SKX Advance

Integration example

1. INTRODUCTION

The purpose of this document is to make the integration of external systems in KNX easier, more specifically devices with **port RS232** as interface.

This integration is based in the special device:

- **SKX Open. Interface bus to RS-232**

This manual is an example of project where SKX Advance application program is used to control the "Panasonic Projector RS232C" and the motor controller for it.

Important: In this document, two concepts will be commonly used: SKX Open and SKX Advance. It must be clear that there is only one hardware device: ZN1RX-SKXOPEN, called SKX Open. The only difference between them is the downloaded application program.

DO NOT MISTAKE THE PHYSICAL DEVICE (HARDWARE) FOR ITS FUNCTIONALITY (APPLICATION PROGRAM)

2. INTEGRATION EXAMPLE MANUALS: OPEN vs ADVANCE

In the current document, an example of integration with SKX Advance is carried out. This example is very similar to the one in *"Integration example with SKX Open"*. The purpose of both examples is showing a real case of communication between KNX system and external devices through Zennio RS232 Interface. However, important differences between them need to be commented:

- **SKX Advance** is a more versatile device, with **1-bit, 1-byte and 14-bytes** objects, which allows controlling a wider range of functions of a device and reception of values different of 1 bit.

- **SKX Advance** allows the definition of **frames up to 29 bytes**, increasing the range of protocols that can be integrated with KNX system. In this document, RS232 frames larger than 10 bytes will be integrated, such as the Input Select of RS232 Panasonic Projector.

- In this project example, two SKX Open devices are used. One of them has SKX Advance application program (Panasonic Projector) due to the length of the frames to be integrated. The other has SKX Open (motor controller) due to the simplicity of the RS232 protocol.

3. INSTALLATION

The no KNX devices that are desired to be controlled with KNX installation are the following ones:

- **Panasonic projector RS232C (PT-DZ6710/DZ6700/DW6300S/D6000S)**
- **Motor Controller for the projector**

This document explains a solution for integration of these devices in an installation of home automation based on KNX Standard.

It is necessary that the installation is provided with one more device for each no KNX device to be integrated, which will work as interface between KNX system and RS232: **SKX Open** with **application programs SKX Open and SKX Advance**. The first one will be used to control the motor controller of the projector and the second one will control the Panasonic projector.

These devices receive values through communication objects from the KNX Bus and transmit the corresponding frames to the RS232 port, and the opposite, as it allows bidirectional communication.

In the following diagram, the **physical connection** of the devices involved in the installation is shown, as well as the physical network where they are placed.

- **First SKX Open:** Motor controller for the projector projector
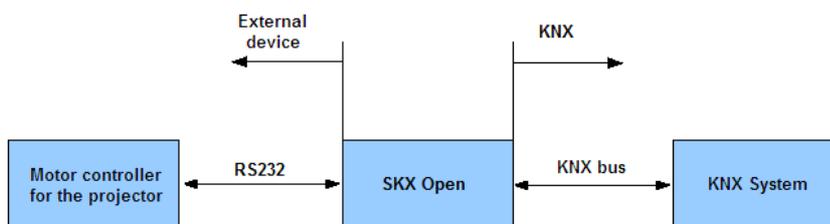
- **Second SKX Advance:** Panasonic Projector
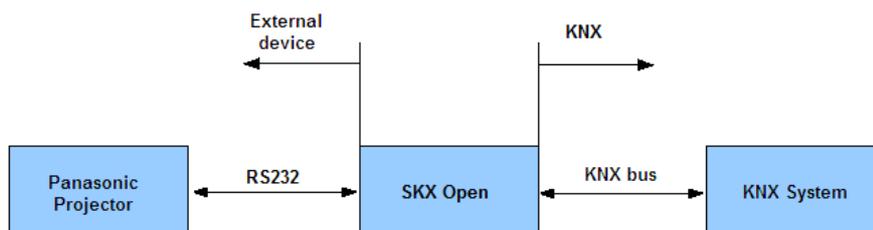
3.1. INSTALLATION CARACTERISTICS

This project will serve as an example of controlling a projector in a KNX installation thanks to the Zennio interface SKX Open with the application program SKX Advance.

The example does not try to control every single function of the projector, but a sample of the available functions, being the configuration of the rest of them very similar.

🔹 **'ON-OFF' Function**

➢ When an ON order is sent through the KNX Bus, the projector must be turned on and the motor controller must start running in order to show the projector screen. When the projector receives this order, it sends its status (Callback) to the RS232 port and the SKX Advance must recognize the frame so that the status can be shown, for example, in ZAS room controller.

➢ When an OFF order is sent through the KNX Bus, the projector must be turned off and the motor controller must start running in order to hide the projector screen. When the projector receives this order, it sends its status (Callback) to the RS232 port and the SKX Advance must recognize the frame so that the status can be shown, for example, in ZAS room controller.

🔹 **'Input Select' Function**→ 14bytes frame that can be controlled by SKX Advance.

➢ When Input Select is changed from KNX bus, the projector must change its input and send its input status (Callback). SKX Advance must recognize the frame so that the Input Select status can be shown, for example, in ZAS room controller.

In this example we use the **Zennio devices** listed below:

🔹 2 **SKX Open** with the application program **SKX Open and SXK Advance**: Interface KNX ⇔RS232

🔹 **ZAS room controller**: Order sending and projector status indicator.

3.2. COMMUNICATION PARAMETERS

Before the integration, we need the communication parameters of the external devices in order to configurate the SKX Advance and SKX Open to send and receive the right hexadecimal frames through serial port.

PANASONIC PROJECTOR

The communication parameters are not always found next to the hexadecimal command specifications in the device manual.

In this case, for example, this information is in the **projector manual** as follows:

Communication conditions (factory setting)

Signal level	RS-232C-compliant
Synchronization method	Start-stop synchronization
Baud rate	9,600 bps
Parity	None
Character length	8 bits
Stop bit	1 bit
X parameter	None
S parameter	None

Figure 1. Communication parameters of Panasonic Projector

PROJECTOR MOTOR CONTROLLER

The communication parameters of the projector motor controller are:

DETAILS

Band rate: 9600
Stop bit: 1
Parity: None
Databits: 8

Figure 2. Communication parameters of the Projector Motor Controller

3.3. HEXADECIMAL CODES

If we have to control an external device trough a RS232 connection with SKX Advance, we need to know the **frames that the device sends and receives** for the desired functions. These frames are set as parameters of SKX Advance, which must fulfill the following requirements:

- The characters we input in the frame fields in SKX Advance must correspond with **hexadecimal values (0-9, A-F)**

- **Maximum length** of the received and sent frame is **29 bytes**.

Important: in SKX Open, the maximum length of the received and sent frame is 10bytes.

PANASONIC PROJECTOR

In the manual of the Panasonic projector, we can find the control frames that must be sent to the serial port to perform the functions. These frames are given in ASCII and hexadecimal format, which is the needed format for SKX Advance.

Thus, the required frames in our project are:

- **Power ON**

Power ON (Lamp ON)

Hexadecimal	02h	41h	44h	5Ah	5Ah	3Bh	50h	4Fh	4Eh	03h
Character		A	D	Z	Z	;	P	O	N	

Figure 3. Power ON frame

- **ON Response (Callback)**

Response (Callback)
In the period when the command can be accepted

Hexadecimal	02h	50h	4Fh	4Eh	03h
Character		P	O	N	

Figure 4. ON Response frame

- **Power OFF**

Hexadecimal	02h	41h	44h	5Ah	5Ah	3Bh	50h	4Fh	46h	03h
Character		A	D	Z	Z	;	P	O	F	

Figure 5. Power OFF frame

- **OFF Response (Callback)**

Response (Callback)
In the period when the command can be accepted

Hexadecimal	02h	50h	4Fh	46h	03h
Character		P	O	F	

Figure 6. OFF Response frame

- **Input Select**

Hexadecimal	02h	41h	44h	5Ah	5Ah	3Bh	49h	49h	53h	3Ah
Character		A	D	Z	Z	;	I	I	S	:
Hexadecimal	*1	*3	*5	03h						
Character	*2	*4	*6							

Figure 7. Input Select frame

- **Input Select Response (Callback)**

Response (Callback)
In the period when the command can be accepted

Hexadecimal	02h	49h	49h	53h	3Ah	*1	*3	*5	03h
Character		I	I	S	:	*2	*4	*6	

Figure 8. Input Select Response frame

In this case, there are 6 different options for the Input Select frame. Values for each option are shown in the table below, as well as an example of the frame when selecting some of these options:

➢ **Input Select Values**

Parameters (*1, *2, *3, *4, *5, *6)

	RGB1			RGB2		
Hexadecimal	52h	47h	31h	52h	47h	32h
Character	R	G	1	R	G	2
	VIDEO			S-VIDEO		
Hexadecimal	56h	49h	44h	53h	56h	44h
Character	V	I	D	S	V	D
	DVI			SDI		
Hexadecimal	44h	56h	49h	53h	44h	49h
Character	D	V	I	S	D	I

Figure 9. Values for Input Select Frame

> **Input Select Frame for RGB2**

Hexadecimal	02h	41h	44h	5Ah	5Ah	3Bh	49h	49h	53h	3Ah
Character		A	D	Z	Z	;	I	I	S	:
Hexadecimal	52h	47h	32h	03h						
Character	R	G	2							

Figure 10. Input Select Frame for RGB2

> **Input Select Frame for DVI**

Hexadecimal	02h	41h	44h	5Ah	5Ah	3Bh	49h	49h	53h	3Ah
Character		A	D	Z	Z	;	I	I	S	:
Hexadecimal	44h	56h	49h	03h						
Character	D	V	I							

Figure 11. Input Select Frame for DVI

PROJECTOR MOTOR CONTROLLER

In the **manual of the motor controller** for the projector we can only find the control frames in ASCII format:

PROTOCOL

ASCI
fa in, = Device IN
fa out, = Device OUT
fa stop, = Device STOP
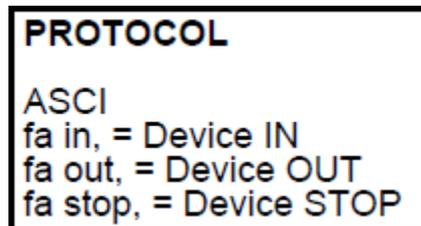
Figure 12. Motor Controller Protocol

SKX Open, the same that SKX Advance, recognizes frames that are configured in its parameters as hexadecimal characters. Thus, these frames in the protocol must be **translated from ASCII to hexadecima**l format so that the SKX Open can recognize them:

🔹 **Device IN:**

"fa in," => 66h; 61h; 20h; 69h; 6Eh; 2Ch

🔹 **Device OUT:**

"fa out," => 66h; 61h; 20h; 6Fh; 75h; 74h; 2Ch

4. ETS CONFIGURATION

4.1. PARAMETERIZATION

In the following sections, the required parameters to configure the KNX devices in this example are detailed.

4.1.1. ZAS ROOM CONTROLLER

ZAS room controller should be configured to enable buttons for **ON/OFF control of projector and motor controller**, as well as for **input selection**. Indicators of **status of projector** and **selected input** will be also needed.

In *General* tab, the following Screens should be enabled: **Screensaver** to show Time and Temperature, **General Indicators** and **Information Screen**:
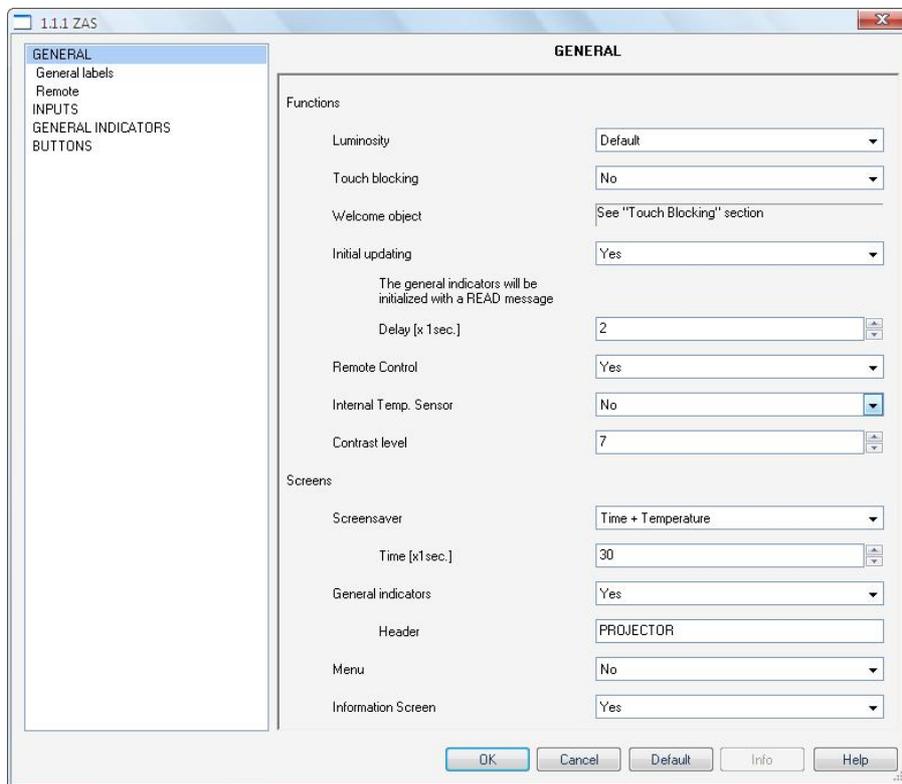
Figure 13. ZAS – General

In *General labels* tab, it is necessary to fill all the label names, since they guide the user during ZAS handling:
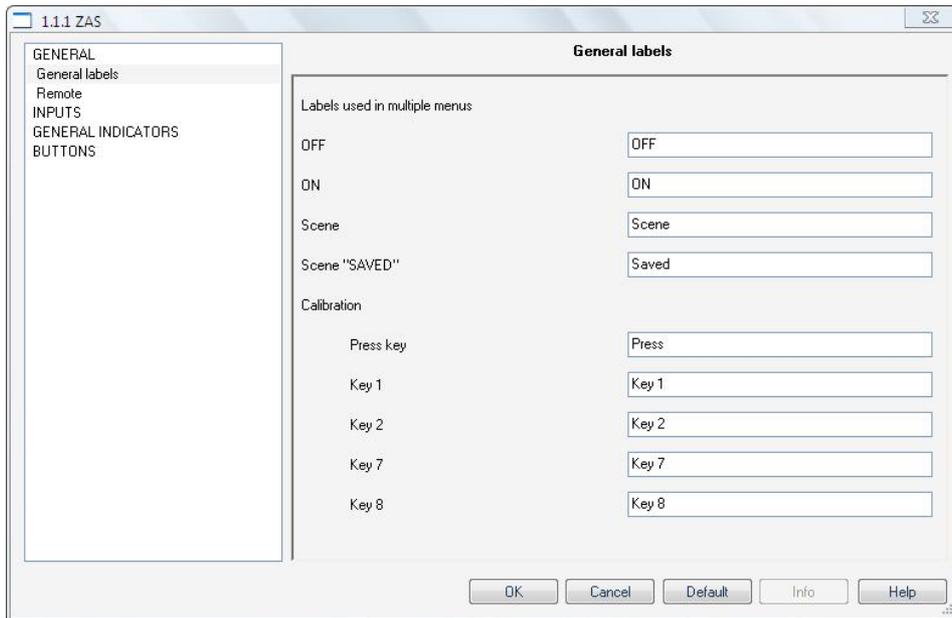
Figure 14. ZAS – General labels

In *General Indicators* tab, a **Binary** indicator should be enabled to show the ON/OFF status of projector and an **Enumeration** indicator should be enabled to show the Selected Input in projector:
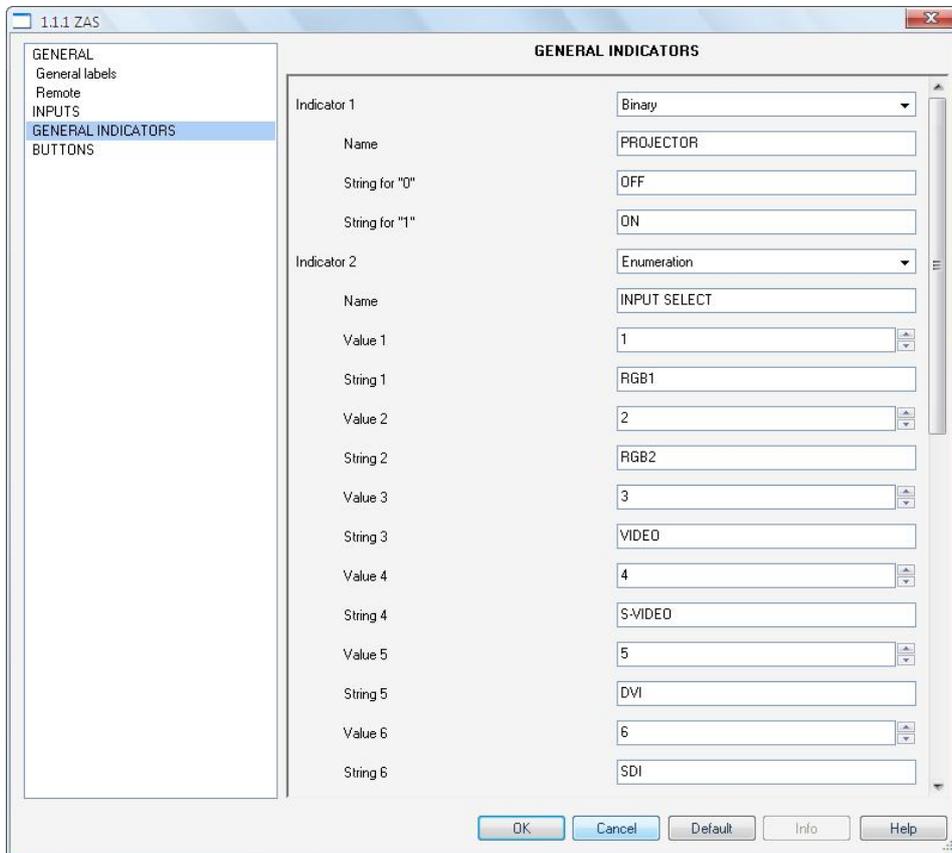
Figure 15. ZAS – General Indicators

In *Buttons* tab, buttons 1-2 should be enabled as a couple for **Switch** function (Projector ON/OFF) and buttons 3-4 should be enabled as a couple for **Enumeration** function, used for Input Select of Projector:
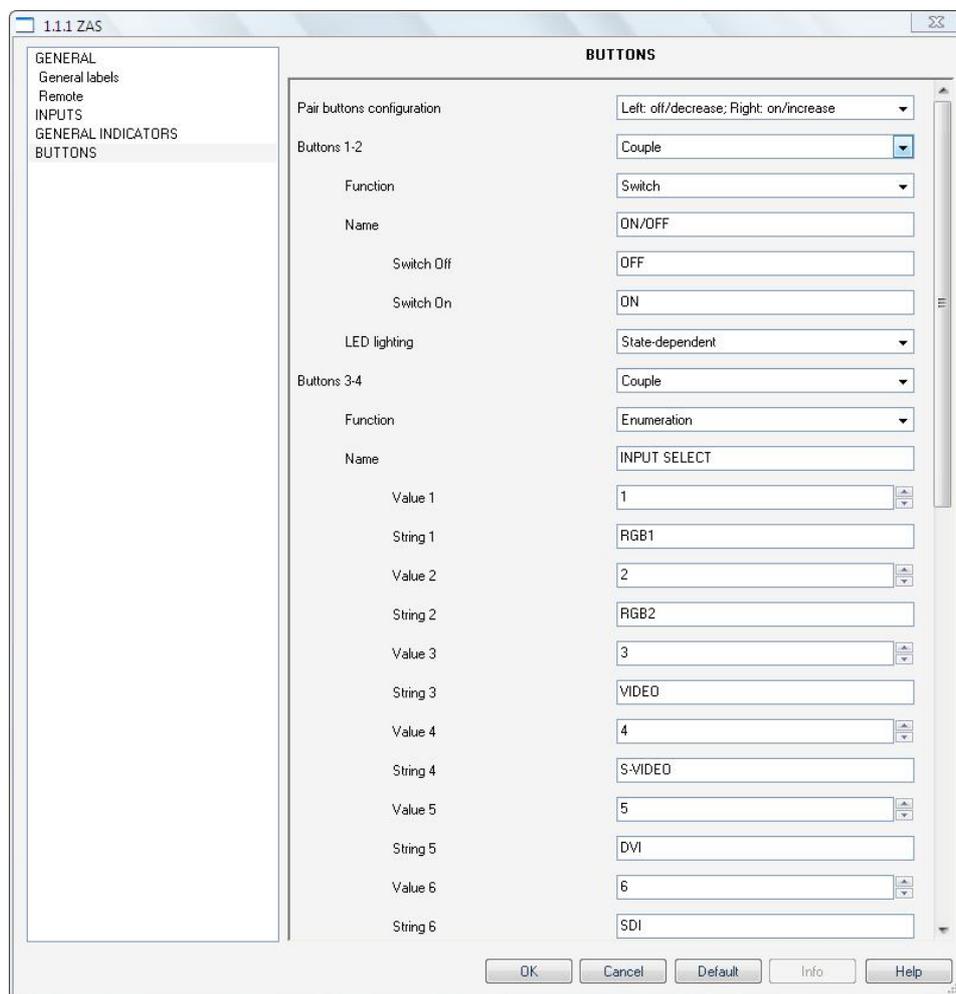
Figure 16. ZAS – Buttons

4.1.2. SKX ADVANCE: PANASONIC PROJECTOR

Next, parameterization of SKX Advance, which allows the communication between KNX and the Panasonic Projector, is detailed.

COMMUNICATION SETUP

First of all, the **communication parameters** should be configured in SKX Advance according to the Panasonic projector specifications:

- **Velocity:** 9600 bauds
- **Parity:** No parity
- **Time between frames to be sent:** 1
- **Reception complete mode:** Timeout (the projector does not use an end of frame byte).
- **Time out:** 10
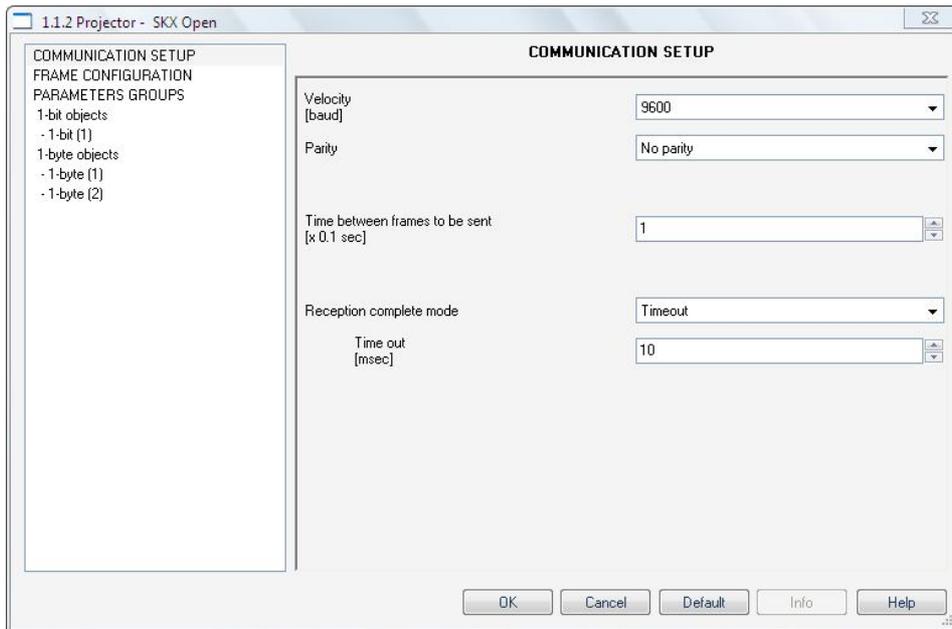
Figure 17. SKX Advance for Projector – Communication Setup

Important: We must bear in mind the external device specifications relative to the RS232 communication. For example, the Timeout must be a value up to the time between frames that the external device sends. Otherwise, the frames would not be recognized by the SKX Advance.

FRAME CONFIGURATION

The hexadecimal frames for ON/OFF control of Panasonic projector have 10-bytes length and the **frames for Input Select have 14-bytes length**. Since parameters for frames are limited to 10bytes (20 characters), **subframes** definition are needed in this case for SKX Advance.

In RS232 Panasonic Project protocol, all the frames have a header byte (02h) and a footer byte (03h). Moreover, the on/off and input select frames have some bytes in common at the beginning, corresponding to device identifier (**ADZZ; → 41h 44h 5Ah 5Ah 3Bh**) which can be configured as **Subframe 1.**

In the following figure, this **Frame Configuration** of SKX Advance is shown:
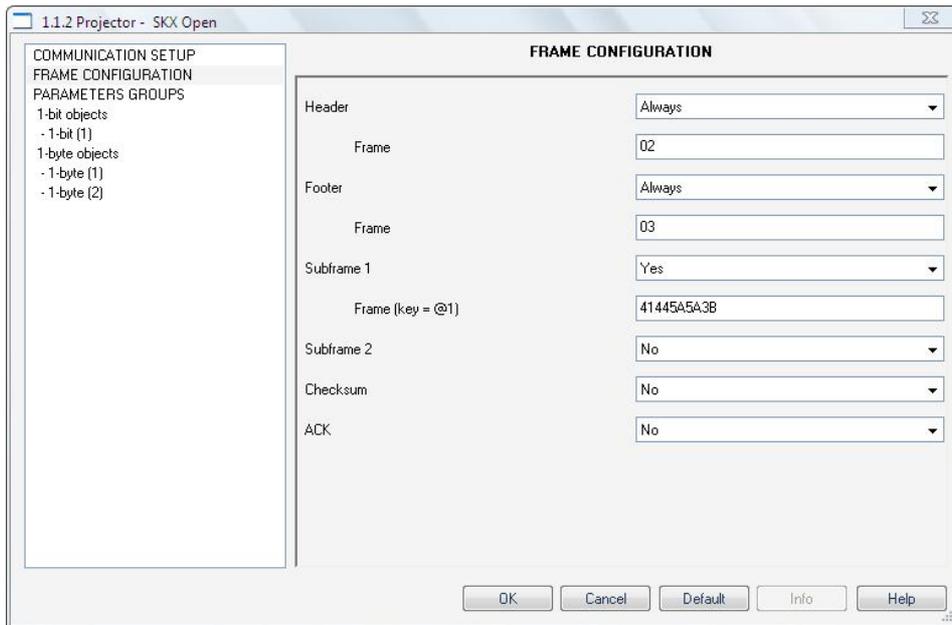
Figure 18. SKX Advance for Projector – Frame Configuration

PARAMETERS GROUP

In *Parameter Groups* tab, the necessary groups of communication objects should be enabled. This project only controls the projector On/Off and Input Select, so the following **14 communication objects** are needed:

- On/Off (1bit): 2 communication objects
- On/Off status (1bit): 2 communication objects
- Input Select (1byte): 6 communication objects
- Input Select Status (1byte): 6 communication objects

Parameter Groups configuration should be:
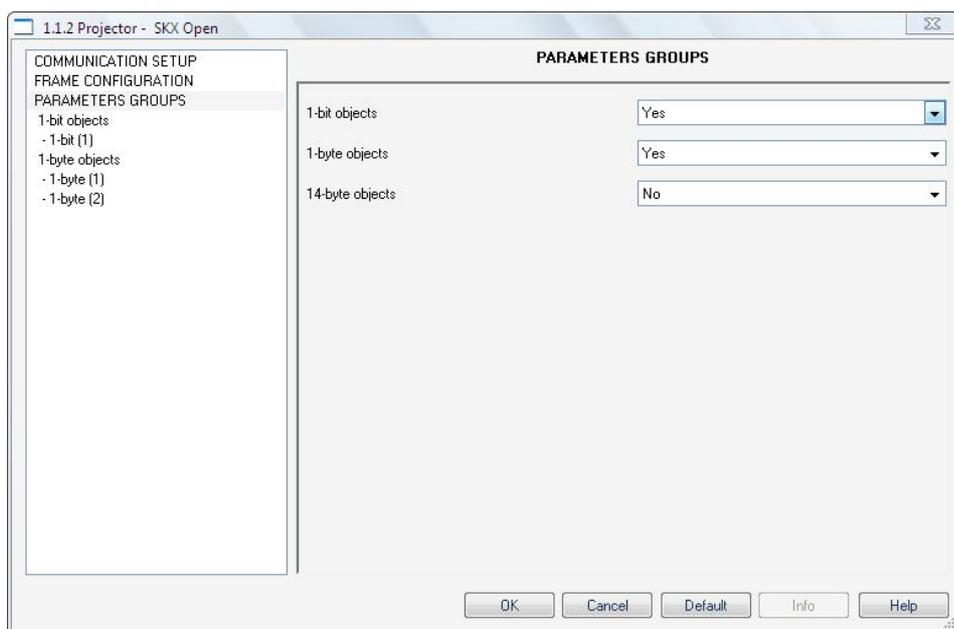
Figure 19. SKX Advance for Projector – Parameters Groups

Once groups are defined, configuration of sent and received frames (ON, OFF and Input Select) should be done.

As it was explained before, the control frames for the projector are in its specifications manual with the format: 02h; 41h; 44h; 5Ah… We need to translate the frame to the **SKX Advance parameters format** so that it recognizes the frames. The format is two hexadecimal characters for each frame byte, which results in:

- 02h; 41h; 44h; 5Ah; 5Ah; 3Bh; 50h; 4Fh; 4Eh; 03h=> 0241445A5A3B504F4E03

In some devices the control frames in the specifications manual have another format, but the translation to SKX Advance format is the same:

- 0x02h; 0x41h; 0x44h; 0x5Ah … 0x03h => 0241445A5A3B504F4E03

Regarding the first and last byte of frames have been defined as header and footer for all the frames (sent and received), they can be removed from parameters. **Subframe 1** has been also defined as the group of bytes corresponding to the device identifier, which can be replaced by **@1 (=41445A5A3B).**

This way, the SKX Advance parameterization regarding the frames is:

- **Object 0: (OFF Sending)**
  - **Control Mode:** Send frame if object is 0
  - **Frame:** @1504F46

- **Object 1: (ON Sending)**
  - **Control Mode:** Send frame if object is 1
  - **Frame:** @1504F4E

- **Object 2: (OFF Status Reception)**
  - **Control Mode:** Object is 0 if frame fits
  - **Frame:** 504F46

- **Object 3: (ON Status Reception)**
  - **Control Mode:** Object is 1 if frame fits
  - **Frame:** 504F4E

- **Object 40: (Input Select RGB1)**
  - **Control Mode:** Send fixed frame
  - **Frame:** @14949533A524731
  - **Byte:** 1

- **Object 41: (Input Select RGB2)**
  - **Control Mode:** Send fixed frame
  - **Frame:** @14949533A524732
  - **Byte:** 2

- **Object 42: (Input Select VIDEO)**

- **Control Mode:** Send fixed frame
- **Frame:** @14949533A564944
- **Byte:** 3

- **Object 43: (Input Select S-VIDEO)**
  - **Control Mode:** Send fixed frame
  - **Frame:** @14949533A535644
  - **Byte:** 4

- **Object 44: (Input Select DVI)**
  - **Control Mode:** Send fixed frame
  - **Frame:** @14949533A445649
  - **Byte:** 5

- **Object 45: (Input Select SDI)**
  - **Control Mode:** Send fixed frame
  - **Frame:** @14949533A534449
  - **Byte:** 6

- **Object 46: (Input Select Status RGB1)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A524731
  - **Byte:** 1

- **Object 47: (Input Select Status RGB2)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A524732
  - **Byte:** 2

- **Object 48: (Input Select Status VIDEO)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A564944
  - **Byte:** 3

- **Object 49: (Input Select Status S-VIDEO)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A535644
  - **Byte:** 4

- **Object 50: (Input Select Status DVI)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A445649
  - **Byte:** 5

- **Object 51: (Input Select Status SDI)**
  - **Control Mode:** Get fixed object
  - **Frame:** 4949533A534449
  - **Byte:** 6
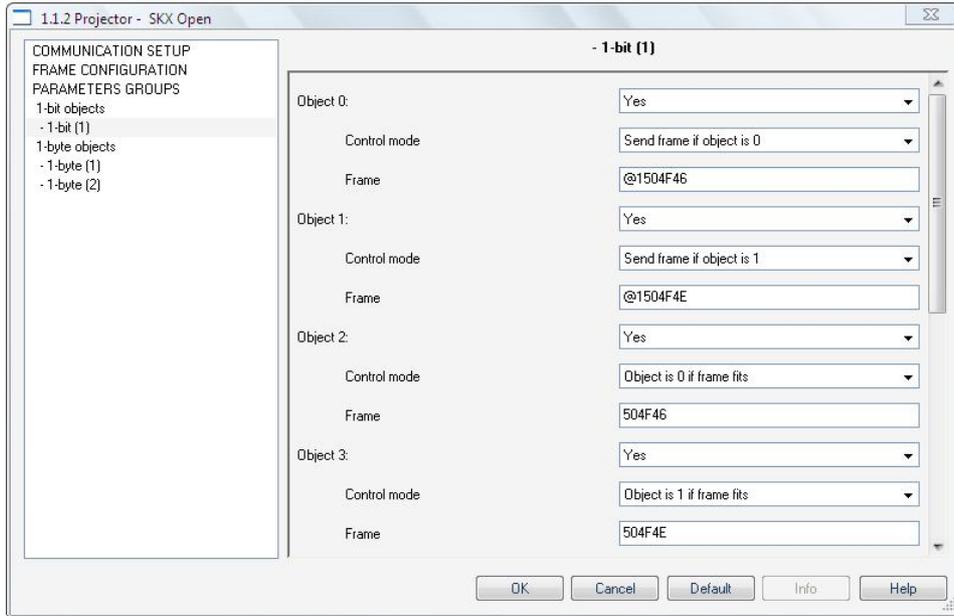
Figure 20. SKX Advance for Projector – 1-bit objects
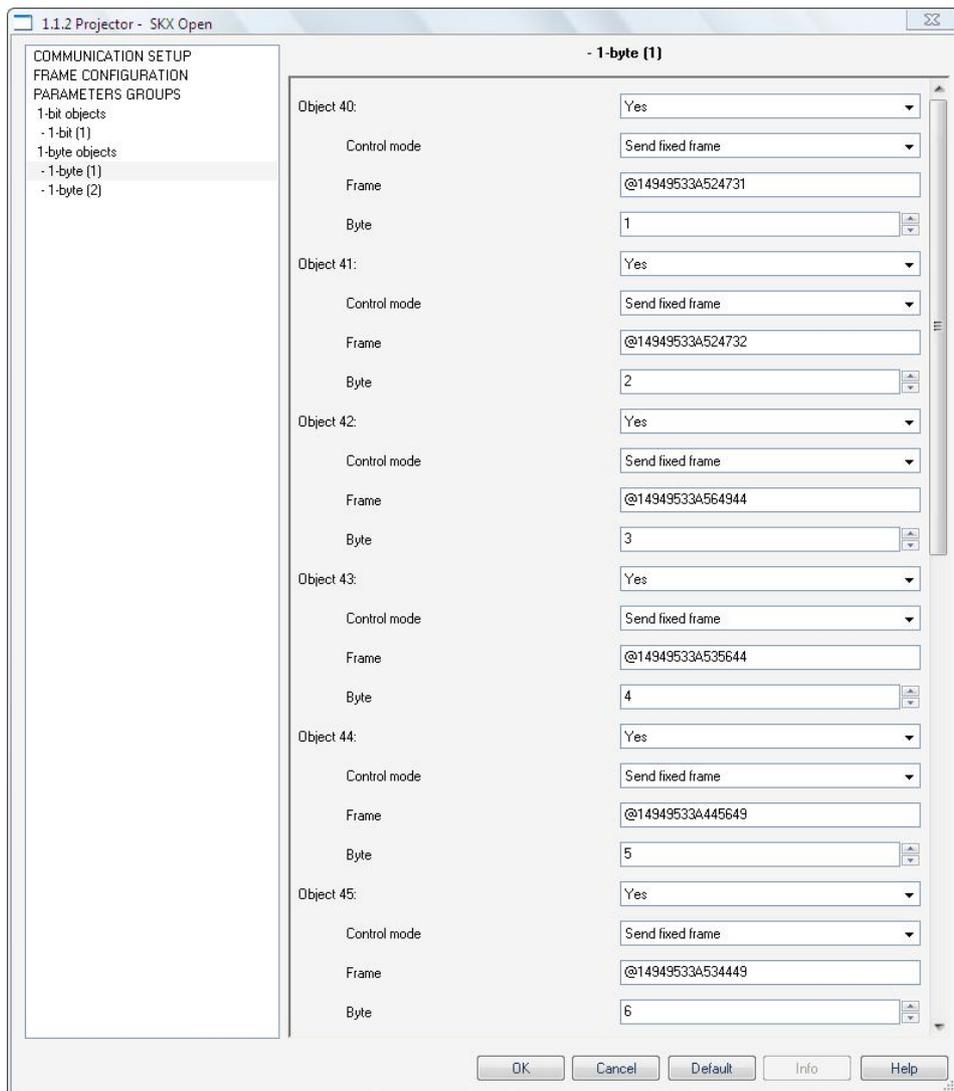
Figure 21. SKX Advance for Projector – 1-byte objects (Input Select)
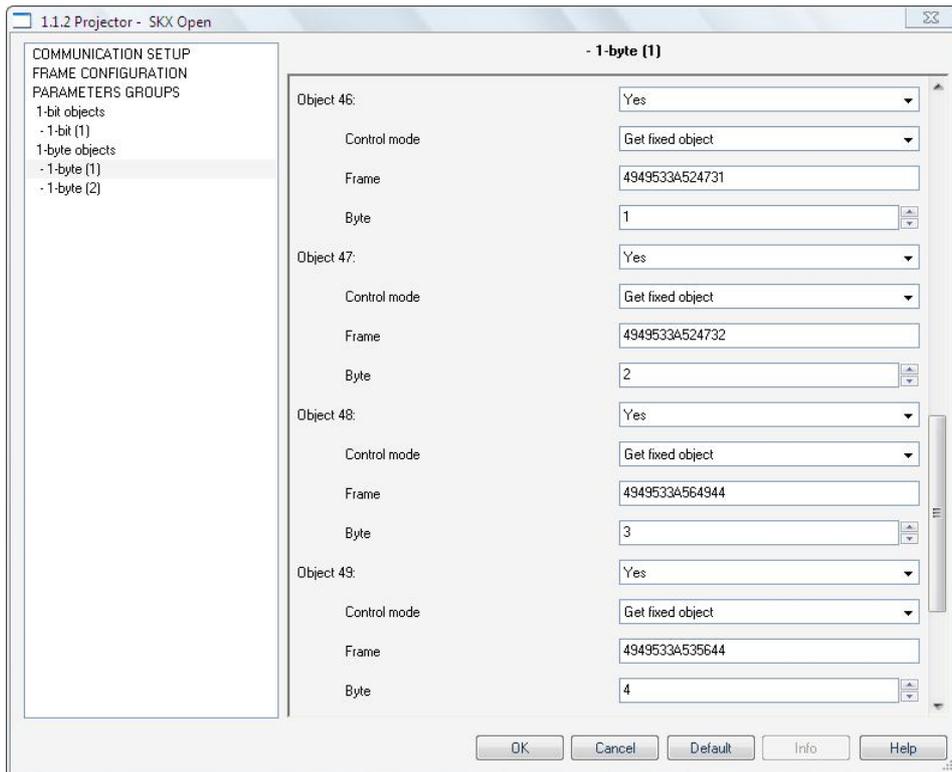
Figure 22. SKX Advance for Projector – 1-byte objects (Input Select Status)
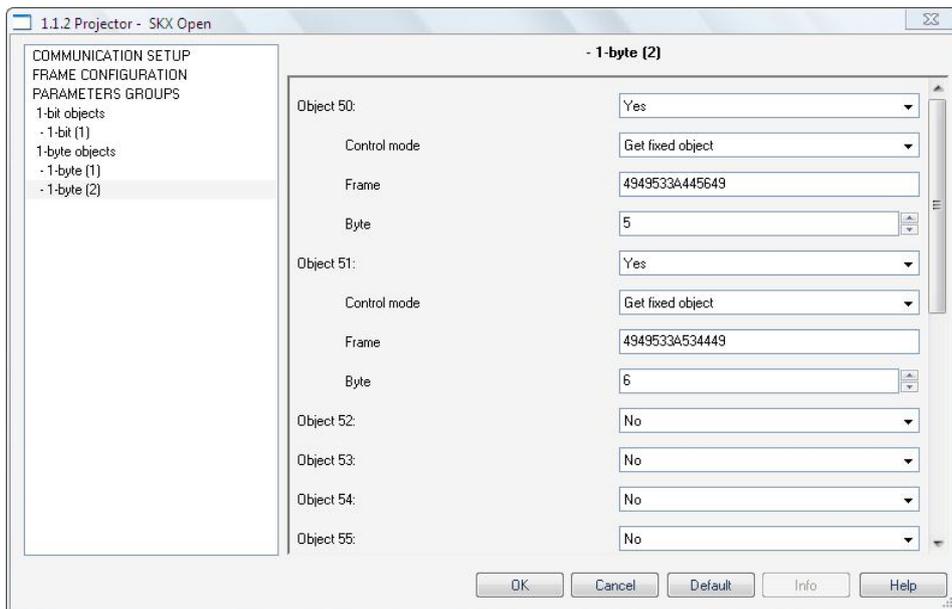
Figure 23. SKX Advance for Projector – 1-byte objects (Input Select Status)

Important: for a better understanding of special characters (## - @h), see SKX Advance manual.

4.1.3. SKX OPEN: MOTOR CONTROLLER

Configuration of SKX Open parameters to carry out the communication between KNX bus and the motor controller of the projector is explained in this section.

GENERAL CONFIGURATION

First of all, the communication parameters should be configured in SKX Open according to the specifications of the motor controller for the projector:

- **Velocity:** 9600 bauds
- **Parity:** No parity
- **Time between frames to be sent:** 1
- **Reception complete mode:** Timeout (the motor controller does not use an end of frame byte).
- **Time out:** 5
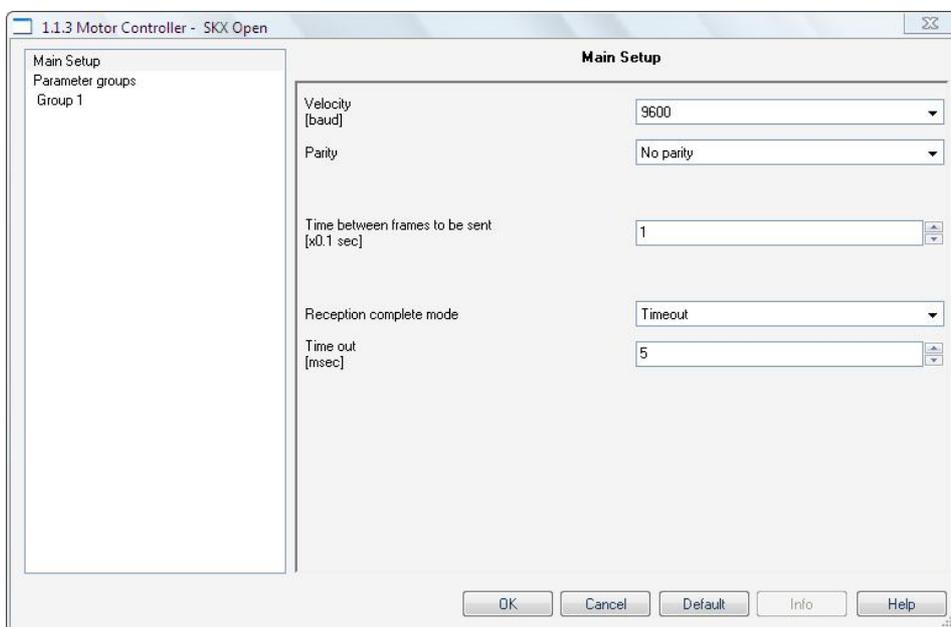
Figure 24. SKX Open for the motor controller – Main Setup

Important: We must bear in mind the external device specifications relative to the RS232 communication. For example, the Timeout must be a value up to the time between frames that the external device sends. Otherwise, the frames would not be recognized by the SKX Open.

PARAMETER GROUPS

In this case, **2 communication objects** are needed**:**

- One for showing the screen when the projector is turned on.
- One for hiding the screen when the projector is turned off.

Thus, only one group of communication objects should be enabled, since each of them contains 10 communication objects.
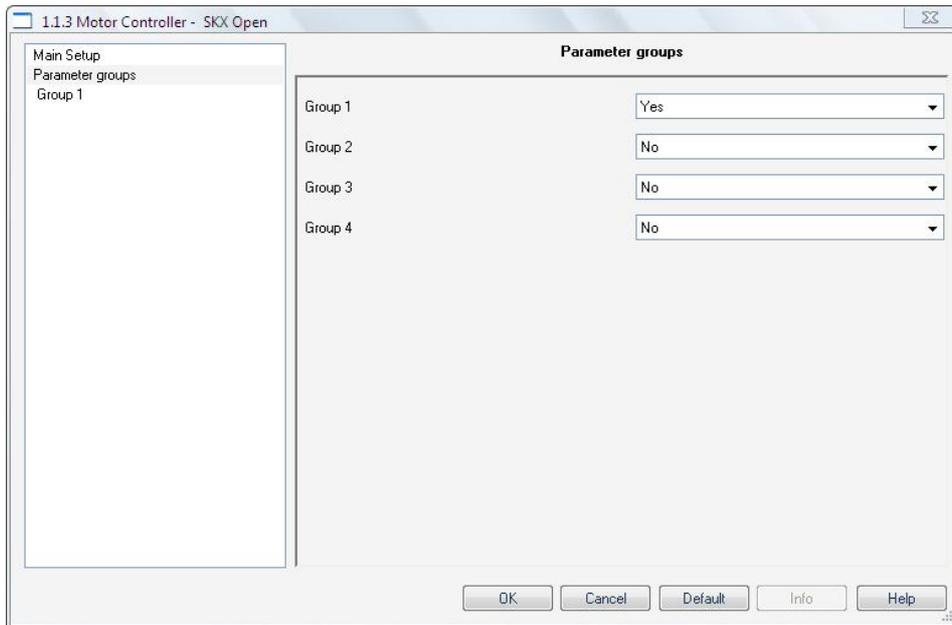

Figure 25. SKX Open for the motor controller – Parameter Groups

Once the group is enabled, in **Group 1** tab the frames associated to any communication object can be parameterized in order to send and receive both orders (ON and OFF).

The control frames have **ASCII format** so they should be **translated to hexadecimal format** for SKX Open.

Example: ASCII to SKX OPEN Conversion of the frame to show the screen.

Código ASCII	Código hexadecimal	SKX Open
fa out,	66h; 61h; 20h; 6Fh; 75h; 74h; 2Ch	6661206F75742C

This way, the SKX Open frame parameterization is:

🔸 **Object 0: (OFF Sending)**

- **Control mode:** Send frame if object is 0
- **Frame to send:** 666120696E2C

🔸 **Object 1: (ON Sending)**

- **Control mode**: Send frame if object is 1
- **Frame to send**: 6661206F75742C
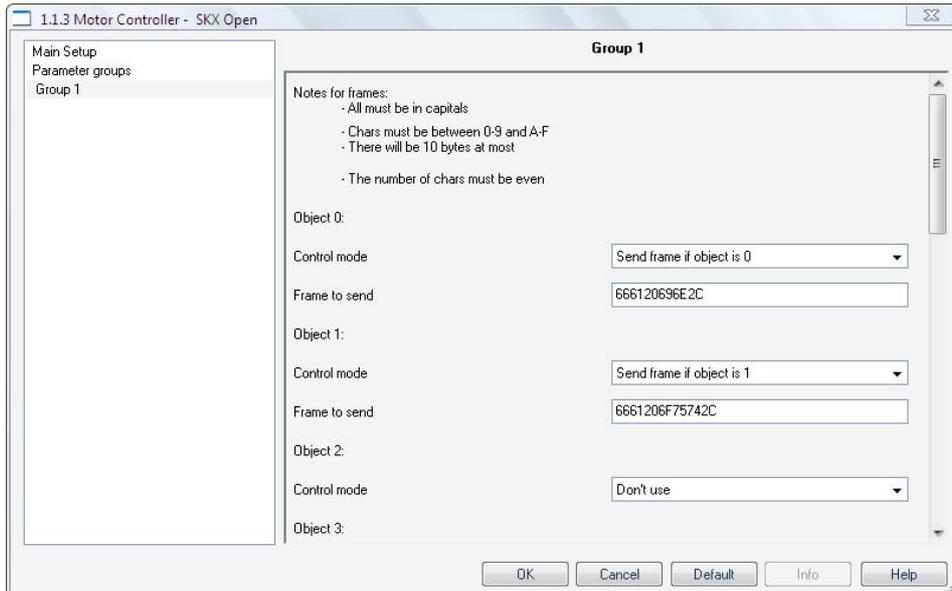
Figure 26. SKX Open for the motor controller – Group 1

4.2. TOPOLOGY

The **topology** of the programming in the ETS for this project will result in:
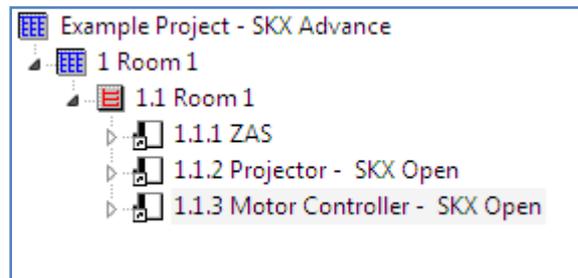
Figure 27. Topology

DEVICE	PHYSICAL DEVICE
ZAS	1.1.1
Projector – SKX Open	1.1.2
Motor Controller – SKX Open	1.1.3

Number	Name	Group Addresses	Length
51	Object 51	0/0/4	1 Byte
50	Object 50	0/0/4	1 Byte
49	Object 49	0/0/4	1 Byte
48	Object 48	0/0/4	1 Byte
47	Object 47	0/0/4	1 Byte
46	Object 46	0/0/4	1 Byte
45	Object 45	0/0/3	1 Byte
44	Object 44	0/0/3	1 Byte
43	Object 43	0/0/3	1 Byte
42	Object 42	0/0/3	1 Byte
41	Object 41	0/0/3	1 Byte
40	Object 40	0/0/3	1 Byte
3	Object 3	0/0/2	1 bit
2	Object 2	0/0/2	1 bit
1	Object 1	0/0/1	1 bit
0	Object 0	0/0/1	1 bit
71	Error: too long	0/1/7	1 bit
72	Error: reception	0/1/6	1 bit
66	Error: odd length	0/1/5	1 bit
73	Error: not hexadecimal	0/1/4	1 bit
69	Error: checksum	0/1/3	1 bit
68	Error: bad usage of '@'	0/1/2	1 bit
67	Error: bad usage of '*' or '?'	0/1/1	1 bit
70	Error: bad usage of '#'	0/1/0	1 bit
65	Error code	0/1/8	1 bit

Figure 28. SKX Advance for projector – Communication Objects

Number	Name	Group Addresses	Length
1	Object 1	0/0/1	1 bit
0	Object 0	0/0/1	1 bit
54	Error: Too long	0/1/14	1 bit
53	Error: Reception	0/1/13	1 bit
51	Error: Odd length	0/1/12	1 bit
49	Error: Not hexadecimal	0/1/11	1 bit
50	Error: Lower case	0/1/10	1 bit
52	Error: In current frame	0/1/9	1 bit
48	Error	0/1/15	1 bit

Figure 29. SKX Open for motor controller – Communication Objects

Number	Name	Group Addresses	Length
16	[Ind 2] 1 byte Indicator	0/0/4	1 Byte
9	[Ind 1] Binary Indicator	0/0/2	1 bit
0	[General] Time		3 Byte
2	[General] Scenes: send		1 Byte
1	[General] Scenes: receive		1 Byte
36	[B34] 1 byte Control	0/0/3, 0/0/4	1 Byte
27	[B12] Binary Control	0/0/1, 0/0/2	1 bit

Figure 30. ZAS – Communication Objects

4.3. GROUP ADDRESSES

The group addresses created for this application example are listed in the table below, as well as the associated communication objects and a brief description for each of them.

ADDRESS	NAME	OBJECT	DEVICE	DESCRIPTION
0/0/1	**ON/OFF**	2	1.1.3	It turns on the projector and shows the screen with the motor controller
		0	1.1.3	
		1	1.1.2	
		0	1.1.2	
		27	1.1.1	
0/0/2	**ON/OFF Status**	2	1.1.2	It shows the status of the projector
		3	1.1.2	
		9	1.1.3	
		27	1.1.3	
0/0/3	**Input Selection**	36	1.1.1	Input Selection for projector
		40	1.1.2	
		41	1.1.2	
		42	1.1.2	
		43	1.1.2	
		44	1.1.2	
		45	1.1.2	
0/0/4	**Input Selection Status**	16	1.1.1	Status of Input Selection of projector
		36	1.1.1	
		46	1.1.2	
		47	1.1.2	
		48	1.1.2	
		49	1.1.2	
		50	1.1.2	
		51	1.1.2	

0/1/0	**Projector – Error #**	70	1.1.2	Error in use of character # in parameters
0/1/1	**Projector – Error * or ?**	67	1.1.2	Error in use of character * or ? in parameters
0/1/2	**Projector – Error @**	68	1.1.2	Error in use of character @ in parameters
0/1/3	**Projector – Error checksum**	69	1.1.2	Error in checksum
0/1/4	**Projector - Error not hexadecimal frame**	73	1.1.2	Non hexadecimal value in parameters
0/1/5	**Projector - Error odd length frame**	66	1.1.2	Odd length of frame
0/1/6	**Projector - Error reception**	72	1.1.2	Error in reception
0/1/7	**Projector - Error too long frame**	71	1.1.2	Too long frame
0/1/8	**Projector - Error**	65	1.1.2	Error in communication with projector
0/1/9	**Motor controller - Error in frame**	52	1.1.3	Error in sent or received frame
0/1/10	**Motor controller - Error lower case**	50	1.1.3	Lower case letter in parameters
0/1/11	**Motor controller - Error not hexadecimal frame**	49	1.1.3	Non hexadecimal value in parameters
0/1/12	**Motor controller - Error odd length frame**	51	1.1.3	Odd length of frame
0/1/13	**Motor controller - Error reception**	53	1.1.3	Error in reception
0/1/14	**Motor controller - Error too long frame**	54	1.1.3	Too long frame
0/1/15	**Motor controller - Error**	48	1.1.3	Error in communication with motor controller

In the following figures the associations of the communication objects and the group addresses are shown:

Figure 31. Group Address 0/0/1: ON / OFF

Figure 32. Group Address 0/0/2: ON/OFF Status

Figure 33. Group Address 0/0/3: Input Selection

Figure 34. Group Address 0/0/4: Input Selection Status

Figure 35. Group Address 0/1/*: Errors of Projector and Motor Controller

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