the famous Industry 4.0. the learning kit builds on the PLC Tecomat Foxtrot control unit and platform. It provides an easy connection for analogue and digital sensors, step / DC motors and hobby servo drives widely used in robot classes including single-chip educational systems such as Arduino, Raspberry, PL or kits such as Lego, Fisher or Merkur – these kids are however designed as toys from the beginning. Unlike these toy kits, the Foxee kit builds on full industrial and programmable automatic controllers which are fully compatible with international standards IEC/EN /CSN-61131 observed by all world manufacturers of systems which belong to this category.

Therefore, Foxee represents the shortest and most direct way of teaching students how technical toys works – all the way up to the actual and professional engineers.

Foxee kit:

– the kit is designed in a certain way allowing the user to build interesting functional models in a short time and which may be used by students to test their technical knowledge when dealing with practical tasks as in the real world – while being able to connect to the Internet and use their own smart phones to do so.
– Students may start with simple logic tasks of statement/propositional logic (Boolean algebra) – pushbutton – control light, motor – all the way up to complex tasks such as programming our wheeled Foxee robot, conveyors and other manipulators which may actually be used in a real factory.

Thanks to the communication abilities of the core you may add more inputs and outputs but most importantly you may communicate directly



through the Internet which goes well with the teaching and requirements of the Industry 4.0 trend and the Internet of things.
- It is built with components produced by 3D printing technology, which alone is one of the main pillars of the Industry 4.0. This further extends and broadens the knowledge of students when creating their own projects, which in turn may be even used it to build a new Foxee educational kit directly in the school or through afterschool activities.
- This kit may be fully integrated with the Internet and it may be monitored controlled and programmed directly – online. Thanks to the integrated web server it may also be connected via an Internet browser through the use of Teco Route service which also monitors and provides high level of cyber security. Teco Route service allows you to connect to the Internet without having a public IP address. For example, you may connect to a project implemented in the school from your home. Of course, the must and standard feature is MQTT protocol which became very popular thanks to the highly proclaimed Internet of things.
- Educational support is provided. Teco a.s. in cooperation with Smart BIT s.r.o company provides support for teachers using Foxee kit in their classes. This support includes operational manuals, leaflets and video courses, technical support and also individual consultations either in person when you are in school, or when you visit the Foxee Lab in Hradec Králové.

The central component or the core of the Foxee kit is a set called the Basic, which consists of a central unit (educational/teaching PLC) modified for the teaching of Mosaic programming methods (programming in line with IEC-61131). In addition the kit also contains components allowing students to build a wheeled robot and additional components to construct a "table factory" or modules which may be used to "control your house", and many other modules which Teco gradually introduces to the market. For more information about the current offer of modules please ask for the "Foxee kit" catalogue.

Foxee Lab

New digital class in Hradec Králové equipped with smart technologies and following trends defined by the Internet of things (IoT) and by the Industry 4.0 standards

Smart BIT s.r.o. in cooperation with Teco a.s. decided to build a development-oriented educational community centre called the Foxee lab. the class offers everything starting with smart electronic toys (Arduin) all the way to real programming of an actual smart house which is represented by the classroom itself. We have built this Centre to allow people interested in these issues, as well as public schools and companies, to meet here and discuss these matters. It is also a Centre for parents who search for creative and purposeful activities for their children. A sort of a starting point where parents and their kids can start playing together and later follow more or less independent ways and finally, even select schools or companies they are interested in, or which they might encounter along their way. It is also a Centre where teachers and students from various schools and universities may meet to exchange practical experiences, broaden their horizons or even meet possible employers.

The era of automation and digitalization waits for us

Each day we are more and more dependent on various technological and automated processes. Everything rushes forward so fast that we barely have the time to think and decide whether we shall prepare young generation for these changes and if so, how. We decided to act now and use what we know and what we have. We built on technology, which is not the cheapest one, but it is used today in various industries and therefore we felt that we cannot go wrong with this. At the same time, we want to make sure that the new generation is not scared of physics, mathematics or computer ... ... technologies. We want them to be interested in these technologies and use practical and real-life examples to achieve that. This is the road we have chosen and it is our contribution to the young generation. In doing so, we feel that they will be able to better compete and succeed in the very competitive world of technology and even get better jobs – future professional and technical careers also follow these trends and keep changing constantly.

Who we are?

We are a generation which began to use information technology and deal with automation processes when microprocessors and personal computers only made their humble introduction. We actually keep developing together with computers and with these technologies. We have been manufacturing and implementing these technologies throughout our lives. This helped us to see how hugely important these issues are and how much in demand these technologies are around the world.

We are people with many practical experiences in terms of implementation of automation projects across the entire industry including building automation, etc. We are people with the necessary experience and we are willing to share it with students and the academic world. We are people working for a Czech company which is constantly developing and manufacturers control systems with a massive scope of application and uses. We take advantage of the most modern technologies and follow hot trends which govern various technologies including IT technologies, telecommunication and cyber security. We are people who decided to find the correct way and we wish to walk the road together with young people and their teachers. We wish to search for new ways and learn how to interconnect dry and boring computer theories defined in books or even presented through simulations played on computers, tablets or mobile phones with the actual reality using real components, machines and instruments.

Why you should visit the Foxee lab?

We decided to spend more time on this topic. We have reconstructed a small area in the town of Hradec Králové and equipped it with the relevant technology – not based on toys but on highly professional systems .... and devices. We gave them the proper shape, form and even the necessary peripherals to attract beginners or regular people and then showed them the most direct way how to learn about technologies and skills which are used and needed in the real world. the fundamental knowledge and skills are introduced using control systems manufactured by Teco, in particular the latest and the most modern and most powerful Foxtrot system. We

have used 3D printing technology to create the actual components and to allow students to further develop this system based on their own creativity and ideas. We call it "Foxee" which finally brings us to the actual Foxee lab where you can experiment with these systems or ideas.

So why should you visit the Foxee lab?

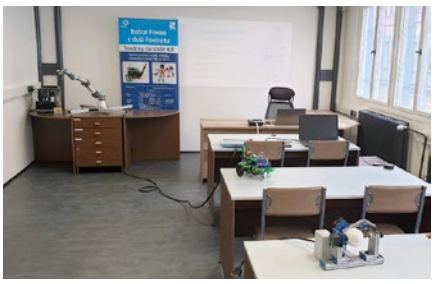
In our laboratory you will have the option to touch and play with actual moving machines represented by models such as conveyor belts, a wheeled robot or even the entire factory sitting on a table or our highly professional robot labeled as UR 3. However, if a moving machines and technology is not your thing, you may choose to talk to Group assistant or to Alexa and use them in your projects. This will improve your navigation abilities which are needed when using technical documentations or you will increase your knowledge or imagination thanks to 3D print applications. Foxee lab will also teach you basic programming which you can try right there in the last using the available programmable electronic components. Everything is done painlessly, step-by-step while knowing that you are learning international programming method which complies with international standard used for real industrial automation projects. We are talking about the IEC EN 61131-3 standard. This will give you the opportunity to use your knowledge immediately because programmers are in high demand everywhere in the world.

In our Foxee lab, which represents a classroom of the twenty-first century, you will learn about the general trends that govern the automation and development of smart technologies. Thanks to companies cooperating with Foxee lab you may even have a chance to visit a real industrial operation. Foxee lab can also arrange a temporary summer job for you and you can work in these factories or you may receive actual tasks from these companies and work on real projects. Foxee lab may also arrange internship for teachers.

What is our goal?

We want to replace the missing article between the theory and practice. That means we need to educate young people and teachers who will show interest in these areas through afterschool activities, courses or single or several-day training sessions. We also want to engage active members, teachers and students in real projects that we receive from the participating companies.

Foxee lab also wishes to engage a large spectrum of neighboring companies which have already realized that they need to look for qualified labor force and that it is beneficial for them to actively



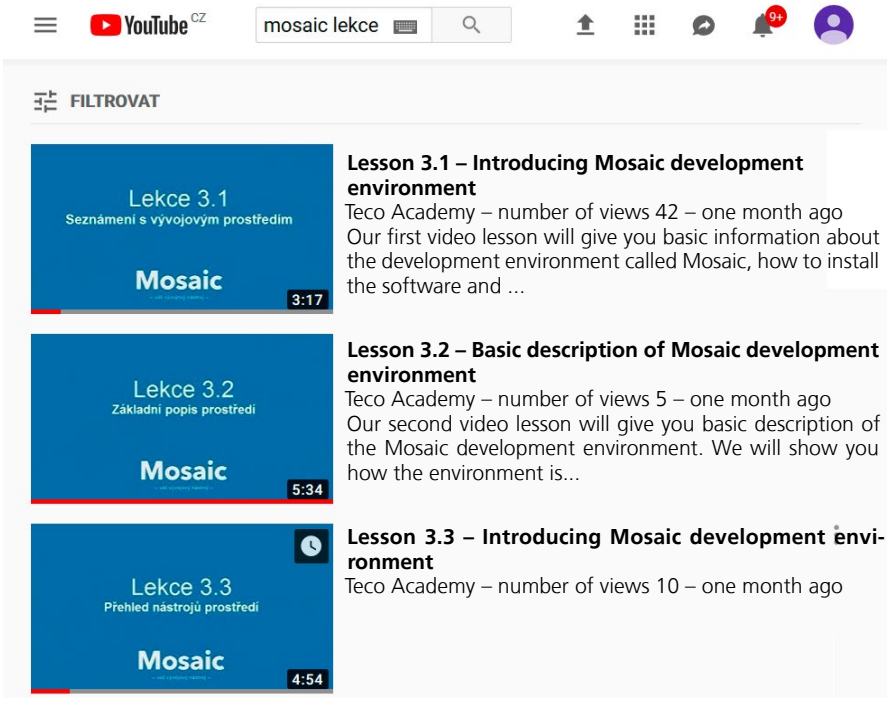
participate and teach "young labor force" and properly direct young and enthusiastic people.

What we wish for?

We hope that small and medium companies will support us while we are developing this project and will join our activities which we like to call "the New National Technical Renaissance 4.0 ".

We also hope that our joint forces will bring back to our school system what is currently missing and what is either willingly or unwillingly and constantly overlooked and that is the real practical experience, actual contact with reality, teaching how to become responsible and independent, how to be creative and how to get back manual dexterity. We hope that this will help us to meet these new progressive trends which are gradually entering the educational system and help schools which search and support these types of projects and activities.

Mosaic video lesson on YouTube



Our third video lesson will give you a list of tools of the Mosaic development environment. We shall introduce tools used for automatic ...

Fig. QR code which will take you to a video lesson available on YouTube.

Mosaic is the only development environment available in Czech language used for development of applications complying with IEC- 61131 standard. Mosaic is an integrated environment used for development, diagnostic and configuration of Tecomat systems. the first steps will teach you how to use this software and are described in detail in eleven video lessons available for viewing on YouTube. You can quickly find and watch these lessons using the above QR code or by simply entering "Mosaic lessons" in the search window on YouTube.

Video lessons may be used for self-learning by new programmers as well as by students but they may also be a great help for teachers when preparing their classes or when managing their lessons.

The first eleven lessons focus on the introduction of the development environment and provid a manual which will show you how to open your own project and begin using the software. These lessons were created thanks to a massive input from our colleagues, in particular by Sergej Ziskovič and Sabina Škrabská. Together we are all waiting for your feedback and please watch for other future lessons. It may be your own feedback which will help us to direct the actual preparation of future lessons or even focus on your priorities.

TECO Advanced Automation

SYSTEM OVERVIEW FOR MULTIROOM CONTROL IN CONVENTION CENTRE OR HOTEL

Room Reservation

amadeus

Information from roomreservation system
(to control lights and climate in the rooms)

Room Combining

Automatic or manual Room Combining
(Control by contacts)

Wireless Microphones

Battery management & Signal monitor
(Control by TCP/IP)

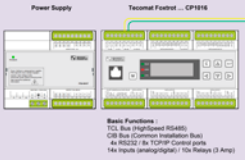
Audio

Digital audio with Dante
(Control by TCP/IP)

Master Control

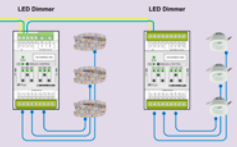
WEB control on 10" tablet

Main System



Switching

Lights



Video distribution

Blackmagicdesign

Blackmagic 12x12 Videomatrix
(Control by TCP/IP)

Projectors

Video showed on projectionscreen
(Control by RS232 and TCP/IP)

Displays

LFD Displays for Narrowcasting & Presentations
(Control by TCP/IP)

Lights

Conventional & Theatre lighting
(Control by TCP/IP, DALI, DMX or KNX)

Teco Advanced Automation by B&R design BV The Netherlands

For more information visit the website www.br-design.nl or www.tecomat.com

TECO Advanced Automation

SYSTEM OVERVIEW IN COUNCIL MEETINGROOM

Conference System

32x Bosch Dicentis conference devices
(Control by TCP/IP)

PTZ Cameras

4x Lumens PTZ camera for Full HD registration
(Control by TCP/IP)

Videomixer & Textoverlay

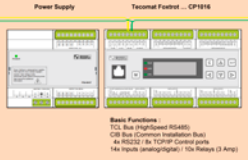
Datavideo Full HD video mixer
(Control by TCP/IP)

Video distribution

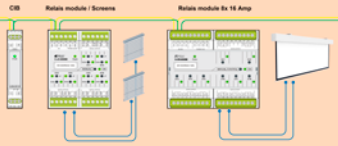
Blackmagic 12x12 Videomatrix
(Control by TCP/IP)

Control

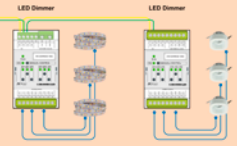
Main System



Switching



Lights



Streaming & Metadata

Live stream or sending metadata to streamingprovider

Recording

Blackmagicdesign

Local recording of the event
(Control by RS422)

Displays & Projector

Video showed on displays and projectionscreen
(Control by RS232 and TCP/IP)

Audio

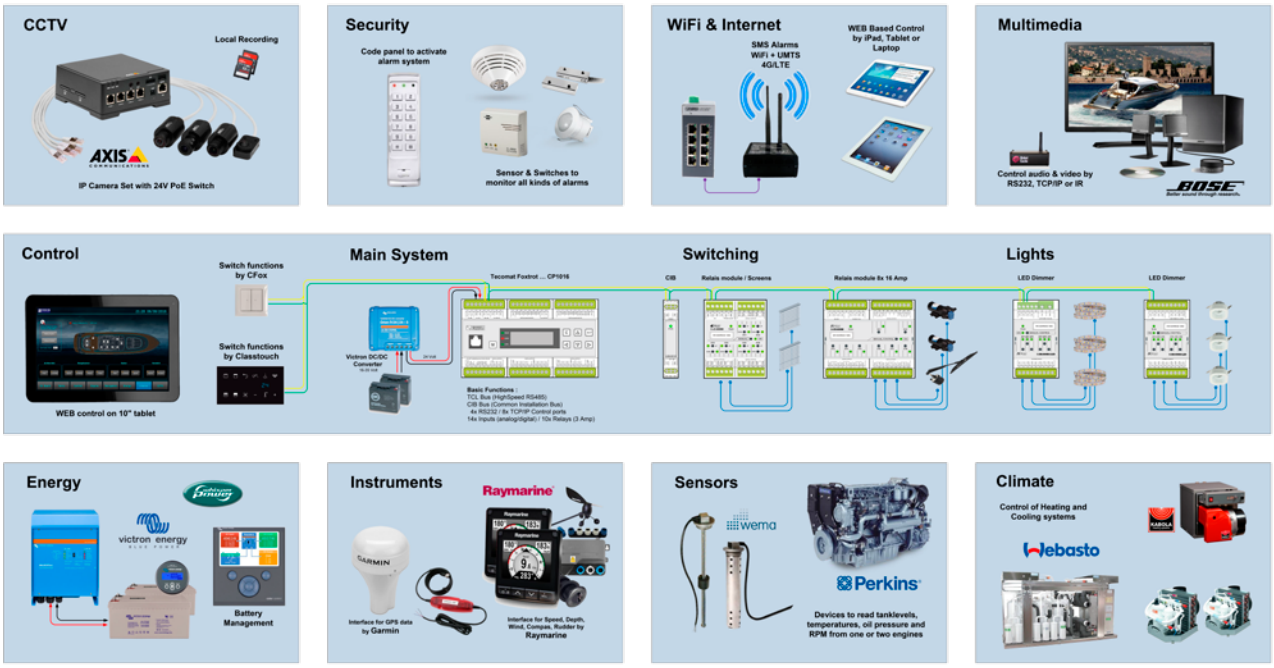
Digital audio with Dante
(Control by TCP/IP)

Teco Advanced Automation by B&R design BV The Netherlands

For more information visit the website www.br-design.nl or www.tecomat.com

TECO Advanced Automation

SYSTEM OVERVIEW FOR YACHTS

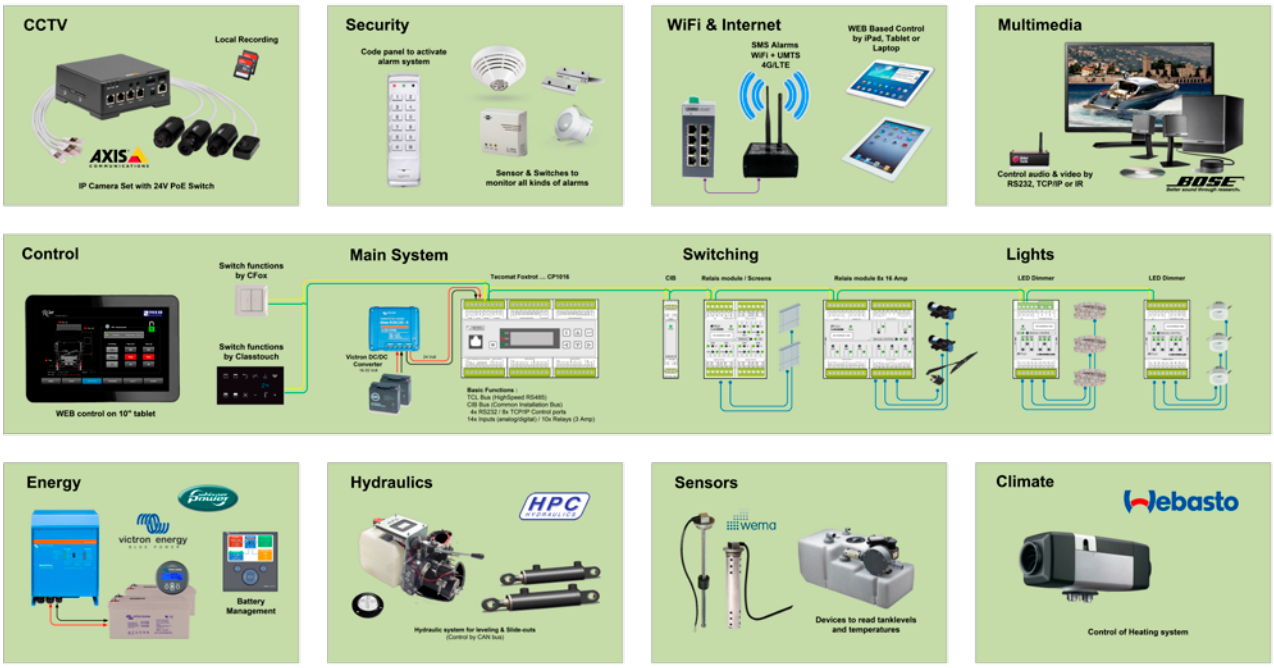


Teco Advanced Automation by B&R design BV The Netherlands

For more information visit the website www.br-design.nl or www.tecomat.com

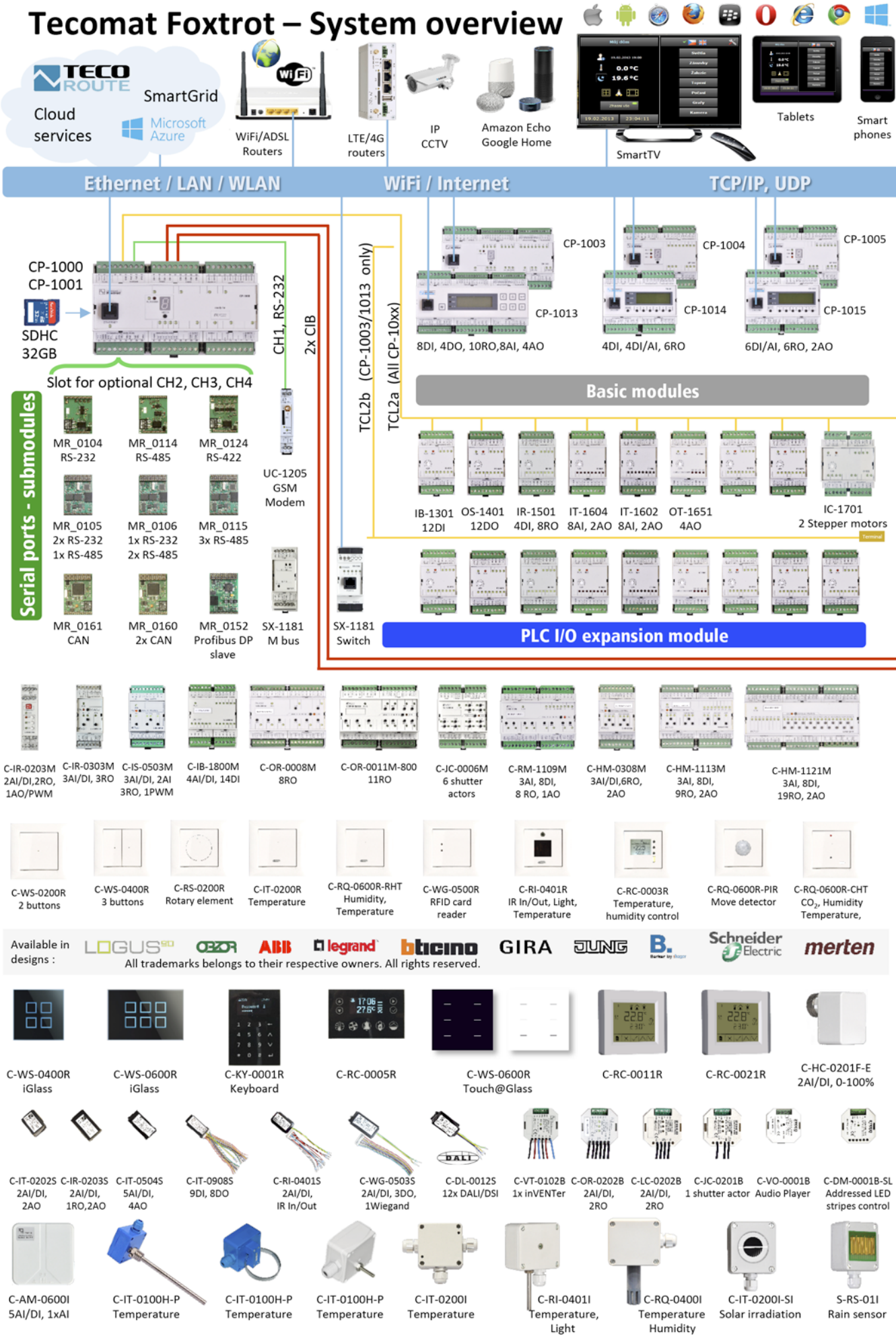
TECO Advanced Automation

SYSTEM OVERVIEW FOR TRUCKS & RVs



Teco Advanced Automation by B&R design BV The Netherlands

For more information visit the website www.br-design.nl or www.tecomat.com


Tecomat Foxtrot – System overview
TECO ROUTE
SmartGrid
Cloud services
Microsoft Azure
WiFi/ADSL Routers
LTE/4G routers
IP CCTV
Amazon Echo Google Home
SmartTV
Tablets
Smart phones
Ethernet / LAN / WLAN
WiFi / Internet
TCP/IP, UDP
CP-1000
CP-1001
SDHC 32GB
Slot for optional CH2, CH3, CH4
CH1, RS-232
2x CIB
TCL2b (CP-1003/1013 only)
TCL2a (All CP-10xx)
CP-1003
CP-1004
CP-1005
CP-1013
CP-1014
CP-1015
8DI, 4DO, 10RO,8AI, 4AO
4DI, 4DI/AI, 6RO
6DI/AI, 6RO, 2AO
Basic modules
Serial ports - submodules
MR_0104 RS-232
MR_0114 RS-485
MR_0124 RS-422
MR_0105 2x RS-232 1x RS-485
MR_0106 1x RS-232 2x RS-485
MR_0115 3x RS-485
MR_0161 CAN
MR_0160 2x CAN
MR_0152 Profibus DP slave
SX-1181 M bus
UC-1205 GSM Modem
IB-1301 12DI
OS-1401 12DO
IR-1501 4DI, 8RO
IT-1604 8AI, 2AO
IT-1602 8AI, 2AO
OT-1651 4AO
IC-1701 2 Stepper motors
SX-1181 Switch
PLC I/O expansion module
C-IR-0203M 2AI/DI,2RO, 1AO/PWM
C-IR-0303M 3AI/DI, 3RO
C-IS-0503M 3AI/DI, 2AI 3RO, 1PWM
C-IB-1800M 4AI/DI, 14DI
C-OR-0008M 8RO
C-OR-0011M-800 11RO
C-JC-0006M 6 shutter actors
C-RM-1109M 3AI, 8DI, 8 RO, 1AO
C-HM-0308M 3AI/DI,6RO, 2AO
C-HM-1113M 3AI, 8DI, 9RO, 2AO
C-HM-1121M 3AI, 8DI, 19RO, 2AO
C-WS-0200R 2 buttons
C-WS-0400R 3 buttons
C-RS-0200R Rotary element
C-IT-0200R Temperature
C-RQ-0600R-RHT Humidity, Temperature
C-WG-0500R RFID card reader
C-RI-0401R IR In/Out, Light, Temperature
C-RC-0003R Temperature, humidity control
C-RQ-0600R-PIR Move detector
C-RQ-0600R-CHT CO_2, Humidity Temperature,
Available in designs :
LOGUS90 OBZOR ABB legrand bticino GIRA JUNG B. Schneider Electric merten
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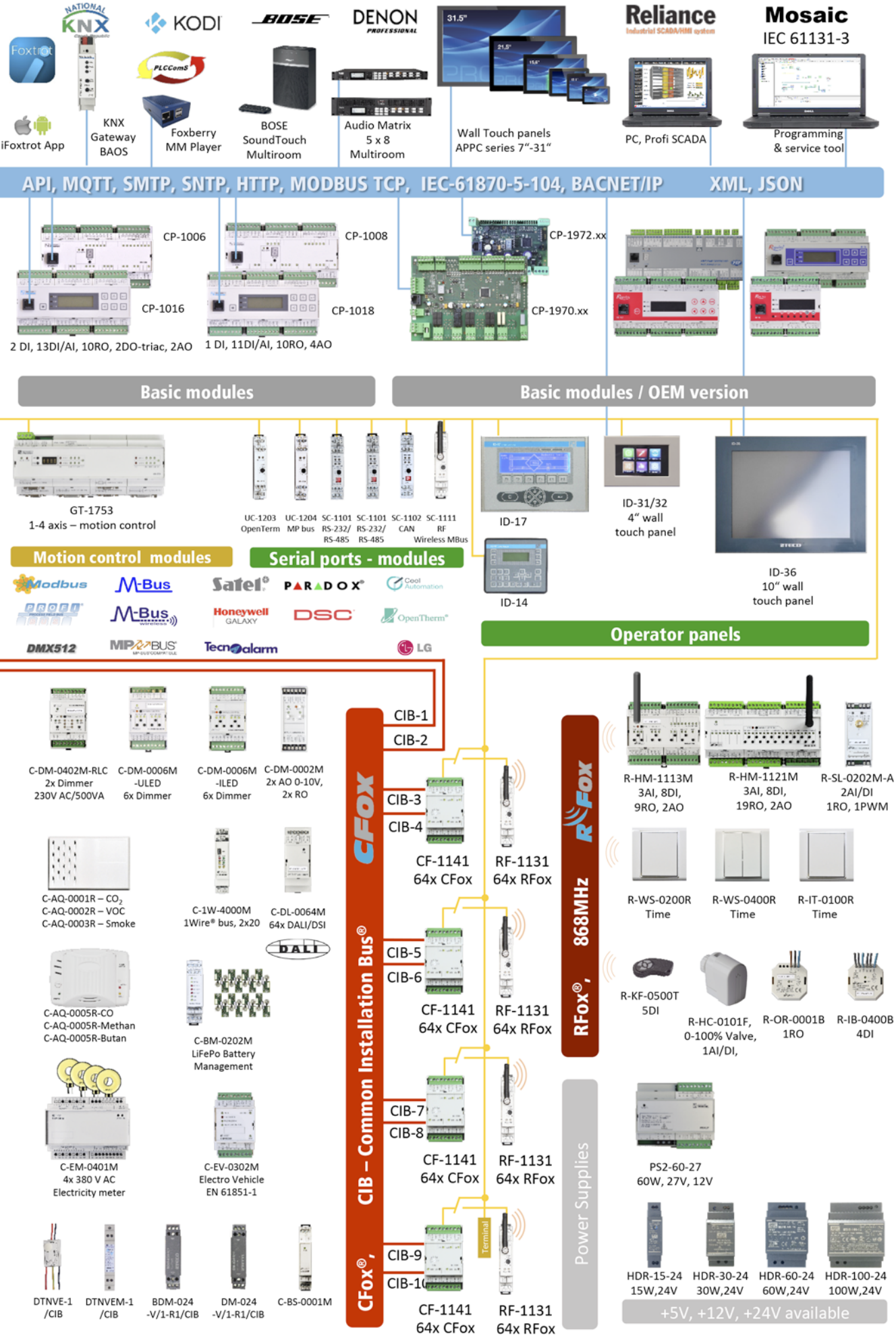
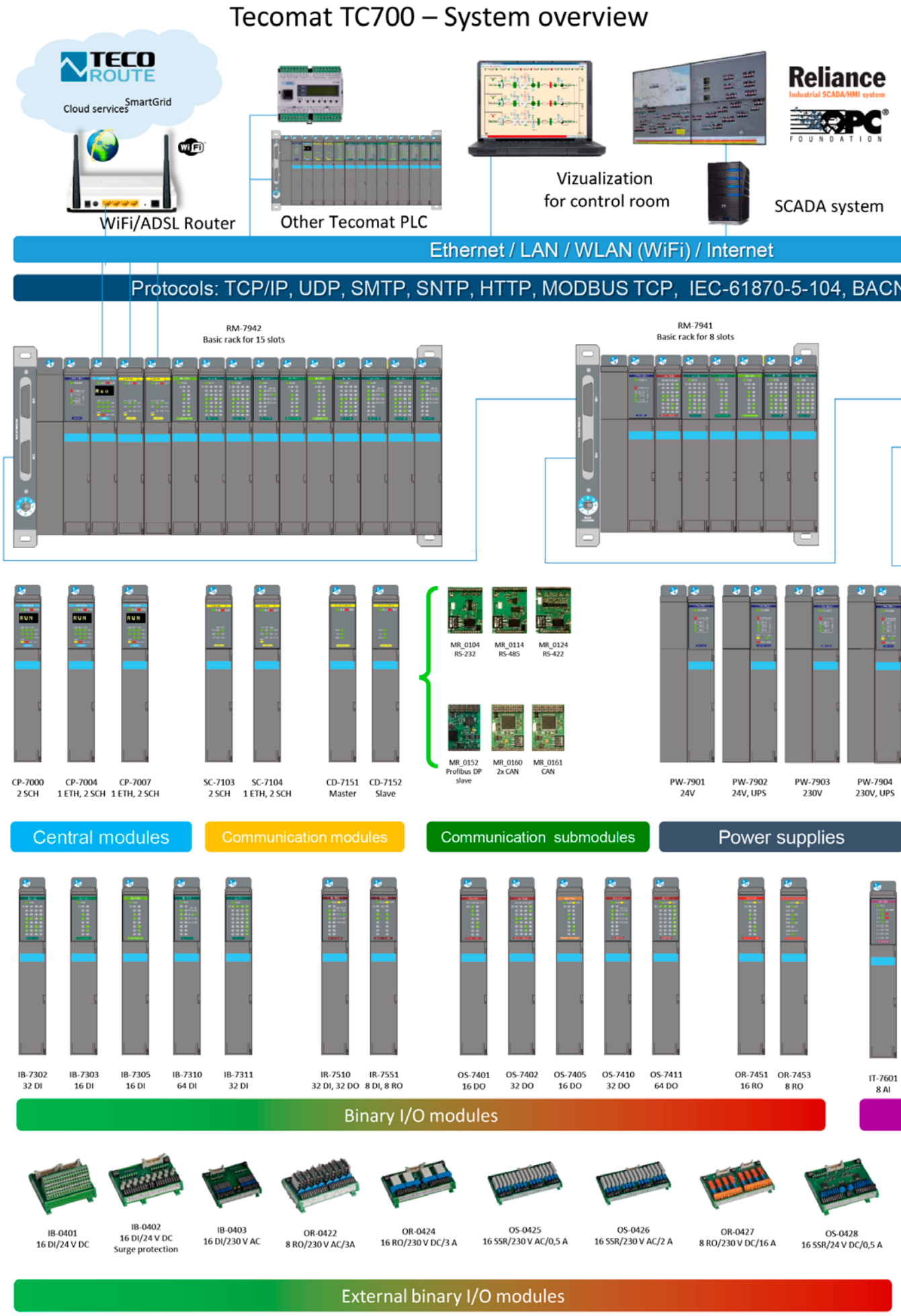
C-WS-0400R iGlass
C-WS-0600R iGlass
C-KY-0001R Keyboard
C-RC-0005R
C-WS-0600R Touch@Glass
C-RC-0011R
C-RC-0021R
C-HC-0201F-E 2AI/DI, 0-100%
C-IT-0202S 2AI/DI, 2AO
C-IR-0203S 2AI/DI, 1RO,2AO
C-IT-0504S 5AI/DI, 4AO
C-IT-0908S 9DI, 8DO
C-RI-0401S 2AI/DI, IR In/Out
C-WG-0503S 2AI/DI, 3DO, 1Wiegand
C-DL-0012S 12x DALI/DSI
C-VT-0102B 1x inVENTer
C-OR-0202B 2AI/DI, 2RO
C-LC-0202B 2AI/DI, 2RO
C-JC-0201B 1 shutter actor
C-VO-0001B Audio Player
C-DM-0001B-SL Addressed LED stripes control
C-AM-0600I 5AI/DI, 1xAI
C-IT-0100H-P Temperature
C-IT-0100H-P Temperature
C-IT-0100H-P Temperature
C-IT-0200I Temperature
C-RI-0401I Temperature, Light
C-RQ-0400I Temperature Humidity
C-IT-0200I-SI Solar irradiation
S-RS-01I Rain sensor


iFoxtrot App
KNX Gateway BAOS
Foxberry MM Player
BOSE SoundTouch Multiroom
Audio Matrix 5 x 8 Multiroom
Wall Touch panels APPC series 7"-31"
PC, Profi SCADA
Programming & service tool
API, MQTT, SMTP, SNTP, HTTP, MODBUS TCP, IEC-61870-5-104, BACNET/IP XML, JSON
CP-1006
CP-1016
2 DI, 13DI/AI, 10RO, 2DO-triac, 2AO
CP-1008
CP-1018
1 DI, 11DI/AI, 10RO, 4AO
CP-1972.xx
CP-1970.xx
Basic modules
Basic modules / OEM version
GT-1753
1-4 axis – motion control
UC-1203 OpenTerm
UC-1204 MP bus
SC-1101 RS-232/ RS-485
SC-1101 RS-232/ RS-485
SC-1102 CAN
SC-1111 RF Wireless MBus
ID-17
ID-31/32 4" wall touch panel
ID-14
ID-36 10" wall touch panel
Motion control modules
Serial ports - modules
Operator panels
C-DM-0402M-RLC 2x Dimmer 230V AC/500VA
C-DM-0006M -ULED 6x Dimmer
C-DM-0006M -ILED 6x Dimmer
C-DM-0002M 2x AO 0-10V, 2x RO
C-AQ-0001R – CO2
C-AQ-0002R – VOC
C-AQ-0003R – Smoke
C-1W-4000M 1Wire® bus, 2x20
C-DL-0064M 64x DALI/DSI
C-AQ-0005R-CO
C-AQ-0005R-Methan
C-AQ-0005R-Butan
C-BM-0202M LiFePo Battery Management
C-EM-0401M 4x 380 V AC Electricity meter
C-EV-0302M Electro Vehicle EN 61851-1
DTNVE-1 /CIB
DTNVEM-1 /CIB
BDM-024 -V/1-R1/CIB
DM-024 -V/1-R1/CIB
C-BS-0001M
CFox®, CIB – Common Installation Bus®
CIB-1
CIB-2
CIB-3
CIB-4
CIB-5
CIB-6
CIB-7
CIB-8
CIB-9
CIB-10
CF-1141 64x CFox
RF-1131 64x RFox
Terminal
RFox®, 868MHz
R-HM-1113M 3AI, 8DI, 9RO, 2AO
R-HM-1121M 3AI, 8DI, 19RO, 2AO
R-SL-0202M-A 2AI/DI 1RO, 1PWM
R-WS-0200R Time
R-WS-0400R Time
R-IT-0100R Time
R-KF-0500T 5DI
R-HC-0101F, 0-100% Valve, 1AI/DI,
R-OR-0001B 1RO
R-IB-0400B 4DI
Power Supplies
PS2-60-27 60W, 27V, 12V
HDR-15-24 15W,24V
HDR-30-24 30W,24V
HDR-60-24 60W,24V
HDR-100-24 100W,24V
+5V, +12V, +24V available


Tecomat TC700 – System overview
TECO ROUTE
Cloud services
SmartGrid
WiFi/ADSL Router
Other Tecomat PLC
Vizualization for control room
SCADA system
Reliance
Industrial SCADA/HMI system
OPC FOUNDATION
Ethernet / LAN / WLAN (WiFi) / Internet
Protocols: TCP/IP, UDP, SMTP, SNTP, HTTP, MODBUS TCP, IEC-61870-5-104, BACN
RM-7942
Basic rack for 15 slots
RM-7941
Basic rack for 8 slots
CP-7000 2 SCH
CP-7004 1 ETH, 2 SCH
CP-7007 1 ETH, 2 SCH
SC-7103 2 SCH
SC-7104 1 ETH, 2 SCH
CD-7151 Master
CD-7152 Slave
MR_0104 RS-232
MR_0114 RS-485
MR_0124 RS-422
MR_0152 Profibus DP slave
MR_0160 2x CAN
MR_0161 CAN
PW-7901 24V
PW-7902 24V, UPS
PW-7903 230V
PW-7904 230V, UPS
Central modules
Communication modules
Communication submodules
Power supplies
IB-7302 32 DI
IB-7303 16 DI
IB-7305 16 DI
IB-7310 64 DI
IB-7311 32 DI
IR-7510 32 DI, 32 DO
IR-7551 8 DI, 8 RO
OS-7401 16 DO
OS-7402 32 DO
OS-7405 16 DO
OS-7410 32 DO
OS-7411 64 DO
OR-7451 16 RO
OR-7453 8 RO
IT-7601 8 AI
Binary I/O modules
IB-0401 16 DI/24 V DC
IB-0402 16 DI/24 V DC Surge protection
IB-0403 16 DI/230 V AC
OR-0422 8 RO/230 V AC/3A
OR-0424 16 RO/230 V DC/3 A
OS-0425 16 SSR/230 V AC/0,5 A
OS-0426 16 SSR/230 V AC/2 A
OR-0427 8 RO/230 V DC/16 A
OS-0428 16 SSR/24 V DC/0,5 A
External binary I/O modules

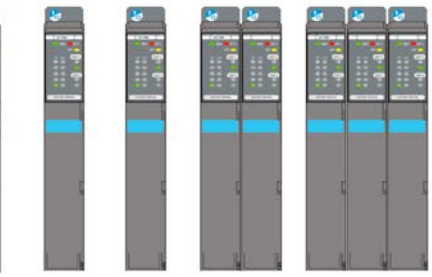
Smart-phones

Tablets

NET/IP, XML, JSON

RM-7946
Basic rack for 4 slots

RM-7944
Basic rack for 2 slots



GT-7752
1 Axis

GT-7752
2 Axis

GT-7753
4 Axis

GT-7754
6 Axis

Motion control 1-6 axis

IT-7602
16 AI

IT-7604
8 AI

IT-7606
32 AI

OT-7652
8 AO

Analog I/O modules

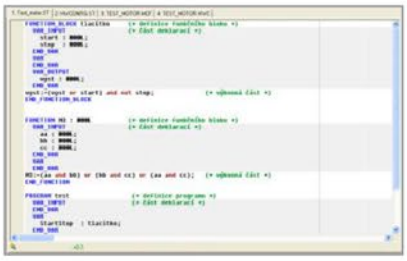
IT-0451
4 AI
Surge protection

IT-0453
8 AI, loop supply, fused

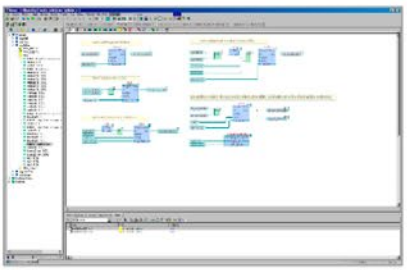
OT-0461
8 AO, loop supply, fused

External analog I/O modules

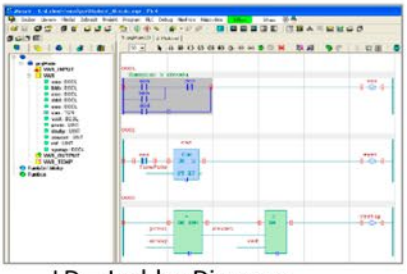
Mosaic – free programming - IEC 61131-3



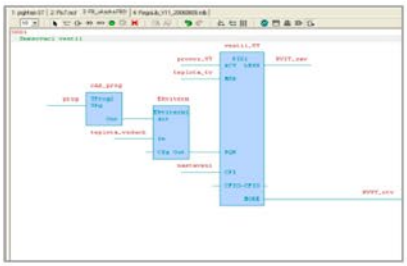
ST – Structured Text



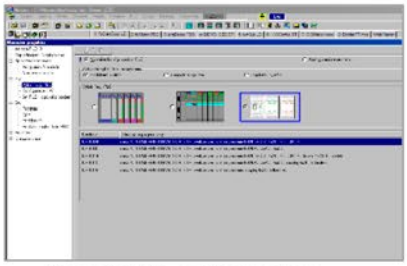
CFC – Continuous Flow Chart



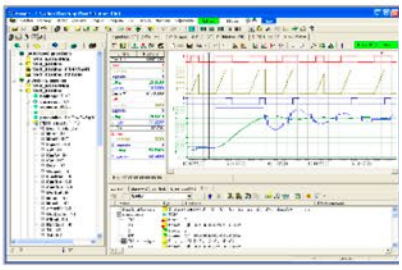
LD – Ladder Diagram



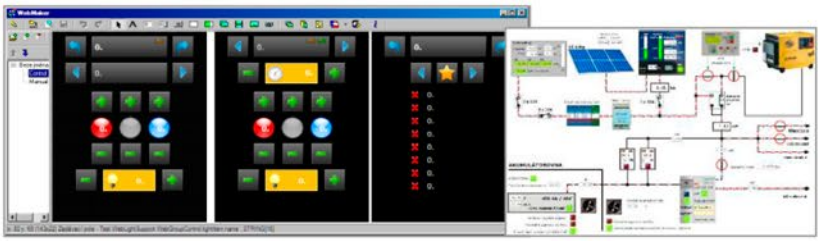
FBD – Functional block Diagram



Target PLC configurator



GraphMaker –signal visualisation



WEB Maker – composer of internal interactive graphic web pages

Firmware Updater

DataLogger

WIRE REWINDING MACHINE – BLACK & DECKER, MIRAS ELEKTRO, CR

Black & Decker is a multinational manufacturer producing mainly electrical power tools and gardening equipment. In 2018 Miras Elektro delivered to Black & Decker a new wire winding machine. In the past Black & Decker experienced various defects in the winding process, the wire got tangled up while being wound onto the spool or it was incorrectly wound around the spool. the new machine has eliminated these issues and gave the technician a peace of mind knowing that the spool is correctly manufactured and may therefore be used in the next manufacturing step.

The machine is equipped with two step motors, one of which makes sure that the wires turns on the spool are properly organized in rows, and the other motor rotates the spool and does the actual winding. This machine is controlled by a central module Tecomat Foxtrot labeled as CP-1003 which is equipped with four high-speed transistor outputs required for step motor control. Two drivers with step motors are connected to these outputs. Motors are synchronized to make sure that the spool rotates properly and that the wire turns are properly organized and to eliminate wire crossing. During the winding process the machine actually monitors "jerks" in the wire tension, or even checks whether the spool is stuck. The system visualization runs on the operator panel ID-28 installed directly in the distribution cabinet. the machine is able to use a secure connection to the Internet thanks to Teco Route service, which allows technicians to service the machine remotely through its integrated interface.

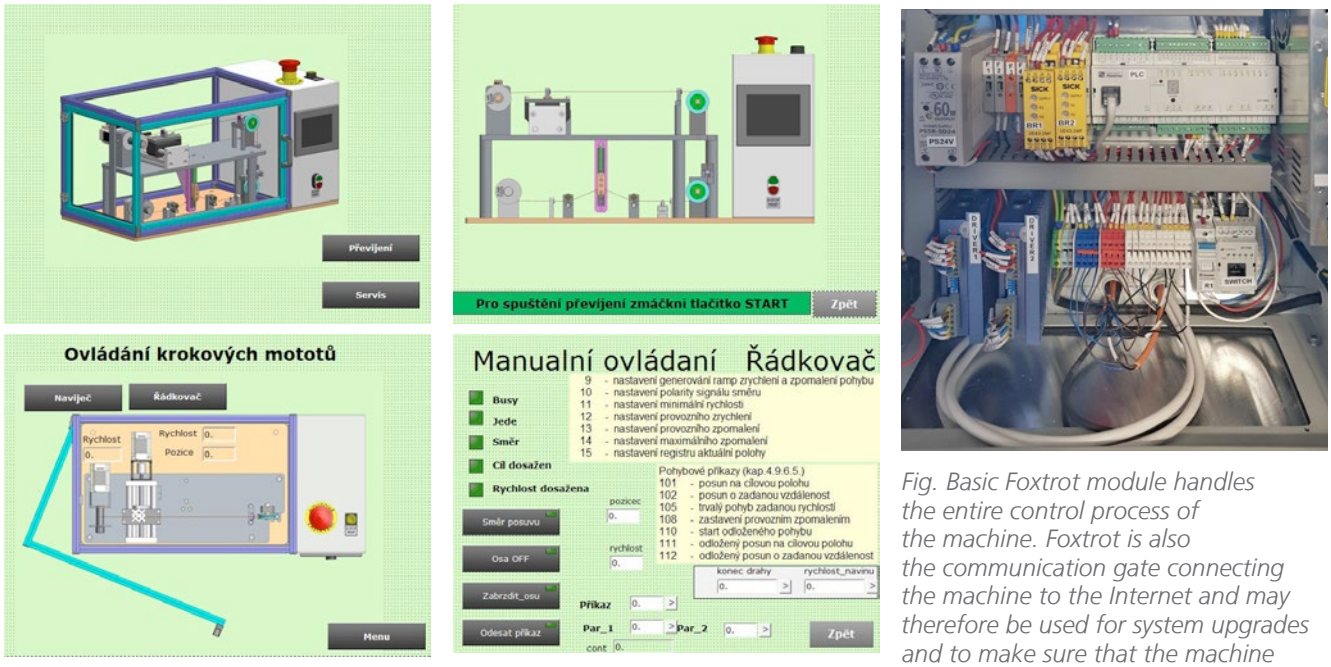


Fig. Interactive control screens of the touch panel clearly depicting the actual machine. Parameters are entered in the tables, which also offer text-based assistance.

Fig. Basic Foxtrot module handles the entire control process of the machine. Foxtrot is also the communication gate connecting the machine to the Internet and may therefore be used for system upgrades and to make sure that the machine complies with the requirements of the famous Industry 4.0 standard.

VACUUM TESTER INSTALLED ON A PRODUCTION LINE IN FRUTA PODIVÍN AND CUP RINSING MACHINE IN HAMÉ

The management of a company belonging to Mr. Jaderníček decided to use Tecomat Foxtrot to deal with several tasks presented by the production line in Fruta Podivín – a manufacturer of canned food products. the machines are installed between the operational sections of the line and monitor the quality of the final product. This inspection also includes the actual checks of the hermetic seal on the glass containers or glasses through the use of a vacuum tester. We all know that vacuum is required inside glass containers which contain preserved food and if no perfect seal is achieved the air will enter inside the glass making the food inside unusable and the consumer most likely will return the product as defective or simply throws the product away. the manufacturer has already been checking the vacuum seal of the glass containers, but using a method which could not guarantee hundred percent reliability. Mr. Jaderníček has innovated the control station which is already installed in the line using a new

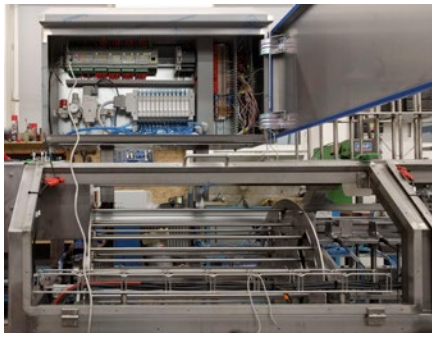
Fig. Another implementation of an inspection station which is used to check the hermetic seal by utilizing Tecomat Foxtrot system. This time the check station is installed on a line that is used to produce ketchup bottles.

principle of monitoring which focuses on the profile or rather on the deflection of the cap. A laser instrument measures the variation in the distances created by the cap deflection. Tecomat Foxtrot is able to monitor this profile even when the glass containers move fast on the conveyor belt and compares the profile with the sample of a correctly sealed glass. Glass caps which do not meet the sample profile are marked as defective.

Another modification of the vacuum tester has been employed in OTMA Mařatice. This time the unit uses an induction sensor. Finished glasses with caps pass the inspection station where the system checks the glasses and the actual presence of the cap. the measurement occurs after the filling station. If the measurement is successful the glass containers go into the "sleeve" where they are sealed. the speed of the conveyor belt is 0.3 m per second.

Fig. Laser unit which measures the distance or rather the deflection of the cap with the accuracy of one tenth of a millimeter, while the finished glasses pass by on the conveyor belt. the deflection of the cap is the best indicator which tells the system whether the correct seal was achieved or whether it is necessary to mark the product as defective.

Figure. Laser detection unit monitors the quality of the seal on the final glass containers. the detection unit is installed near the conveyor belt. the evaluation is done by Tecomat enclosed in a small distribution box equipped with a touchscreen just above the conveyor belt.



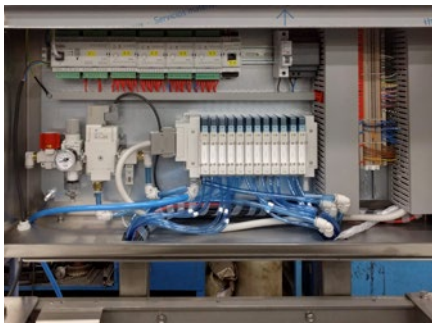
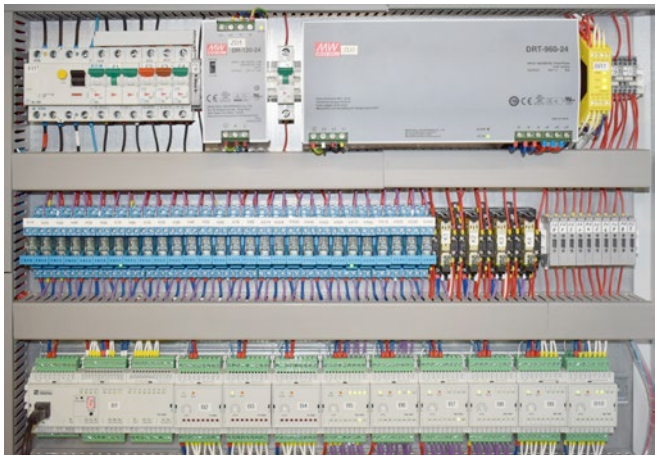


Fig. These two pictures show the assembly phase and commissioning/ startup of a production line used to rinse and air dry plastic cups in HAMÉ. Tecomat Foxtrot control system is also used here and it is installed in an integrated distribution box equipped with a pneumatic valve panel, which transfers the output commands sent by Foxtrot to the pneumatic members of the system. Tecomat controls the process at the beginning of the filling line where the plastic cups are filled with fruit jam or marmalade.

SERVICE LIFE TESTER (RELIABILITY TESTER)



Emerson company, which is located right next to us in the Industrial zone Štáralka in Kolín also uses Tecomat systems for many technological projects or equipment, gave us a permission to publish the following text and photographs.

Service life tester (reliability tester)

This machine is used to test the service life/reliability and stability of products under specific loads manufactured by Alco Controls spol. s r.o.

PLC Tecomat Foxtrot manufactured by Teco a.s. (CP 1003) is used to evaluate measured data based on the preset parameters (pressure, electrical resistance or time). Based on these data the system either starts or ends individual test cycles. the testing machine consists of 8 independent testing positions which may be used to test up to 48 various types of products independently (the number of products that may be tested on this machine is constantly expanding). the machine was put into operation in 2017.

CZECH SELF-SUFFICIENT HOUSE IN 2019

Fig. Designs and proposals submitted by students for the competition event called Czech self-sufficient house

The mission of the Project called the Czech self-sufficient house is to promote construction of houses complying with various self-sufficiency levels and to develop clean technologies for households. This project even received an award from United Nations for contributing to social benefits and the Energy Globe reward for innovations related to energy savings and finally, the top award of the European Commission the so-called EU Sustainable Energy Award. This project achieved all this success with no grants.

During the three-year existence of this project, a wide network of top experts from related industries was established and got involved in the Czech self-sufficient house project. These experts created a unique team dealing with technological and design issues. Further, this team is preparing two demonstrations or rather events which will be available to the public and will display great self-sufficiency levels – two island houses not connected to the power grid. the entire technological concept and the logic behind the used equipment has already been created and designed, assembled and tested. At the registered seat of ELPRAMO company in Prague, you may see all technologies fully operational as they are being tested. At the same time this demonstration is used as a showroom for anyone who might be interested in these technologies.

Fig. A unique show room equipped with Foxtrot which controls the technologies of the island house – a house which is not connected to the public power grid. This house may be seen in Prague at the ELPRAMO company headquarters.

The entire operation of the house including production and consumption is simulated in a real environment and the collected data are used for evaluation and optimization of the control system algorithms. In a brief, we may say that in one test room you will see a technological room designed for the actual and real houses. All technologies (including rain simulations) are controlled by Tecomat Foxtrot which was installed and programmed by ELPRAMO. You can learn about the technical solution in more detail from the attached panorama photograph showing the entire test room. Great technical gadgets include for example a pellet boiler made by Austrian manufacturer Okofen and equipped with a Sterling motor which is used to recharge the battery pack with a capacity of approximately 900 W.

The most important players in the implementation teams are: GWL Power/i4wifi (Europe's leading supplier of lithium batteries and solar technologies), ELPRAMO (premium electrical components), V-Invest (the new and fresh blood for the project), Teco (advanced systems Tecomat Foxtrot used for automation processes and building control), WAFE (air-conditioning components), Envi-Pur (water distribution and management).

Each year, the Czech self-sufficient house also organizes a national competition event, which is also called the Czech self-sufficient house, for students focusing on architecture and building construction. All building concepts involved in the event and focusing on self-sufficient buildings may be downloaded by any company or by the public for free from www.csdum.cz. You may find your inspiration there.

Another part playing an important role in supporting the wide expansion of the power and energy decentralization concept, as well as self-sufficiency and energy sharing, is the existence and availability of sufficient battery storage. These must be easily installed and must offer long service life which is needed for households. the Czech self-sufficient house has already begun with the development of such battery pack. At present, the following companies are involved in the battery pack development process: Nano Energies, GWL Power and ELPRAMO.

Ing. Petr Pokora, ELPRAMO s.r.o..

Fig. the winning project introduced during the first year of the event has received a building permit and after three years of preparations and modifications this project is ready for the actual construction, which shall begin in 2019.

Fig. Control screen developed for the control and monitoring of the Czech self-sufficient house project.

DESIGN LIVING CONCEPT – A NEW PLATFORM FOR A NEW SHOWROOM

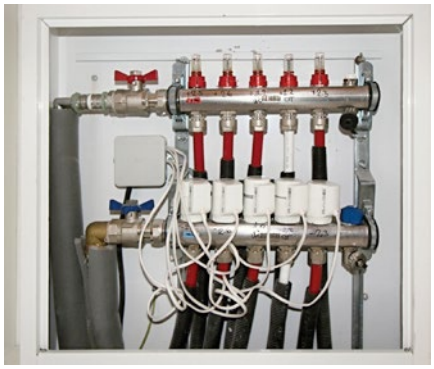
At the beginning of 2019 a showroom style and fully functional modern apartment equipped with premium and intelligent electrical systems based on Tecomat Foxtrot will open at the Rohanské nábřeží, address: U mlýnského kanálu 5, Prague 8. Thanks to long-term cooperation between individual suppliers on previous projects we have designed a platform called Design Living Concept.
Here, in a single location the customer has a chance to see and discuss issues concerning the entire interior starting with the initial design and ending with the actual implementation of the project. Bathroom, furniture, tiling, flooring, illumination and dimming systems and the use and installation of premium electrical components – all in one place. Tecomat Foxtrot is used to control ventilation and heating systems and it is a part of the complex delivery offered by ELPRAMO, s.r.o. This company is the partner of the part of the project which deals with the installation of premium electrical components and systems. Here, Foxtrot has been integrated with the Lutron system which is used to control the illumination and dimming system in the apartment and it also handles the security system. Starting in April, the showroom will remain open every business day from 9:00 to 16:00.

Ing. Petr Pokora, ELPRAMO
www.elpramo.cz
www.designlivingconcept.cz

Fig. Photographs showing top-of-the-line interior equipment in the fully functional showroom-style apartment installed at Rohanské nábřeží.

DEVELOPER PROJECT BERANKA – HOME AUTOMATION SYSTEMS – HAIDY – CR

In 2018 our customer – HAIDY a.s. used our system Tecomat Foxtrot in a developer project called Beranka in Prague – Horní Počernice. This project integrates practical benefits of an apartment with the benefits offered by a house. Beranka project is a typical example thanks to its modern and decent architecture and well-thought layout and arrangement, which follows and matches the characteristics of the given location and complies with high demands of future tenants or users. Even the acquisition cost for the house is comparable with the price of a typical apartment.



Under this project HAIDY has installed its solution in several houses where it controls various automation systems and which builds on Foxtrot system. Thanks to proposal and changes submitted by clients houses were created exactly according to individual requirements or images of customers. HAIDY installed components which control the heating and cooling systems and even offer a special summer mode – the option to run cool water through the flooring system. Customers are able to control the il-

lumination systems through wall-mounted pushbuttons or through the time program app in mobile devices, as well as motion sensors and magnets For example, these sensors turn off automatically all lights when you leave the house. As a standard feature, houses are equipped with smoke detectors of course.

The project implementation includes the following:

Heating/air conditioning system control:

- 7 heated zones, temperature sensor and summer mode – option to run cool water through the floor

Bathroom rack control:

- Electric heating insert button switching option to dry towels during summer

Outdoor window blinds control

- Pushbutton control, time program using the application in your mobile device (meteo function (brightness and temperature sensor)

Illumination system control

- control of all light fixtures in the house
- only switching light fixtures
- light scenes controlled with one pushbutton

Security:

- motion detectors, magnets – house envelope locking (all lights switching encoded)
- smoke detector – when smoke is detected the selected loop is disconnected

FOXTROT CONTROLS ILLUMINATION SYSTEM AND MORE IN GEEN COMPANY

GEEN – a company located in Brno is focused on energy. In 2018 the company completely reconstructed the ninth floor in a high-rise building at Mariánské square and turned the former technical tenth floor into a comfortable meeting room with a terrace which offers a unique view of the center of the city of Brno dominated by Petrov and the Špilberk castle. Here the company operates its surveillance system and manages its photovoltaic and small hydro power plants. Communication with these systems and their graphic visualization displayed on a set of large monitors has been handled for several years by Tecomat Foxtrot systems produced by Teco a.s. company located in Kolín.

It is thanks to a long cooperation and many good experiences with the use of Foxtrot systems as well as thanks to the universality of Foxtrot, which really opened the door for this company and gave the company the option to control the complete infrastructure on the reconstructed floors. In this article we shall try to convert the dry list of technical parameters and descriptions of the technical solution into more friendly and pleasant narrative.

There are only few light fixtures which are directly switched through controlled relays. Probably around ten. These mostly include LED light fixtures and lights in technical rooms. All other illumination systems including toilets, dressing rooms, handrails and RGB stripes are controlled through the DALI bus. There are around 170 DALI ballasts – that is addressed/controlled lamps.

Wall-mounted switches (total of 25) are installed in all office rooms. These are however, used only minimally or maybe not at all. the company management even disabled them for a certain time to make sure that employees will get use to controlling the light systems by selecting the preset and optimized scenes. Wall-mounted switches connected through bus CIB (Common Installation Bus™) are now used for backup control and to handle the interior temperature through individual zoning control system in each room separately, because the switches are equipped with integrated temperature sensors.

The light intensity in each of the 25 rooms or areas is controlled and automatically adjusted to the desired constant value. Each such room is equipped with CIB bus which is used to connect

Fig. In addition to basic illumination system the meeting room is also equipped with color scenes.

Fig. 2 Photovoltaic (solar) and water power plants in Bohemia, Moravia and Slovakia represent the basic business line of GEEN in terms of the energy industry; Here you may see a remote dispatch supervision system implemented by Ing. Pavel Smílek of Rameco, which also uses Foxtrot systems.

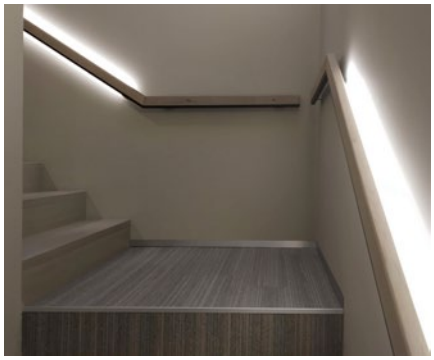


Fig. 3a, b, c. Illumination system design plays an important role in the reconstructed office spaces and in the interior corridors in the GEEN building

two or three ceiling sensors monitoring the light intensity in combination with motion detectors. the preset value of the light intensity may be changed in each room dynamically during the day and based on the time program. Individual control of certain light fixtures is also connected to an interactive website which is available through a mobile phone or tablet. To achieve light scenes at the outdoor terrace, which is on the roof, the designer used LED stripes built into handrails and directional LED lamps which illuminate the roof.
Several RGB stripes, which seamlessly change colors in order to create the desired mood, are installed in the meeting room and in the island at the front desk. Foxtrot also controls the ventilation system through a central air-conditioning unit which is installed in the technical room on the roof and consists of three independently controlled loops, one for the eighth floor, one for the ninth floor and one for the tenth floor. the power output of the unit, which in this case refers to the amount of the replaced air, is controlled in each loop based on the measured concentration of CO2. Night ventilation is controlled by the time program.
During the summer the interior is cooled down by twelve air-conditioning units installed in the ceiling. Foxtrot system together with the illumination system controls all loops/circles and maintains the desired target temperature automatically (AUTO mode). Also the MANUAL mode is available where the temperature, fans, grille lamellas angles and the relevant modes may be set by the people in the office using their mobile phones – providing that they have an authorized access to the Foxtrot website. In winter, Foxtrot also controls the heating process. This is possible thanks to 35 radiator valves connected by CIB bus. These valves offer a smooth and gradual control ranging from 0 to 100% of the valve capacity.
Outdoor blinds are installed almost around the entire perimeter of the building. In addition to providing proper shading, the blinds has also been designed to minimize undesirable warming of the building interior. When Foxtrot is in the auto mode, the east and the west side of the building are shadowed centrally. the shade level or the coverage depends on the combination of two factors. the height of the sun, and the outside brightness. Blinds may also be controlled from each office by using a mobile phone. In order to protect the blinds from strong wind the building is fitted with a central meteo-station which provides information about the current wind speed and direction.

The reconstruction of the technological equipment was completed within three months. At the end of this period the entire central program for Foxtrot was programmed and debugged. This project is yet another example of a successful implementation among the huge number of other projects dealing with comprehensive solutions for office buildings and spaces.

Ing. Jaromír Klaban,
Teco a. s.

Fig. 4 Blinds, light fixtures, cooling and heating systems, ventilation and the access system represent one integrated and logically operating unit installed in each office and controlled by Foxtrot

Fig. 5 the outside terrace seamlessly connects to the meeting room through a large glass sliding wall; the terrace offers a unique view of the city of Brno, not only from the terrace. You may enjoy the view from the meeting room as well

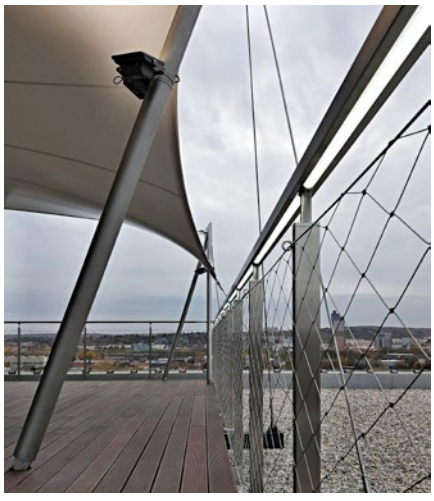


Fig. 6 the terrace is protected with a tensioned canvas roofing. the indirect illumination of the roofing and the built-in LED stripes in the lower section of the handrail area create interesting light effects and scenes, particularly at night.

Fig. 7 Ing. Pavel Snílek has the necessary knowledge and skills needed to completely debug of the interior control system and to handle the special communication with remote photovoltaic (solar) power plants manufactured by GEEN.

Fig. 8 This picture shows Foxtrot control system in the distribution cabinet which manages the entire floor. You may see ballasts for six branches of DALI buses. Other components are installed in rooms, such as sensors and switches, and are connected through CIB (Common Installation Bus™)

KROMĚŘÍŽ CITY OFFICE – FOXTROT AS A SYSTEM FOR INDIVIDUAL ZONING EGULATION OF A LARGE-SCALE HEATING SYSTEM – MICRONIC PŘEROV s.r.o.

During summer months and under the reconstruction project of the building "B", which is operated by the Kroměříž city office, and also as a part of the energy audit, a company called Micronic Přerov s.r.o. has began with the deployment of Tecomat Foxtrot system designed to control individual zone regulation of heating systems and the relevant boiler room. the main objective was to achieve maximum energy savings while maintaining optimal temperatures for the staff.

This project is another implementation performed by a company called www.TopeniChytre.cz, which follows modern energy savings trends and observes the need for recording measured and operational

Fig. Kroměříž city office

Fig. Wall-mounted touchscreen controller belonging to Touch@Glass series connected via CIB bus.

Fig. Visualization and control using the floor plan layout

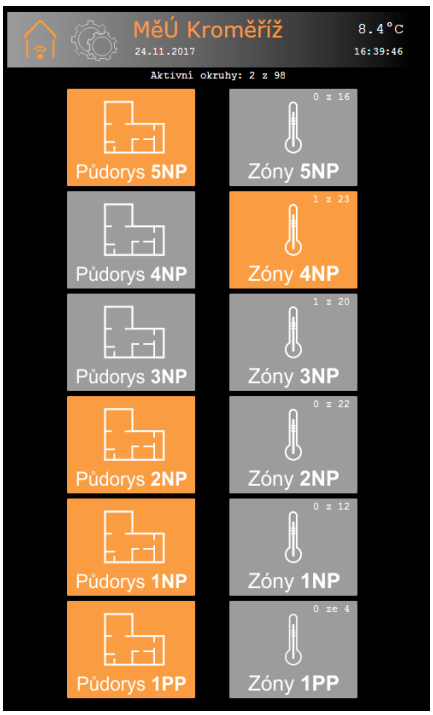


Fig. After proper authorization the system may be accessed from any device, including mobile phones

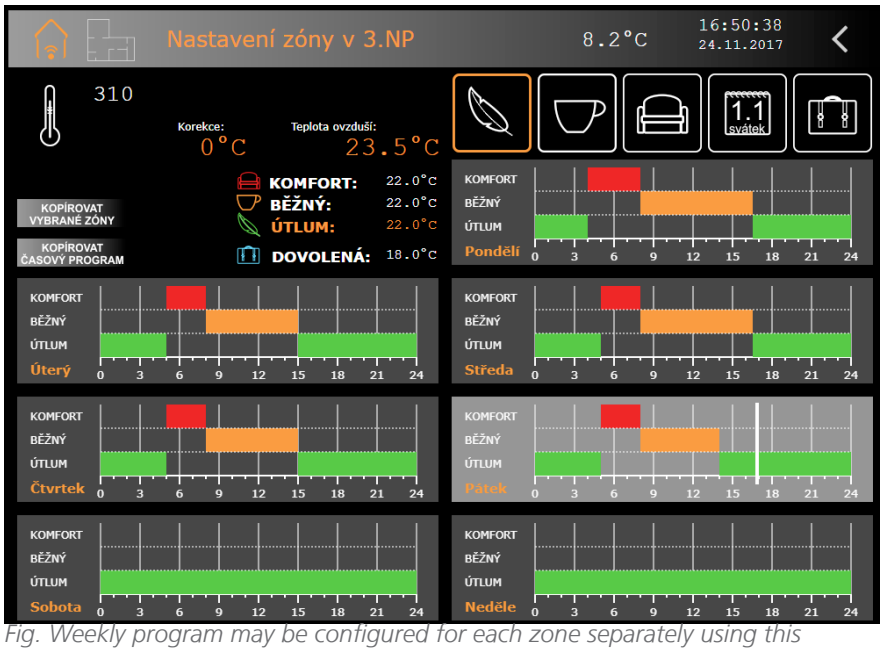


Fig. Weekly program may be configured for each zone separately using this interactive graphic interface

values using a large-scale data repository system.
The stored data are then used to analyze and optimize the operation of the building. Interesting innovation in this project is the use of CIB buses (Common Installation Bus™), glass touch-thermostat with LCD display (Touch&Glass series), which was designed based on the idea and specifications of the building operator, including the logo of the operator. the new thermostat offers a simple control using six touchscreen areas supported by LED indicators of different colors which define the operational status, and also a three-digit display. This display shows the measured and the desired temperature. This building contains 89 regulated rooms of which 80 rooms are equipped with this touch-control element. In total, 119 electric heater control heads are connected to the system. the zone regulation system is connected to the control system in the gas boiler room which handles several heating loops.

Fig. This picture shows the central source of heat together with a cascade of gas boilers

In addition to the touchscreen control elements the entire system may also be controlled using intuitive graphic visualizations. the administrator or users may use this system to login – based on their access rights. *Daniel Smička, Micronic s.r.o*

REMOTELY CONTROLLED SMART HOUSE – A FAMILY HOUSE IN RAKOVNÍK, 2018

In 2018 Tefora has completed the implementation of rather small and quiet but at the same time unusual smart house built near the town of Rakovník. At first Tecomat Foxtrot system was designed to control zone heating system, and also window electric blinds – remotely controlled. Later the client decided to control also a certain part of the illumination system. By the way the eleven light circuits which were selected, match exactly the number of control contacts in the expansion relay module C-OR-0011M. But why this project is so interesting?
The implementation documentation of the control system was prepared using a shared Internet storage called Google Suite. To apply modification or changes to the system (changes in the layout, type and functions of individual switches, etc.), the client simply accesses the system through the Internet.
Based on the documentation the electrician of the client has prepared the necessary connection cables which run between switches and light fixtures and window blinds including cables for the heating system distributors.
In parallel with this preparation process Tefora has prepared a program for the central unit and connected components installed on DIN bar in the distribution cabinet. When completed, only one meeting with the client took place – at Tefora headquarters. During this meeting the client received a completed and fully functional Foxtrot system in a "box" including the control application in a mobile phone. Only light fixtures and blinds were monitored by LED indicators installed on output modules.
Then the electrician of the client used the documentation to connect Foxtrot control system in the distribution cabinet and then used the prepared cables. the electrician also called in but only with two questions, but that seemed to be enough to complete the installation.
After the entire connection in the house was finished and operational, Tefora programmer accessed the operational system remotely using TecoRoute and applied small modifications.
The entire project was implemented without a single trip to the actual house and based on one personal meeting with the client.
This was possible thanks to the technical knowledge and overview of the client, thanks to proper sharing of the project documentation over Internet, but also thanks to the properties of our Foxtrot system. In particular, Teco Route service was used twice: first, the client connected remotely and reviewed the Foxtrot control site when the system was operational in Tefora and later when the system was already installed at the client, the programmer of Tefora remotely edited and completed the system settings.

Ivan Libicher, Tefora s.r.o.

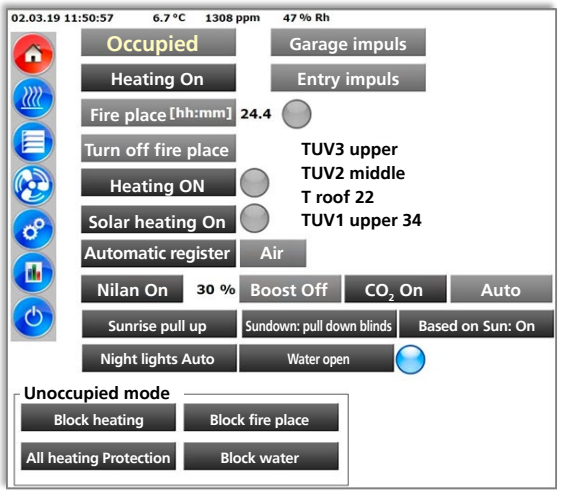
"SMARTIFIED" HOUSE – GETTING SMART AFTER YEARS OF REGULAR OPERATION, SOUTH BOHEMIA, 2019

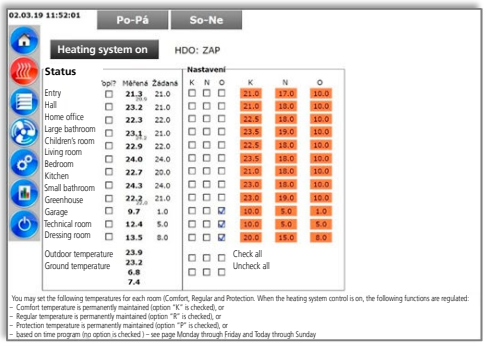
In 2019 Tefora completed installation of Foxtrot system which was used to control technology in a low-energy family house located in South Bohemia. This project is interesting because of the wide range of control technologies used and in particular because the task of the project was to add and install control systems in a house which was already inhabited for several years and therefore under "full" operation. the investor was an experience electrician who prepared a pipe distribution system at the time the house was being built, and even added some redundant cables at certain locations which could be used as a control Bus. Thanks to the "pre-installed" wiring the reconstruction took only several months and without impacting the actual operation of the house. Foxtrot control system is used here to handle the following functions:

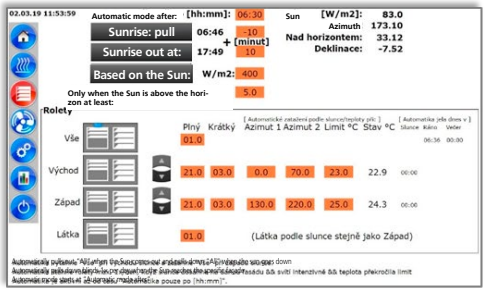
- Foxtrot replaced the original ventilation system control unit with Nilan recuperation feature. This unit is controlled by weekly time program handled by Foxtrot which either increases the performance based on the measured CO2 values or based on the commands initiated by the pushbuttons installed in individual rooms equipped with automatic and manual control of the "bypass" flap.
- As a new feature the automatic and manual control of the flap of approximately. 2 m long underground pipe register was added. During winter this system warms up and during the summer cools down the clean air which is drawn in by the ventilation system from the outside.
- It also controls an additional electrical heating system (it replaced the old regular thermostats) using the weekly time program which controls the temperature in individual rooms and offers the user the option to reduce the heating output if for example, the fireplace is on or if no one is present in the house (the Unoccupied mode).
- Allows a mobile application to control the entry gate and garage doors
- Automatically controls the fireplace equipped with a pellet storage using the time program (automatically) or even handles the manual control which is done from your application and in accordance with the selected time interval (before the user arrives and enters the house etc.). the system also offers the option to use the heat to warm up hot water.
- It controls hot water temperature in the boiler using three sources: Solar panels installed on the roof of the house, excessive heat produced by the fireplace and the electrical heating unit. the heating process of the electrical heating unit is controlled by the time program which makes sure that when the system is off for a longer period – the HDO signal is off, that is between 18:00 – 19:00 and 20:00 – 21:00, there is still enough hot water available.
- Controls groups of window blinds and outdoor shades blinds covering three façades of the house. Based on the user settings the systems either opens up the blinds at the dawn or pulls them down at dusk. It also closes the blinds at individual façades when the sunlight intensity reaches a certain brightness level and when the temperature in the controlled rooms reach certain preset levels.
- It also controls outside lamps – turns them on during sundown and shuts them off during sunrise while observing the preset night interval.
- Monitors the minute and hour consumption of water and when the preset limit is exceeded the system automatically closes the water intake safety valve and sends a warning email message to the user.
- It uses several power meters and water meters to monitor and measure the energy consumption and displays the last consumption values at the website controlled by the application
- Monitors and stores complete history of measurements in text files in the central unit which allows for later data analysis, for example in Excel.

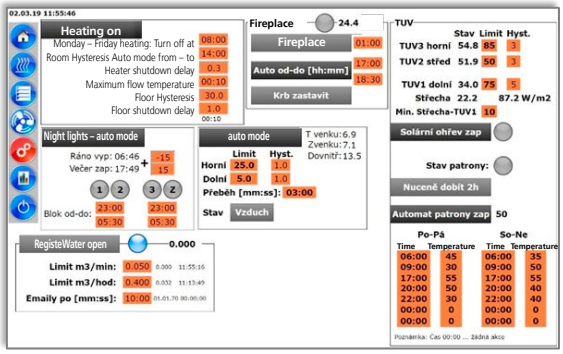
The scope of used technologies and user configurations are clearly seen on the screens below:

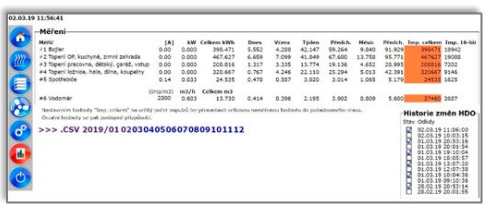
Ivan Libicher, Tefora s.r.o.











TECOMAT SYSTEM INSTALLED IN VAN DER VALK BREUKELEN HOTEL

Fig. Interactive control screens for each hall separately are generated by Foxtrot. Commands are then interpreted and transferred into a rack full of audio amplifiers ECLER, video matrix Black Magic and central wireless microphone systems Sennheiser. the system also controls projector screens, window blinds and monitors the temperature in individual halls.

Following the installation of our Tecomat Foxtrot system in the Dutch hotel in Van Der Valk in Veenendalen, which we have already been reported in 2016 also another hotel belonging to the same chain in Breukelen decided to use our Tecomat Foxtrot system. Also here Tecomat systems control congress halls and saloons. There are 22 of Them. LAN network connects seven basic Foxtrot module's which are then connected to stationary control panels installed in each room/hall. Of course, direct access and control through mobile tablets is a standard feature.

Fig. the information and booking system is also integrated with Foxtrot. Information is displayed clearly on a large display and then on small displays installed before the entry into each hall.

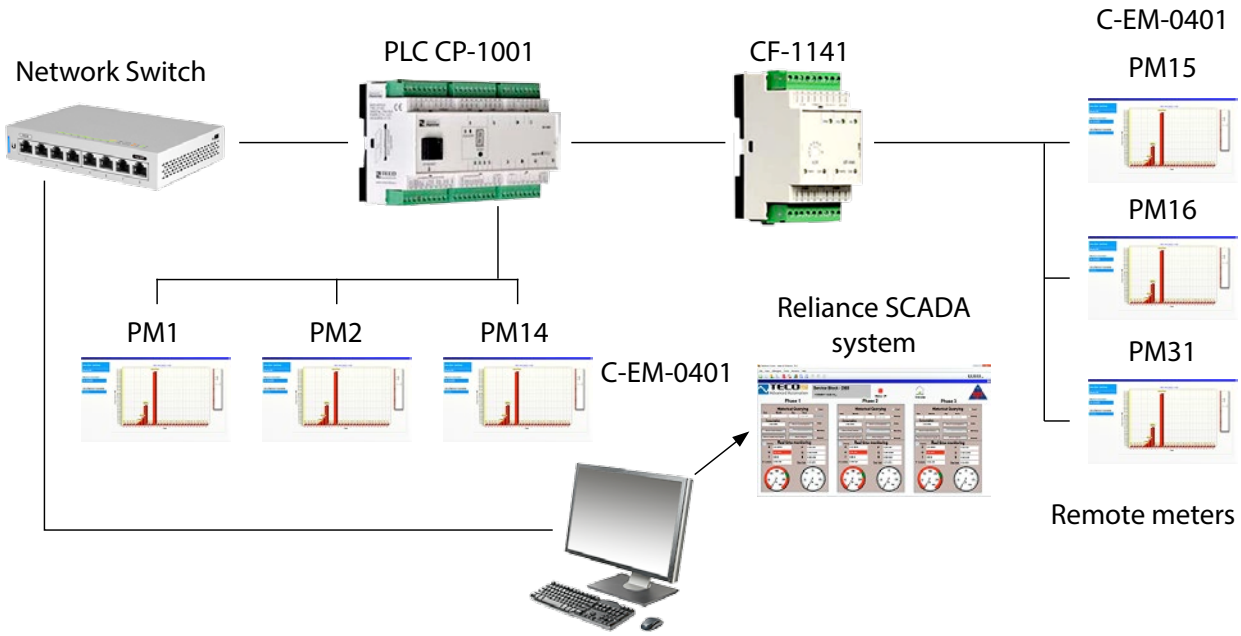
Fig. Seven basic Foxtrot modules CP-1005 are the backbone of the control infrastructure which monitors the congress halls.

Fig. Distribution cabinet with multi-channel audio amplifiers, video matrixes and wireless microphones.

Fig. the control panel in each hall is connected to Foxtrot system which allows the operator to access all functions and set parameters in the hall.

Fig. We are proud of the fact that we manufacture Foxtrot systems in Czech Republic/Bohemia in the town of Kolín and that the systems are used to provide high-quality services for congress halls around the world. Here in particular you see the Dutch city of Breukelen. B &R Design is one of those companies which expect Foxtrot systems to perform sophisticated and above-standard services demanded by top technical solutions the company offers to its customers.

POWER CONSUMPTION MONITORING IN JABEL AT- DHANNAH RESORT, ABU DHABI, UNITED ARAB EMIRATES



At the beginning of 2017, Orient Protection Systems (ops) implemented Tecomat Foxtrot control system with the intention to monitor power consumption in the Abel At- Dhannah resort in Abu Dhabi.

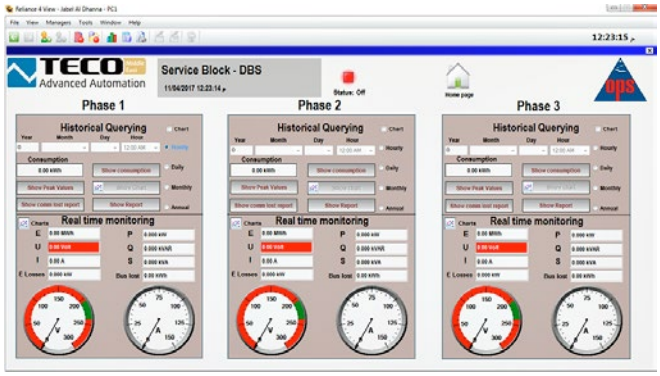
The implemented project takes care of the following functions:

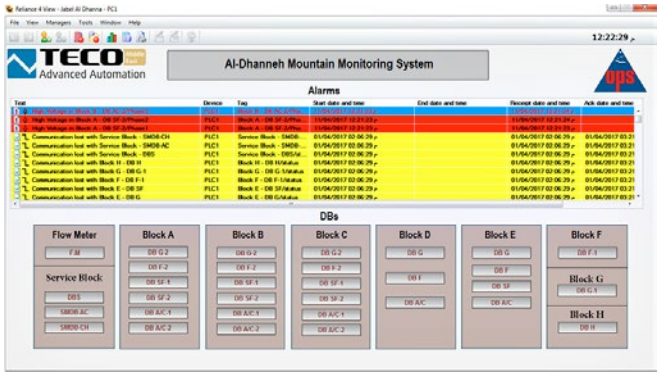
- Monitors all distribution cabinets within the resort
- Monitors all parameters in the electric distribution grid in real-time
- Keep logs of these parameters for history data analysis
- Data are displayed in several ways
- Numerically as a reply to specific time interval entered by the user
- Historical assemblies

– In the form of diagrams which demonstrate daily, weekly, monthly and yearly ranges

– The application also generates alarms in case of overvoltage, under voltage or unusual power draw occurring within the given month

– The system also monitors water consumption and water pressure





EVENING WITH FOXTROT IN THE CZECH HEAVEN

You may find České nebe – in English the Czech Heaven, near the town of Budkovice which is close to the village of Ivančice. It is a private airport for model planes. I visited this airport for the first time when they organized an event called ("Jet over Czech") which was an event showing model airplanes equipped with the jet engines. In addition to fighter jets such as the Mirage and SU-27 as well as other models, by the way perfectly crafted down to the smallest detail , you could also see acrobatic routines – even performed by a four-meter double engine passenger aircraft. And as a bonus, a hanger full of old-timers such as Mercedes, Rolls-Royce, MG and Humber – including one Foxtrot. Out Foxtrot is responsible for making sure that they are all safe and protected. I was little surprised (just a little) because I heard before I arrived at this event that people working at this airport were very fond of Last summer I have learned about the intention to build here a new landing runway for sport and acrobatic planes, including gas station for planes. In April of the last year,

Fig. At first sight the gas station in Czech Heaven looks like any other gas station. However, Foxtrot will only give fuel to those who log into the station using a chip. the fuel price is then added to the total amount under the account of the relevant client.

Fig. Night covering the central area with a tribune and commercial building, which also includes a small dormitory – also controlled by Tecomat Foxtrot.

Fig. Judging by the icons on this billboard, České nebe (Czech Heaven) offers beer, food, free Wi-Fi, accommodation, camping and gas stations. What else you could possibly want? "It is out of this world, right"

Fig. A complete view of the airport before sunset as seen from a drone sent to take the pictures for this article. In the background you see a small concrete runway for model airplanes and at the front to the right there is a large grass-covered runway for sport and acrobatic airplanes.

Fig. You may use your mobile phone to remotely control the outdoor or interior lights in the new hanger.

Fig. Runway lights for acrobatic planes may be turned on by the pilot remotely using his own mobile phone and based on his own needs. the signal is received by Foxtrot unit installed in the new hanger.

Fig. A detail of the landing runway light installed in the center of a white rectangular with highly reflective surface.

I was on my way back from Bratislava from an event called Smart Energy Forum and I remembered this news. I called and find out that the runway has already been completed and that I can come to see it. So I took the highway exit to Ivančice. When I arrived, I learned that the highway was already christened by the very first landing. A Boeing plane landed here. I could not believe it. Then I saw a video and realized that it was a small double-wing plane. I had a hard time believing it, because I was not aware that Boeing ever produced such small planes. But it is true.

So I humbly asked the owner and the people at the airport whether anyone had a drone with a camera. They were not surprised at all and they were willing to spend the necessary time and even gave me two recharged batteries to take exclusive pictures for readers of the Světlo (Light) magazine including video clips and pictures of the airport from angles seen only by flying model planes, and starting on this day, also by pilots of acrobatic planes.

Ing. Jan Klaban,
Teco a.s.

FOXTROT CONTROL SYSTEMS DELIVERED AND INSTALLED BY HORA ENERGY IN A HYBRID PHOTOVOLTAIC POWER PLANT FOR JIMI TORE COMPANY IN KROMĚŘÍŽ AND FOR ALL AG FOIL IN BŘECLAV

In 2017 a company called Jimi Tore s.r.o based in Kroměříž decided to innovate its energy base by building a hybrid photovoltaic power plant with 116 panels and with installed output of 30 kWp. As battery storage they selected a battery pack produced by BYD with total capacity of 40 kWh. This battery pack is connected through three hybrid converters Studer in a form of "AC Coupling". the installed arrangement is equipped with PLC system Foxtrot which controls and directs overflows into the storage of domestic hot water and regular hot water. the current connection of Jimi Tore s.r.o. to the power grid including measuring methods were not impacted and remained the same. the facility of Jimi Tore s.r.o. is connected to the existing low-voltage distribution system managed by E.ON through power meter distribution box which is used for direct measurements.

The superior control system of the solar power plant and the recharging station is handled by PLC programmable controller and handles the following functions:

- covers current peaks using batteries (equipped with a function which limits current excesses in the branch set by the value of the main circuit breaker 63 A)
- controls electrical vehicle recharging station (based on the current load of the building and based on the production of power supplied by the solar power plant
- utilization of energy stored in batteries during blackouts or failures in the power grid (so-called prioritization feature under Backup mode)
- controlled battery discharge based on weather forecasts and with the intention to extend battery service life (controlled battery cycles) – increase in the battery service life

Obr. Instalace HFVE ve firmě AG Foil v Břeclavi je podobná. Je také třífázová s měniči Studer a bateriovým uložištěm BYD a Foxtrot tu řídí nadřízené funkce

Fig. Picture showing the installation of a 3-phase hybrid power plant in Jimi Tore s.r.o.

- electric power management in terms of overflows directed to the electrical boiler and to the hot water reservoir.
- Prioritizing the electrical boiler in the heating process of the office building based on the use of energy overflows during weekends and based on the current status of the gas heating system
- energy flow monitoring in real-time
- historical data recording using 32 GB built-in memory card
- PLC programmable controller is also ready to control energy produced by the solar power plant – energy overflows produced during weekends: cooling and heating systems in halls equipped with the current gas heaters.

HORA ENERGY

A HYBRID PHOTOVOLTAIC POWER PLANT FOR COMPANY GUMEX SPOL. S.R.O. IMPLEMENTED BY HORA ENERGY s.r.o.

Fig. In 2018 Hora Energy installed a hybrid solar power plant with a battery storage controlled by Foxtrot system in a company called GUMEX.

Basic information about the photovoltaic power plant system: backup mode
- 41.6 kWp installed output
- 41.4 kWp, battery, Studer chargers
- XTH 8000-48, converter SMA STP CORE 1 50-40
- PLC CP1094 + SOLAR MONITOR
- 2×22 kW Schneider recharging station for electric vehicles

Description of the control system:
- Battery charging and discharge control process based on consumption and on the quarter-hour maximum. Discharge cycles controlled based on the current season and based on estimated intensity of sunlight
- Failure-free backup of office/administrative building and the computer room in case of distribution grid failure or blackout
- Prioritization of the existing diesel generator and the battery system based on the capacity of the battery field and on the current power draw
- 2×22 kW charging station performance control socket based on the current load at the drawing point while monitoring the L' maximum
- Control of extra energy for 4 reservoirs (boilers) with a total volume of 1,400 l based on priorities
- If necessary, the excessive energy is used for the air quality control, ventilation + air-conditioning
- Connection of the Solar Monitor allows the user to create diagrams and ensures static monitoring including the option to connect to the OTE portal
- The solar monitor also ensures emergency restrictions of the power output of the converter (on-grid)
- option to use overflows for power grid or the option to eliminate overflows/ excessive energy

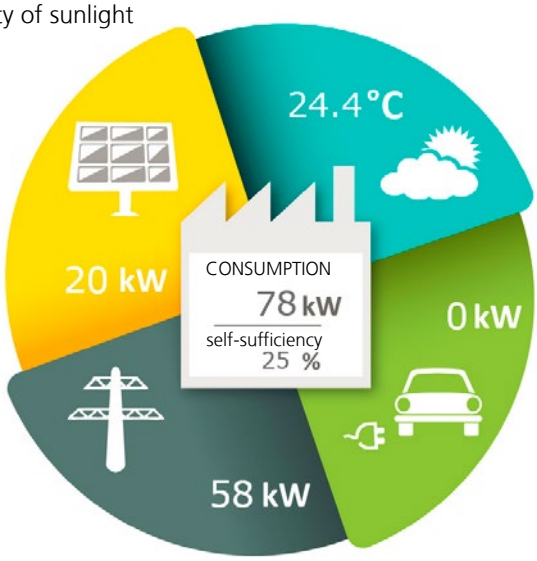


Fig. MENU = Homepage (a printscreen from 31/ 10/2018)
- Quick overview menu displaying:
- Current production (yellow)
- Current power draw from power grid (gray)
- Current power draw by the recharging station 2×22 kW (green)
- Current weather (blue)
- Total company consumption
- Current self-sufficiency of the entire company

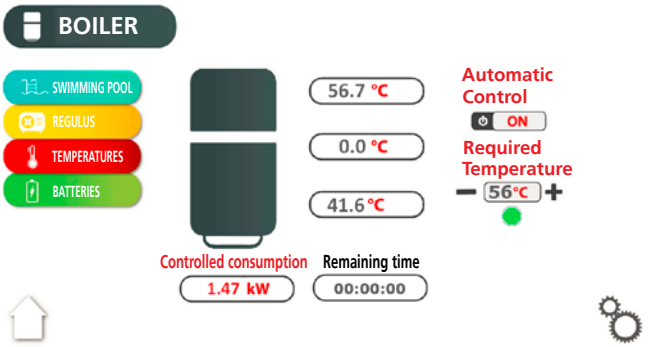
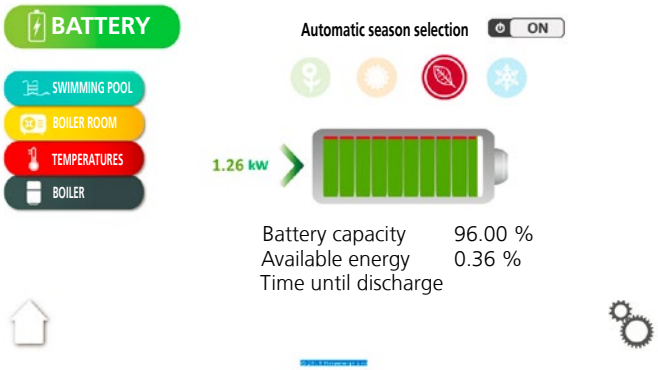
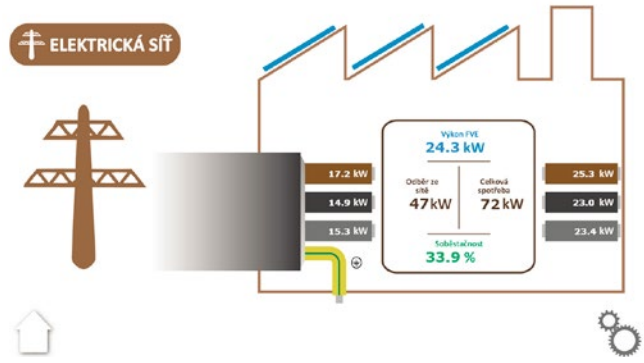


Fig. Batteries
- Automatic selection of the season in the given year precisely defining the level of discharge / option to switch to manual and configure the discharge level
- Current battery capacity – displays the current charge level
- Available energy represents the remaining usable energy until the preset discharge level is reached
- Time until discharge is the estimated time while the distribution grid is supported. In case of a blackout/failure it displays the estimated backup time based on the current power draw (backed circuits)

Fig. PPP (solar power plant)
- Displays the current performance of the solar power plant + utilization in %
- Option to go to the Solar Monitor system to display detail statistics



Obr.Síť
Fig. Power grid
- Displays detailed individual power draws at individual phases both on the Power grid side and on the side of the entire company while using power supplied by the solar power plant
- Displays the power output of the photovoltaic (solar) power plant and the overall self-sufficiency



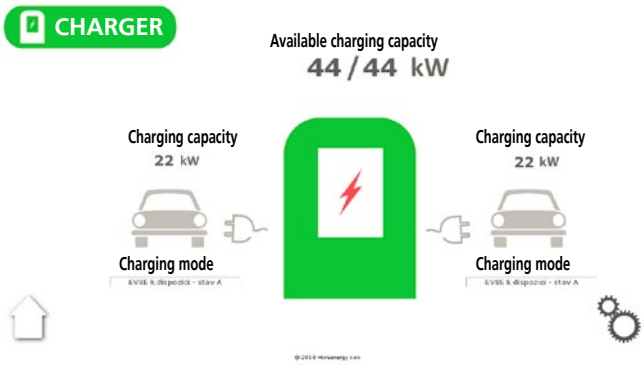


Fig. Charging station for electric vehicles
- displays the current status of the electric vehicle charging process based on the allowed capacity and on the building load
- displays the current status of individual charging sockets
- charging capacity 44 kW refers to the sum of capacities (2 x 22) available for charging
- available charging capacity refers to possible sum of energies for the given power draw limited by the actual preset value defined for the main circuit breaker while taking into account production of solar power plant

Fig. TUV
- displays temperatures in boilers of the upper and lower section of the reservoir
- option to set target temperature
- indication of the functionality of the spiral element
- displays the current excessive power = controlled consumption

The left side shows the controlled/regulated appliances. Swimming pool, Regulus, Temperatures, batteries.
All these devices may be connected to the system. This includes the control of the swimming pool technology, connection to heat pump REGULUS and its control system (IR 12 and IR 30 = mutual interconnection) and also temperatures which are used to control zone regulation for the heating system (electrical components, water, heat pump). Graphics (graphic interface) made by Hora Energy is universal and used for all applications supplied by the company.

Text, photos and visualization: Hora Energy s.r.o.

HORA ENERGY

STEAM TURBINE CONTROL – MARTINSKÁ TEPLÁRENSKÁ – SLOVAKIA

Martinská teplárenská a.s. is one of the largest producers of electric power and a supplier of heat. the heat is provided for the central system used in Slovakia.
During the process of modernization, which took place between 2017 and 2019 the production was increased from 60,000 MWh to 160–210 MWh.
This company has been using various generations of Tecomat control systems for a long time. Under the modernization process, which took place at the beginning of 2019 a new control system handling the oil management utilized by a steam turbine was introduced. A large module Tecomat TC 700 was used for the upgrade of the oil management system due to the fact that the entire turbine has been controlled for several years by Tecomat NS 950. During the upgrade process new pressure switches and converters were installed. the deployment of the TC 700 system was implemented directly by the employees of Martinská teplárenská a.s.under the supervision of Ing. Miroslav Čuboň.

Fig. Steam turbine at Martinská teplárenská a.s.controlled by Tecomat NS 950

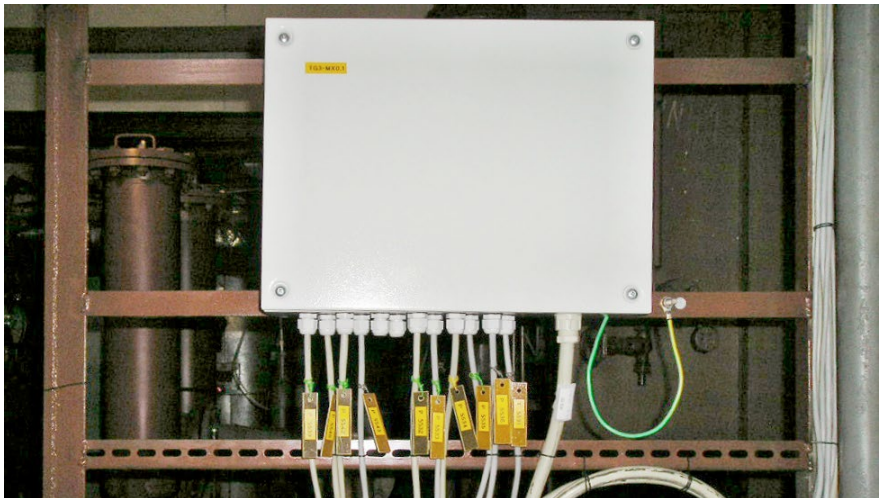


Fig. This picture shows the data collection system. Data are received from the modernized oil management system overseen by Tecomat TC 700.

MODERNIZATION OF A CONTROL SYSTEM OF A SMALL HYDRO POWER PLANT EQUIPPED WITH KAPLAN TURBINE AND TECOMAT FOXTROT

Water levels, network, generator and scrubber are the parts controlled by Tecomat foxtrot on the Kaplan turbine installed at the Opava River near the town of Vrbno pod Pradědem. GEEN, a company located in Brno which mainly focuses on energy and power projects, has become the owner of this small hydro power plant. In 2018 GEEN decided to modernize the plant and to connect it to the monitoring dispatch center at its headquarters in Brno. This article shall demonstrate the universality of Foxtrot control system which has become very popular recently thanks to projects dealing with so-called smart houses or intelligent buildings. Nevertheless, Foxtrot is also the core – and we mean software and hardware core, of full-scale industrial PLCs designed to control machines and processes occurring in factories including various nonstop operations. the above hydro power plant is equipped with one Kaplan turbine HH 550 SK delivered by Hydrohrom in 2007.

The turbine features a flow of 1.6 cubic meters per second. the output side of the asynchronous power generator offers maximum output of 133 kW at 760 RPM. Before the end of the last year the scrubber was reconstructed. A scrubber is a mechanical component which cleans collected dirt (tree leaves, etc.) from blades as well as other impurities which are caught before entering into the turbine. In parallel with this reconstruction the control system was modernized as well. the control system not only controls but also optimizes the mechanical assembly turbine-generator and communicates all operational data over the Internet and transfers them to the headquarters in Brno.

It is no coincidence that the system was programmed by Ing. Pavel Smílek from Rameco, who used Foxtrot control systems and created the monitoring center with a video wall and 8 large-screen displays for GEEN. Until now they used Foxtrot systems to connect mainly solar power plants to the centre. However, if the small hydro plant was connected Foxtrot was used for monitoring purposes only but here Foxtrot not only communicates with the small hydro power plant but it controls the entire process. It sends all data to Foxtrot systems in the headquarters where the data are "attached" with a graphic interface and displayed. Ing. Smílek wrote to me these exact words: "Today, instead of the old scrubber on the picture, they use a modern and automatic scrubber controlled by Foxtrot and their distribution cabinets are properly protected with covers I am sure. I was planning to visit one more time and see the final start up, but because the commissioning/startup was postponed due to low water level until the end of January, we have started up remotely using the assistance of the distribution cabinet supplier – the Albrecht Elektro company located in Bruntál." This is also Foxtrot system of today. Fully integrated with Internet Foxtrot not only transfers data but may be programmed and the entire system or tasks may be performed remotely.

Instead of the original control system, Foxtrot was installed in distribution cabinets using "boxes" with indicators, protectors and compensation elements produced by various manufactures and without remote monitoring or control. As Ing. Pavel Smílek said, "The usual PLC would most likely not be sufficient to precisely measure RPM of the generator or to handle the variability of various functions and modularity which allows easy expansion of the system. But if you use Foxtrot

Fig. Control of the distribution wheel in Kaplan turbine. Tecomat Foxtrot configures the settings of both the distribution and the rotating wheel of the turbine to maximize the output at the generator side.

you can do that with no worries and easily. Today, one central module CP-1000 controls everything here – automatic control of the small hydro power plant, compensations, scrubber operation, water level management, floodgate control, security of the facility, communication with the supervising centre in the town of Brno and also the web interface which is used to remotely control and service the system. There are tenths of sensors connected which are used to monitor the water level, temperature, position – induction end sensors, RPM sensors which monitor the RPM of the generator and the status of all contactors and circuit breakers. There are many processed data points. Approximately 150. This includes output data which provide information about the production, generator status and EZS (electronic safety system). Everything is archived in Brno in the monitoring department of GEEN. Data are transferred online over the Internet. There are two connections – local Internet provider and LTE modem. And software gadgets? As for me I felt like Alice in the wonderland. I really enjoyed setting up all the operations – such as the implementation of auto-tuning, which searches gradually for an ideal combination of configurations between the distribution and rotating

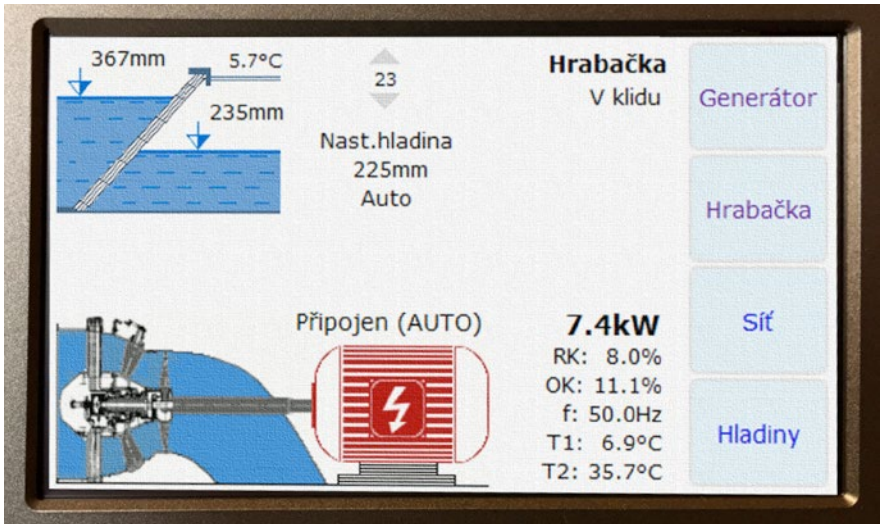


Fig. Local visualization on the touchscreen display ID-31 installed on the lid of the distribution box.

Fig. Basic module and 3 expansion modules handle the entire control of the hydro power plant

wheel of the turbine, and it does so during the actual operation with the intention to maximize the power output. the system also offers an analysis which decides about possible restarts of the power plant, or whether to call the operator. Operator may use mobile phone to control the system so he or she is able to see anything and everything from anywhere."
It is clear that the universal system Foxtrot in the hands of technical experts, and Ing. Smílek surely is an expert, is able to bring top and innovative solutions suitable for various industrial and power/energy applications.

Ing. Jaromír Klaban,
Teco a.s.

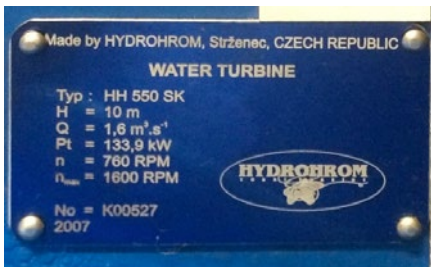


Fig. GEEN monitoring center in the reconstructed upper floors of the high-rise building at Mariánské náměstí in Brno. Here we can also "monitor" the entire city of Brno.

TECOMAT FOXTROT AS A COMPLEX CONTROL SYSTEM FOR A CASCADE OF STIEBEL ELTRON HEAT PUMPS

EL-BA Group from Rožnov pod Radhoštěm, a long-term partner of Teco a.s. and an integrator of heat pumps produced BY STIEBEL ELTRON needed to address switching of larger power outputs produced by several heat pumps depending on the current consumption of the building. EL-BA Group selected Tecomat Foxtrot to handle these requirements. It has done so thanks to Foxtrot's high modularity, operational stability and flexibility in communication protocol programming. Boiler room monitoring and the control system was already deployed by EL-BA Group in several apartment buildings and also in commercial building such as the Casino Caesar in Dolní Dvořiště, the office building with a coffee shop in Rožnov or the Wellness center in Litomyšl, etc.
A boiler room like that is always equipped with one basic PLC module Foxtrot CP-1006 and added with relevant expansion modules which offer several inputs and outputs. Data from the regulator, built into the heat pump STIEBEL ELTRON, are read through CAN bus modules SC-1102. EL-BA Group deploys heat pump systems in thermally insulated revitalized buildings which offer reduced heat losses. Remote control including parameter setting is done through Foxtrot website and allows you to lower the building heating cost, permanently monitor the boiler room or perform servicing without unnecessary service trips. the operator or the investor enjoys a comfortable and permanent overview of the entire status of the boiler room. This concept achieves significant cost savings, mostly in apartment buildings at the beginning and at the end of the season.
Options available thanks to the combined installation of Tecomat Foxtrot systems and Stiebel Eltron heat pumps:

- Cascade switching of heat pumps based on outside temperature and based on control heating curve.
- During very low temperatures, when air-water heat pumps offer lower efficiency, the operation is limited and bivalent additional heating is switched on to achieve proper heating (electrical boiler, gas boiler).
- Inspection of all sub-systems of the boiler room including error / non-standard status reporting via email or SMS
- Switching of backup domestic hot water heating sources (DHW) (option to remotely and manually switch backup sources)
- Switching of circulation pumps – circulation pumps for hot water, circulation pump for domestic hot water (cycle setting – energy savings).
- Monitoring of individual motor-hours (hours of use) of individual resources
- Monitoring of operational temperatures in the boiler room
- Output for TUV, UT, AKU reservoir, output from electrical boiler, etc.

EL-BA Group,
Rožnov pod Radhoštěm

Fig. CASINO CAESAR – on the left: a cascade of five "air-water" heat pumps – 5× WPL57

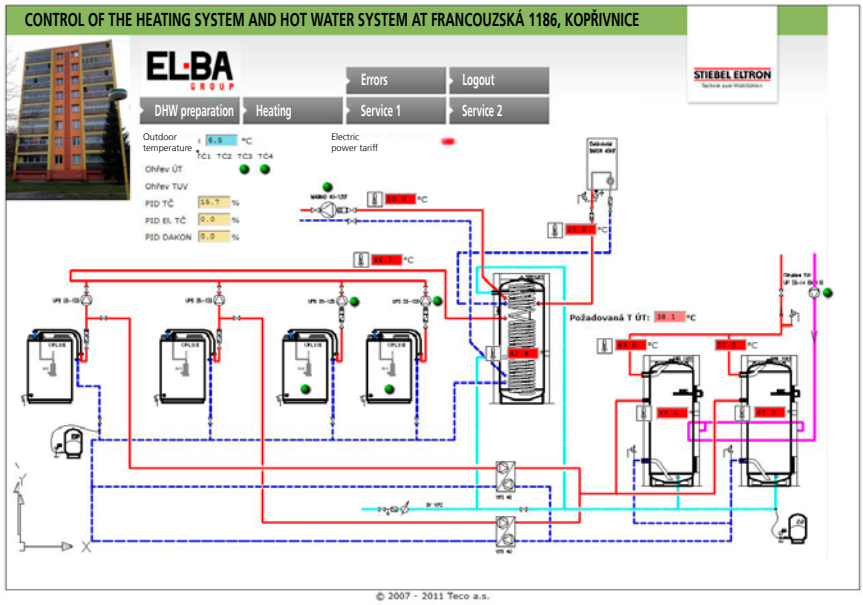
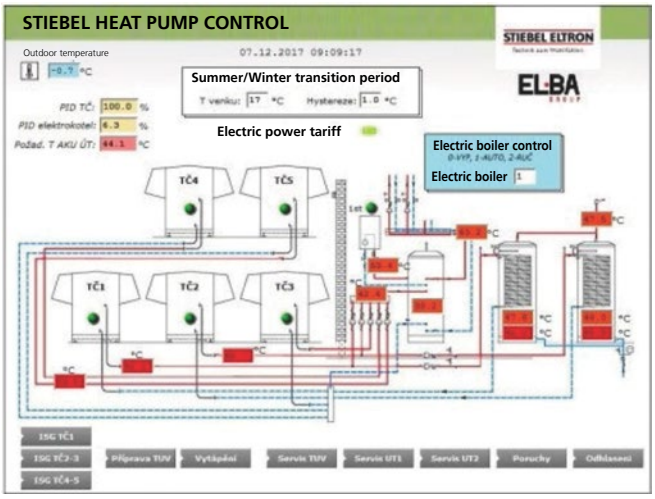


Fig. Visualization of an apartment house heating system using four heat pumps in a cascade working with accumulation reservoirs



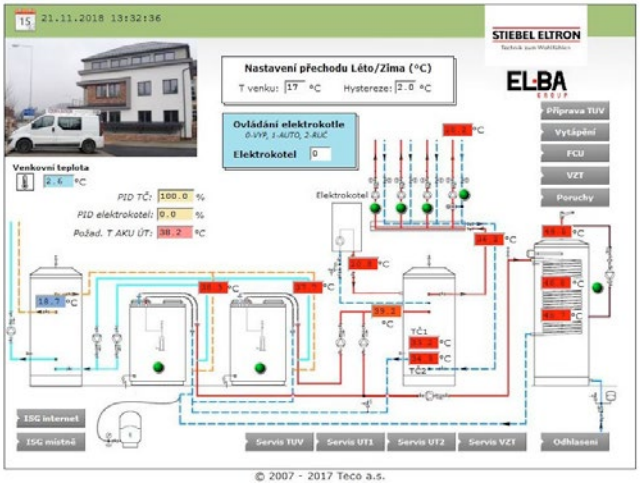


Fig. An apartment building in Francouzská street in Kopřivnice uses a cascade of four heat pumps Stiebel Eltron "air-water", type WPL 23E. This system has demonstrated over the past 7 years that savings of 50% are possible when compared with regular central heating system

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