University of Pécs

Final paper:

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOUSE

Author:

Guillermo Sánchez Fernández

Resumen

En el presente Proyecto de Fin de Carrera, he realizado la instalación de una vivienda familiar, la cual siguiendo con la actual conciencia medioambiental, se ha planteado desde el punto de ser energéticamente autosuficiente, aunque la vivienda estará conectada a red, en caso de haber algún problema etc, no pudiera darse esa autosuficiencia, y no quedarse sin electricidad.

Para ello el Proyecto se ha dividido en dos partes bien diferenciadas, instalación eléctrica y la automatización de la casa(también conocida hoy día como domótica).

En lo que respecta a la instalación eléctrica lo primero que se ha realizado es una estimación de las potencias que se consumirán en la vivienda, lo cual condicionará la instalación total de la vivienda.

Se realizará la instalación de enlace de la vivienda con el suministro eléctrico, pasando por la acometida, la caja de protección y la derivación individual, hasta llegar a la caja general de la vivienda, ofreciendo la mejor opción para la conexión en todo momento.

Llegados a la propia vivienda, se llevará a cabo la protección eléctrica de toda la instalación, punto en que se necesita fundamentalmente las potencias estimadas anteriormente, de forma que puedan diseñarse los diferentes interruptores de protección, ya sean diferenciales o magnetotérmicos, aunque antes de nada esas

potencias estimadas, se les tendrán que aplicar una serie de coeficientes de corrección, que intentan ajustar la potencia total estimada, a la que realmente se utiliza en una vivienda.

Lo siguiente a realizar una vez se tenga protegida la instalación, se llevará a cabo la instalación de todo el cableado necesario en la instalación, así habrá que determinar los diferentes circuitos que serán alimentados, para así determinar el tipo de cableado que se usará(secciones, material, etc), en lo que respecta a circuitos y secciones de cables, se seguirán las normas pertinentes que el Reglamento Electrotécnico de Baja Tensión establece.

Otro aspecto muy importante que se tendrá que tener en cuenta, son las caídas de tensión que se producen en cada circuito, puesto que el Reglamento, exige que no se superen unos máximos, que en caso de superarse, tendrían que regularse de alguna manera en la instalación.

También se ha realizado el estudio de que tipo de luces corresponderán a los usos de cada estancia de la vivienda, siempre en todo caso, buscando lámparas, etc cuyo consumo no sea elevado, para continuar con el ideal de vivienda respetuosa con el medio ambiente.

La vivienda contará con la pertinente puesta a tierra, para evitar que se puedan dar en ningún caso contactos indirectos, de forma que las personas pudieran correr un riesgo de ser electrocutados.

Se realizará la instalación de un sistema de paneles fotovoltaicos en el tejado de la vivienda, que conformarán el principal aporte de energía eléctrica, y con ello aportarán la autosuficiencia a la vivienda.

Se contará con paneles policristalinos que darán un buen rendimiento.

La mejor característica que tendrá la instalación fotovoltaica, es que dispondrá de un sistema de guiado solar, es decir, los paneles estarán durante todo el día enfocados hacia el sol, de modo que el aprovechamiento solar será máximo que si contáramos con un sistema fijo de paneles, ya que es muy importante que sobre los paneles incida la luz solar, de forma perpendicular para llevar a cabo un aprovechamiento máximo.

Tendremos además el resto de elementos necesarios para la instalación como serán el inversor, el regulador, o las baterías que permitirán tener acceso a la energía eléctrica en todo momento, pero claro puede darse que en algunos momentos, no se tenga la energía suficiente, ya que dependerá en todo momento de las condiciones climatológicas, para lo cual, la vivienda estará conectada a la red eléctrica por si en algún caso se necesita acudir a ella.

Por otro lado se tendrá la instalación domótica, por medio de la cual se busca obtener la mayor eficiencia y comodidad para las personas.

Para el sistema domótico se usará un sistema EIB, que se trata de un sistema descentralizado que puede realizar varias funciones automáticamente, además permitirá que todos los componentes se encuentren en intercomunicados de forma que puedan actuar en consecuencia uno con respecto a la acción de otro.

Todo el sistema domótico se basa en la recogida de datos por medio de los diferentes sensores que se situarán por la casa, recogiendo la información pertinente, que será transmitida a los actuadores, que realizarán la orden pertinente, por medio de

los acopladores de bus.

Entre las partes que cuentan con inteligencia en el sistema contaremos con, el bus de unidad de acoplamiento, la interfaz externa y física, y el módulo de aplicación.

En el bus de unidad de acoplamiento, será donde se encuentre la electrónica necesaria, y responsable de la dirección con el bus.

El módulo de aplicación se encargará de reconocer de parte de quien llega una señal, y actuar en consecuencia.

Mientras que el interfaz hace la labor de conexión.

Una vez realizado el cableado de la instalación domótica que podrá ir conjuntamente con la instalación eléctrica, pero en todo caso con la suficiente protección para no poder ser dañada, se llevará a cabo la programación del sistema, lo cual se podrá realizar por medio de un portátil.

De esta forma los campos en los que se centrará la domótica serán:

Iluminación, hoy día es la tarea principal de la domótica, así se podrá contar con el control de la misma por medio de los sensores, o por medio de la programación para diferentes situaciones, o actividades(niveles de luz).

Seguridad, ante los posibles intentos de robo, o también en el ambiente de que pueda producirse un incendio, sea cual sea, dependerá de los diversos sensores que se colocarán para evitar dichas situaciones.

Confort, que se verá reflejado en la facilidad con podremos actuar sobre

persianas, iluminarias, etc, todo ello mediante la pantalla táctil de que se dispondrá.

Y por supuesto eficiencia, en el control de la enrgía que se consume, puesto que por ejemplo se puede accionar la opción de que si no hay nadie en cierta sala, las luces no se mantengan encendidas, o con lo sistemas de calefacción también.

Entre los componentes de las instalación, se podrá hacer referencia en los siguientes:

-Fuentes de alimentación, que se encargarán de aportar la energía necesaria para el sistema EIB, que dependiendo para que elemento en concreto, serán de una corriente u otra.

-Acoplador de línea, puesto que en la vivienda se dividirá el control de la misma, en 2 líneas, cada una para cada piso, se necesitará conectar ambas con la principal.

-Actuadores, que controlarán la acción de los diversos dispositivos, como puede ser el caso de las persianas.

-Terminal de zona, que se encarga de conectar la información que recogen los sensores con el propio sistema EIB.

-Gateway EIB port LAN/RDSI, que conseguirá la comunicación entre el sistema domótico y las personas.

-El interface USB, que hará de puente entre el ordenador donde podremos programar los distintos dispositivos, con el sistema EIB.

-Los diferentes tipos de interruptores o pulsadores que se utilizan en la vivienda.

-Acoplador de bus, que transmitirán la información de los diferentes interruptores.

MEMORY

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1 Introduction

Today, the use of renewable energy, is more and more common, because it is obtained from natural sources inexhaustible, some by the immense amount of energy they contain, and others because they are able to regenerate themselves by natural means.

In addition they are clean and don't produce pollution.

The solar energy, is the energy obtained by the uptake of light and heat emitted by the sun, the radiation that reach until the earth, can be harnessed through various mechanisms.

It should be noted that the radiation is produced during all the day, even with all the weather conditions. The power of the radiation reaching the surface Earth varies according to the moment of the day, weather conditions and the latitude. It can be assumed that in one moment, with good conditions of irradiation, the value is about 1000 W / m^2 wich arrive to the surface.

Currently, we can find a lot of systems that are used in the planet, of course, most of these are concentrated in regions where the radiation of the sun is during more hours of sun, but of course not only in these regions.

If we collect this solar radiation, of a properly way, in order to get electricity for illuminate our house, use various appliances, this way the electricity produced can be used directly or if not it can be stored in batteries for be used later at night, or days without the presence of the sun.

This application of solar energy exists thanks to the known solar panels.

It is precisely in the broad field of renewable energies and especially, solar energy which will develop the project. It is intended to perform the electrical installation of a familiar house. The house, is located in the city of Valladolid, has two floors, the first with 97,2m^2 and the second with 69.7m^2, and a flat roof with availability for the installation of photovoltaic panels.

This way, the study will be focused on providing the different consumes by appliances and the rest of the equipments, which are in the house, and need to be supply with electricity, so the

house can be self sufficient by itself, and noot depend on the grid, getting a sustainable house with the environment, in addition the energy saving that will be obtain, after amortize the installation.

All the time we will follow the rules establish in the Low Voltage Electrotechnical Regulations(REBT).

In recent years, it has been got several important advances in the field of electronics, especially in the section of the domotic, with wich it succeeds in carrying out the automation of home, providing some services such as energy management, safety, welfare and communication, being able to keep control of it all, inside and outside the house.

Everything will be executed as the nest way, the domotic system will obtain the information through some sensors, which will send the information, and it will be processed, sending to the actuators the order of act or not, depending on the information received.

Owning to the huge range that exists today in the market, domotic is not so expensive like it was some years before.

So we can say that our home will be the most respectful with the environment, since we get the energy to be consumed by the solar panels, without obtaining the electricity networkfrom the grid, and the energy we use, will be used intelligently and effectively.

2 Electrical installation

2.1 Location of the house

The plot for the construction of the house is located in the northeast of the city of Valladolid, on the outskirts of the city

2.2 Load forecast

The first thing is going to be calculated, is the total demand, that all the charges will be able to consume, in order to know, the maximum consume the house will be able to consume.

For do the study, it is necessary calculate the total load forecast, and after apply to it the factors of utilization and simultaneity, this way, the dimensioning of the house will not be the total of the loads, since in no one moment will not be used all the electrical stuffs, so the installation will be less, saving one cuantity of energy, can be very important.

Below is shown the relation of the consumed power and the finally predicted:

Circuits	Power installed(W)	Simultaneity factor	Utilization factor	Planned power(W)
Illumination(C_1)	1330	0,75	0,5	498,75
Plugs first floor(C_2)	3445	0,2	0,25	172,25
Kitchen/Oven(C_3)	10250	0,5	0,75	3843,75
Washing machine, dishwahser, thermo(C_4)	6000	0,66	0,75	2970
Bathroom and auxiliare plugs(C_5)	4200	0,4	0,5	840
Plugs second floor(C_7)	1945	0,2	0,25	97,25
Air conditioning(C_9)	3500	-	-	3500
Domotic(C_{11})	1200	-	-	1200
Windows' blinds(C_{12})	1400	0,6	0,6	504

2.3 Electrical connection

The electrical connection is the part of the installation of the distribution network, that supplies the general protection box, this way, in order to supply the house, it will be used one electrical connection subterranean, due to the biggest simplicity that will suppose this type electrical connection.

The supplying company that supplies the zone, will have the responsibility of decide where put the general protection box with the promoter, in order to link with the grid, supposing that the house will need energy from the grid, having the company all the time access to the box.

The electrical connection, will be subterranean under pavement to a minimum deep of 60cm, and in the case it is a zone with road, the minimun will increase until 80cm.

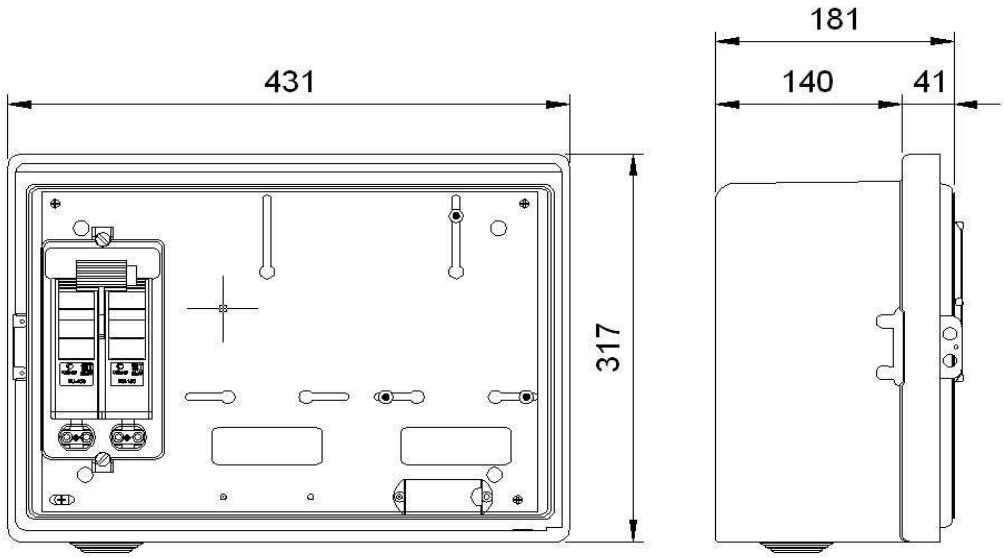
The conductors will have a XLPE insulation, whose current highs, according to the ITC-BT-07, are the largest between the most common wiring. So they will be two the cables used, a phase and neutral, both under flexible pipe underground.

2.4 Protection and safety box

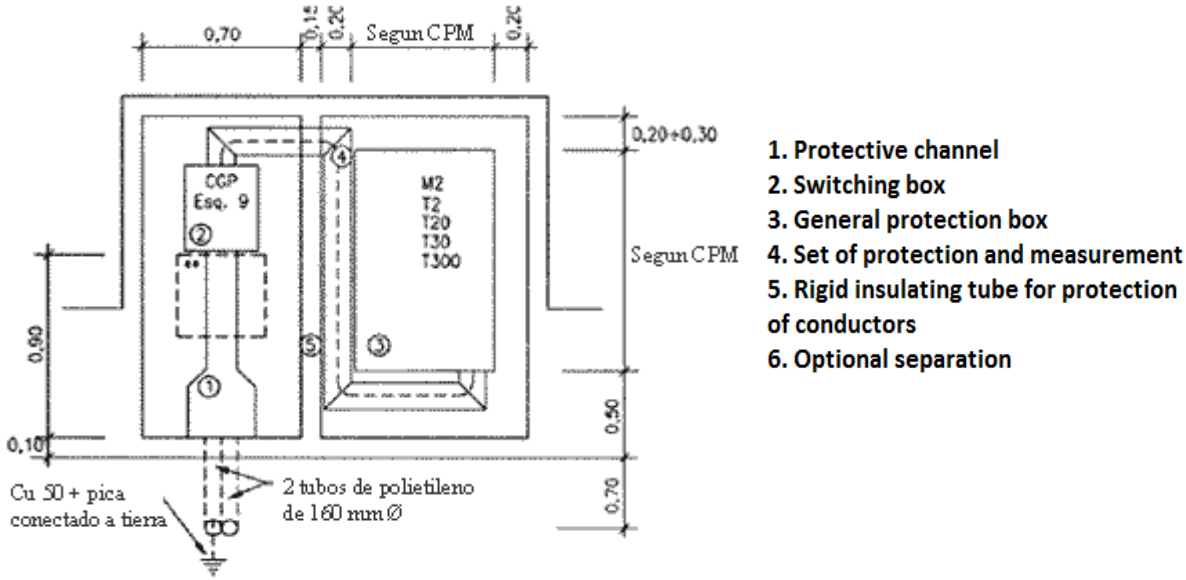
The protection and safety box, is the point where arrives the electrical connection, where are the protection elements of the general line.

Since the electrical connection will be underground, in the fachade of the house, there will be a niche, where the protection and measurement instrument will be, and which will be closed with a metal door, with a degree of protection IK 10, according to the UNE-EN 50.102, and which lock will be standardized by the supplier company. The niche will be 80 cm above the floor.

In our case, what will be done, is in the same box, have protective equipment, the circuit breakers on each conductor , phase and neutral, and also the counter, to which the supplier will have access at all times.



Protection and safety box



Prefabricated cabinet

2.5 Single derivation

The single derivation is the part that connects the protection box with the general box of the home.

In our house, was carried out with tubes, where will be found the phase, neutral and grounding wire.

The cables will be fire retardant, and in case of burning, smoke emission and opacity is reduced.

The maximum allowable voltage drop for single bypass will be 1.5%.

2.6 Installation of the house

Concerning the interior installation of the house, it is going to be performed in a separated way, it means, the circuits will be very different, and all independent from the rest, so what we want to achieve is, that in case of any failure somewhere in the house, do not force the rest of the house can't use the electricity if the failure more or less important.

This way, at the entrance of the house, it will be found the general box, in which will be located the differential switch and the circuit breakers that will protect the various circuits of the house.

2.7 General box

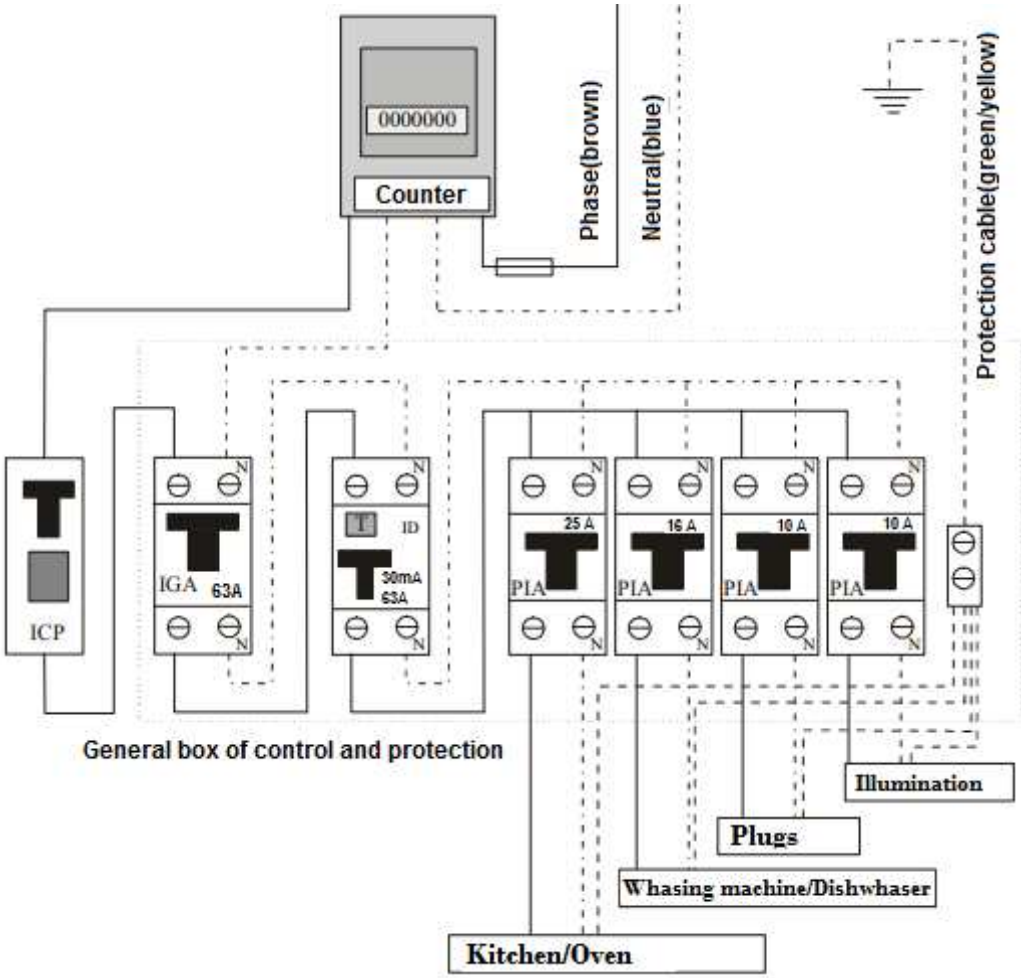
As it was said, in the general box will be the devices for the protection of housing, breakers and differentials switches.

The general box will be supply from the simple derivation, with a contracted power of 4600W, and a nominal current of 20A.

This way, from the general box, the different circuits in which the installation is

divided(C1,C2,C3,C4,C5,C7,C9,C11,C12), will be supply, circuits that will be explain so one.

The disposition of the different switches will follow the next configuration, in which they will be shown only four circuits, since the rest are connected the same way than these.



Configuration of the General box

The different devices will be used, will be with two poles, it is said, they will have only phase and neutral.

This way they will be found the next devices(everyone is bipole, and in any case tetrapole):

- The ICP(Power Control Switch) with a nominal current of 20A, cut power of 3kA,

which will act in less than 0,02 seconds.

- One General Automatic Switch (IGA) of 63A with protector against overvoltages permanents and transients.
- One diferential switch of 63A, with a residual current of 30mA, which will protect the whole circuits.
- One breaker of 10A, wich will protect the circuit C1.
- One breaker of 10A, wich will protect the circuit C2.
- One breaker of 25A , wich will protect the circuit C3.
- One breaker of 16A, wich will protect the circuit C4.
- One breaker of 10A, wich will protect the circuit C5.
- One breaker of 10A, wich will protect the circuit C7.
- One breaker of16A, wich will protect the circuit C9.
- One breaker of 10A, wich will protect the circuit C11.
- One breaker of de 10A, wich will protect the circuit C12.

All the chosen switches, will be made by General Electric, which a company that offer a great hopefully between his products.

Due to the number of switches the house has, It will be neccessary put a general box with 36 modules, built, from the brand ABB, being the reference of the product 44.20.00.22, although they are going to be used 22, if in the future there is a ampliation, there will be space.

2.8 Illumination circuit C1

All the lights will be connected at this circuit, since the number of them is not so big in order to do two circuits.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 498,75W.

The control of the lights, will be done by the domotic system, this way each point of

illumination will be connected with the output of the actuator belongs in the domotic box.

Meanwhile, the driving mechanisms of illumination, switches,etc, will be connected to the bus line.

2.9 Plugs first floor circuit C2

The plugs of the first floor will be supply by this circuit, this manner, the tactil screen and the fridge will be supply by this circuit.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 172,25W.

The plugs will be of the type 16A 2p+T.

2.10 Kitchen/Oven circuit C3

This circuit will only supply the kitchen and the oven.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 3843,75W.

The plugs will be of the type 25A 2p+T.

2.11 Washing machine, dishwasher, thermo circuit C4

This circuit will only supply the washing machine, the dishwasher and the thermo.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 2970W.

The washing machine and the dishwasher will be connected with the network by plugs of the type 16A 2P+T.

2.12 Bathrooms and auxiliary plugs C5

All the plugs, that are in the two bathrooms, for get more safety because of the water can be appear in this rooms, and the same for the plugs in the kitchen, so they will be separated from the others circuits.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 1080W.

The plugs will be of the type 16A 2p+T.

2.13 Plugs second floor C7

This circuit will supply, all the plugs that are in the second floor, since being more than 30 plugs in the house, it is necessary spread the loads, thus the consumes will be divided.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 97,25W.

The plugs will be of the type 16A 2p+T.

2.14 Air conditioning circuit C9

This circuit will supply the system of air conditioning is in the house.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 3500W.

2.15 Domotic circuit C11

With this circuit will be supplied the domotic boxes, this manner the power sources, actuators, etc, will be supply.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 1200W.

2.16 Windows' blinds C12

The engines that will have to go up/down the windows' blinds, will be supplied by this circuit.

The planned power for this circuit, after do the calculates, using the simultaneity and utilization factors is 504W.

2.17 Illumination

In this part of the project, they will explained the different types of lights, that will be used in the house, and they will be controlled by the domotic system.

In the whole situations, the lights were chosen, trying to obtanied the best efficiency in the electrical consume, getting one house which respects the environment as much as possible, avoiding this way unnecessary losses of energy.

All the lights are from Indal, which is a Spanish company, and they are the next:

- **Downlights;** they will used two different models.

  * **Type COMPLET**, model/reference 80007 with metal halide, so the color

representation will be so realistic to use in the hall. The consumption will be 70W.

* **Type TOP**, model/reference 3000, with metal halides, so the color representation will be so realistic to use in corridors, rooms, dining room, living room, bathrooms and the storage room. The consume will be 70W.

-**Metal halide;** with them is achieved the representation of the colors very real, so the view gets better feeling. In addition of the two downlights discussed before also it will be found one model more.

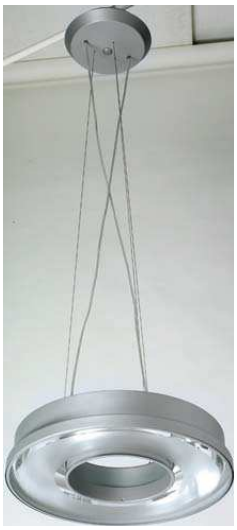
***IQN type**, model / referenceP170MT IQN, it will be used for the entrance to the house, wich is outside , so in times of darkness people can see without problem the lock . The consume will be 70W.

***Type VIOS**, model / reference 68050EL, it will be used to illuminate the stairs. The consume will be 50W.

-**Fluorescent;** so used in domestic uses, and its greatest advantage over the other is the most efficient of the fluorescents.There will be two different models.

*__MURAL type__, model / reference 72123EL, it will be used to illuminate sinks from bathrooms. The consume will be 24W.

*__RONDA type__, model / reference 50002EL, it will be used to illuminate the kitchen and pantry. The consume will be 55W.



*__TUBE type__, model / reference 700128EL, it will be used to light the garage. The consume will be 28W.

2.18 Cables

In the installation, it will be used only one type of cable, which will be the type Barry, of course, each circuit will use different section from the others, depending on the current they are going to support, what in the ITC-BT-07 and ITC-BT-19 is explained.

The cable chosen is the type H05V-U, the tension it will support will be 300/500V, made with overdone electrolytic copper, that will have a flexibility of 5 class, it will be able to support 70ºC in continue service, and 160ºC in short circuit, the insulation will be a thermoplastic with features LSOH, and it will be a cable with a emission of smoke and toxic gases low, it won't be propagator of the flame and neither the fire.

It will follow all the time, the rules in the IRAM 62267.

Anyway, will be used for the phase and the neutral single phase cable, like the one in the next photo, being possible see the different between the phase and the neutral, thanks to the color of the insurance, black, brown or grey for the phase and blue in the case of the neutral.

Since our pipes were held in wall recessed, the choice of tubes for the cables, it will have to go to the ITC-BT-21, so we will have the following:

The wires will be carried by false roof, as well as recessed wall, with their protective tubes.

Circuits	Type of cable	Conductors	Section(mm^2)	Diameter PVC tube
Illumination(C_1)	H05V-U	2	1,5	12
Plugs first floor(C_2)	H05V-U	2	2,5	16
Kitchen/Oven(C_3)	H05V-U	2	6	16
Washing machine, dishwahser, thermo(C_4)	H05V-U	2	4	16
Bathroom and auxiliare plugs(C_5)	H05V-U	2	2,5	16
Plugs second floor(C_7)	H05V-U	2	2,5	16
Air conditioning(C_9)	H05V-U	2	6	16
Domotic(C_{11})	H05V-U	2	1,5	12
Windows' blinds(C_{12})	H05V-U	2	2,5	16

At all times the distribution of the cables will be made trying the disponibilty of them, overall in case of reparation, etc.

It will take great care in orden to in any case, the wires can come into contact with the heating pipes, or in case you can not avoid it, place a protective shield to prevent damages.

The cables will not be able to bend or twist during its travel, for get it will be used strips necessaries for this purpose, which will not propagate the flame, insulation and provided with enough space for the cables wich go inside, well as a possible expansion that may occur in the future.

2.19 Voltage drop

Is normal that, in all the installation appear a voltage drop, due to little losses, etc.

In family houses, the maximun voltage drop that is allow is 3%, this way, no one circuit should increase the quantity.

Circuit	Power(W)	Lenght(m)	Section(mm^2)	Conductivity of couper	Voltage	Voltage drop (%)
C_1	1330	17,93	1,5	56	230	2,47
C_2	3445	13,87	2,5	56	230	2,97
C_3	10250	8,94	6	56	230	2,37
C_4	6000	8,16	4	56	230	1,9
C_5	4200	11,27	2,5	56	230	2,94
C_7	1945	16,31	2,5	56	230	1,97
C_9	3500	13,6	6	56	230	1,23
C_{11}	1200	13,97	1,5	56	230	1,74
C_{12}	1400	16,59	2,5	56	230	1,44

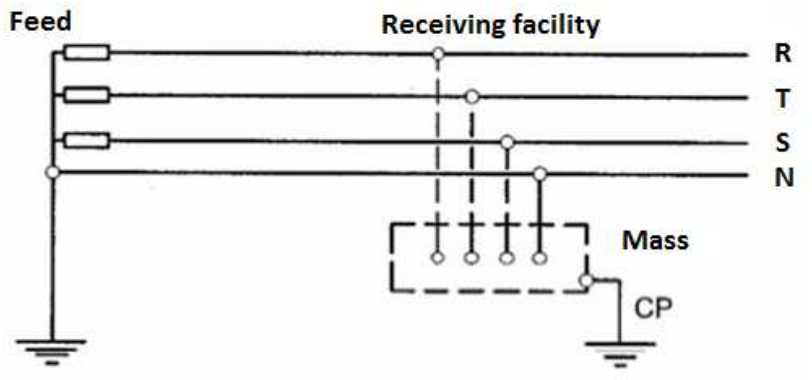
2.20 Grounding

In any case the installation must not has electrical risk for people, so, in addition the different switches of protection that will have in the installationwe will have to prepare the ground for the house, that in case of indirect contact, drive the current that appear until the ground avoiding a potential danger to people, so grounding, will connect one part of the ground circuit with an electrode, will be found interred bare in it.

Never the way of the grounding, will have fuses, etc, nothing that could avoid the movement

of the current, getting the people some risks.

The installation of the house will have the form TT, which is shown in the next picture.



But in the case of the house. The connection will not be with three phases, if not with one and neutral.

Grounding will follow the rules, that appear in the ITC-BT-18, this manner it will be put an electrode connected with all the metal structure of the house.

2.21 Installation of the photovoltaics panels

In order to be self-sufficient in the house, it will be held the installation of photovoltaic panels, thus, it is going to try not depend on the grid, but of course, it will not be possible keep the control of the weather, in order to every day , receive the amount of solar radiation we need, getting well, have enough power at all times.

The installation will be formed of:

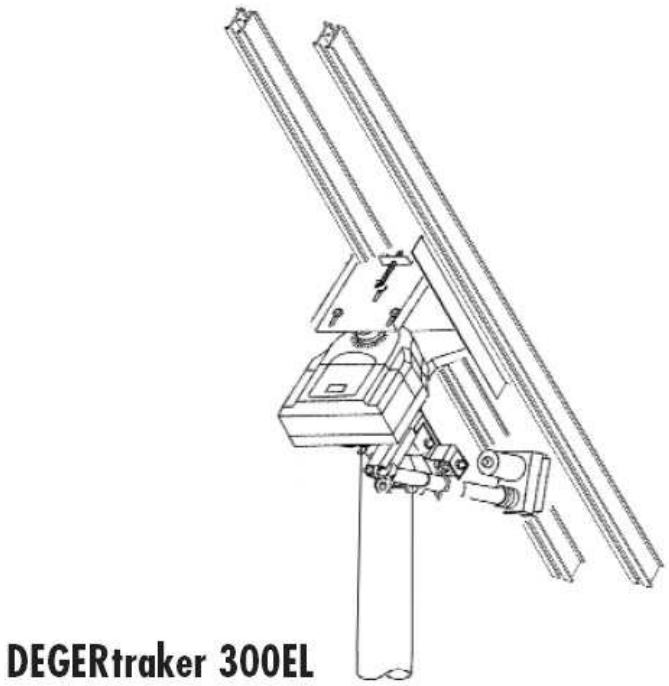
- **Solar panels;** they will be the reponsable of take the radiant energy from the sun, in order to obatain the electrical energy, this way all the panels will be connected in serie, what nowadays is so easy, since the panels are ready like plugs for connect them. The panels chosen will be from the company Yokhon, and the model is

YE6120P_65, polycrystalline silicon, with a effiency of 13,58%, wich size is 0,49m^2, and they will use the tracking system, that will be put in the roof, which is almost flat, leaving a little inclination, for avoid problems with the acumulation of water, and this way don't have obstacles for the panels.

Policrystalline panel

The installation will not be fixed, if not with the tracking system, the panels will follow the sun during the day, this way it will be possible obtain 45% more of efficiency, than in the fixed systems.
De esta forma llevaremos a cabo la instalacion de un sistema de seguimiento solar, siendo la empresa elegida para obtenerlos, la alemana DEGER ENERGY, los cuales estan especializados en el campo de los paneles solares rotativos.
This way, it will be held the installation of a tracking system, being the company chosen for obtain it, the german DEGER ENERGY, who are specialized in solar panels with tracking system.
El modelo elegido sera el DEGER traker 300EL que se muestra a continuacion, asi como la hoja tecnica

The model chosen is, DEGER traker 300EL, which is shown in the nexts pictures, like the technic paper.



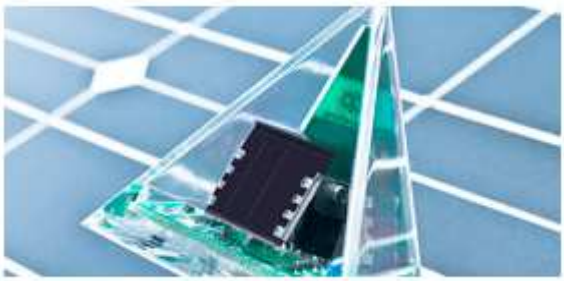
DEGERtraker 300EL

	300EL
For solar yield	100 - 400 Wp
Module area up to	3 m²
Rotation angle east-west	200°
Elevation inclination angle	15°... 90°
Control unit	DEGERconecter
Energy converter	I or III
East - west drive	drive integrated in the power head
Elevation drive	linear drive, 200 mm stroke path
Internal power consumption: control mode	0.3 Watt
during drive operation approx.	5 Watts
Power consumption per year approx.	3 kWh
Mast length	mast not included, Ø 90mm
Weight (without mast)	30 kg
Maintenance	maintenance-free

Since the surface of the panels is 0.49 m2, and the follower is 3m2, it will be possible put until 6 panels per tracker.

The number of followers on the roof will be 12, because it is neccesary maintain a minimum separation between the panels, so in case of failure, repair, etc., the operator have space to maneuver at all times.

The solar tracking , will be done by sensor, created by DEGER ENERGY, which is integrated into the structure of the panel, which will get the collection of energy through the panels is the maximum possible, obtaining in this way, more energy system that by a mere fixed panels, and so the panel's amortization will also be faster.



Solar sensor

- **Regulator;** is the responsible of, when the batteries are charged, stop the supply of them, in addition, it protect them, avoiding be totally flat, what is not good for them, and in the moments it is not necessary take more energy from the panels, the regulator will introduce it in the grid.
The model used is PR1515 Steca.

Regulator

- **Inverter;** since, the solar panels, produce direct current, and the appliances of the house, will consume alternating current, and for the grid is the same, it will be needed transform it. The model used will be Inversor Senoidal Solener ISC 300 12V.

Inverter

- **Batteries;** they will the responsible of keep the energy obtained from the solar panels, they will be of 2V each battery, the batteries will be of type “Stationary Storage 2 OPzS 100 150 FIAMM”.
The number of batteries will depend on the tension is going to have, in this case, the house, since is a domestic installation, will consume 12V, this way, they will be needed 6 batteries.

Batteries

The only disadvantage, that the photovoltaic system will have, will be the amortization, which will take between 10 and 20 years, but anyway, the invest is worth it, in addition it will get a pespected consume with the environment.

Another thing very important will be the clean of the panels, since the photoelectric cells are connected in serie, and one representation of them, is like they are current sources, so if one can't receive directly the light because the crystal is dirty, it does not matter the reason, that cell will not give all the electricity it could, and the rest of the cells will have to give the same current, because they are in serie, so the efficiency will drop.

3 Domotic installation

In order to obtain bigger eficiency in the house, it will be used a domotic installation.

Thus it will provide a home with a domotic installation, which will be able to automate a home, providing energy management services, safety, welfare and communication, and they can be integrated through internal and external networks of communication, wired or wireless , so it is possible summarized , as the creation of a smart home.

The purposes of the domotic will be facilitate day to day life of people in the following fields:

- **Get a high level of comfort;** the use of an integrated communications system makes available to the user facilities, such as using remote control, programming the lights, blinds, etc.

- **Improve the safety of goods and people;** so they will be found two different types of alarms, the first in terms of protection of the building, fire, smoke, etc, and secondly in terms of burglary.

- **Efficient management of the energy;** it is one of the most important aspects for the domotic, since it searchs the optimization of the electrical consumption and air conditioning (heating cut-off when is not needed etc.), which will be achieved by sensors, programming schedules, etc.

- **Communication;** today it is possible take the control of the house from a distance without having to do it always from the central computer, which is a huge independence in this sense, such that it can carry out this task through Internet and even phones.

3.1 EIB system

For the house will be chosen the EIB system, since it is a decentralized system in which there are devices that can do a number of functions automatically or related with other devices.Being a decentralized system when an element fails for some reason, it can continue working even if it is partially.This is because all devices, are connected to the data communication bus, has its own microprocessor and electronic media access.

In the EIB network, they will be able to find five types of components: modules of network supply, line couplers to connect different network segments, the bus, actuator elements and sensing elements.

The bus, is the physical medium where all the components of the system are connected.

The sensors are the elements responsible of detect the changes in any activity of it(physical changes in the atmosphere, movements,etc) while the actuators receive from the sensors, the orders, and they do what they must in that situation. The sensors, will act, so, like inputs in the system, while the actuators, will be the outputs.

The EIB has the next advantages comparing with the typical installations:

- Less cables.
- Less spending.
- Integration of different functions in one system.
- Flexibility for future expansions and modifications. It is possible to reprogram the operation of the installation by connecting a computer to the system or remotely via a telephone link or via the Internet.
- Installation and proyect easy.
- Enables higher transmission because it has a specific bus for transmitting data.
- Less sensitive to disturbances that may occur on the network by electromagnetic effect.
- Facility for plan the areas of building management, control, safety and alarm systems.

Between the disadvantages are:

- High price, since the control elements, need another elements in order to communicate with the system.
- In biulding built, it has less sthetic benefits, than the X10 system, since it needs cables extra that, it is hidden, it supposes the increase of the price.

In the family house, the system chosen will be EIB KONNEX.

3.2 Characteristics of the transmission

The house is going to be built, so the best option, will be use the twisted pair, doing this way the transmission, with two wires, called bus, that will cover all the installation.

The transmission will be differential, that adding the symmetry characteristic of the wires, it will be guaranteed that the noise will affect the two wires the same quantity, so the difference between the tensions, will be nothing.

The cable that will be used for the bus line, will be YCYM 2 x 2 x 0,8mm, which will have 4 wires, two are the possitive(red) and the negative(black), and the other two will be able to use them for other applications.

The bus lines, will be distributed, respecting all the moments, the topology decided in the beginning, and always without overload the lines, just in case in the future, it is decided to do an extension necessary.

3.3 Topology

EIB, will allow the components that form part of the installation, are intercommunicate between them, getting in each moment, any element can order something to other, independently

the distance what they are.

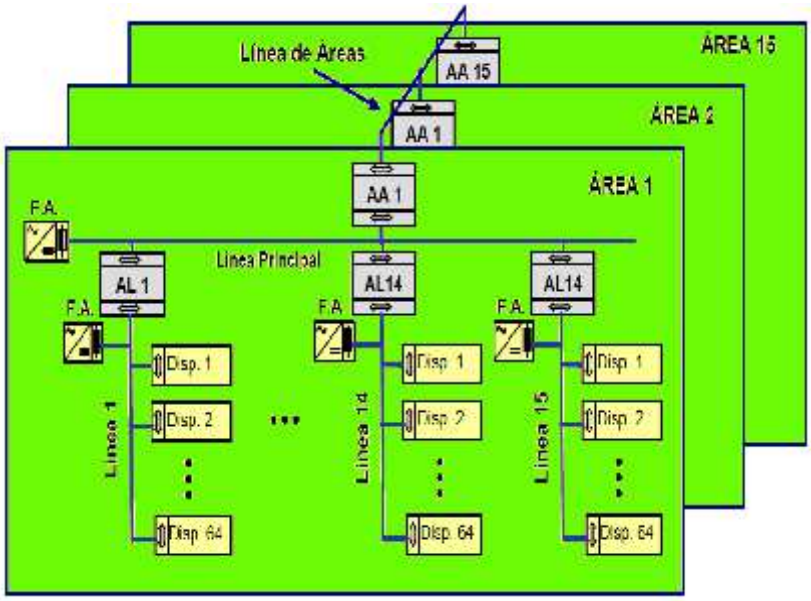
Between the topologies, it is possible to find some: tree, star or bus, what will do easier the installation of the house, since there are some possibilities.

It will found three different levels of connection:

The line will be the smallest unit of installation, being able to connect to it until 64 devices.

In the case of want to connect more devices with the bus, it will be necessary install another line, which will be connected with the first, being possible connect until 15 lines, creating this way an area, in this case it would be able to connect until 960 devices.

It will not be possible connect more than 15 areas.



Topology of an EIB installation

3.4 Components

In this part, it is going to be explained the components of the system, which have intelligence, this way it is not going to speak about the rest of the auxiliar components, which make

possible.

- **Bus coupler;** it has enough technology in order to manage the linking, sending and receiving of telegrams, executing the application objects physical address filtering and gruop for recognise telegrams destined to the device, cheking of errors, sending of acknowledgments,etc. The coupler cyclically examines the application interface to detect signal changes.

- **Sensors;** they are responsible of detect the changes and transmit the information to the actuators. They are formed by one bus coupler and a terminal module. The same sensor will be able to practise some functions, this manner it will have to program it one application when it is being programmed, for exampe the light sensor, etc.

- **Actuators;** they receive the information from the sensors, reacting in each situation, that actuator. Some examples are those open and close one trip relay, illumination actuators, etc.

There are two types of EIB components, depending on the way of installation:

- Components of 35mm DIN rail, with the same format than the electrical protection (circuit breakers or differential).

- Componentes de empotrar, para su instalacion en cajas universales de empotrar, falso techo o cajas de emplame.
Embedding components, for install in universal Boxes recessed, false ceiling or splice boxes.

Consulting the technical characteristics of each component it could be possible know the method of installation is required.

3.5 Addressing

All the existing elements in one EIB KONNEX installation, are totally identified thanks to the addressing system.

Exist two different types, physic addresses and group addresses.

3.5.1 Physical addresses

Physical addresses uniquely identify each device and correspond with their location in the global topology of the system (area - online - device). The physical address consists of three fields, which are shown separated by dots:

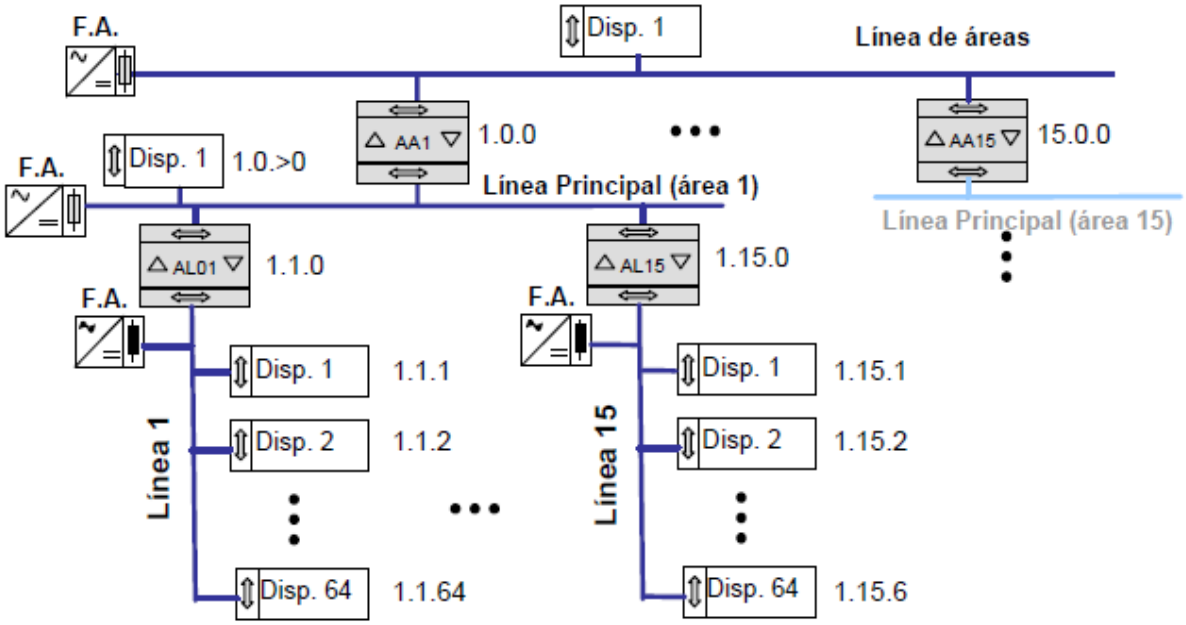
- Area (4 bits). Identifies one of the 15 areas. A = 0 corresponds to the direction of the areas' line of the system.

- Line (4 bits). Identifies each of the 15 lines in each area. L = 0 is reserved in order to identify the main line within the area.

- Device (8 bits). Identifies each of the possible devices within a line. D = 0 is reserved for a line coupler.

In the line of areas until 15 area couplers are connected , whose addresses go from 1.0.0 to 15.0.0. This line can be connect standard devices (addresses 0.0.> 0).

Each area has a principal line, with its power source, whose the line coplers are connected, with addresses 1.1.0 to 15.0.0, and to each second line connected with a line coupler, is possible connect until 64 devices.



Physical routing

For the interconnection of different lines and different areas, is used the coupler unit. This elementis the same for different types of connection, and depending on the physical address, that be assigned to it, it will work like line coupler, area coupler, or even repeater inside the same line.

In the case of a line or area coupler, the coupling unit acts like router, and keeps one intern table of addresses, of the subnetworks it connects in order to insulate the traffic between them.

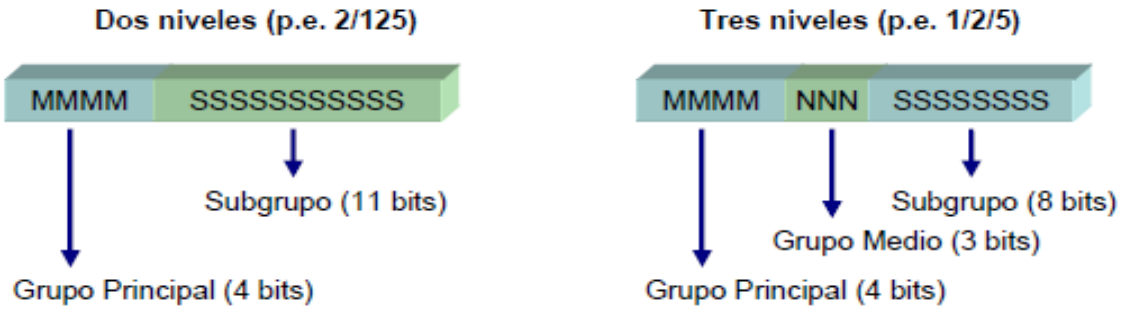
3.5.2 Group addresses

The group addresses are used for define specific system functions, and they are which determine the associations of working devices (and the communication between application objects).

The group addresses assign the correspondence between the system inputs (sensors) and output elements (actuators).

They can be used two types of group addresses: two and three levels, depending on the

needs in the hierarchy of system functions.



Levels in the group routings

In the configuration of EIB KONNEX, the assignment of group addresses is basic for guaranteed the right working. Those group addresses that mix sensors with actuators, can be assigned with each device in each line(independently on the physical addresses) with these conditions:

- The sensors can send one group address.
- Some actuators can have the same group address, it is said, they answer the same message or telegram.
- The actuators can answer more than one group address.

The functioning will be the next: the emitter sends a telegram to the bus.

This telegram arrives until all the devices, which read the camp of the group address, and only what have that address, answer like the correct way.

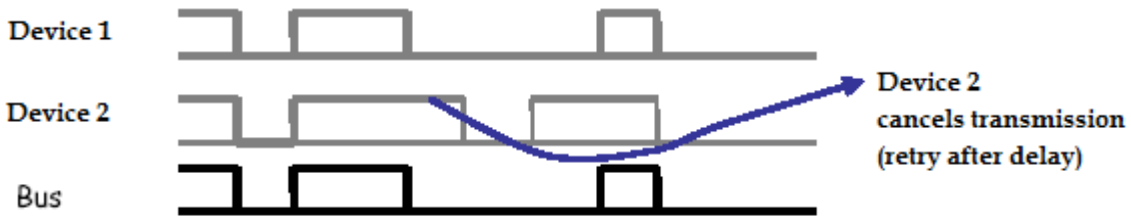
3.6 Coding signals

3.6.1 Method of signals

The access method to the medium used in EIB KONNEX is the type CSMA/CA. the encoding is performed so that the logic state '0 'is dominant (current flow) on the '1', which is called

recessive (no current flows). The collision resolution mechanism is as follows:

- The device check the bus, and if it is free, it begin the transmission.
- During the sending, each device listen to the present dates in the bus, comparing them during all the time with it has sent.
- During the sending, each device listen to the present dates in the bus, comparing them during all the time with it has sent.
- If not, there is a collision with the sent dates, by other equip, the arbitration resolve using priority of dominant over recessive bits.



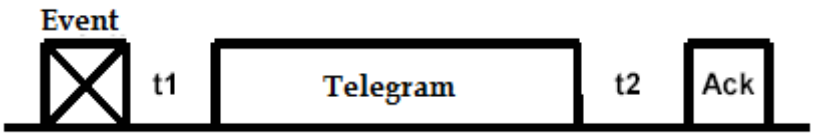
Verdict of collisions CSMA / CA in KONNEX EIB

3.6.2 Telegram format

Sending a message or telegram in a EIB KONNEX system is performed when an event occurs, for example, activation of a pushbutton or presence detection. The sending device (sensor) checks the availability of the bus for a time t1 and send the telegram.

If there is no collision, at the end of the transmission wait the time interval t2, the reception acknowledgment (Ack). If the reception is wrong, no acknowledgment is received (or you receive no recognition), and the transmission is retried up even three times.

All the addressed devices send the acknowledgment simultaneously.

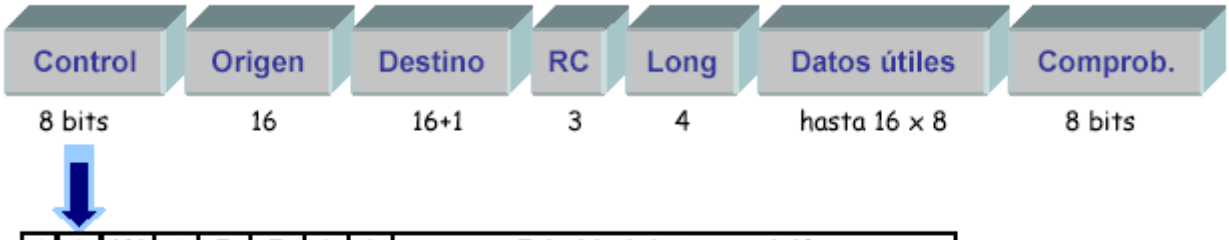


Telegram sequence before sending an activation event

The telegrams are transmitted in asynchronous mode, at a speed of 9600 baud, where each character or byte consists of 1 start bit, 8 data bits, 1 parity bit, 1 stop bit, and a pause of 2 bits until the next transmission.

Thus the transmission of one byte takes the time of 1.35 ms, and a telegram complete between 20 and 40 ms (most orders are on-off and assume the sending time of 20 ms).

The telegram is transmitted through the bus, and contains specific information about the event has occurred, it has seven fields, six of control to achieve reliable transmission and a field of data with the command to run.



1	0	W	1	P	P	0	0	Prioridad de transmisión
				0	0			Funciones del sistema (prioridad máx.)
				1	0			Funciones de alarma
				0	1			Prioridad de servicio elevada (manual)
				1	1			Prioridad de servicio baja (automático)
		0						Repetición

Format of the telegrams. Control field

Like is possible see in the last picture, it is shown the frame format and the size of each field, which are described below:

- **Control;** this field of 8 bits, includes the priority that the telegram has by the fact of be sent, depending on the type of function(alarm, system services or normal services). The bit of repetition put itself in 0 in case of repeat some sending because of non-recognition of any of the consignee. Thus it is tried to avoid the mechanisms that have already executed the order of repeat.

- **Address of origin;** the device that retransmits the plot that sends its physical address (4 bits with the area, 4 bits of line identifier and 8 bits of device identifier), so being a mode to know the sender of the telegram in maintenance tasks.

- **Address of destination;** the destination address can be of two types, depending on the value taken by the most significant bit of this field (bit 17). If it has value `` 0" is a physical address, and the telegram is going only to one device. If it has value `` 1" is a group address, and the telegram is going to all the mechanisms to be listening (the ones with that group address).

- **Length and useful information;** It contains the information necessary for the execution of orders and transmission of values. In the four bits length is indicated how many bytes contains the data field (0 = 1 byte, 15 = 16 bytes). The useful data field contains the type of command (only four) and the data, according to the EIB Interworking Standard (EIS).

The EIS contains the useful datas for each function assigned to the communication objects.

According to this standard there are seven different types, each one assigned to a type of control action (switching, Light regulation, sending absolute value, sending floating point value, etc). This will ensure the compatibility between devices of the same type from different manufacturers.

The communication objects are instances of classes defined in the standard, and programs are stored in the memory of the devices to perform a certain action.

- **Checking field;** it consists in a byte which is obtained from the calculation of longitudinal

parity pair (LRC2) of all previous bytes included in the telegram. When a device receives the telegram, check if this is correct from a byte checking.

If this reception is correct, it is sent an acknowledgment. Otherwise it is sent non acknowledgment in order to the issuer repeat the sending.

3.7 Components

In the EIB system, it is possible to find, passive elements, like are the power sources or the bus cable, and the active elements provided with a certain intelligence.

Thus these are the most important and intelligent devices and are those that give the system its main advantages. The architecture of these devices are divided in three basic parts:

- Bus coupling unit (BCU).
- External Interface and Physics (PEI).
- Application Module (AM).

3.7.1 Bus coupling unit

Is in the bus coupling unit, where is the electronics needed, responsible og the manage of the link with the bus, this way like the application program. It will be the responsible of functions like sending and receiving telegrams, executing of application objects, maintenance of the internal state of the device, leaking of physical and group addresses, cheking of errors, etc. It is divided in two parts: the transmission module o transmissor and the controller of the bus' link.

The link to the bus driver; It is only a microprocessor that has a memory map consisting of a ROM, which stores the software of the system and it will come recorded from the fabric, a RAM, which will temporarily save data from the device, and a non-volatile memory, where are stored the application program, the physical addresses and the group addresses table.

The module of transmission; it wil be the responsible of the protection against the investment of polarity, the generation of the reset of the microprocessor if the bus voltage

falls below the threshold, expansion, logical functions for the transmission and reception from the bus, etc.

3.7.2 External and physical interface

It is a standard ten pin connector, of which, five are used for data (4 digital or analog and one digital input or output), three are used for supply voltages and one is an analog input to the bus coupler wich is used to identify the type of end device.

In order to identify the type of device, is used the resistor voltage of the input thereto. So that the tension is in the pin of identification from the final device, changes depending on thereof.

3.7.3 Application module

The task of this part will be particularize the particular device.

This way, it will determine, if that is a switch, a regulation element, etc.

The BCU knows the change in the AM thanks to the PEI.

In the case of the sensors, the application module, transfers the information is taken from the environment to the BCU through the PEI. The BCU will encode and send the data collected through the bus. This information reaches until the actuator where the BCU receives data and sends them through the IEP to the application module , that will act.

It is possible count the fourth part of the components, which is the program of the application, that include all the software part of the device, that will be in each case different, depending on the task, it is going to do.

Changing the application program, is possible modify quickly the behavior of one device, without touch the physical devices, however, if the type of device is unrequited with the application program, the bus coupler stops it inmediatly.

3.8 Cabling

The domotic cabling of the house will be in the wall, or in the fake roof, and always preventing futures extension.

In any case it will be careful, in order to not put domotic cabling with the electrical supply, with different canalizations, or in case of not being able, with the necessary isolation.

They exist limits with the cable's length, being the maximum 200m, so in the house is going to be built, there will not be problem.

3.9 Programming of the installation

The programming, is the last part in the installation, after finish with the domotic installation.

Usually, it is done, connecting one laptop, through one link. In this phase the programing of the physical addresses of the devices is realized, like the load of the extension programs where the components, and programing of the group addresses.

For the programing are used tools of software specifics, like the ETS. From the link of the components' manufacturer EIB, is possible download the catalogs of the company and upload in the software ETS, in order to do the programing.

This process, as the diagnostic labours and modification of the programmings, is possible do in a local model or also with connexions through the telephone line or Internet.

3.10 Description of the domotic installation

Now the field where the domotic will be used are shown, in order to make easier the whole day for the people in the house.

3.11 Illumination

It will be one of the most important fields inside the domotic.

The control of the illumination, will be realized with press bottom sensors, or with presence sensors. The last, also act like light sensors.

Although always is possible program different situations, for example for the living room, there are moments when you can be taking a coffee with someone, so they will need more light than one night they want to watch a film.

Thus, regulators of light will be set in common rooms like the living room, the living room.

3.12 Safety and security

Nowadays something very important, is the security in the houses, for that reason, the house's security is one important point for to treat, in the case of robberies, accidents inside, etc.

In the case of robberies, will be set movement sensors, that will be in the entrances of the house.

In the case of fire, there will be smoke sensors, overall in the kitchen, for gas sensors the same.

For bathrooms, and the kitchen, and all the room where is possible find one appliance which can lose water, it will be installed water leak detectors, at the same level than the floor. When the detectors realize about the leak, they will activate some solenoids, that will cut the water supply.

Speaking about the alarm, it will be controlled by the alarms center, just together its LED panel.

In the access of the house, there will be a video entry phone.

3.13 Air conditioning

The control of the air conditioning, will be through thermostat, that will set in all the rooms of the house, although also will be able to use a remote control.

In the case of the heating, all of them will have a little screen showing the temperature, and individually it will be possible, change the temperature in each one, without change the temperature in the rest.

3.14 Confort

There are some aspects for see, in the case of the comfort.

The windows' blind will be automatic also, thanks to a little engine in each of them, and they will be controlled with press bottom sensors, that will be in all the rooms.

As to the illumination, it will be created different situations, depending on the light is necessary in each moment, and of course, at the same light level, also it is possible to obtain it, with windows' blinds, changing the temperature, etc. This way, it will be possible have different functions, depending on the hour, the day.

In each floor, it will be set one tactil screen, with wich it will be possible control, and see the state of all the parts are being controlling by domotic, in addition, also will be like a information source, because it will show dates like the temperature outside and inside, date, etc.

This way the EIB system is so versatile, so we will be able to reprogram or extend easier the system, without high prices.

3.15 Efficiency

Another searched objetive, with the use of the domotic, is obtain an important efficiency,

this manner, they will appear aspects like the illumination, the security, the air conditioning, trying to be more responsible with the environment.

3.16 Comunication

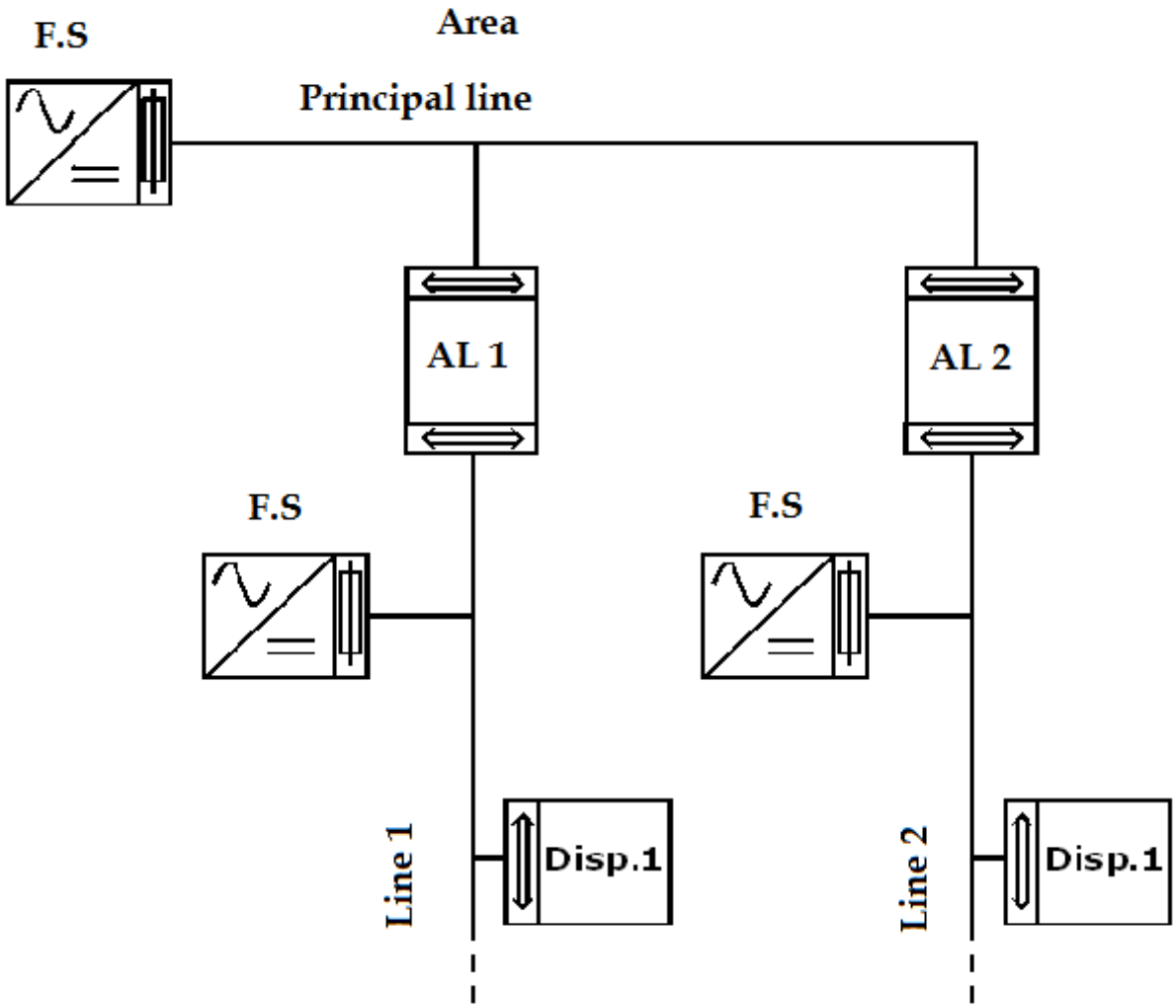
The communication will be realized by the EIB port LAN-LAN/RDSI Gateway, and with it will be possible control the lights, air conditioning, etc, through internet, sms, and more ways.

3.17 Topology in the family house

The installation will consist in only one area, which will be formed by the main line, that will be supplied by the power source.

The main line will connected with the two different sectors, in which the house will be divided, first and second floor.

For carry out the communication of the different components from each line, both lines will be connected with the main, through a coupler line, in addition per each line it will have a power source, that is possible see in the next picture.



TOPOLOGIA DE NUESTRA INSTALACION DOMOTICA

Where:

- AL is the coupler line
- F.S. is the power source
- Disp is the domotic device

The design that will be carry out, will be a decentralized system.

Having two floors the house, it will have a domotic box per floor, it is said, for each line, this way it will obtain have more distributed the installation, and at the moment of one failure

appear, it will be able to discover before where was the incident, or when it is necessary extend the installation, putting new elements, etc.

This way, the division will be, the domotic box 1 will be for the line 1 and will be in the first floor, and for the domotic box 2, it will be for the line 2 and will be in the second floor.

The boxes will be connected through the main line, and the power source of the main, will be situated in the domotic box 1. This way each domotic box will include the line coupler corresponding to the line it controls.

3.18 Components of the installation

Below are described the different domotic boxes, with the components are in each one, and where are they in the house.

The products chosen are from ABB, which has a high prestige in the world in the field of domotic elements, and in addition it has a big reliability.

In Spain, probably ABB is the most important brand in this field, so it will be easier buy with them, and if there are any problem, is simple obtain the help of the technical service, etc, although some products will be also from NIESSEN, since it sells products of ABB, so it will be like if we buy directly to ABB.

In addition each day they sell new products about EIB system in the market.

Below is going to be explained the different elements, what they can do, where they will be, and the main characteristics, which reference in the catalogue is also shown, in order to consult if it is necessary.

All the components of DIN rail installation will be connected with the bus through the conexion terminal with the bus.

Domotic box 1

Inside the domotic box 1, there will be the next elements:

- **Power sources;** they will be the responsibles of produce and regulate the tension of the EIB system. They will supply the bus with a tension of 24V DC, and in this case they will have a currents of 160mA(reference – 9680.8), and this will supply the main line, 640mA(reference – 9680.1), which will supply the line 1. The bus line will be uncoupled electricaly from the tension of the supply of 230V AC with a bobine integred. The supply tension is connected with the bus line with a bus connecting terminal.
  There will be one of each type.

.

Power source 9680.8

Power source 9680.1

- Line coupler; it will be the responsible of connect the line 1 with the main line in order to tranfer the data, in addition it is able to insulate electricaly.
  At the same time the telegrams can be filtered, this way, only will pass telegrams that it

wants, because they are necessary for one line, this manner inside the diagnostic field, is possible stop or leave pass all the telegrams.

Reference – 9687 ABB.

There will be only one installed.

Line coupler

- **4 channels Windows' blind actuator;** is used for control the position of 4 windows' blinds with a engine, consuming a tension of 230V AC. In the actuator, are the bottoms, which function is go up/down, stop the movement, and adjust them.

  It has LEDs which will say the direction of the windows' blinds.

  Reference – RA/S 4.230.1 NIESSEN.

  There will be only one.

8 channel blind actuator

- **Zone terminal with four inputs;** is designed for be the connector between the security sensors and the EIB. Here will be connected the water leak detector, smoke and gas detectors.
  It will need an auxiliary source of 12V DC(reference – 234-458)
  In the case of the zone terminal, the reference is 9610(ABB).
  There will be only one installed.

Auxiliar source

Zone terminal with four inputs

- **Output actuator;** is able to act some independent loads through contacts free of power, thus it will be possible act as loads as outputs it has, being all the time the limit of the load, the limit of current that the actuator supports in each output.
  This way they will be used always for illumination, although for another type of load, like electrovalves, etc.

The model used has the reference – SA/S 8.6.1 (NIESSEN), being the actuators of 8 outputs. It will be used two in this box.

Actuator output

- **4 channel electronic switch actuator MDRC;** controls without noise the heating and refrigeration, through acting in electrothemal valve, having one valve for drain automatic, that guaranteed a constant volume of flow.
  Reference – ES/S 4.1.1 NIESSEN.
  There will be only one.

4 channel electronic switch actuator

- **Gateway EIB port LAN/RDSI;** will make possible the communication between the domotic system and the people, being them aoutside from the house, through internet, sms and WAP.
  With it it will be possible check the state of the installation, program actions, control the illumination, etc.
  Reference – 9637.1 ABB.

There will be only one installed.

Gateway EIB port LAN/RDSI

- **USB Interface;** with it, will be got the communication between the PC and the EIB installation, this way, it will be possible transmit the executed programming in the computer until the bus components.
  The USB interface is connected with the EIB bus, and then with the USB of the computer, being this last detected and installed automatically by the operating system of the PC.
  Reference – 6123 USB – 84 NIESSEN.

USB Interface

They are going to be described the different rooms of the house, which will be controlled by the domotic box 1, and the different components that are in each one.

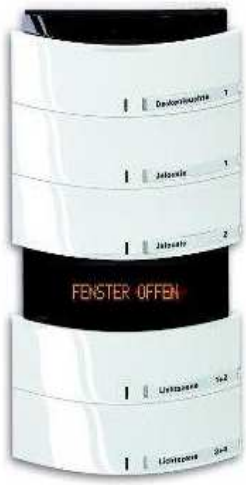
Dining room

- 5 channel triton with display and thermostat; it will send telegrams for connect and regulate the wondows' blinds, the value or control the ventilation.
  It has a thermostat with functions PI, PWN, or two steps, in addition through the display shows, the temperature in the room, the symbol of functioning, heating/air conditioning.

Thanks to a infrared receiver, it can be controlled with a remote control.

Reference - 9625.3 ABB.

There will be only one installed.



5 channel triton with display and thermostat

- **Two channels switch;** it will send control telegrams of conexion, of illumination, and of the windows' blinds until the EIB actuarors.

  The reference is 9602 ABB.

  While in the case of the one channel switch the reference is 9601 BA ABB.

  There will be two of two channels, that will control the lights, and one of one channel, that will control the windows' blinds.

Two channel switch

One channel switch

- **Presence detector;** between the actions it can do, are connecting the heating, air conditioning or turn on / off control system ventilation, independently of the control system regardless of the brightness.
  The sensor can detect movement, during a specified time period, thus the system can be integrate the sensor system into the alarm system.
  The time and the sensitivity of the twilight switch can be selected by means of three potentiometers on the back of the presence detector.
  Reference - 6131/74-102-500 NIESSEN.
  There will be only one installed.

Presence detector

- **Tactil screen;** color screen, free programming with a rotate element.
  Allows viewing of up to 120 functions.
  With time switch, alarm and timer weekly integrated lighting scenarios function, screensavers and multimedia control.

Free registration functions with text and symbols defined by the user.

Reference - 6344-24G-101-500 NIESSEN.

There will be only one installed.

Tactil screen

- **Bus coupler;** will be found embedded in the wall, and carry out data transfer, so will allow the connection to the EIB pushbuttons, movement sensors and tritons.
  It stores the physical address and the application program with the group address .
  In the case of triton coupler it will have one with reference - 9693.2 ABB.
  And two for the pushbottom of the coupler with reference - 9620 ABB.

BUS coupler

Kitchen

- **One channel pushbottom;** it will be used the same type that was explained for the dining room.
  There will be 2 of the one channel switches, the first will be for the lights, while the second is for the windows' blinds.

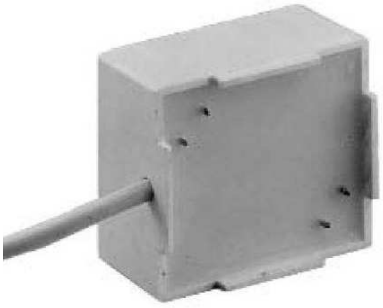
- **Gas sensor;** it detects the concentrations of gas in the atmosphere, and it is sensitive with gases like, propane, metani, butane, natural gas and town gas.
  When the gas is exceeded the maximum allowed, the buzzer emits a sound signal, the red LED lights, and the signal can go to the alarm receiving center.
  The alarm value is 20% lower that the limit explosive.
  The green LED says that the sensor is working.
  It will be connected with the auxiliary supply.
  Reference – 9611.2 NIESSEN.
  There will be only one.

Gas sensor

- **Smoke sensor;** it is used for detect the smoke, avoiding possibles personal and material damages if there is fire. It will be supply with a intern battery of 9V DC, it will be connected with the zone terminal, for send telegrams to the bus, in case of fire.
  Reference – 9611.9 ABB.
  There will be only one installed.

Smoke sensor

- **Water leak detector;** it is used in order to control the possible leaks, that may occur in the pipes, drains, washing machines etc.
  So after receiving the alarm signal of the detector will activate a electrovalve to cut water supply of housing, this way does not worsen the problem.
  The sensor reacts to a rise of the water level at ground through 4 external electrodes that are 1mm protruding edge of the casing / detector package.
  Reference - 9611.8 NIESSEN.
  There will be only one installed.



Water leak detector

- **Coupler bus;** is used the same types explained in the case of the dining room.
  2 couplers are placed for the buttons, with reference - 9620 ABB.

Living room

- **A channel switch;** it will use the same type explained in the case of the room.
  There will be three of one channel switch , the first two will be responsible of the lighting, while the third will take care of the blinds.

- **5 channel triton with display and thermostat;** it will be use the same type explained in the case of the dining room.
  There will be only one installed.

- **Presence detector;** it will be used the same case explained in the dining room.
  There will be only one installed.

- **Bus coupler;** is used the same types explained in the case of the dining room.
  There will be 5 couplers, 4 will be of the type with reference 9620 ABB for the 3 switches and the presence detector, while for the triton will be the reference 9693.2 ABB.

Hall and corridor

- **Two channels switch;** it will be use the same type explained in the case of the dining room.
  There will be a two channel switch, whose task will be the lighting of the hall.
  Shall be adjacent to the front door.

- **Two channels switch;** it will be use the same type explained in the case of the dining room.
  It will be the responsible of turn on the lights in the corridor.

- **Presence detector;** it will be use the same type explained in the case of the dining room.
  There will be only one installed.

- **Bus coupler;** it will be use the same type explained in the case of the dining room.
  It will be used three in order to connect the two channel switch, another for the one channel switch, and the last for the presence detector, all of them with the reference 9620 ABB.

- Alarm central; it leave see during all the time, the different sensors, and in case of one alarm sounds, it will act depending on the program.
  It has a keyboard which facilitates the control of the keyboard.

Reference - L240/PT NIESSEN.

There will be only one installed.

Central alarm

- **Video door;** it will be integrated with the domotic system via the gateway Twinbus - KNX. With it we will be able to control the access of people to the house.
  Reference - 2NPMNA101 NIESSEN.
  There will be two installed, one on each floor.

Video door

Bathroom first floor

- **Two channel switch;** it will be use the same type explained in the case of the dining room.
  There will be only one installed, which task is the illumination of the bath.

- **Water leak detector;** it will be used the same type than in the kitchen.
  There will be only one installed.

- **Bus coupler;** it will be used the same type than in the dining room.
  One will be used for the two channel switch with the EIB system, with the reference 9620 ABB.

Garage

- **One channel switch;** it will be used the same type than in the dining room.
  Reference – 9601 BA ABB.
  There will be only one installed.

- **Presence detector;** it will be used the same type than in the dining room.
  There will be only one installed.

- **Bus coupler;** it will be used the same type than in the dining room.
  This way, there will be used two, with the next reference, 9620 ABB, one for the switch, and the other for the detector.

Pantry

- **One channel switch;** it will be used the same type than in the dining room.
  Reference – 9601 BA ABB.
  There will be only one installed.

- **Bus coupler;** it will be used the same type than in the dining room.
  This way, there will be used one, with the next reference, 9620 ABB.

Stairs

- **Two channel switch;** it will be used the same type than in the dining room.
  There will be used two of this type, one at the beginning of the stairs, on the other at the end of them.

- **Presence detector;** It will be used the same than in the dining room.
  There will be only one installed.

- **Bus coupler;** it will be used the same than in the dining room.
  There will be three, two for the switches, and the other for the presence detector with reference 9620.

Domotic box 2

In this domotic box, it will be the below elements:

- **Bus power source of 640mA;** It will be used the same type than the explained in the domotic box 1, that will supply the line 2.
  Reference – 9680.1
  There will be only one installed.

- **Bus coupler;** it will be used the same type explained in the case of the domotic box 1, wich will connect the line 2 with the main.
  There will be only one installed.

- **4 channels Windows' blind actuator;** is used for control the position of 4 windows' blinds with a engine, consuming a tension of 230V AC. In the actuator, are the bottoms, which function is go up/down, stop the movement, and adjust them.
  It has LEDs which will say the direction of the windows' blinds.
  Reference – RA/S 4.230.1 NIESSEN.

There will be only one.

4 channel blind actuator

- **Output actuator;** it will be used the same type explained in the domotic box 1.
  But in this case, only one will be used and not two like in the domotic box 1.

- **Zone terminal with four inputs;** it will need a auxiliar source of 12V, being both of them, the same types explaining in the domotic box 1.
  There will be only one installed.

- **4 channel electronic switch actuator MDRC;** it will be used the same type explained in the domotic box 1.
  There will be only one installed.

Corridor

- **Two channel switch;** it will be used the same type than in the dining room.
  There will be used two of this type, one in each side of the corridor, doing easier the lit of the corridor.

- **Presence detector;** it will be used the same type than in the dining room.
  There will be only one installed.

Bus coupler; it will be used the same type than in the dining room.
So there will be three, two are used in order to connect the two switches, and the other for the presence detector.

- **Video door;** it will be used the same type than in the hall/corridor.
  There will be only one installed.

- **Tactile screen;** it will be used the same type than in the dining room.
  There will be only one installed.

Storage room

- **One channel switch;** it will be used the same type than in the dining room.

- **Bus coupler;** it will be used the same type than in the dining room.
  This way there will be only one installed.

Bedroom 1

- **5 channel triton with display and thermostat;** it will be used the same type than in the dining room.
  This way there will be only one installed.

- **One channel switch;** it will be used the same type than in the dining room.
  They will be 4, one in the door of the bedroom for turn on/off the light, another close to the windiws' blinds for it, and the other two close to the bed, for turn on/off the light from the bed.

- **Bus coupler;** it will be used the same were explaining in the case of the dining room.
  For the triton will be with the reference 9693.2 ABB.
  And for the 4 switches, 4 couplers with the reference 9620 ABB.

Bedroom 2

- **5 channel triton with display and thermostat;** it will be used the same type than in the dining room.
  This way there will be only one installed.

- **One channel switch;** it will be used the same type than in the dining room.
  They will be 2, one in the door of the bedroom for turn on/off the light, and the other close to the windiws' blinds for it.

- **Bus coupler;** it will be used the same were explaining in the case of the dining room.
  For the triton will be with the reference 9693.2 ABB.
  And for the 2 switches, 2 couplers with the reference 9620 ABB.

Bedroom 3

- **5 channel triton with display and thermostat;** it will be used the same type than in the dining room.
  This way there will be only one installed.

- **One channel switch;** it will be used the same type than in the dining room.
  They will be 2, one in the door of the bedroom for turn on/off the light, and the other close to the windiws' blinds for it.

- **Bus coupler;** it will be used the same were explaining in the case of the dining room.
  For the triton will be with the reference 9693.2 ABB.
  And for the 2 switches, 2 couplers with the reference 9620 ABB.

Bathroom second floor

- **Two channel switch;** it will be use the same type explained in the case of the dining room. There will be only one installed, which task is the illumination of the bath.

- **Water leak detector;** it will be used the same type than in the kitchen.
  There will be only one installed.

- **Bus coupler;** it will be used the same type than in the dining room.
  One will be used for the two channel switch with the EIB system, with the reference 9620 ABB.

3.19 Cabling of the installation

For the design of the EIB installation , has been taken into account , at all times, all limitations that BUS technology imposes.

This way the lines will follow the planned topology and will be distributed throughout the installation based on the different tables domotic boxes built following a radial distribution.

Two lines have been installed, to thereby avoid overloading a single line with all the installation, also in the future could be expanded, which in the case of not having more than one line, could be difficult, since would be overloaded that line.

To accommodate the modules, have been installed two boxes of 48 modules each one but can be extended until 56 modules, the model will be 540STE UK, with the reference 77724.

The EIB devices, will be protected against overloads, but for greater security, a overload protector will be installed in each of the BUS lines, that will support a discharge current of up to 5 kA.

The installation will be made as follows, the blue terminal will connect anger at the regular place of connection to the BUS terminal, red wire and black wire are connected to the BUS cable, and green / yellow was connected to ground.

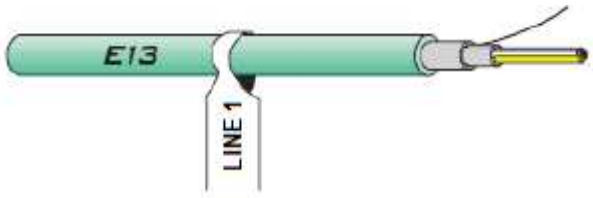
Surge protector

Some devices in the domotic installation are supplied directly from the BUS line, normally sensors, other components will connect in addition to the line of force that corresponds to your circuit.

The laying of the EIB bus line will take place through the following steps:

- The two wire bus cable should be peeled 10mm and connect to terminal blocks for connection / bifurcation (maximum 4 lines per block). The extra screen should be removed. The two additional wires BUS and the tracer are not cut and collected on the same cable.The two wire bus cable should be peeled 10mm and connect to terminal blocks for connection / bifurcation (maximum 4 lines per block). The extra screen should be removed. The two additional wires BUS and the tracer are not cut and collected on the same cable.

- All bus lines must be correctly marked and identified as follows:



Labeling of BUS

- They will prepare distribution boxes with connectors mounted on the data profiles attached to DIN rails.

- It must be respected topological limitations of the lines.

- It can not be possible connect components from different areas or lines if it is not through the corresponding couplings.

- It should be checked with a voltmeter the voltage and polarity of all end of line and terminal connections are correct.

The bus lines will follow the same route as the power circuits, but always will be made in different tubes to avoid possible damages to the domotic circuit wiring.

The bus will be housed inside a PVC corrugated tube of 16 mm diameter, which will run through clearings in the walls or ceiling, provided the ITC-Bt21. The components that need additional wiring to the BUS run in tubes of the same characteristics.

For the derivation of the bus line is used recessed PVC boxes with lid 10 x 10cm. Both splices and taps as the union of the mechanisms, will be made through connectors for bus elements.

In the case of actuators , will be placed in recessed wall.

3.20 Connection of the components

In this last paragraph, it will be explained the basic characteristics and connecting of the main domotic components of the house.

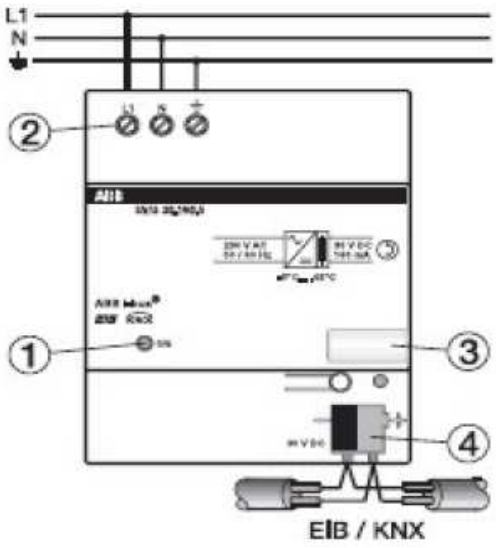
3.21 Supply source

They will be supplied by the circuit C11.

The supply voltage is connected to the bus line, with a bus connecting terminal. A reset is activated by removing the connexion terminal with the bus for about 20 seconds.

The bus line, is disconnected from the supply voltage and the bus devices connected to this bus line, back to their initial states.

1. Green LED
2. Main power
3. Label holder
4. BUS connection terminal (output EIB/KNX)



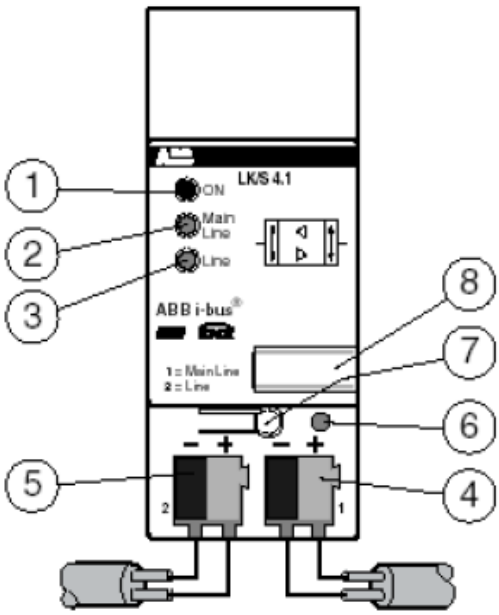
Power source

Line coupler

It will be responsible for connect the main line with secondary lines, in this case line 1 and line 2, which will be done by connecting the 1 terminal with the power supply and terminal 2 to the secondary line.

To carry out the programming line coupler, at least the main line should be connected, in the event that was also connected to the second line, may also be programmed from the second line.

1. Operating LED ON
2. LED for telegram traffic on primary/main line
3. LED for telegram traffic on secondary line (line)
4. Bus connection terminal for EIB connection of primary/main line
5. Bus connection terminal for EIB connection of secondary line (line)
6. Programming LED
7. Programming button
8. Label holder

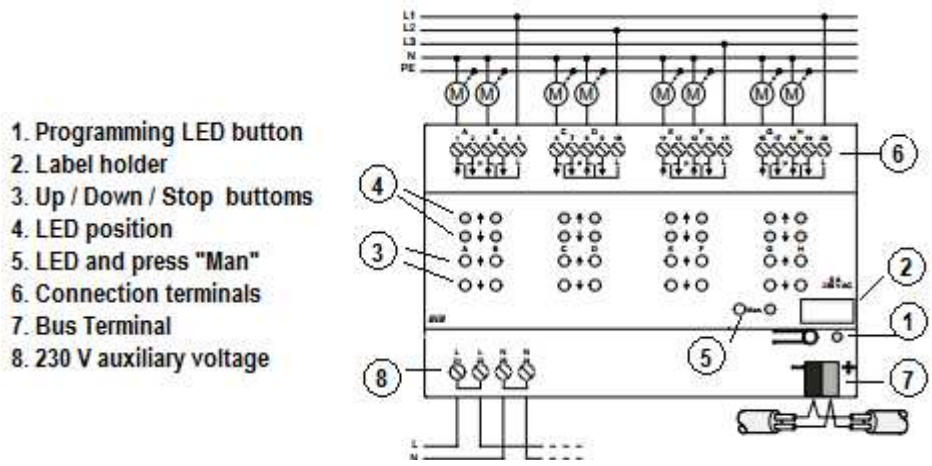


Line coupler

Windows' blinds actuator

The windows' blinds actuator must be connected to the circuit C11, through which will be supplied.

Outputs of the actuator will connect the engines of the windows' blinds with the corresponding circuit ready for use it, depending on the zone of the house, where it is.



Blind actuator

Zone terminal

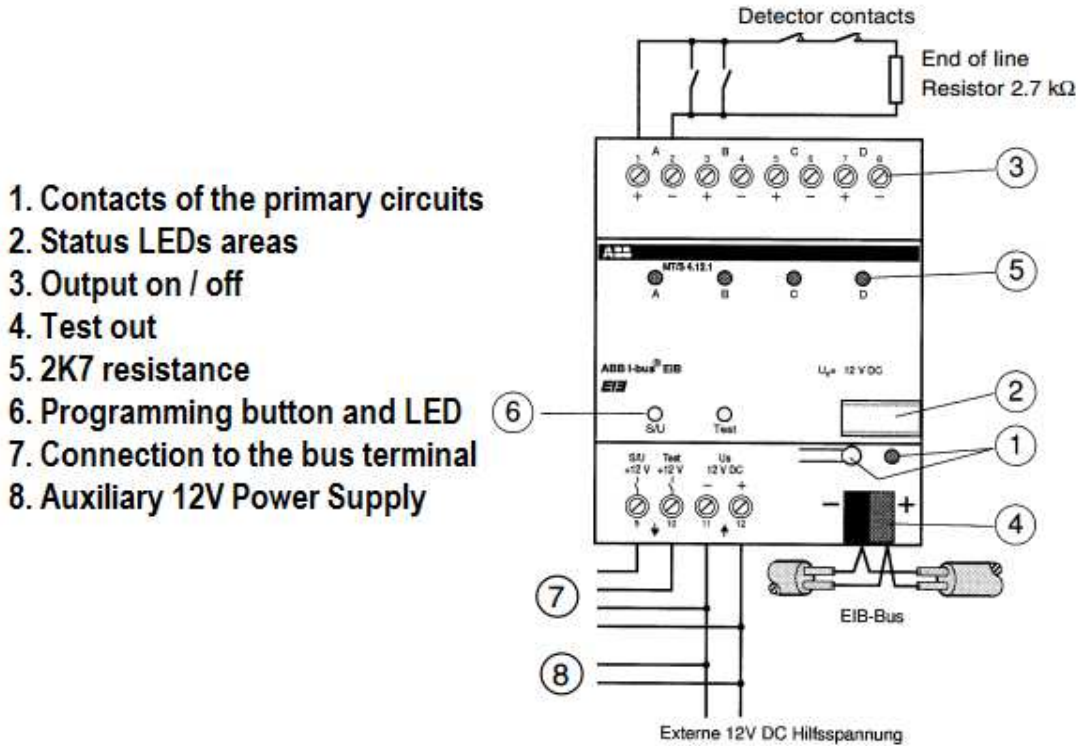
The gas, smoke, etc detectors, will connect with the zone terminal.

In addition of the EIB bus, it is necessary an auxiliary supply of 12V DC MBT, given by a power source of this type, put in the domotic box.

This auxiliary supply is apply through the terminals 11 and 12, although the number 11 also is used like reference of common power for the two outputs.

Each group of sensors is connected in paralel with the inputs of the terminal.

The device has 4 zone inputs, which state is shown with 4 LEDs. The primary circuits have to finish in a resistor of 2K7Ω.



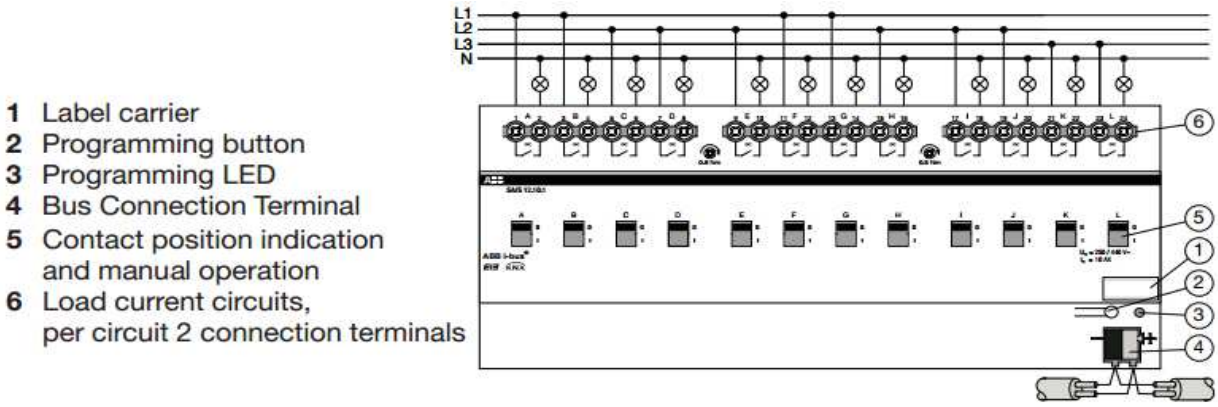
Terminal zone

Outputs and regulation actuator

The actuators will be able to operate independent loads through potential free contacts, while each output will be controlled separately through the EIB.

In most cases, the charges will be lights, which will be supplied through the circuit C1,

depending on the domotic box to take care of that room, domotic box table 1 for the first floor, domotic box 2 for the second floor.



Output actuator

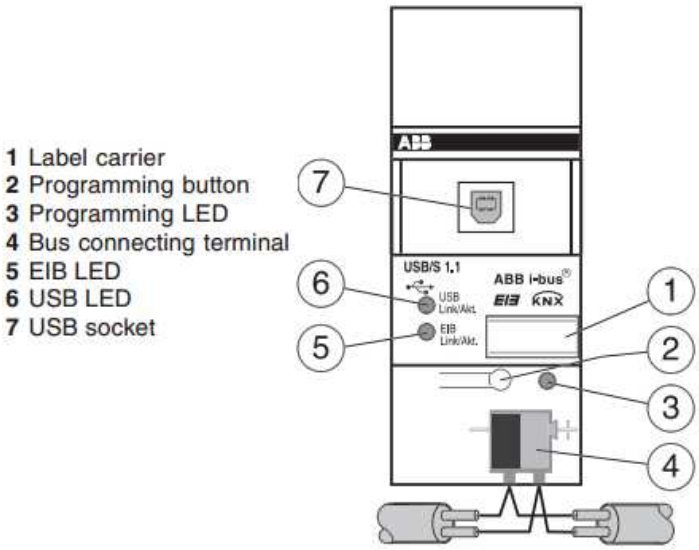
Interface USB

It allows the communication between the PC and the EIB installation, and will not be necessary to use any application program for operating the USB interface.

The interface is connected via a cable ISB type B, connected to the interface, and the other end a USB type A, which will be connected to the PC.

After the initialization of the PC and open the program ETS3, first connect the interface to the EIB bus and then to the USB.

EIB LED will light as soon as the device is connected and ready for operation. This blink as soon as traffic of EIB telegrams begins.



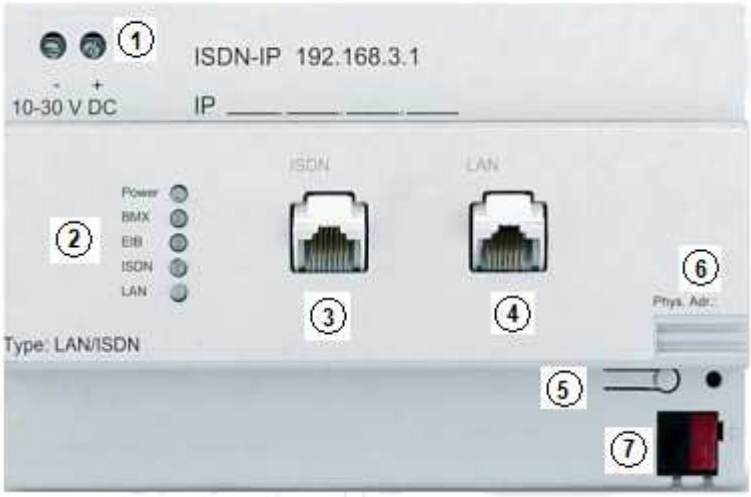
USB interface

EIB port LAN-LASN/RDSI Gateway

Through this element, it is allowed the communication between the house and the user while he is not in the home, via Internet or sms.

It will be supplied through the auxiliary power source of 12V DC, also it has two RJ-45 ports for connection to the ISDN network and LAN.

1. Power source
2. LED signaling
3. RJ45 connector for ISDN
4. RJ45 Ethernet LAN Network
5. Programming button EIB-BCU
6. LED button EIB-BCU
7. Bus EIB terminals



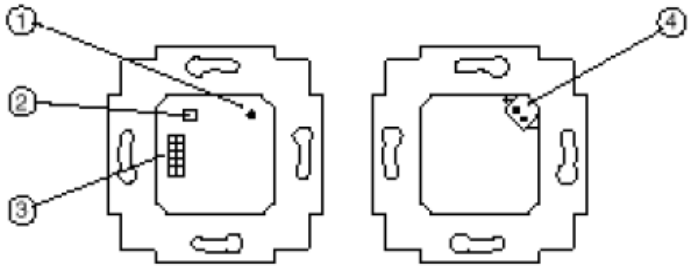
EIB port LAN-LASN/RDSI Gateway

Bus coupler(9620 ABB)

The bus couplers enable connection of different components to the bus, and thus enable communication between them.

They will be installed in-wall boxes 58mm in diameter and will go to the bus.

1. Programming LED
2. Button programming
3. The application interface
4. Terminals for connection to the bus terminal

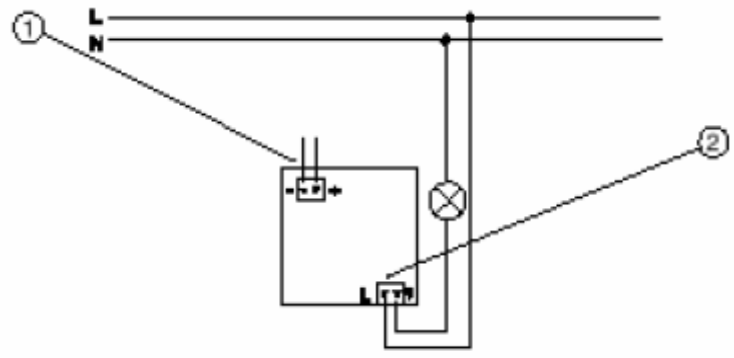


Bus coupler

<u>Bus coupler(9693.2 ABB)</u>

Because the tritones are going to be used, have an LCD display, the bus coupler, shall be supplied by the circuit of plugs in addition connected to the bus line.

They will be also in in-wall boxes 58mm in diameter.



1. Bus connection
2. Plug circuit with triton

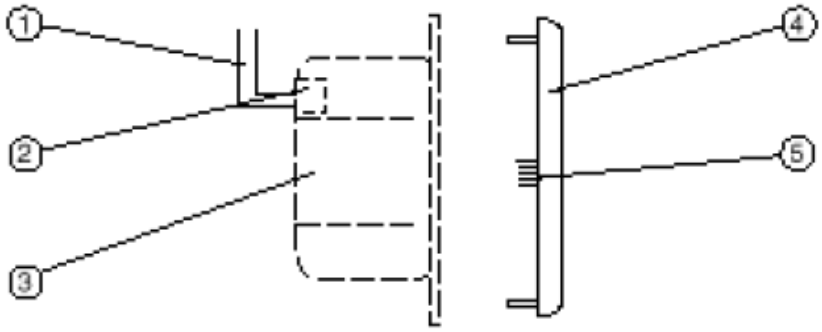
Bus coupler with triton

One and two channels switch

Both of them will be installed in the same way, they do so by the bus coupler.

The switch is coupled to the bus coupler perfectly and thus connected to the domotic network.

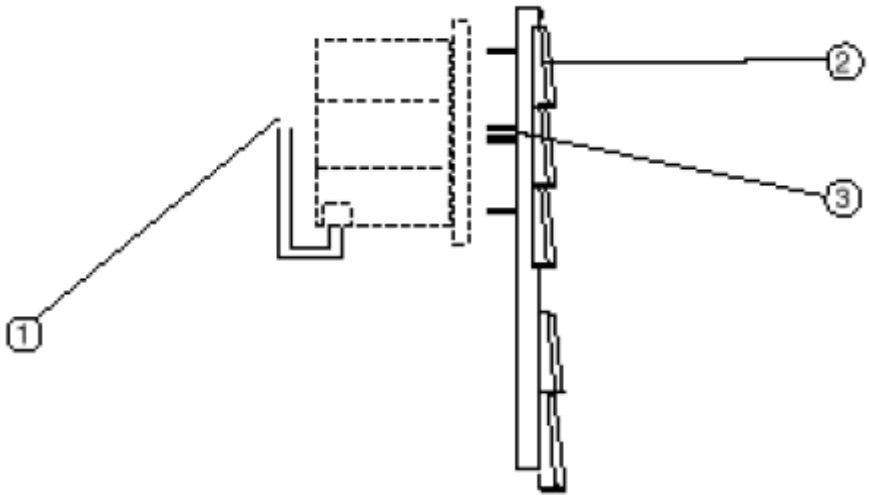
1. Bus Cable
2. Connection to the bus terminal
3. Bus coupler embedded
4. Application module
5. 10 pole connector



Switch

5 channels triton

All the tritons will be installed through one embedded bus coupler, explained before. The conexion will be the next.



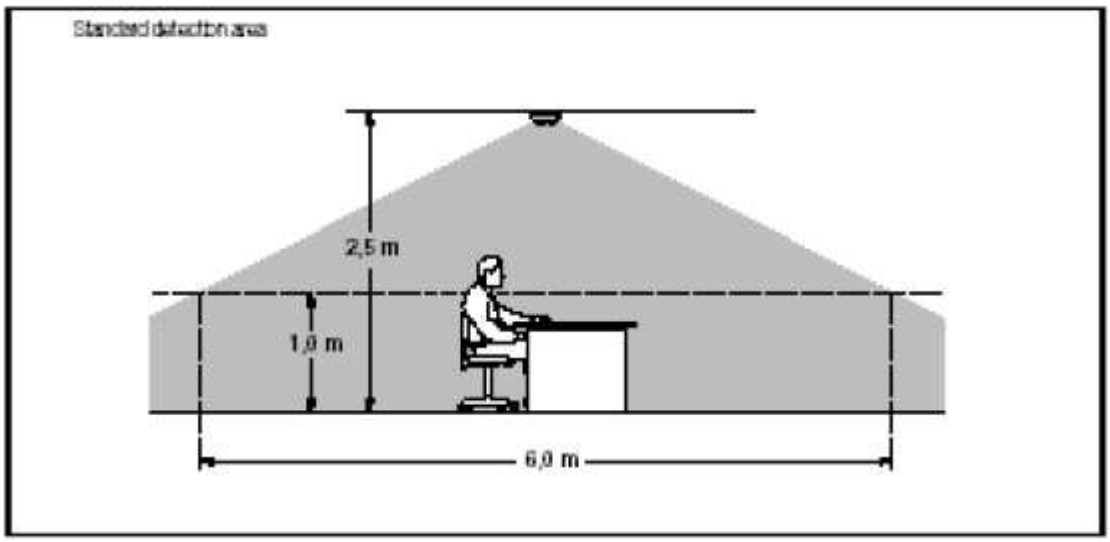
1. Embedding bus coupler
2. Triton
3. 10 pole connector

Triton 5 channels

Presence detector

It will be connected the same way as the switches, by means of the bus coupler.

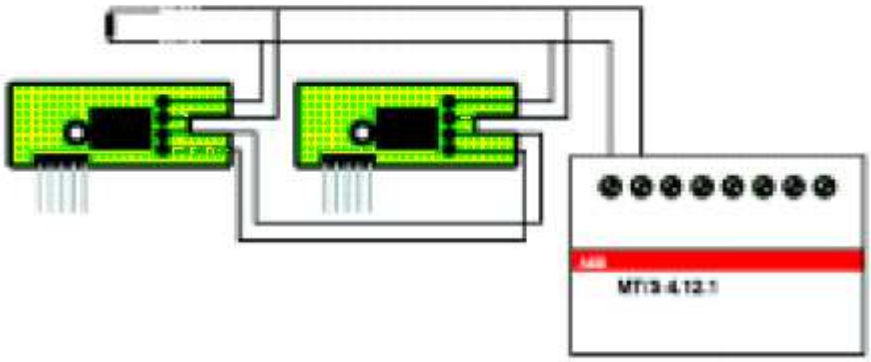
The detection area can cover the detector is:



Presence detector

Smoke sensor

This sensor is supplied by a 9V DC alkaline battery, and connects directly to the terminal area of domotic box box that applies.

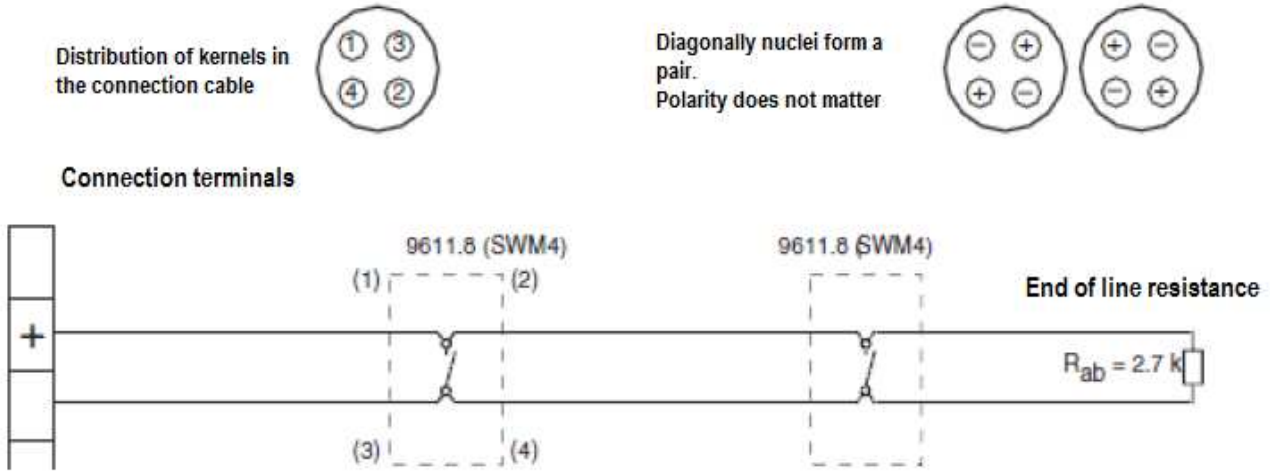


Smoke sensor

Water leak detector

In this case, these detectors do not need their own supply, as they are supplied from the

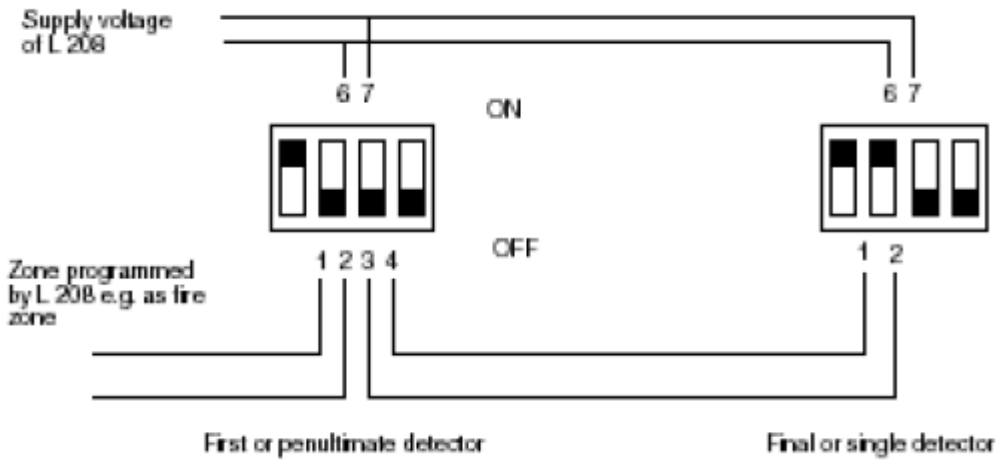
system it is connected, in this case will be the zone terminal corresponding with the box where they are.



Water leak detector

Gas sensor

The sensor will need an operation voltage from 10 to 30V DC, and in this case the sensor will be supplied directly from the alarm center as follows:



Gas sensor

4 Biography

- http://www.geelectrical.com.ar/industrial/indsecondcat.aspx?id=157&id2=1203
- http://www.storetech.pe/cajas_distribucion.php
- http://www.indal-lighting.es/
- **http://www.miguelez.es/home.php**
- **http://www.yohkon.com/**
- **http://www.degerenergie.de/**
- **http://www.tutiendasolar.es/**
- http://library.abb.com/GLOBAL/SCOT/SCOT209.nsf/VerityDisplay/07D2D526A123431AC1256C1C002D2549/$File/CAT_NIESSEN_EIB.pdf

CALCULES

INDEX

1 Load forecast

It is made the estimation of the electrical loads, that will be consumed in each electrical circuit, anyway it is an estimation, for this reason we will think in the worst case for the circuits, this way the breakers will protect better the circuit against overloads.

And now it will be shown all the circuits:

Illumination circuit(C1)

In this case like we have 22 lights in all the house, we will take, that 19 are turned on, for calculate the power they will consume, and in addition we will think that all of them will consume 70W, although some of them will consume less.

Power = 19 x 70(W) = 1330W

Plugs circuit(C2)

In this case we will plan some stuffs we will use at the same moment for estimate the power, and they will be the next:

- Aspirator; 1200W
- TV; 240W
- PC; 170W
- Radio; 325W
- Lamps; 170W
- Coffee machine; 1000W
- Fridge; 560W

TOTAL; 3445W

Oven/kitchen(C3)

This circuit only will cover the kitchen and the oven, since they consume too much energy although they are only two appliances.

- Cooktop; 6600W
- Oven; 3650W

TOTAL; 10250W

Washing machine, dishwasher and thermo(C4)

This circuit will be the responsible of supply these three stuffs, which will be in the kitchen.

- Washing machine; 700W
- Dishwasher; 2300W
- Thermo; 3000W

TOTAL; 6000W

Plugs in bathrooms and auxiliar plugs in kitchen(C5)

There will be one circuit for only bathrooms' and kitchen's plugs, because they are more sensitive, being in rooms with some places with water.

The consumes will be estimate are:

- Microwave; 1075W
- Mixer; 700W
- Hairdryer; 2100W
- Radio; 325W

TOTAL; 4200W

Aditional circuit for help the C2 (C7)

In order to don't overload the circuit C2, because like the low voltage rules in Spain, there are enough plugs in the house, for do two different circuits, this way the consumes will be:

- PC; 170W
- Aspirator; 1280W
- Lamps; 170W
- Radio; 325W

TOTAL; 1945W

Air conditioning(C9)

The power estimate for this circuit will be:

TOTAL; 3500W

Domotic(C11)

The consume of the actuators, the power sources, etc, will be low, and for this reason the estimate for this circuit will be:

TOTAL; 1200W

Windows' blinds(C12)

There will be one circuit for supply only the little engines, which will be used for go up/down the blinds, and the power estimate will be:

TOTAL; 1400W

2 Calculation of the sections

The section of the conductors, will be what the spanish rules say, and we are going to check that our installation is right for each section, using the next formula:

$$S = \frac{2 . \rho . P . L}{U . \Delta U}$$

Being:

ρ; the conductivity of couper
P; the power of the circuit
L; the length of the line
U; the tension of the line
ΔU; Voltage drop

In the next points they will be calculated, the sections there will be with the power of each circuit.

Illumination circuit(C1)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.1330.17,93}{230.6,9}=0,53\,mm^2$$

Since is less than 1,5mm^2, it is right.

Plugs circuit(C2)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.3445.13,87}{230.6,9}=1,07\,mm^2$$

Since is less than 2,5mm^2, it is right.

Oven/kitchen(C3)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.10250.8,94}{230.6,9}=2,06\,mm^2$$

Since is less than 6mm^2, it is right.

Washing machine, dishwasher and thermo(C4)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.6000.8,16}{230.6,9}=1.10\text{mm}^2$$

Since is less than 4mm^2, it is right.

Plugs in bathrooms and auxiliar plugs in kitchen(C5)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.4200.11,27}{230.6,9}=1,06\,mm^2$$

Since is less than 2,5mm^2, it is right.

Aditional circuit for help the C2 (C7)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.1945.16,31}{230.6,9}=0,71\,mm^2$$

Since is less than 2,5mm^2, it is right.

Air conditioning(C9)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.3500.13,6}{230.6,9}=1,07\,mm^2$$

Since is less than 6mm^2, it is right.

Domotic(C11)

$$S=\frac{2.\rho.P.L}{U.\Delta U}=\frac{2.\frac{1}{56}.1200.13,97}{230.6,9}=0,37\,mm^2$$

Since is less than 1,5mm^2, it is right.

Windows' blinds(C12)

$$S = \frac{2 . \rho . P . L}{U . \Delta U} = \frac{2 . \frac{1}{56} . 1400 . 16,59}{230 . 6,9} = 0,52\, mm^2$$

Since is less than 2,5mm^2, it is right.

3 Calculation of the protections

After know what are going to be the consumes of each circuit, it will be necessary protect them against overloads, overcurrents, indirect touches, etc.

This way, with the power they consume, it will be possible to know what protection need each circuit, since every circuit uses 230V, so obtain the current is very easy, and with it, is necessary only protect the circuit in order to if in one moment this current pass through the cables, but of course before the simultaneity and utilization factors will be used, so the protections will be:

Illumination circuit(C1)

P = 498,75W

V = 230V

$$I = \frac{P}{V} = \frac{498,75}{230} = 2,16\, A$$

So with a thermalmagnetic circuit breaker of 10A is enough.

Plugs circuit(C2)

P = 172,25W

V = 230V

$$I = \frac{P}{V} = \frac{172,25}{230} = 0,74\,A$$

So with a thermalmagnetic circuit breaker of 16A is enough.

Oven/kitchen(C3)

P = 3843,75W

V = 230V

$$I = \frac{P}{V} = \frac{3843,75}{230} = 16,71\,A$$

So with a thermalmagnetic circuit breaker of 25A is enough.

Washing machine, dishwasher and thermo(C4)

P = 2970W

V = 230V

$$I = \frac{P}{V} = \frac{2970}{230} = 12,91\,A$$

So with a thermalmagnetic circuit breaker of 16A is enough.

Plugs in bathrooms and auxiliar plugs in kitchen(C5)

P = 840W

V = 230V

$$I = \frac{P}{V} = \frac{840}{230} = 3,65\,A$$

So with a thermalmagnetic circuit breaker of 10A is enough.

Aditional circuit for help the C2 (C7)

P = 97,25W

V = 230V

$$I = \frac{P}{V} = \frac{97,5}{230} = 0,42\ A$$

So with a thermalmagnetic circuit breaker of 10A is enough.

Air conditioning(C9)

P = 3500W

V = 230V

$$I = \frac{P}{V} = \frac{3500}{230} = 15,21\ A$$

So with a thermalmagnetic circuit breaker of 16A is enough.

Domotic(C11)

P = 1200W

V = 230V

$$I = \frac{P}{V} = \frac{1200}{230} = 5,21\ A$$

So with a thermalmagnetic circuit breaker of 10A is enough.

Windows' blinds(C12)

P = 1400W

V = 230V

$$I = \frac{P}{V} = \frac{1400}{230} = 6{,}08\ A$$

So with a thermalmagnetic circuit breaker of 10A is enough.

Automatic general switch

This one, will protect all the circuits against overload, being the first protection, before the thermalmagetic circuit breakers of each circuit.

Knowing the total power, which will be consumed in all the house, it will be able to know what protection this one should have.

Total power = C1+C2+C3+C4+C5+C7+C9+C11+C12 = 498,75 + 172,25 + 3843,75 + 2970 + 840 + 97,25 + 3500 + 1200 + 504 = 13626W

$$I = \frac{P}{V} = \frac{13626}{230} = 59{,}24\ A$$

So, this way with a switch of 63A will be enough for protect everything.

Differential switch

Is allow put the differential switch in order to protect against indirect touches, the switch has to support the current of 63A, because if not it could burn, and in addition, it will have to realise when a current of 30mA pass through the cables.

Power switch control

The electrical company will put this switch in our house, for avoid we consume more than the power is contracted with the company.

In this case the power contracted will be 4200W, so the switch will be of 20A.

Calculation of the voltage drop

For all the circuits is not allowed have more than 3% of voltage drop, this way it is going to be calculated what is in each circuit for validate them.

The formula for do it is:

$$u = \frac{2 . \rho . P . L}{U . S}$$

Illumination circuit(C1)

$$u = \frac{2 . \rho . P . L}{U . S} = \frac{2 . \frac{1}{56} . 1330 . 17{,}93}{230 . 1{,}5} = 2{,}47$$

Since is less than 3%, it is right.

Plugs circuit(C2)

$$u = \frac{2 . \rho . P . L}{U . S} = \frac{2 . \frac{1}{56} . 3445 . 13{,}87}{230 . 2{,}5} = 2{,}97$$

Since is less than 3%, it is right.

Oven/kitchen(C3)

$$u=\frac{2.\rho.P.L}{U.S}=\frac{2.\frac{1}{56}.10250.8,94}{230.6}=2,37$$

Since is less than 3%, it is right.

Washing machine, dishwasher and thermo(C4)

$$u=\frac{2.\rho.P.L}{U.S}=\frac{2.\frac{1}{56}.6000.8,16}{230.4}=1,9$$

Since is less than 3%, it is right.

Plugs in bathrooms and auxiliar plugs in kitchen(C5)

$$u=\frac{2.\rho.P.L}{U.S}=\frac{2.\frac{1}{56}.4200.11,27}{230.2,5}=2,94$$

Since is less than 3%, it is right.

Aditional circuit for help the C2 (C7)

$$u=\frac{2.\rho.P.L}{U.S}=\frac{2.\frac{1}{56}.1945.16,31}{230.2,5}=1,97$$

Since is less than 3%, it is right.

Air conditioning(C9)

$$u = \frac{2 . \rho . P . L}{U . S} = \frac{2 . \frac{1}{56} . 3500 . 13,6}{230 . 6} = 1,23$$

Since is less than 3%, it is right.

Domotic(C11)

$$u = \frac{2 . \rho . P . L}{U . S} = \frac{2 . \frac{1}{56} . 1200 . 13,97}{230 . 1,5} = 1,73$$

Since is less than 3%, it is right.

Windows' blinds(C12)

$$u = \frac{2 . \rho . P . L}{U . S} = \frac{2 . \frac{1}{56} . 1400 . 16,59}{230 . 2,5} = 1,44$$

Since is less than 3%, it is right.

Order	Description	Cuantity	Unit price	Total price
1	**Electrical connection**			
1,1	m. connection Line Conductor, (ground) PR pole insulated copper 0.6 / 1 kV. of 1x120 mm2. and cover PVC. Tended, placed, connection and dielectric rigidity test.	11,47	8,30	95,2
1,2	m. connection Line Conductor, (ground) PR pole insulated copper 0.6 / 1 kV. of 1x70 mm2. and cover PVC. Tended, placed, connection and dielectric rigidity test.	2,38	7,9	18,8
1,3	m. Tube of thermoplastic material (or Similar) red internal diameter 225 mm. fully placed.	13,85	1,30	18
1,4	m. Tape signs "Danger below electric cables "PVC.	10	0,30	3
1,5	m. Excavation of trench in 400x850 semihard ground and subsequent covering with river sand and earth leaves from the excavation, without replacement pavement	84,42	17,10	1443,58
1,6	m. sand river(10cm) and protections of conductors' tube placed.	10	11,00	110
	Total electrical connection;			**1688,58€**

Order	Description	Cuantity	Unit price	Total price
2	**Interior installation**			
2,1	m. Deliver and referral line individual, formed by conductors of couper 2(1X25)mm2 with insulate type VV-06/1 kV, PVC tube channeled under double layer D = 40 mm. in mounting 0Flush with connecting elements, fully installed, transport, assembly and connection	24,64	22,40	551,94
2,2	m. Rigid cable Barry unipolar copper-section of 2x1, 5 mm ² + T, H05V-U, low-shrink tubing is not flame retardant, flexible to install recessed ø 16 mm . Even p.p. of boxes and manpower placement for lighting circuits.	58,75	0,84	49,35
2,3	m. Rigid cable Barry unipolar copper-section of 2 x 2,5 mm ² + T, H05V-U, low-shrink tubing is not flame retardant, flexible to install recessed ø 16 mm . Even p.p. of boxes and manpower placement for lighting circuits.	130,6	1,38	180,23
2,4	m. Rigid cable Barry unipolar copper-section of 2 x 4 mm ² + T, H05V-U, low-shrink tubing is not flame retardant, flexible to install recessed ø 16 mm . Even p.p. of boxes and manpower placement for lighting circuits.	13	2,15	27,95
2,5	m. Rigid cable Barry unipolar copper-section of 2 x 6 mm ² + T, H05V-U, low-shrink tubing is not flame retardant, flexible to install recessed ø 16 mm . Even p.p. of boxes and manpower placement for lighting circuits.	36,4	3,19	116,17
2,6	m. PVC corrugated pipe12 mm internal diameter. (fully place)	60,4	0,85	51,34
2,7	m. PVC corrugated pipe16 mm internal diameter. (fully place)	377,6	1,05	396,48

Order	Description	Cuantity	Unit price	Total price
2,8	Ud. derivation PVC Box Crady, recessed 100x100, 100x160 and 200X200; placed.	4	3,20	12,8
2,9	Ud. Plugs of 16A schuko 2P+T 16A, including universal mechanism box with screws.	33	10,84	357,72
2,1O	Ud. Plugs of 25A schuko 2P+T 25A, including universal mechanism box with screws.	5	23,20	116
	Total interior installation;			**1859,98€**

Order	Description	Cuantity	Unit price	Total price
3	**Domotic**			
3,1	Ud. power source 160mA for supply the main line	1	182,64	182,64
3,2	Ud. power source 640mA for supply the line 1 and 2	2	385,33	770,66
3,3	Ud. line coupler will couple the line 1 with the main line	1	385,33	385,33
3,4	U.d 4 channel blind actuator will do move the windows' blinds	2	348,38	696,76
3,5	Ud. Zone terminal with four inputs will link the security sensors with the EIB	2	274,28	548,58
3,6	Ud. Actuator output will trigger a certain number of independent loads	2	401,17	802,34
3,7	Ud. 4 channel electronic switch actuator will control the temperature of the rooms, by the heating	2	274,11	548,22
3,8	Ud. Gateway EIB port LAN/RDSI will make possible the communication between the home automation system and the user from outside the house	1	1979,44	1979,44
3,9	Ud. USB Interface will get the communication between the PC and the EIB installation	1	262,34	262,34
3,1O	Ud. 5 channel triton with display and thermostat take care of sending telegrams to connection and regulation of the blinds, security or ventilation control to EIB actuators.	5	437,81	2189,05
3,11	Ud. two channel switch will be used for actuated on the switches, windows' blinds	10	55,42	554,2
3,12	Ud. one channel switch	15	60,17	902,55
3,13	Ud. presence detector will detect if there is someone in the room	6	179,62	1077,72
3,14	Ud. BUS coupler	38	89,73	3409,74
3,15	Ud. Gas sensor will detect if there is gas in the atmosphere	1	306,76	306,76
3,16	Ud. smoke sensor will detect if there is smoke in the atmosphere	1	175,54	175,54

Order	Derscription	Cuantity	Unit price	Total price
3,17	Ud. water leak detector in the case there is some leak,the detector will send a signal to the actuator for clase the valvules.	3	124,80	374,4
3,18	Ud. central alarm	1	1047,42	1047,42
	Total Domotic;			**16249,69€**

Order	Description	Cuantity	Unit price	Total price
4	**Photovoltaic installation**			
4,1	Ud. solar panels will take the energy from the sun, and will transform it in electricity.	36	95	3420
4,2	Ud. tracking system in order to get obtain more energy from the sun, with more efficiency.	6	310,65	1863,9
4,3	Ud. regulator for controlled the energy that passes until the batteries from the solar panel, and what go to the house's consumes.	1	115	115
4,4	Ud. inverter in order to convert the direct current in alternative current.	1	300	300
4,5	Ud. batteries, which will keep the energy obtained from the sun	6	725	2175
	Total photovoltaic installation;			**7873€**

Field	Price
Electrical connection	1.688,58 €
Interior installation	1.859,98 €
Domotic	16.249,69 €
Photovoltaic installation	7.873,00 €
Total;	**27671,25€**

LEGEND

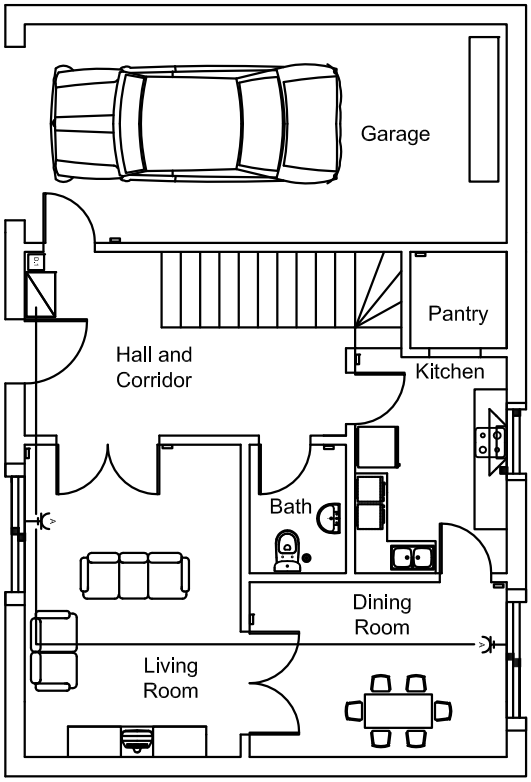
Plug 25A

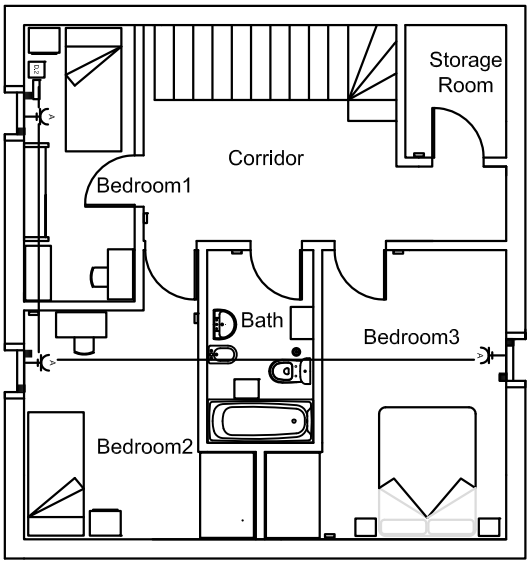
D.1 Domotic box 1

D.2 Domotic box 2

Box register

General box





UNIVERSITY OF PÉCS

POLLACK MIHÁLY MÜSZAKI KAR

TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Air conditioning
(C9)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº:

8.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

LEGEND

Plug 16A

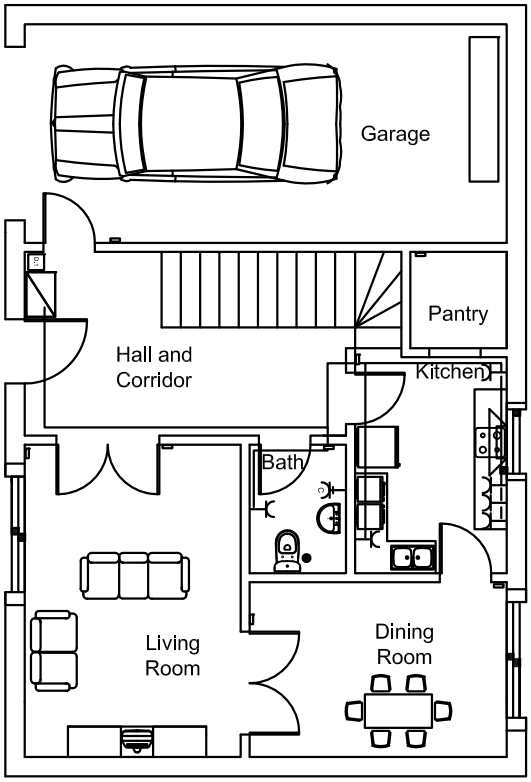
D.1 Domotic box 1

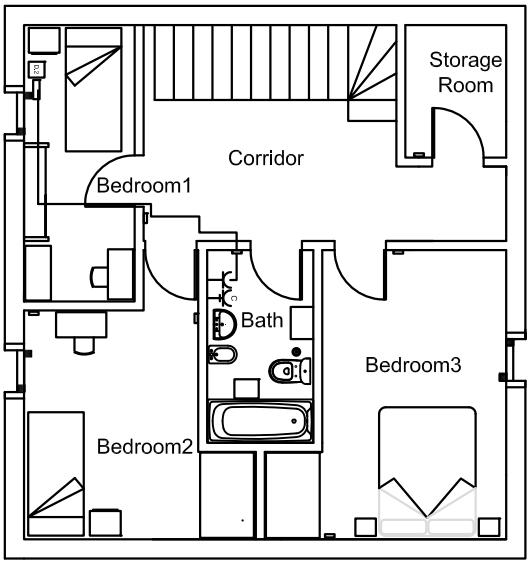
D.2 Domotic box 2

C Heating

Box register

General box





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TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Bathroom and auxiliary plugs
(C5)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº:

6.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

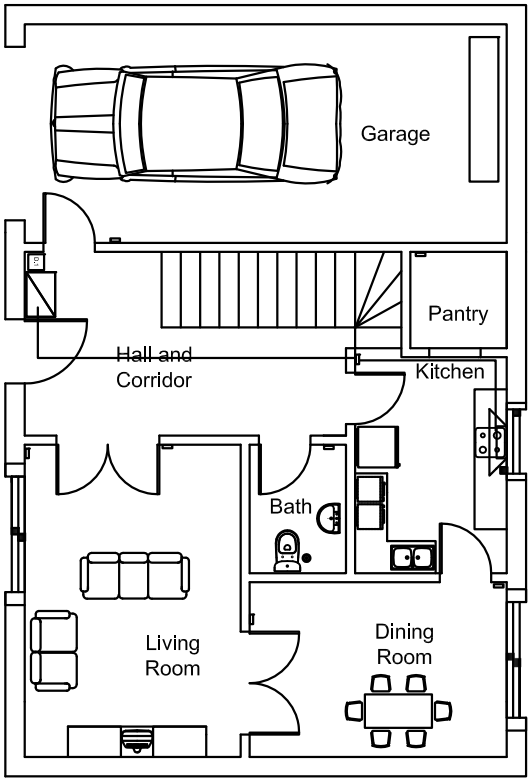
LEGEND

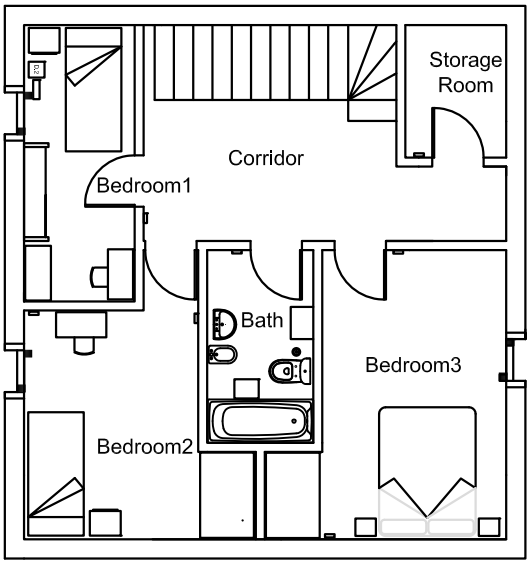
D.1 Domotic box 1

D.2 Domotic box 2

Box register

General box





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TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Kitchen/Oven circuit (C3)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº: 4.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

LEGEND

Plug 16A

D.1 Domotic box 1

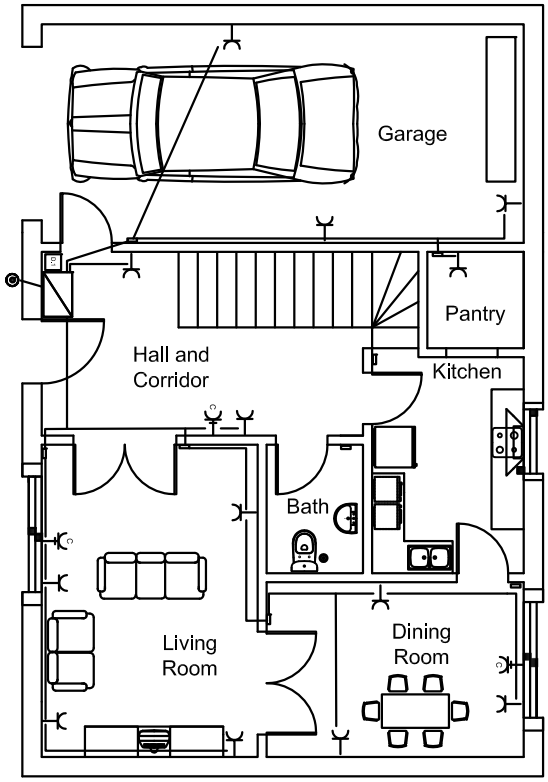
D.2 Domotic box 2

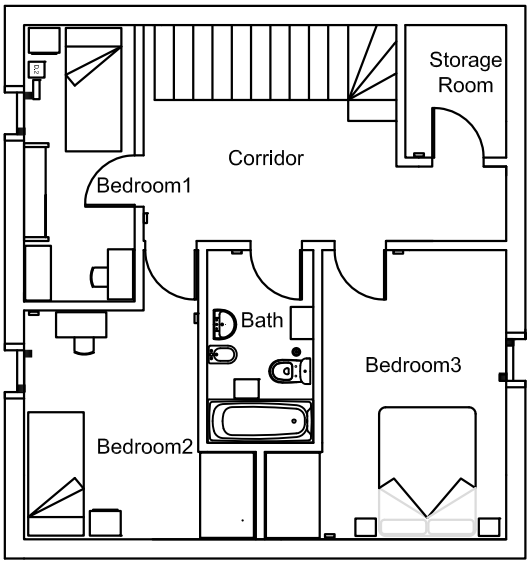
Ring

Box register

C Heating

General box





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TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Plugs first floor
(C2)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº:

3.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

LEGEND

Plug 16A

Heating

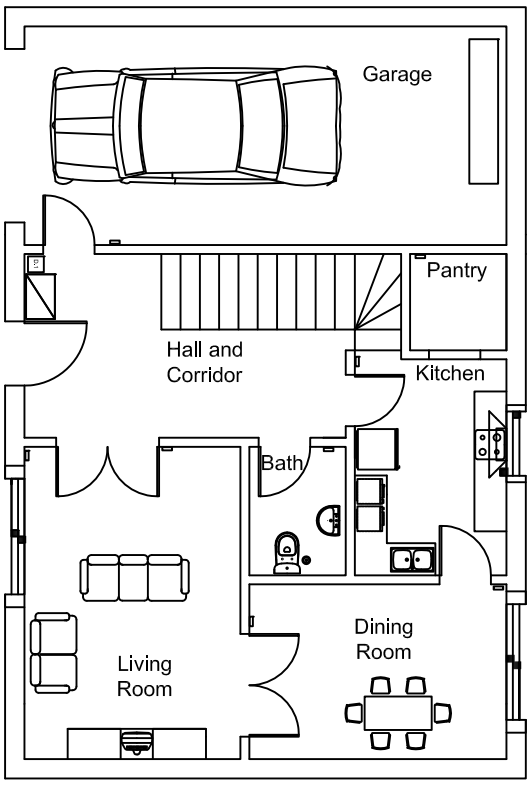
C

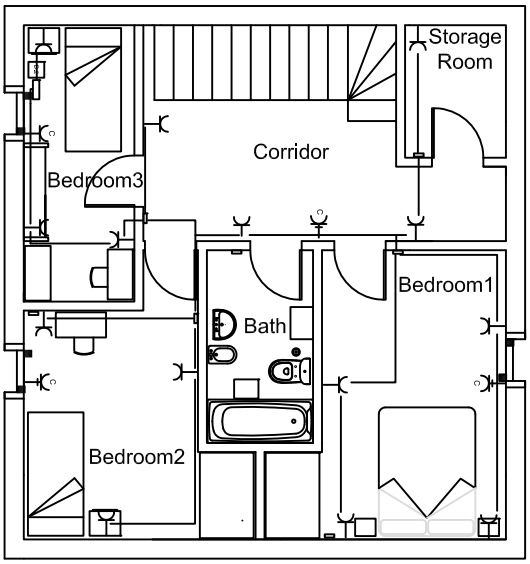
D.1

Domotic box 1

Box register

General box





UNIVERSITY OF PÉCS

POLLACK MIHÁLY MÜSZAKI KAR

TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Plugs second floor (C7)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº:

7.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

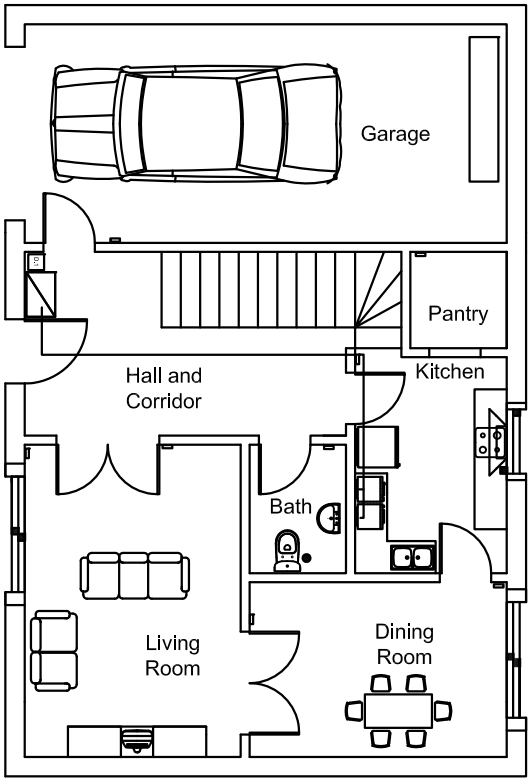
LEGEND

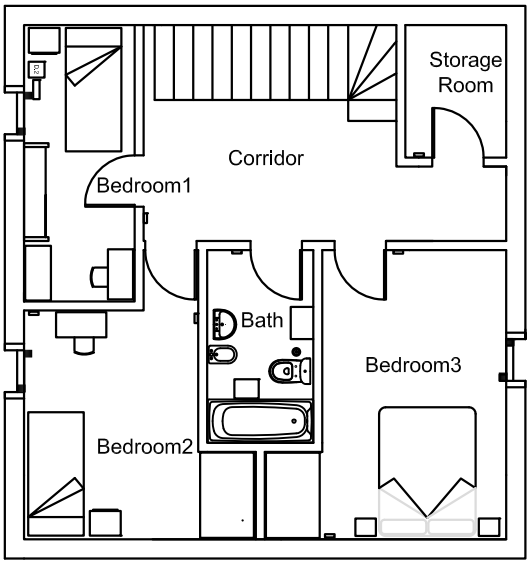
D.1 Domotic box 1

D.2 Domotic box 2

Box register

General box





UNIVERSITY OF PÉCS

POLLACK MIHÁLY MÜSZAKI KAR

TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Washing machine, dishwasher, thermo (C4)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº: 5.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29

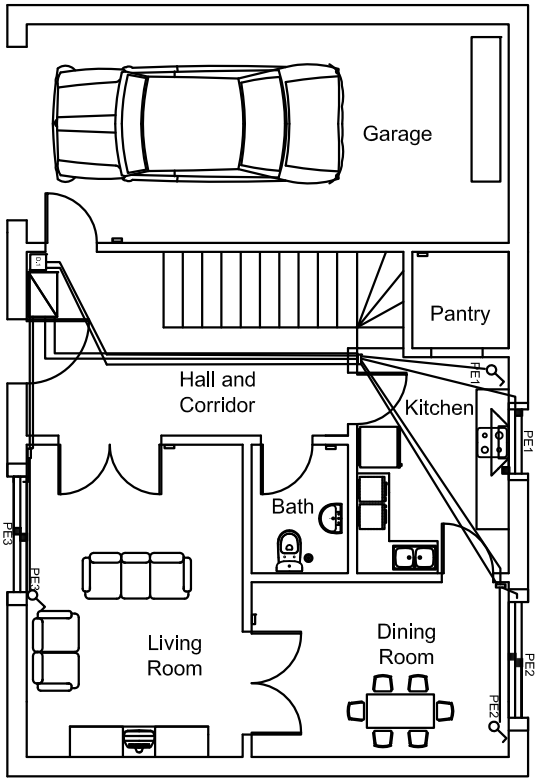
LEGEND

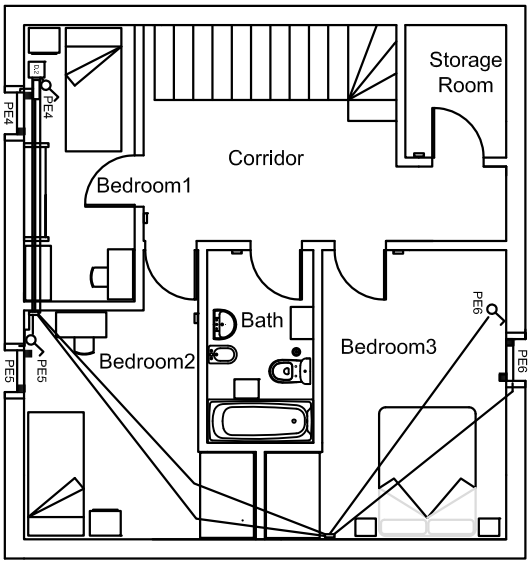
D.1 Domotic box 1

D.2 Domotic box 2

Box register

General box





UNIVERSITY OF PÉCS

POLLACK MIHÁLY MÜSZAKI KAR

TUTOR:

GYÖRGY ELMER

DENOM. PLAN

Windows' blinds (C12)

ELECTRICAL AND DOMOTIC INSTALLATION IN A FAMILY HOME

PLAN Nº:

9.

THE ENGINEER:

GUILLERMO SÁNCHEZ FERNÁNDEZ

SCALE: 1:200

DATE: 2012.05.29