

# Smart House and Its Possibilities

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Everybody has its own and individual house or flat furnishing. Today's houses are equipped by a lot of technical devices: sources of energy, electric appliances, security systems, multimedia and entertainment systems, computers, telecommunication and internet connection. And for sure in the future will be equipped by other devices, who still doesn't exist, because the development is still faster and the interests and needs of residents are developing.

Regarding equipment of houses by smart device, we live in a break times. On one side manufacturers are specialising and bring their products for house use to the perfection. Each manufacturer of boiler, air-conditioning, jalousie, light system, security system or multimedia system give consumers own remote controller, own application to his mobile phone and own logic of control with own icons, own detectors, sensors and actuators.

On the other side there is a user there, who is lost in that. Sometimes he may found, that separately delivered air-conditioning, heating system, ventilation or jalousies are working against each other for example when the window is opened. He may find he has two Windows detectors – one for connection to security system and another one for heating system. As well he may have on the facade free outside temperature sensors for free different devices. The user would prefer to harmonize all functions and such house to be able to control all automatically, and he – the resident would have possibility to choose modes, that house should use for automated control of itself. The user would prefer to have the same control inside the house and even remote control from his phone, organized under one icon according to his own individual logic.

And that's what the Smart Houses are about. Where the concentration of technical device reach some level, there is necessary to coordinate them and find out new kind of integrated control. Each house device has inside some subsystems, tuned by manufacturer to coordination and best functions. As well the higher composition, that creates a Smart House, have to be tuned and function optimized. Smart House is becoming a one large device and its functions are not determined by the supplier, but the user or investor. The difference of Smart House from standard manufactured devices is in unrepeatable combination of device types from different manufacturers and a specific logic of control devices. And moreover in different interior design.



Image: Modules of system Tecomat Foxtrol from company Teco a.s.

## Specifics of Smart Home implementation

The builder or investor of Smart House, or Intelligent House, has some important question to be answered:

What to begin with? What „production documentation“? What Home Automation system? Who will implement the system? What functions are possible? What new functions he may wish? Should the Smart House be created at once or step by step? What to prepare in the house as the later changes should be possible with low costs? How to choose device to be able to integrate into Smart House?

Smart House cannot be chosen in a catalogue and bought like unified project of the house. First of all we have to define it. The best with an architect or specialised project designer. In discussion with him we should specify the required functions. There is not good choice to solve this phase with designers specialised on narrow focus (heating systems, security systems, ventilation etc.).

Much better service may be provided by architect or project designers, who see the house as functioning complex with balanced space and its functions and technical equipment. With such person go through all possibilities, offered by each subsystems and all your wishes, ideas and functions. Consult benefits, positives and negatives and communication possibilities of all separate devices, that investor got offered from suppliers of heating systems, boilers, heat pumps, solar panels, radiators, air-conditioning units, controlled ventilation, security systems, camera systems, electronic locks, household device multimedia systems, water irrigations, pools etc.

## Mutual communication of various devices

An idea that we may buy any device and then anybody is able to connect or integrate them without any troubles, is not right. Standards in this field are on its beginnings. Or better said, there are more standard there, specialized and no one is totally universal.

Again, there is an important role of project designer, who is in contact with manufacturers and has information about what devices communicate with what systems for home automation. Some manufacturers equip their devices by communication Charles, but doesn't publish the protocols. And for integration into a system they deliver special communication modules, whose price is sometimes surprisingly too high in comparison with the device itself. Even this we should calculate during the choice. This often happens at famous Asia brands – suppliers of air-conditioning units, some boiler manufacturers, heat pumps and security systems. Some such systems doesn't expect to be combined with products of third parties.

### Available systems for Smart Houses on the market

There are a lot of systems available today. Their features, functions, variability and flexibility to fast changes on the market are various and depend on where they are coming from to the field of Home Automation.

At American systems we may see the origin in priority control of audio / video systems, home cinema and home entertainment. Control via touch panels or TV green is almost perfect. A logical step is expansion with control of lights, setting the temperature for each room, connection of cameras and security system. On concrete house and concrete audio / video device are usually these systems configured from pre-programmed functions available in graphic configuration tools. On European market these systems meet different standards of electric installation and a creativity of project designers and users. Often we add to these systems wireless heat control or coordination of heating systems in the house.

Sometimes there are completed by simple home automation functions the security and access systems. We may add them few output relays, other switches or temperature sensors and possibility to set the simple logic of switching.

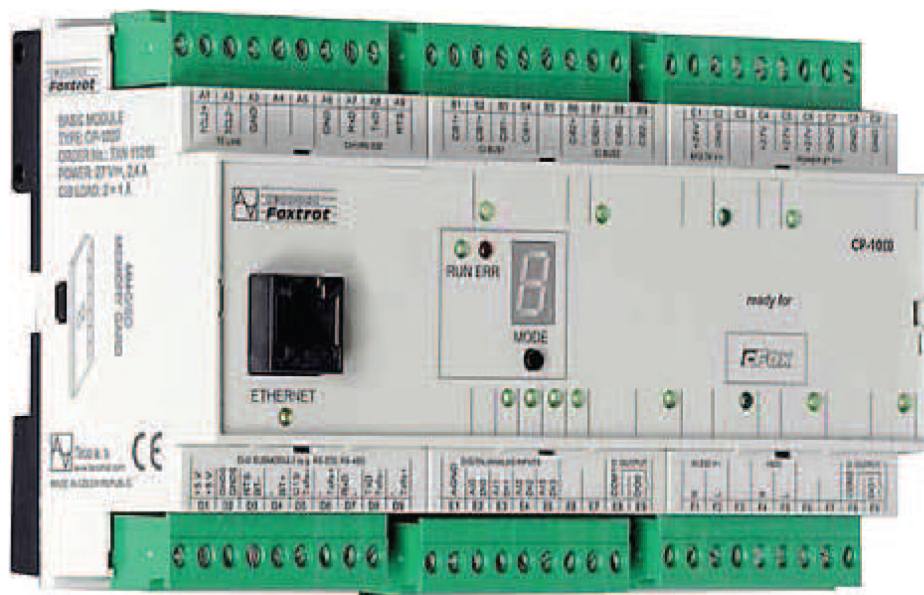


Image: Central module of system Tecomat Foxtrot

As well we may find some systems coming from own sophisticated control of heating, again expanded by few simple actuators and sensors and its simple functions. These systems are not free programmable and they may be used only for a limited number of functions. That's why they will go to a limit when we will need to expand the system and as well we may need software upgrade after few years of operation.

But there exist the systems designated right for home automation. Each one stays on the different basis. For end users the differences in functions may not be often visible. But important differences will find those who install them and set functions according to user needs. Some of them are standardised by international standards. Here we may speak about KNX (originally from Europe) and LON (originally from USA). Both systems are decentralized and the argument for their use is that in failure of one element (wall switch, sensor or relay module) the others are still working.

These systems have been created more than 20 years ago, before a mass expansion of internet, telecommunication and mobile phones. Because of a mass expansion of LAN and WAN networks, graphical displaying and multimedia files transferring they have to be today completed with some centralised elements. Only with them we may access to these networks and systems remotely.

We find on the market also wireless systems working in licence-free bands, typically 433 and 868 MHz. They are also often decentralized. In such systems we cannot speak about free programming, but about connection and parametrization of built-in function pre-programmed by manufacturer. During choice of elements we have to carefully read the documentation and find, whether the element has the required function.

On another side we may choose from many control systems for home automation based on a central module. Some of such systems are controlled by computers coming from office applications, adapted for connection of temperature sensors, relay switches, dimmers etc.



Image: Interior with TV and control via TV screen





Other kind of centralized control system is PLC – programmable logic controller. The origin of PLC is in industrial applications and it has existed long time ago the first computer. Construction of PLC is designed for permanent stable operation in all possible conditions. It is equipped by terminals for direct connection of switching contacts, temperature sensors, and other values and PLC control connected devices by relay outputs and other types of switches, built-in in the controller. Computing and memory capacity of such systems is still increasing with development of electronics.

Thanks to this, category PLC holds its dominant position in industry, despite the press of industrial PC. And thanks to its universality many PLC manufacturers offer solution for home automation based on this platform. During choice of elements for a concrete project,

the only thing we need to know is a total number of inputs and outputs and their type. According to these information is the system connected. Regarding the required functions, we may be 100% sure, that the fiction may be programmed or anytime changed. Because the function is not fixed into the peripheral elements.

## How to prepare the building for a system installation

Sometimes it is necessary to postpone intelligent installation from finishing the construction, of the house. And here is the question – how to, install the wires, as we doesn't block our house for installing the home automation system with additional modifications etc. There may be more opinions there. The most simple may be this one: Install at least one data cable for Ethernet into each room.

By this way you may in the future connect computer, smart TV, multimedia system, IP telephones, internet gateway OR other device transferring a high data volume. Typically it is sound, video, images, photos. Ethernet is at the moment, and for sure will be for a long time, the mass standard for such kind of data. This, let's say „structure wires“, is installed in „star“ and in the central point is connected by a switch. In the room we may connect at this data transmission level also wireless Wi-Fi network. It is useful solution for connection of smart phones and portable tablets, but it doesn't solve everything. Especially in heavy city built-up areas the stability and permeability of home Wi-Fi networks depends on number and density of other network operated by neighbours.

For connection of wall switches, lights, locks, heat valves, air-conditions etc., where we transfer short commands like „switch off, open, send code from the reader“, the connection via Ethernet is not advantageous regarding price and energy consumption.

For connection of such device it is advantageous to use system bus. There are few buses on the market and they need various numbers of cores in cable. But we may summarize that most buses may fit in the limit of 4 cores wire. Such cable may be led in each socket or wall switch installation box or threaded around the whole room. And when there will be a requirement to connect any device, we may cut the shortest way to this cable. We may recommend using of deeper installation boxes. Into such boxes we may in the future anytime add bus relay or button sensor. For a wireless bus option there is no need to prepare anything.

One note for complete information. In Europe is for transmission of such data from common device dedicated licence-free band 868MHz.



Image: Examples of control and visualization screens

The third kind of cable, we have to think about in Smart House project, is power wire. In contrast of classic installation, where we have to lead cable first to switch and then to a light, in Smart House we lead power wire to a light or socket, where is placed miniature actuator – relay. The command for switching is coming by bus cable.

A lot of installation companies and project designers doesn't use bus elements and design the project of installations to star structure. In the central point there is one large switchboard box. In this large box we place all elements of the system. On one side this solution denies distributed systems advantages, but on the other side, it has a logical base. All is available at one place after opening the doors of the box and easily available for a maintenance or potential changes in connection. In this case it is necessary to discuss this solution with investor or house owner, if he accepts more kilometres of cables and their thick bunches in the house, often with not easy identification.

#### Possibilities of system bus installation with central module and distributed peripherals

One of the centralized systems based on a proved principle of universal free programmable PLC is system Tecomat Foxtrot. Electric features and programming comes from worldwide standard IEC. Foxtrot's central module holds a unique combination of communication channels and buses specialized for specific tasks. For Home Automation market the strong point is two wires installation bus CIB - Common Installation Bus. The CIB bus makes simple connection of up to 320 common or system wall switches, window contacts, controlled sockets, lights – lamps, tubes, LED lights, thermostats, radiator valves, security sensors, locks, code keyboards, card readers, fingerprint readers etc. in radius of 400 m. And with using any branches, with a high resistance to interference.

System Foxtrot may be completed by wireless modules RFox (frequency 868 MHz). An extreme, but possible and also applied solution is the whole wireless installation with Foxtrot central module.

The central module is connectable into LAN network too. On this side it provides all data by many standard and open protocols. The most interesting is http, known by most people while entering the name of required web page into a browser. In Foxtrot interpretation it means that after entering its IP address into a web browser, Foxtrot provides web pages on internal web server. Via these web pages we may control and visualize the house or building. And it doesn't matter whether it is a browser in computer, tablet or Smartphone and whether the user is connecting in home network or anywhere in internet network. The graphic and the structure of web pages are fully under control of the user or installation company. They are stored in high capacity memory up to 32 GB, what may store and archive any measured data, events, alarms or images from connected IP cameras. This ability of direct visualization and archiving in central module without any complement device with minimum energy consumption is an important feature for using this system. In home applications as well as in industry these systems are working and consuming energy continuously.

Built-in Ethernet and serial channels let you connect at once a lot of sophisticated devices. We may connect audio / video and multimedia systems of various manufacturers, air-conditioning units or heat pumps, security systems and access systems. We may also connect it with camera systems or direct with IP cameras. And communication channels are programmable. They are designed as universal and their protocols may be user programmed without waiting on the manufacturer. This may be done in the same programming tool like all other relations and functions of the system.



Image: House control via iPad

The professionals from industry applications appreciate on Foxtrot its native expansion with installation bus and possibility to connect sensors and actuators simile like in distributed systems. Although there still maintains full programming according to industrial standards and customs. On other side, the professionals-practitioners from electrical installation field appreciate central module Foxtrot in situations where they found limits of other installation systems. Usually in need of complicated and more sophisticated functions, data recording or connection with other systems.

#### Conclusion

we may notice that Home Automation and Smart Houses go in a fast development. On one side the knowledges of benefits from all device integration in houses is growing, on another side there is a fast news penetration in consumer electronics, telecommunication and computers. Next year we will see, what direction will be directed the Home Automation market by manufacturers of TVs, portable computers and phones.

**někdy je lepší menší...**

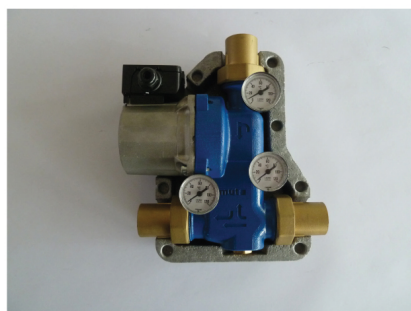
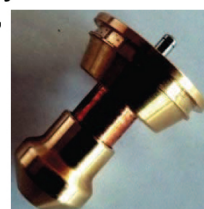
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