



# ALARM SYSTEM AND SMART BUILDING SYSTEM INTEGRATION Real need or a fad?

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*Many people ask a question whether to integrate an Intrusion Alarm System (IAS) with a Building Automation System (BAS)? If so, how? What kind of equipment is best suited for integration? This article will consider these and ensuing questions. In writing this I was inspired by the launching newer and newer interfaces between integrated security systems and smart building KNX bus.*

## INTRODUCTION

Let us first answer the question: why the **KNX** interface system was chosen for small and medium facilities on European market? In fact, KNX protocol (formerly called as **EIB** – *European Installation Bus*), promoted by **KONNEX** organization, is currently the most popular and widely supported **BAS** standard for small and medium buildings. KNX supports four type of transmission: **TP** (*Twisted Pair*), **PL** (*Power Line*), **IP** (*Internet Protocol*) and **RF** (*Radio Frequency*). Many European, international and domestic norms were set for *KNX* standard (e.g. BS-EN 13321-1, DIN-EN 13321-1 and BS-EN 13321-2, DIN-EN 13321-2). This has made of KNX equipment possible all over the world. The compatibility between different manufactures KNX equipment is ensured through testing in **KONNEX** laboratories. Visible elements can have different

designs, catering to different tastes of the most demanding end-users. In addition, many producers of proprietary BAS solutions, e.g. WAGO or COMEXIO from Germany, include KNX ports in their systems. It shows that the IAS can be integrated not only to the native KNX bus systems but also to many different systems equipped with KNX port. There is another intriguing question: what are the requirements for a security system that is designed to integrate with building automation system? Valuable integration can only be achieved in the case of a system that is capable of transmitting information such as the activation of individual detectors after the system is disarmed.

**IS SYSTEMS INTEGRATION NEEDED?**

The answer is multi-threaded. You can imagine that your house is equipped with two separate systems, Intrusion Alarm System (IAS) and Building Automation System (BAS) as shown in Fig. 1.

Information from opening contacts, movement or presence detectors must be sent to each system separately. Arming and disarming information is not transferred between systems. All this information is essential to the BAS to properly manage ventilation, air conditioning, heating and lighting, and in consequence to rationalize energy consumption in the building. How automation system uses this information? Motion detector from an alarm system and presence detectors from an automation system can notify BAS that someone is in the room. Windows and doors opening contacts inform the system that the room is not sealed, and therefore, reduce heating and cooling parameters, which is needed to minimize energy losses. Arming the alarm system or part of the

system can inform the BAS whether in the building or in part of it there are no people. Disarming the system indicates that in the building could be people, but there is not enough information to precise if they really are in the building or where they are. These features are used when integrating the security system and automation system at so-called low level – on LLI signals level (*Low-Level Interface*). This method of integration is shown in Fig. 2.

This is the most common way of integration. It does not cause any savings in installed equipment but at least partially automate the energy saving managing process. But it is far from optimum solution. With this, the most popular implementation, we are only half way. To achieve optimal power consumption management the BAS should know if the room is actually occupied by people or if the room is not currently in use. The presence detectors and instead of them the motion detectors from the IAS are used for this purpose. Of course, the presence detectors are much more sensitive than the motion detectors, and can perform more functions. But in many situations a motion detector can replace a presence detector especially if BAS controls the functions which have relatively high inertia of changes, such as heating. Usage of motion detectors is enough to control the temperature of the premises or switching off unnecessary lighting. We do not use it as a rule for example to switch the lighting in the hallways, because they do not work as fast as the presence detectors. In the case of the heating control, the detector may for example vary room temperature from 17°C to 21°C, depending on whether it is used by people or not. Most often, it is done in fact by changing mode of the temperature controller installed in the room. Sample

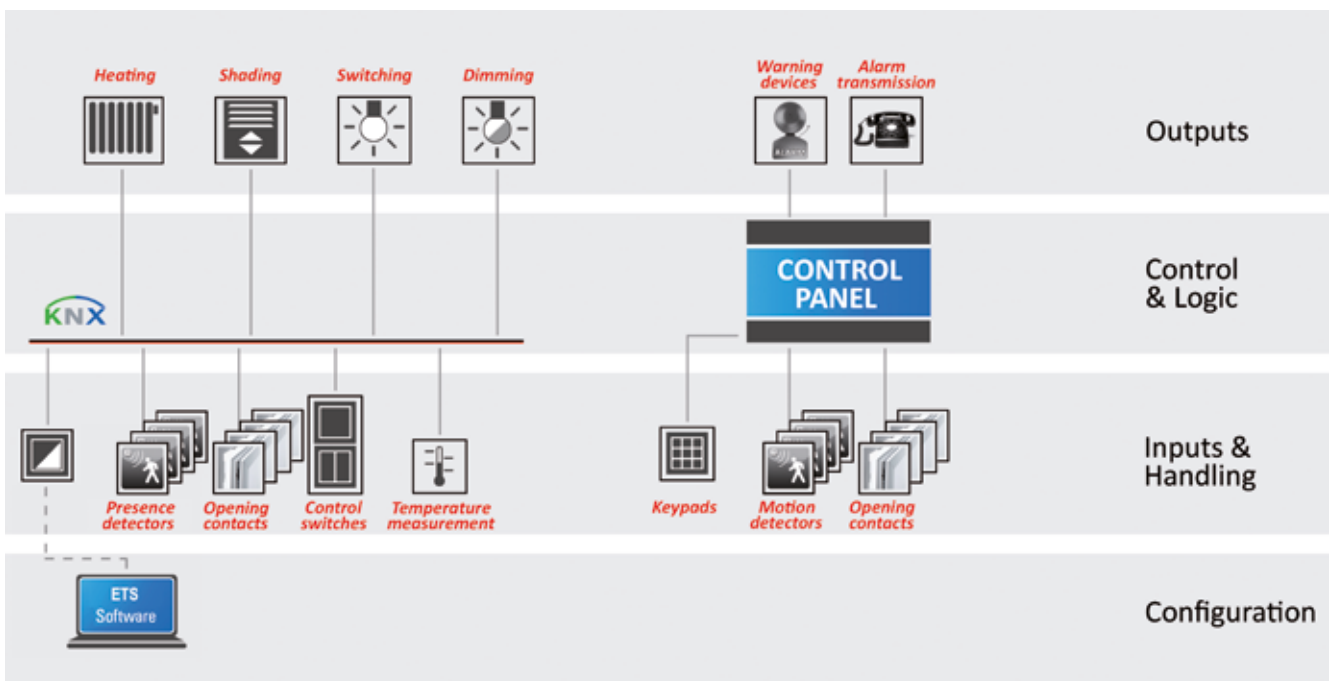


Fig. 1. Not integrated a KNX Building Automation System and an Intrusion Alarm System

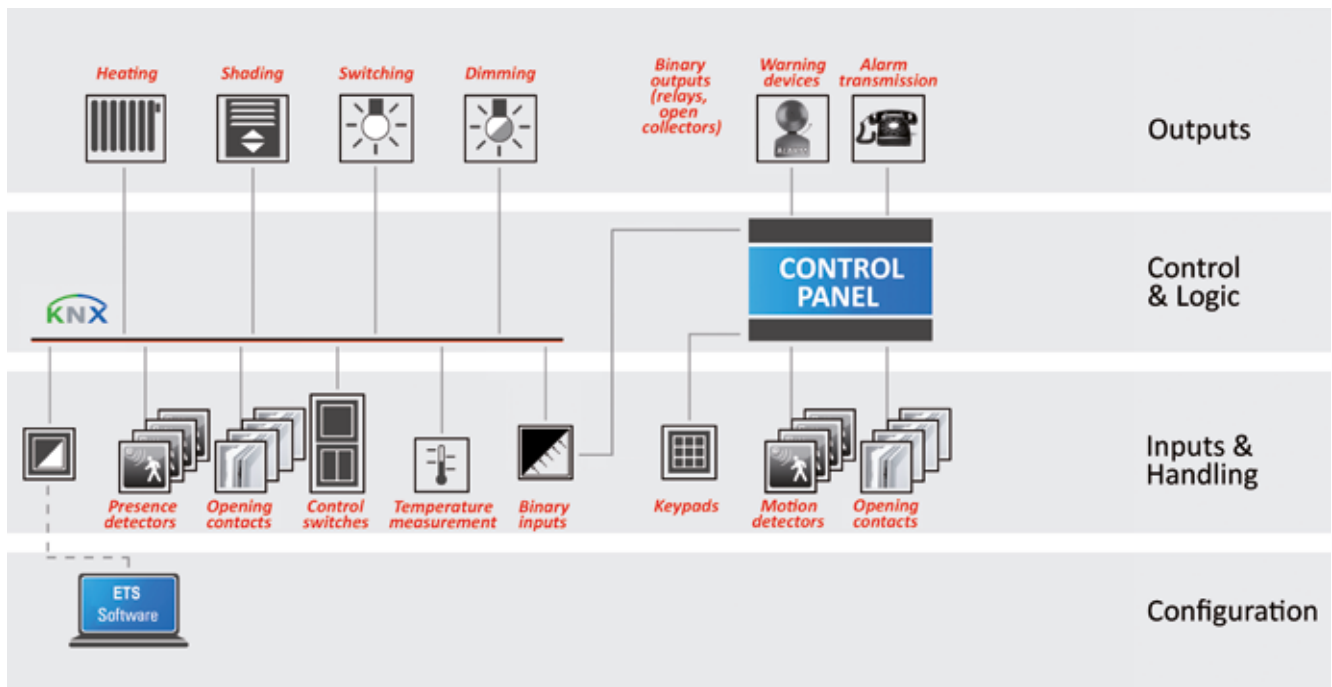


Fig. 2. Integration at the level of the exchange of the signals about arming and disarming the alarm system or part thereof

working modes of the room temperature controller are shown in Table 1.

These modes can be set manually, can be triggered on the basis of the obtained information or to be switched according to the schedule, usually weekly. Setting modes manually for each room is entirely impractical. We can create weekly automation work schedules if we have no other possibility. We can stop there, but this is not an optimal solution. Whether at home or in the office there will be rooms, which at the moment are not in use, even though the residents or employees are in the building. Moreover, it is very difficult to determine in advance when we leave the house and when we come back. From that point of view, scheduling is more useful for offices than residential properties.

In brief, it is very important to have the ability to determine automatically whether someone is staying in the room and therefore should have adequate light and thermal comfort or nobody is in the room, and so we can start saving algorithms. Therefore, we need additional information about the presence of people in each room. If we use the presence detector signal to determine the mode of BAS, even if we sit reading a newspaper, the detector in its operation area will detect us. If we apply the motion detector, it can respond to our immobility with lack of activation. Then the automation system receives such information that can start saving algorithms, even though the room had not been vacated by the users. When it comes to heating, the system needs several minutes to change room temperature. If during this time we activate a motion detector, the comfort mode is restored. It is worth choosing the automation

algorithms that exercise control not at the expense of user comfort. If you want to use motion detectors to turn off the light, you must do so in a manner that will not disturb those who are in the room (not detected by the detector). For example, if after 10 minutes of lack of activation the system determines that the room is unoccupied, turns down the light and waits for the reaction of a potential user. If in the next, say one minute movement is not detected, the light can be turned off completely.

Why we devote so much attention to the use of motion detectors in place of presence detectors? The main reason is the cost of these components. Presence detectors are much more expensive than conventional

Table 1. Example of default settings of the room temperature controller

Icon	Tryb pracy (po polsku)	Default temperature
	Comfort	21°C
	Standby	19°C
	Night	17°C
	Frost/heat protection	7°C/40°C

alarm motion detectors. In the case of IAS and BAS integration at a high level by HLI (*High-Level Interface*), you can easily eliminate some fairly expensive presence detectors with dual use of alarm motion detectors. Opening contacts used in the automation system can be replaced by opening contacts applied in the security system. Of course, there are two basic conditions to the following. Alarm detectors must protect exactly those places that are of interest to the automation system. That is not hard. The second condition is much harder to meet. The control panel must send information about the individual detectors activation while it is in off mode. This function is performed only by a few of the control panels. The standard control panel sends this information when it is armed, but then this information is for BAS no so important. BAS „knows” that the object is in the supervisory and runs algorithms associated with the absence of people. Sending information from activated detectors in disarmed zones is therefore critical to select the control panel to be integrated with automation system. On Fig. 3. the full integration with HLI is shown.

It should be noted that after two systems have been integrated, in the automation system can be reduced the number of opening contacts and presence detectors. There is also no need to duplicate the installation equipment in some areas. The case of replacement of the presence detectors by the motion detectors has already been discussed. It should therefore consider the use of open contacts in both systems. From the point of view of managing HVAC (*heating, ventilation and air conditioning*) in automation system all windows in the controlled premises should be equipped

with the opening contacts. In security systems, the system can receive the 2nd or higher grades (as in European Norm EN 50131-1 & CENELEC Technical Specification CLC/TS 50131-7) only when windows are protected by opening contacts. Why such an obligation is imposed on alarm systems designers and contractors? You cannot arm the alarm system when opening contacts are activated, in other words, when the user going out of the premises leaves windows or balcony doors open. The use of sensors in windows and balcony doors causes that alarm system somehow „forced” to close them before each departure from secured places. Otherwise it can not be armed. Using the windows and balcony doors opening contacts in the IAS we do not have them duplicated in the BAS (of course, if we have fully integrated these two systems).

**KNX INTERFACE**

The interface between the security control panel and Building Automation System equipped with KNX port allows for systems integration, preferably by providing bi-directional communication between the buses. It should allow operation of so-called “KNX group objects”. These “group objects” are memory locations in bus devices. The size of group objects used by interface can be 1-bit, 1-byte or more. The size of the group objects is dependent on its function. For example if only two states (on & off) are required for switching, 1-bit group objects are used. This interface can continuously monitor the status of detectors, system inputs, doors, areas, system outputs and auxiliary outputs. The automation system can control doors, areas, system outputs and auxiliary outputs in intrusion and access control systems. Fig. 4 shows

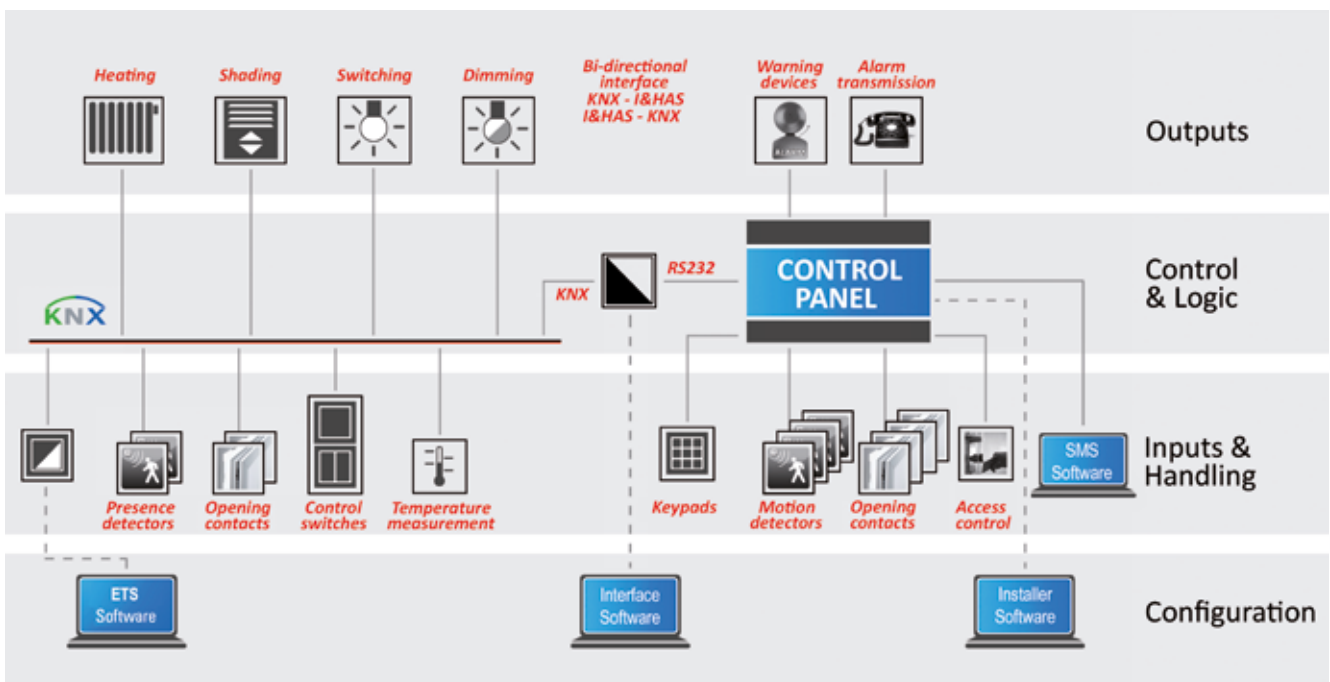


Fig. 3. The integration between the IAS and BAS based on HLI



**Fig. 4.** The interface board connected between a KNX bus and the security system control panel

the example interface board, which was designed to fit housing of security system control panel.

**SUMMARY**

In the modern world it is more and more difficult to live without systems integrating. The benefits of full

integration of intrusion alarm system with building automation system are undeniable. This will not only simplify the user operation but also gives the multidimensional savings. Firstly, investment savings (no need to duplicate the installation), but also the long-term ability to better manage energy consumption (customers usually decline expensive presence detectors on their premises, but as a rule they have the motion detectors connected to the alarm system). In addition, it is much easier to convince the client that alarm sensor to be installed in the corner of the living room (which in any case it should be there for security reasons) rather than the additional presence detectors, localized mostly on the ceiling. Therefore an ever increasing number of building automation systems contractors take advantage of the possibility of full integration of these two systems.



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