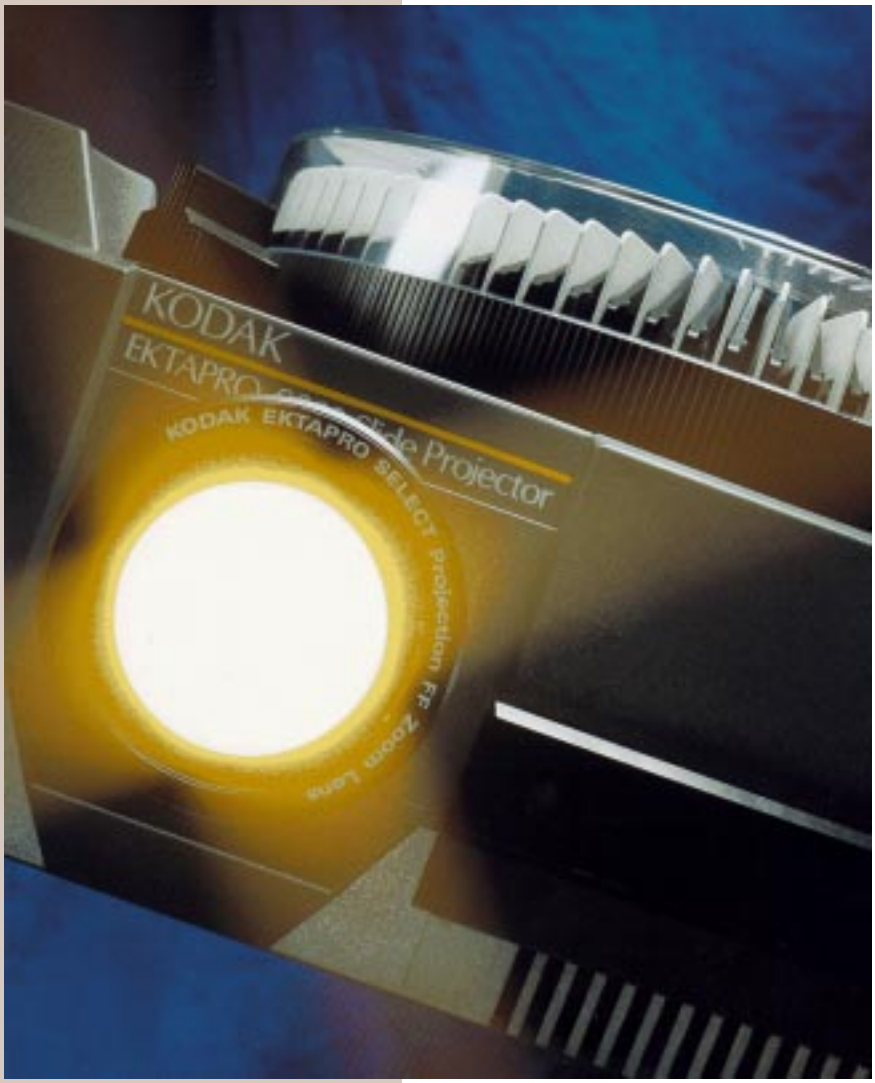
Kodak Ektapro P-Com Protocol



Kodak Ektapro P-Com Protocol contains all commands and information to control an Ektapro via the RS-232 interface.

Content

1 Introduction

1.1 The Slide Projector Becomes Computer Clever

The possibility of a computer connection is one of the most important requirements placed on modern presentation equipment. Kodak has provided the "traditional presentations tool" - the slide projector - with the latest technology and has furnished their EKTAPRO Slide Projectors with a computer interface.

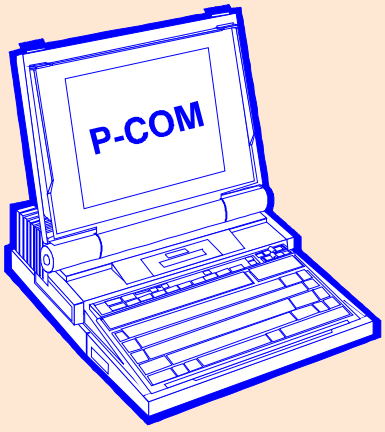
This interface - a RS232 standard interface - is called **P-Bus** and enables a communications exchange between the projector and computer. For the first time, it is possible to directly programme and control slide projectors from Kodak via the computer and the projector, in turn, is able to pass on status information to the computer. The command language for this is **KODAK EKTAPRO P-COM Protocol**. It is now possible to tie-in slide projectors to the new multi-media landscape.

1.2 Information for AV and Computer Specialists

The following information is aimed at two groups:

1. All *computer specialists* that would like to make use of the fascinating possibility of controlling slide projectors via their PC. They have knowledge of programming languages at their disposal and are less familiar with slide projector technology.

2. All *AV specialists* who are versed in slide presentation and creation of professional slide shows (multi-vision). This group would also now like to use the possibility of directly controlling the projector via a computer.



1.3 KODAK EKTAPRO Slide Projectors -Important note

In '97 Kodak has launched its latest Ektapro generation. New models with computer interface are the EKTAPRO 4020, 5020, 7020 and 9020. The main feature of the new models is the Extra Bright Lamp Module which provide 30% higher light output than compared to former models. In addition models 4020 and 5020 will now show some of the features such as the *GET Tray Position* which have already been implemented with the 7010 and 9010 models.

ACCORDING TO MODEL CHANGING AND DIFFERENT FEATURES NOT ALL COMMANDS CAN BE USED FOR ALL MODELS. USE TABLE AT PAGE 34 TO FIND OUT WHAT COMMAND IS POSSIBLE FOR YOUR EKTAPRO MODEL! A CLICK ON THE ? ICON WILL SHOW UP THE TABLE.

1.4 From P-COM and P-Bus

Certain hardware and software provisions must be given if equipment is to be connected to a computer.

The Interface

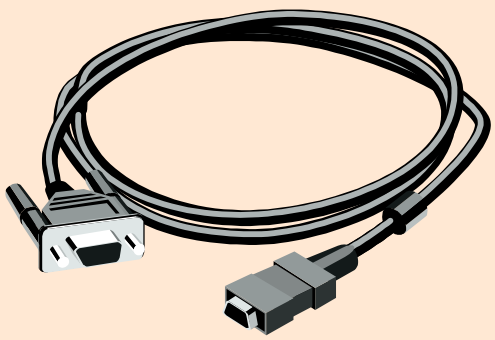
Both the computer and the equipment to be connected must have a connection place. This connection possibility is called an interface. Computers generally have one or more interfaces to attach VDUs, printers, scanners and other accessories. Matching external equipment to the computer interface follows by means of a special electronic circuit. To obtain greatest versatility those interfaces are standardized (e.g. RS232).

The interface of KODAK EKTAPRO Slide Projectors is called **P-Bus**. P stands for projector and BUS is the general term for a remote data transmission lead.

The P-Bus is bodily a standardized interface with the name RS232. Cables available from the usual computer specialist shops are, therefore, also suitable. The plug allocation has, however, been slightly modified by Kodak.

The Command Language

A character string that both the computer and the projector understand must be defined in order to be able to give the projector clear commands. The defined character string for the KODAK EKTAPRO Slide Projectors is called **P-Com Protocol** and is in binary form. Please note this is **not** a software to be installed once on the computer to produce the necessary commands. It is simply the character strings necessary in order to programme the commands. Hidden behind the name P-Com is, therefore, nothing other than the "projector's communications language". Programmes can be written to the individual needs of the user.



1.5 The Command Administration of the EKTAPRO Slide Projectors

Knowledge of the structure and construction of the projector is necessary in order to be able to give the projector clear commands or to receive information from it. Readers who are familiar with the KODAK EKTAPRO Slide Projectors can skip this section.

The heart of the EKTAPRO Projectors is a micro-processor. It is here that commands, from the keyboard or the various interfaces, such as remote control or P-Bus, are received, administered and carried out. The commands are mainly concentrated on brightness control, tray transport and random access. The micro-processor also performs a number of co-ordination and supervision tasks.

To command means to define. To define means to divide commands into regular and ever reproducible steps. All mechanical movement must, for example, be divided into the smallest steps. The stepper motors are, here, clear favourites. For example: The command <<go to slide no: 12>> means to the micro-processor <<turn the stepper motor for the tray drive xx steps further>>.
For dissolving, it is important that the projection lamp has reached a particular brightness. Therefore, the EKTAPRO Projectors defines the projection brightness in 1000 steps from the smallest value (lamp out) to the highest value (lamp at brightest).

The breakdown of movements and lamp brightness into the smallest steps allows the universal control of the projector. All types of dissolving and the most diverse slide transport cycles can be realized. Computer programs can now be written for the individual, specific needs of the user. This stresses, once more that **P-COM Protocol** is **not** a software that can be bought on a disk. It is simply a character string - communications language - to control the projector. A description of this command language follows.

2 Getting Started

2.1 Hardware configuration

Type of computer
Any computer with a standard RS232 interface is able to control the projector.

The P-Bus (a serial interface):
The interface used is according to the RS232C (V.24/V.28) standard. This is an asynchronous data transmission.

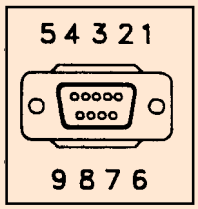
Computer configuration:
The data transmission is asynchronous. Set the following data format and transmission rate:

* 1 start bit
* 8 data bits
* no parity
* **1** stop bits
* 9600 baud

Note: *Data setting information can also be found in the accompanying books for your operation system (e.g. DOS).*
PC users, who run the MICROSOFT Window 3.0 or higher on their PCs, can input these settings very quickly via the command "System control".

Signals:
Following signals are used for data transmission (9 pin SubD-Connector):

Signals	*Pins*
Transmit Data (TxD)	**2**
Receive Data (RXD)	**3**
Signal Ground	5



- The levels must be according to the EIA RS232C (CCITT V.28) standard.
- Both, the computer and the projectors can transmit and receive.
- The computer is the controller and determines when and which projector has to transmit.
- No hardware handshake is implemented.
- No x on/off software handshake is implemented.

2.2 Connector and cables

■PCs with a standard (modern) 9-Pin RS232 Interface
As a rule, the connection of your computer to the projector should not cause any problems as both interfaces are standardized and the appropriate cables and adapters are available from your computer dealer.

Please note:
• The cable must be a **1:1 cable and connector shielded)!**

■PCs with a standard (older) 25-pin RS232 Interface
There might be some problems with these computers, because the pin configuration is different to the one of the 9-pin sub D connector. In most of these cases the following will help to make the connection to your EKTAPRO Projector:

1. Use a standard 25-pin to 9-pin adapter on your PC and connect the projector with the standard monitor-cable.
2. Make your own cable by new arrangement of the pins inside the 25-pin connector. The illustration on page 7 will give you more details.

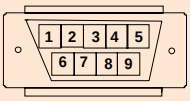
***Note**:* In some cases the pin configuration of the 25-pin RS232 computer interface will be different. To connect the projector, the computer manufacturers have to state the arrangement of the plug connectors.

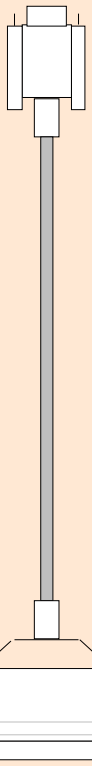
■Apple Macintosh computer
Owners of these computers cannot use the PC standard cable because of the different socket on the computer. PCs have a 9-pin sub-D (equivalent to P-Bus); Macintosh computers have a 8-pin Mini DIN socket. More details can be found in the illustration (next page).

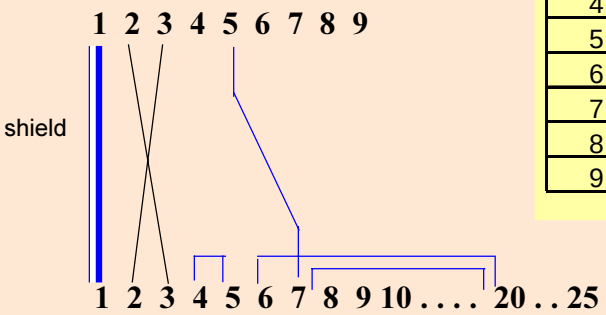
Cable for PCs with 25-Pin Sub D RS232 Interface

View from front side!

9-Pin Sub D Connector

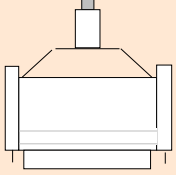




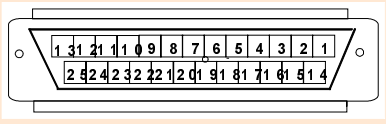


P-Bus Connector DB9 male		
Pin No		Description
1	NC	
2	RXD	Transmit Data
3	TXD-	Receive Data
4	NC	
5	GND	Ground
6	NC	
7	NC	
8	NC	
9	NC	

25 -Pin Sub D Connector

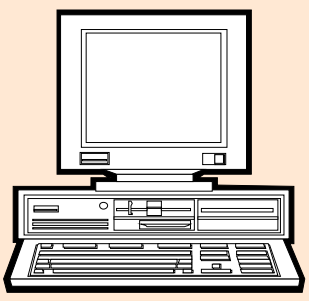


View from front side!



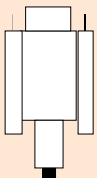
Note: The following bridging inside **25-Pin** connector is necessary:
pin **4** with pin **5**
pin **6** with pin **20** and
pin **8** with pin **20**

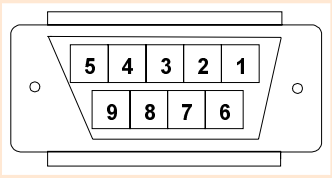
Connector 25 pin male		
PIN No		Description
2	TXD	Transmit Data
3	RXD	Receive Data
4	RTS	
5	CTS	
6	DSR	
7	GND	Ground
8	DCD	
20	DTR	
22	RI	



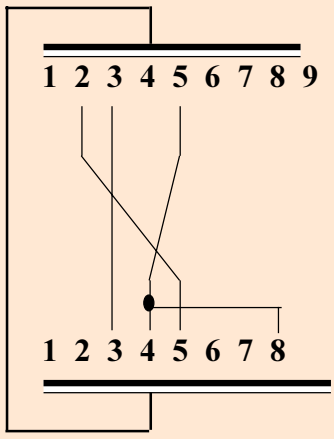
APPLE MACINTOSH CABLE

9-Pin Sub D Connector

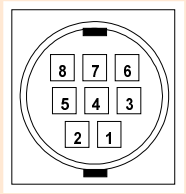




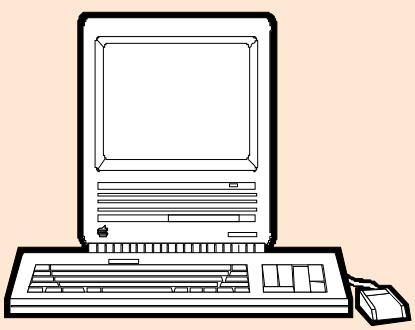
P-Bus Connector DB9 male		
Pin No		Description
1	NC	
2	RXD	Transmit Data
3	TXD-	Receive Data
4	NC	
5	GND	Ground
6	NC	
7	NC	
8	NC	
9	NC	



Mini DIN 8 male Connector



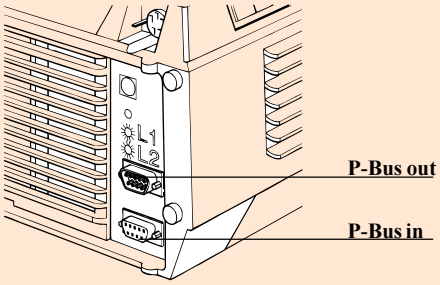
Macintosh Mini DIN 8 male		
Pin No		Description
1	HSKo	Handshake out
2	HSKi	Handshake in
3	TXD-	Transmit Data inverted
4	GND	Ground
5	RXD-	Receive Data
6	TXD+	Transmit Data
7	GPi	General Purpose Input
8	RXD+	Receive Data



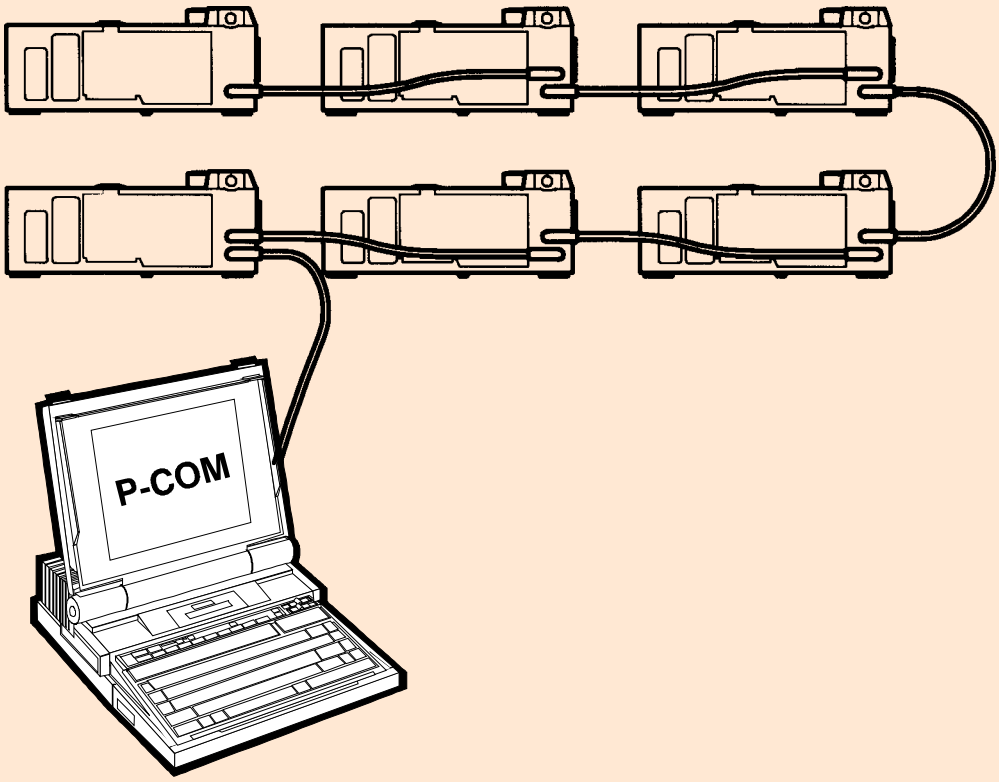
Daisy Chaining

- A 9-pin Sub-D female connector **(P-Bus in)** is used to connect the slide projector with the RS 232 connector of the controlling computer.

- A 9-pin Sub-D male connector **(P-Bus out)** is used to connect this first slide projector with the female Sub-D connector of the second one (daisy chain communication).



- All further projectors are connected the same way.



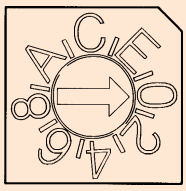
• The computer is a DTE, that means it transmits data (TxD) on pin 3 and receives data (RxD) on pin 2.

• The female connector of the projector is a DCE, that means it receives data on pin 3 and sends data on pin 2.

• The male connector of the projector is also a DTE.

DTE = Data terminal equipment
DCE = Data communication equipment

***Note**:*
It is important to switch on all connected projectors.
For proper operation, first switch on all projectors and then the control unit!



ADDRESS Selector

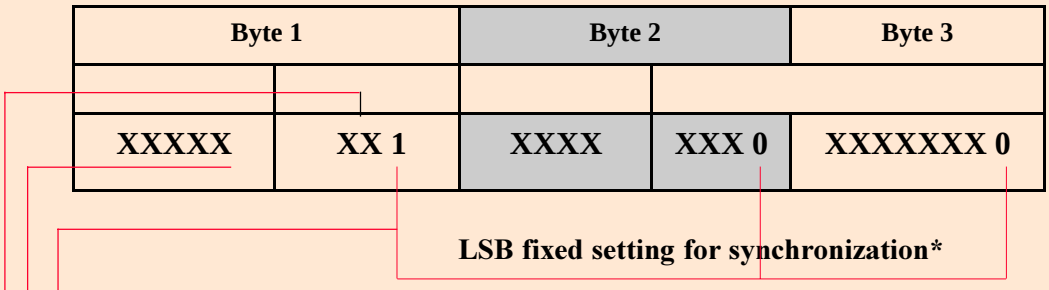
Address selection:
The KODAK EKTAPRO Slide Projector has an encoded rotary Dip switch with 16 positions in order to define the projector address. The code switch shows the figures **0-9, A-F*.**
These 16 positions correspond with the 16 possible addresses.
Use the global address << **1F** >> or the << **0** >> for EKTAPRO Projectors without an address switch (such as the Ektapro 4020 or 5020).

***Note**:*
• *As long as the projectors are correctly addressed it is **not** necessary to daisy chain the projectors in sequence (e.g. projector 4 can be daisy chained with projector 12).*
• *Projectors without P-Bus out interface can be used as the last in the row in a daisy chain.*

3 Commands

3.1 The command string:

A command string consists of **3 consecutive bytes**.



*** Please note:** The LSB (Least Significant Bit) in each byte is used for synchronization. Synchronization is only achieved when the LSB in the first byte is set to 1 and when the LSB in the following two bytes is set to 0!

The first five bit of each command specifies the address of the selected projector (**0-F** hex).
16 hardware addresses are possible **0-F** (hex)
The address **1F** (hex) specifies the global address which all connected projectors accept.
Several projectors can be combined to a group by assigning them a special group address (**10-1E** hex) with a software command.
Using global or group addresses the projectors are addressed independently from the position of the address switch.

Bit 6 and 7 of the first byte specifies the **command modes.**
4 command modes are used:

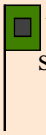
Command Mode	Binary Code
Parameter Mode	**00**
Set/Reset Mode	**01**
Direct Mode	**10**
Status Request Mode	**11**

3.2 Coding

Coding is **binary**. It can be done in **two** ways:

1. Fill the appropriate command string with binary values. If needed you could also evaluate the **Hex-Code** of each byte. A conversion table (dec > bin > hex) is to be find in the appendix, page 38. Use the 

icon to show up the table!

2. Use a math-formula **(use figures on decimal base)**. Presuming you are a little bit familiar with mathematics, especially with *DIVISION* and *MODULO* and it is easy to evaluate the binary code of each byte. For your convenience all formulars are indicated by the  symbol to be found on the left margin.

Arithmetic with *DIVISION* and *MODULO*

■ *DIVISION (DIV)* - also known as *INT* - means that within a division only the integer numbers of the result are used, fractional numbers are neglected.

Example:
1000 : 7 = 7.8125
1000 DIV 128 = 7
(Sometimes you also will find the term: INT(1000/128) = 7)

■ *MODULO* (MOD)- means to work with the remainder of a DIVISION.
Example:
1000MOD128 =104
1000 : 128 = 7 and remainder is 104

3.3 Parameter Mode

Commands with a 10-bit argument are used for setting parameters that require special values like brightness, slide number and group address.
All other command codes (CCCC) are reserved. **Do not use these codes!**

Byte 1		Byte 2	Byte 3	
Projector No	Parameter Mode	Command	Parameter	
AAAAA	**00 1**	**CCCC**	**XXX 0**	**XXXXXXX 0**

The following commands and parameter can be executed:

	CCCC	XXX 0	XXXXXXX 0
Random Access	0000	00X 0	XXXXXXX 0
	Slide no from 0-140		
SetBrightness	OOO1	XXX 0	XXXXXXX 0
	Value from 0-1000		
Group Address	0011	000 0	0XXXXX 0
	Address 10-1F (hex)		
Fade up/down	0110	00D 0	XXXXXXX 0
	Value from 0-127 in tenth of seconds		
	D =1 Fade up		
	D = 0 Fade down		
SetLowerLimit fo	0111	XXX 0	XXXXXXX 0
	Value from 0-1000		
SetUpperLimit fo	1000	XXX 0	XXXXXXX 0
	Value from 0-1000		

The three 8-bit bytes are used in the following way:

Byte 1: **(projector's address * 8) + (mode * 2) + 1**
Byte 2: **(command * 16) + (parameter DIV 128) * 2**
or (command * 16) + INT(parameter/128) * 2
Byte 3: **(parameter MOD 128) * 2**

For fast hex-coding of **byte 1** use the following table:

Proj. No.	HEX of Byte 1	Proj No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1
0	1	4	21	8	41	12	61
1	9	5	29	9	49	13	69
2	11	6	31	10	51	14	71
3	19	7	39	11	59	15	79

Example:
Projector 1 should project slide no 10:

Byte 1		**Byte 2**		**Byte 3**
Projector 1	**Parameter Mode**	**Command Random access**	**Parameter Slide 10**	
00001	00 1	0000	000 0	0001010 0
Hex- Code of byte 1-3				
09		00		14

or with formula:
Byte 1: (1 * 8) + (0 * 2) + 1 = 9 =bin00001001 =hex09
Byte 2: (0 * 16) + (10 DIV 128) * 2 = 0 =bin00000000 =hex00
Byte 3: (10 MOD 128) * 2 = 20 =bin00010100 =hex14

RandomAccess:
The value is the desired tray position.
The maximum value depends on the tray type (80 or 140 slides).

SetBrightness:
You can control the brightness of the projection lamp in **1000** steps.

Value 0 = minimum brightness (Lamp off)
Value 1000 = maximum brightness

GroupAddress:
15 Group addresses are available(**10-1F** hex). After assigning several projectors to the same group address, they are addressable together under this group address. But each projector can only be combined with **one** group! To take a projector out of a group, assign this projector to the global address **1F** (hex).

LampFading
With a single command the fading of the lamp can now be set. Fading time is 0-12.7 s and can be set in tenth of seconds (127 settings). The fade operation will use a linear ramp of the brightness values. It will start with the brightness value momentarily set at the projector. The decision of fading down or up will be set by a bit (D) in the byte 2 of the command string.

SetLowerLimit
This command specifies the brightness value where a fading should stop in case of a **fading down** operation. This value will be kept until it is overridden with a new one.

Please note:
If the momentary brightness of the projector lamp is **lower** than this value, the fade down operation will stop at **0**!
After power-up or reset of the projector the value is defined as **0**.

SetUpperLimit
This command specifies the brightness value where a fading should stop in case of a **fading up** operation. This value will be kept until it is overridden with a new one.

Please note:
If the momentary brightness of the projector lamp is **higher** than this value, the fade up operation will stop at **1000**!
After power-up or reset of the projector the value is defined as **1000**.

3.4 Set/Reset mode

Byte 1		Byte 2		Byte 3
Projector No	Set/Reset Mode	Command	Set Bit	Not used
AAAAA	**01 1**	**CCCCCC**	**S 0**	**NNNNNNN 0**

The three byte command string is used in this way:
AAAAA is the address of the projector.

CCCCCC is a binary command number indicating the type of set/reset command to be issued:

000000	**AutoFocus on/off**
000001	**Highlight on/off**
000011	**AutoShutter on/off**
000101	**BlockKeys on/off**
000010	**BlockFocus on/off**
000111	**Standby on/off**

S indicates the set bit. When this bit is set, the command will set the parameter, when cleared the command will clear the parameter, i.e. AutoZero on/off, AutoFocus on/off.

N indicates a bit which is not used in this mode (it may be either 0 or 1).

Byte 1: **(projector's address * 8) + (mode * 2) + 1**
Byte 2: **(command * 4) + 0 < Reset>** or
(command * 4) + 2 < Set>
Byte 3: **0**

For fast hex-coding of **byte 1** use the following table:

Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1
0	3	4	23	8	43	12	63
1	B	5	2B	9	4B	13	6B
2	13	6	33	10	53	14	73
3	1B	7	3B	11	5B	15	7B

Example:
Projector 1 in Standby mode:

Byte 1		Byte 2		Byte 3
Projector 1	**Set/Reset Mode**	**Command <Standby>**	**Set "On"**	not used
00001	01 1	000111	1 0	0
Hex- Code of byte 1-3				
0B		1E		00

or with formula:
Byte 1: (1 x 8) + (1 * 2) + 1 = 11 =bin00001011 =hexB
Byte 2: (7 * 4) + 2 = 30 =bin00011110 =hex1E
Byte 3: 0 =bin00000000 =hex00:

AutoFocus on/off

This command gives the possibility to switch on or off the AutoFocus functions. Please note, Block key commands must be set inactive! If not the default value is the projector switch setting!

HighLight on/off

This command enables you to increase the brightness of the lamp by approx. 20%. (This is possible due to a new improved cooling system in the projector.) If the command is sent, the red lamp failure LED will flash as an indication of HighLight operation. The lamp curve used up to now will be extended to a higher voltage.

> **Please note:**
> It is in the nature of physics that lamp average life will be **decreased**!
> Please do also note that the projector should not be operated at maximum ambient temperature (see specification in the projector`s manual).

AutoShutter on/off

With this command you can execute the transport cycle (including shutter open and shutter close) without moving the shutter.

AutoShutter off: After the input of this command, all following transport cycles will be executed without moving the shutter. The shutter stays in the present position (open or close).

AutoShutter on: After the input of this command, the complete transport cycle will be executed again. With the shutter open/close commands you can override this function. An AutoShutter-on command must be resent to set the standard transport cycle active. This is the default value.

BlockKeys on/off
With this command, the Timer, the AutoZero and the AutoFocus input signals from the projector keys will not be accepted! That means the connection between the function keys and the microprocessor is disconnected.

Tip
Although the block key command is set it is still possible to call for the position of the keys and the timerwheel. The information can then be used for further control (e.g. to control the room lights etc.).

The command is not active:
All input signals from other sources are accepted. For the Timer, AutoZero and AutoFocus function the projector key settings are valid. These values can not be changed by software. This is the default value.
The command is active:
No Timer or AutoZero or AutoFocus command from the projector´s keyboard is accepted. After the BlockKeys command is inactive again the above operations will be finished.

Block Focus on/off
This command gives the possibility to block the focus motor of the projector.

Block focus on
After the input of this command the focus motor is blocked. The signal cannot be overridden by any focus command neither from a remote nor from the keypad of the projector.

Block focus off
With this command the focus motor is activated again.

Standby on
The projector lamp and fan are switched off. The micro-processor is still active and stores the brightness value.
The following commands are accepted during standby on:

See also special note about control of former Ektapro models at page 37!

Standby off	SwitchLamp
ClearErrorFlags	AutoShutter on/off
ResetSystem	HighLight
SystemStatus	AutoFocus on/off
SystemReturn	BlockKeys
SystemReport	

Standby off
Projector and fan are switched on again. The stored brightness value will be set again.

Note:*If standby was set right after a reset, the lamp will stay dark with a following standby-off command.*

3.5 Direct mode

In this mode the three bytes are used as follows:

Byte 1		Byte 2		Byte 3
Projector No	Direct Mode	Command	Not used	
AAAAA	**10 1**	**CCCCCC**	**N 0**	**NNNNNNN 0**

AAAAA is the binary address of the projector.

CCCCCC is a binary command number indicating the type of direct command to be executed, i.e. tray forward, SlideLift up.

000000 **Slide forward**	00
000001 **Slide backward**	04
000010 **Focus forward**	08
000011 **Focus backward**	0C
000100 **Focus stop**	10
000111 **Shutter open**	1C
001000 **Shutter close**	20
001011 **Reset system**	2C
001100 **Switch lamp**	30
001101 **Clear error flags**	34
001111 **Stop fading**	3C

For fast **hex-**coding of **byte 2:**

N indicates a bit which is not used in this mode (it may be either 0 or 1).

Byte 1: **(projector's address * 8) + (mode * 2) + 1**
Byte 2: **(command * 4)**
Byte 3: **0**

For fast hex-coding of **byte 1** use following table.

Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1
0	5	4	25	8	45	12	65
1	D	5	2D	9	4D	13	6D
2	15	6	35	10	55	14	75
3	1D	7	3D	11	5D	15	7D

Example:
Open shutter of projector 2:

Byte 1		Byte 2		Byte 3
Projector 2	**Direct Mode**	**Command <Open Shutter>**	**not used**	
00010	10 1	000111	00	0
Hex- Code of byte 1-3				
15		1C		00

or with formula:
Byte 1: (2 * 8) + (2 * 2) + 1 = 21 =bin00010101 =hex15
Byte 2: (8 * 4) = 32 =bin00011100 =hex1C
Byte 3: 0 =bin00000000 =hex00

Slide forward:
Execution of the transport cycle in forward direction. The kind of transport depends on the command *AutoShutter*.

Slide backward:
Execution of the transport cycle in backward direction. The kind of transport depends on the command *AutoShutter*.

Focus forward:
The focus motor turns in one direction until the stop command is received.

Focus backward:
The focus motor turns the opposite direction until the stop command is given.

Focus stop:
Switch off of the focus motor.

Shutter open:
This command opens the shutter. If the Autoshutter is switched on, the shutter will first be opened after the transportcycle is complete - and if then should be no slide in the gate the shutter will **not** be opened.

Shutter closed:
The shutter will be closed independantly from the AutoShutter command.
ResetSystem:
With this command the **initialization cycle*** is executed and the keyboard settings are valid again. The default values are valid again.

Switch lamp:
An automatic lamp change is executed by this software command.
No lamp failure must have taken place.
If lamp 1 is active, the system will change to lamp 2 and vice versa.

Clear error flags:
With the clear error flags, command bits 0-3 (FE, BOE, OE, CE) are reset.
SME, TME and L1, L2 are not resetable. The command buffer is cleared after receiving this command.

StopFading (Freeze)
This command interrupts a fade command in progress. If there is no fade command executed in the moment the command will be ignored.

*The initialization cycle consists of system check and zero positioning of the tray.

3.5.1. Direct (User) Mode

In the Direct Mode we have reserved space for free use. New commands to control customer`s auxiliaries together with EKTAPRO Projectors can be created. Up to 64 auxiliary devices can be controlled. 128 different commands per device are possible.

Free definable commands

Byte 1		Byte 2	Byte 3
Device No	Direct Mode	Command	Not used
AAAAA	**10 1**	**1CCCCCCC**	**0000000 0**

AAAAA is the binary address of the user`s device.

1CCCCCCC is a binary command number indicating the type of the user free definable command. C may be either 0 or 1.

Note: The most significant bit (MSB) must be 1!

3.6 Status request mode

By issuing a status request command the device will return the status of the parameter asked for. The return code is always coded in three consecutive bytes.

Byte 1		Byte 2		Byte 3
Projector No	Status Request Mode	Command	Not used	
AAAAA	**11 1**	**CCCC**	**NNN 0**	**NNNNNNN 0**

AAAAA is the binary address of the projector.
CCCC is a binary number of following command codes:

1010 GetTray position **1011 GetKeys** **1100 System status** **1101 System return**	For fast **hex** coding of **byte 2**	**A0** **B0** **C0** **D0**

N indicates a bit which is not used in this mode (it may be either 0 or 1).

***Please note**:*
Commands, which expect a return value from the projector, cannot be used together with a group or a global address. Only one projector at a time can transmit. Otherwise transmission could result in a framing error and/or data mismatch.

Byte 1: **(projector's address * 8) + (mode * 2) + 1**
Byte 2: **(command * 16)**
Byte 3: **0**

For fast hex-coding of **byte 1** use the following table:

Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1	Proj. No.	HEX of Byte 1
0	7	4	27	8	47	12	67
1	F	5	2F	9	4F	13	6F
2	17	6	37	10	57	14	77
3	1F	7	3F	11	5F	15	7F

Example:
Projector 1 is asked for system status.

Byte 1		Byte 2		Byte 3
Projector 1	**Status Request Mode**	**Command <System Status>**	**not used**	
00001	11 1	1100	000 0	0000000 0
Hex- Code of byte 1-3				
0F		C0		00

or with formula:
Byte 1: (1 * 8) + (3 * 2) + 1 = 15 =bin00001111 =hex0F
Byte 2: (12 * 16) =192 =bin11000000 =hexC0
Byte 3: 0 =bin00000000 =hex00

Notes

GetTrayPosition

The projector transmits a **return value** with information about:

- *Slide in **G**ate*
- ***A**ctive lamp*
- ***S**tandby*
- ***H**igh Light*
- *Tray **P**osition*

Byte 1		Byte 2		Byte 3
Projector No	Status Request Mode	Command System Status	Parameter Field	
AAAAA	**11 1**	**1010**	**GASH**	**PPPP PPPP**

AAAAA is the binary code of the projector's address.

GASH PPPP PPPP is the 12 bit parameter field with the following information:

G = Slide in Gate
Flag = 1.
A slide has dropped into the gate
Flag = 0.
No slide is in the gate

A = Active lamp
Flag = 1.
Lamp 2 is in use.
Flag =0.
Lamp 1 is in use.

S = Standby
Flag = 1.
The projector tray is in standby (standby - on)
Flag = 0.
The projector tray is in operation (standby - off)

H = High Light
Flag = 1.
High Light mode is switched **on**
Flag = 0.
High Light mode is switched **off**

PPPP PPPP = Tray Position (0-80 or 140)
Example:
1001010 = Slide No. 74

GetKeys

The projector transmits a **return value** with information about:

- *Auto**F**ocus*
- *Auto**Z**ero*
- ***L**ow lamp*
- ***T**ray Size*
- *Timerwheel position*

Byte 1		**Byte 2**		**Byte 3**
Projector No	Status Request Mode	Command System Status	Parameter Field	
AAAAA	**11 1**	**1011**	**NNNN**	**FZLTtttt**

AAAAA is the binary code of the projector's address.

N indicates a bit which is not used (it can be either 0 or 1)

FZLTtttt is the 8 bit parameter field with the following information:

F = Autofocus
Flag = 1.
The autofocus is switched **on**.
Flag = 0.
The autofocus is switched **off**.

Z = AutoZero
Flag = 1.
The AutoZero is switched **on**.
Flag = 0.
The AutoZero is switched **off**.

L = Low Lamp
Flag = 1.
The lamp is switched into the economy mode (low lamp mode).
Flag =0.
The lamp is **not** switched into the economy mode (standard setting).

T = Tray Size
Flag = 1
A 140 slide tray is in use
Flag = 0
A 80 slide tray is in use

tttt = Timerwheel position
The position of the timerwheel is indicated with these four bits.
It is expressed in 12 positions ranging from 0 (timer is set to 1 second) to 11 (timer is in the OFF position).
Note:
Some older projectors without a timer will show the 0-Position!

Returned binary value tttt	Corresponding decimal value	Corresponding timerwheel position
0000	0	1 sec
0001	1	2 sec
0010	2	3 sec
0011	3	5 sec
0100	4	5 sec
0101	5	8 sec*
0110	6	10 sec
0111	7	20 sec*
1000	8	30 sec
1001	9	45 sec*
1010	10	60 sec
1011	11	OFF

* These values are unmarked interim values

SystemStatus

The projector transmits a **return value** with information about:

- errors
- zero position
- busy/ready

Byte 1		Byte 2		Byte 3
Projector No	Status Request Mode	Command System Status	Parameter Field	
AAAAA	**11 0**	**1100**	**XXXX**	**XXXXXX 11**

AAAAA is the binary code of the projector's address.

XXXX XXXXXX is the 10 bit parameter field with the following information:

9	8	7	6	5	4	3	2	1	0	bit
L1	L2	B/R	ZP	SME	TME	CE	OE	BOE	FE	Flags

L1 and L2 = Lamp Status
Flag = 1
Lamp 1 or lamp 2 is defect.
Flag = 0
Lamp 1 or lamp 2 is o.k..

B/R = Projector Status:
Flag = 1.
The projector is still busy. At the moment, it can not execute a new command. It can receive, if the 15 byte buffer is not full.
Flag =0.
The projector is ready to execute a new command.

ZP = Zero Position:
Flag = 1.
The projector tray is in the zero position
Flag = 0.
The projector tray is not in the zero position.
SME = Slide Lift Motor Error

TME = Tray Transport Motor Error:
Flag = 1.
The motors are controlled during operation and switched off in case of mechanical blocking in order to prevent overheating.
After setting the flag, the projector will be inactive -the power LED is blinking- and accepts no further commands except the SystemStatus command.
After removal of the error the projector must be reset by starting it again.
Flag = 0.
No motor error.

CE = Command Error:
This error occurs, if the projector reads an unknown command in the input buffer.

OE = Overrun Error:
Flag = 1.
A byte was sent to the projector, before the device has finished reading the last byte.
Flag = 0.
No overrun error.

BOE = Buffer Overflow Error:
Flag = 1.
The internal device command buffer is 15 bytes long. This error occurs, if the internal buffer is completely full with received commands and a new command is sent before the device was able to execute the commands in the buffer.
After setting the flag in the status byte, no further commands will be accepted.
As soon as the storage space is available the flag is deleted.
Flag = 0.
No buffer overflow error.

FE = Framing Error:
Flag = 1.
A framing error occurs, when the specified baud rate or data format is not used.
The projector must be reset by starting it again or using the Clear Error Flag command.
Flag = 0.
No framing error.

System Return

Byte 1		Byte 2		Byte 3	Byte 4	Byte 5
Projector No	Status Request Mode	System Return	Parameter Field			
AAAA	**11 0**	**1101**	**XXX 0**	**TTTT VVVV**	**VVVV VVVV**	**PFZL TASH**

The parameter field shows system information. The projector sends a set of **5** consecutive bytes with the following structure:
AAAAA is the projector that was asked.

TTTT is the type of projector

Projector	TTTT
4010	0111*
4020	0100
5000	0101
5020	0110
7000	0111
7010	1000
7020	1000
9000	1001
9010	1010
9020	1010

* This model has same software as EKTAPRO 7000.Therefore both models are of same identification.

VVVV VVVV VVVV is the software version (3 BCD coding).

Example: Version 2.31: **0010 0011 0001**

PFZL TASH is a 8 bit parameter field containing the following information:

P = Power frequency (Hertz):
Flag = 1
60 Hz
Flag = 0
50 Hertz

F = Autofocus:
Flag = 1.
The autofocus is switched on.*
Flag = 0.
The autofocus is switched off.
Note*: *The flag is also set if a projector is used **without autofocus!*

Z = Autozero
Flag = 1.
The autozero is switched on*
Flag = 0.
The autozero is switched off.
Note*: The flag is also set if a projector is used **without autozero function!*

L = Low Lamp:
Flag = 1.
The lamp is switched into economy mode.
Flag = 0.
The lamp is switched into standard mode.

T = Tray Size:
Flag = 1.
140 tray in use
Flag = 0.
80 tray in use

A = Active Lamp:
Flag = 1.
Lamp 1 (L2) is in use.
Flag = 0.
Lamp 1 (L1) is in use.

S = Standby
Flag = 1.
The projector is switched into the standby mode.
Flag = 0.
The projector is in operation mode (standby off).

H = High Light:
Flag = 1.
The lamp is switched to High Light.
Flag = 0.
The lamp is run in standard mode (High Light off).

***Note**: We recommend to use the GetKeys and SlidePosition commands to receive the above information (not Power frequency)! If information is asked too fast by using the System Return, a data overflow may result.*

3.7 Table of all P-COM Commands

In the following you will find an overview of all P-COM Commands as previously written. The table contains also the information.

- if a command is buffered (in a 5 command buffer)(non buffered commands will be immediately executed)
- if the commands are executed when projector is in standby
- if the command is influencing the busy state
- if the command is executed when projector indicates operating error (jam)

command	command binary	mode	mode binary	buffered	sets busy flag	executed when projector is in stand-by	executed when projector indicates jam
RandomAccess	0000	parameter	00	yes	yes	no	no
SetBrightness	0001	parameter	00	no	no	no	yes
GroupAddress	0011	parameter	00	no	no	no	yes
FadeUP/Down	0110	parameter	00	yes	no	no	yes
SetFadeLimit High Value	1000	parameter	00	yes	no	no	yes
SetFadeLimit	0111	parameter	00	yes	no	no	yes
AutoFocus	0000	set/reset	01	yes	no	no	no
HighLight	0001	set/reset	01	yes	no	no	no
AutoShutter	0011	set/reset	01	yes	no	no	no
BlockKeys on/off	0101	set/reset	01	yes	no	no	no
BlockFocus	0010	set/reset	01	yes	no	no	no
Standby on/off*	0111	set/reset	01	yes	no	no	no
SlideForward	0000	direct	10	yes	yes	no	no
SlideBackward	0001	direct	10	yes	yes	no	no
FocusForward*	0010	direct	10	yes	yes	no	no
FocusBackward*	0011	direct	10	yes	yes	no	no
FocusStop*	0100	direct	10	yes	yes	no	no
ShutterOpen	0111	direct	10	no	no	no	yes
ShutterClose	1000	direct	10	no	no	no	yes
ResetSystem	1011	direct	10	yes	yes	yes	no
SwitchLamp	1100	direct	10	yes	no	yes	no
ClearErrorFlags	1101	direct	10	yes	no	yes	no
StopFading	1111	direct	10	yes	no	no	no
GetTrayPosition	1010	status	11	yes	no	yes	no
GetKeys	1011	status	11	yes	no	yes	no
SystemStatus	1100	status	11	no	no	yes	yes
SystemReturn	1101	status	11	yes	yes	yes	no

* The command needs time for execution

3.8 Projector models and their commands

According to model changing and different features not all commands can be used for all models. The following list gives you the allocation.

command	Valid for the following EKTAPRO Models									
	4010	4020	5000	5020	7000	7010	7020	9000	9010	9020
RandomAccess	X	X	X	X	X	X	X	X	X	X
SetBrightness	X	X	X	X	X	X	X	X	X	X
GroupAddress	X	X	X	X	X	X	X	X	X	X
FadeUP/Down						X	X		X	X
SetFadeLimit High Value						X	X		X	X
SetFadeLimit Low						X	X		X	X
AutoFocus ON/OFF			X	X				X	X	X
HighLight ON/OFF						X	X		X	X
AutoShutter On/OFF	X	X	X	X	X	X	X	X	X	X
BlockKeys on/off	X	X	X	X	X	X	X	X	X	X
BlockFocus on/off		X		X		X	X		X	X
Standby on/off	X	X	X	X	X	X	X	X	X	X
SlideForward	X	X	X	X	X	X	X	X	X	X
SlideBackward	X	X	X	X	X	X	X	X	X	X
FocusForward	X	X	X	X	X	X	X	X	X	X
FocusBackward	X	X	X	X	X	X	X	X	X	X
FocusStop	X	X	X	X	X	X	X	X	X	X
ShutterOpen	X	X	X	X	X	X	X	X	X	X
ShutterClose	X	X	X	X	X	X	X	X	X	X
ResetSystem	X	X	X	X	X	X	X	X	X	X
SwitchLamp	X	X	X	X	X	X	X	X	X	X
ClearErrorFlags	X	X	X	X	X	X	X	X	X	X
StopFading						X	X		X	X
GetTrayPosition		X		X		X	X		X	X
GetKeys		X		X		X	X		X	X
SystemStatus	X	X	X	X	X	X	X	X	X	X
SystemReturn	X	X	X	X	X	X	X	X	X	X

3.8 Hex -Table of Byte 1 for all modes

This table will give you the Hex codes of Byte 1 for all Modes.

Hex Code of Byte 1				
Address	**Parameter Mode**	**Set/Reset Mode**	**Direct Mode**	**Status Request Mode**
0	1	3	5	7
1	9	B	D	F
2	11	13	15	17
3	19	1B	1D	1F
4	21	23	25	27
5	29	2B	2D	2F
6	31	33	35	37
7	39	3B	3D	3F
8	41	43	45	47
9	49	4B	4D	4F
10	51	53	55	57
11	59	5B	5D	5F
12	61	63	65	67
13	69	6B	6D	6F
14	71	73	75	77
15	79	7B	7D	7F

4 Appendix

4.1. Slot card identification

Slot cards are identified with a 3 bit address.

ADDRESS	FUNCTION
0	12/7 pin adapter (backwards compatibility)
1	reserved for future use
2	reserved for future use
3	serial card with 9600 baud
4	serial card with 4800 baud
5	serial card with 2400 baud
6	serial card with 1200 baud
7	no card installed

Appendix

4.2. Controlling KODAK EKTAPRO 4020, 5020, 7020, 9020 Slide Projectors with P-COM Command „Standby-on“

General

After switching on (and RESET) the **lamp** and the **fan** of the former models 4010, 5000, 7000, 7010, 9000 and 9010 are **active**.

The new models 4020, 5020, 7020 and 9020 show a different behaviour:
The **lamp** and **fan** are switched **off!** With a next strike on the transport or standby button the projector will “wake up”, fan and lamp are activated. Advantage: The projectors stay quiet (sleeping mode)

P-COM Control
Please keep this difference in mind when programming Ektapro projectors!
In order to keep projectors “silent” till the moment they are needed, many producers sent a standby-on command right after the reset (switching on) of the system.

The new models 4020, 5020, 7020 and 9020 show same behaviour as if they were controlled via keyboard buttons. **After sending a standby-on command the projector will wake up!**

Solution for all Ektapro models

- If you control **both** new and old models:
  In any case send **two** standby-on commands right after **switching on** or **reset**.
  Now **all** projectors are in standby!

Alternatives

- Only for **former** Ektapro models (4010, 5000, 7000, 7010, 9000 and 9010):
  Go on sending the standby-on command after the reset to keep projectors silent.

- Only for **new** Ektapro models (4020, 5020, 7020 and 9020):
  Do not send a standby-on command after the reset command! The projectors already are in the “silent” mode.

4.3 Binary - Hex Table 0 -15

Dec	Binary	HEX
0	00000	0
1	00001	1
2	00010	2
3	00011	3
4	00100	4
5	00101	5
6	00110	6
7	00111	7
8	01000	8
9	01001	9
10	01010	A
11	01011	B
12	01100	C
13	01101	D
14	01110	E
15	01111	F