PJLink Specifications

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1. Overview

As the demand for projectors increases with the popularization of personal computers, many manufacturers have branched out into projector markets.
With the recent diversification of digital media and growth of IP networks, projectors with a higher utility value, namely support for networks, are now on the market.
Network-ready projectors provide significant convenience for users: the constraints of placement location and distance are relaxed and it is possible to control and monitor more than one projector at once.
However, the convenience can be impaired by differences among manufacturers in control system configuration and command type. Projector control software provided by a specific manufacturer can be used only for projectors manufactured by the same manufacturer and would be useless in a large-scale system where multiple projectors with different control systems and command types are to be controlled/monitored simultaneously. Some users have independently developed very complicated control software.

In order to eliminate such inconvenience and to promote network-ready projectors, JBMIA has been working on the standardization of protocol used for controlling projectors. Thus, a standard protocol for projectors, “PJLink”, was designed.
“PJLink” defines the following:
- Procedures for connection to projector via network
- Security
- Control command form

It will be possible to control/monitor projectors of different manufacturers or models with single-application software if the projectors support “PJLink” a standard protocol for controlling projectors. As a result, user convenience will be greatly improved. Especially, the time and cost for introducing projectors as part of a system would be reduced, encouraging large-scale introduction of projectors into firms and organizations.

This specification defines only Class 1 which performs the fundamental control of projectors.
In addition, in PJLink other classes according to functions and applications should be defined one by one.

This document was prepared to complement Japanese document and the Japanese document have a priority to any contents of this document.

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2. Command Format

2.1. Command line

The structure of a PJLINK command line is as follows:

Header + Class	Command body	Separator (Space)	Transmission parameter	Terminator (CR)
2 bytes	4 bytes	1 byte	128 bytes or less	1 byte

All PJLINK command lines, without exception, start with '%'.

Added to the PJLINK header '%' is a 1-byte ASCII numeric character that shows the PJLINK class. As these draft specifications define Class 1, "1" is added accordingly.

The command body is a 4-byte fixed-length string predetermined for each command.

The separator separates the command body from the transmission parameter. In command lines, a blank character (space: 0x20) is always used as the separator.

The transmission parameter is a variable-length string that can contain up to 128 bytes.

All command lines end with a terminator (carriage return code (CR): 0x0d).

The command body is case-insensitive. The transmission parameter may be case-sensitive when treated as an arbitrary string in accordance with the specifications of each command.

2.2. Response line

The structure of a response to a PJLINK command (hereinafter, simply "response") is as follows:

Header + Class	Command body	Separator (=)	Response parameter	Terminator (CR)
2 bytes	4 bytes	1 byte	128 bytes or less	1 byte

The header and class of a response are the same as those of a command.

The command body contains the entire command line received by the projector.

The separator separates the command body from the response parameter. Unlike in the case of a command, '=' (equal: 0x3d) is always used for the separator of a response.

The response parameter contains the description of the response to the command. The parameter is a variable-length string that can contain up to 128 bytes.

All responses end with a terminator (carriage return code (CR): 0x0d).

The command body is case-insensitive. The response parameter may be case-sensitive when treated as an arbitrary string in accordance with the specifications of each command.

2.3. Set commands

Commands fall into two broad categories: set command and get command.

Set commands are for operating the projector and changing the settings of the projector.

The parameter of a set command contains setting descriptions defined by the command.

The response parameter of a response to a set command generally contains any of the following response codes. Detailed specifications of each command are given in Chapter 4.

The undefined command (ERR1) will be returned when received the unsupported commands by projectors.

Definitions	Response codes
Successful execution	OK
Undefined command	ERR1
Out of parameter	ERR2
Unavailable time	ERR3
Projector failure	ERR4

2.4. Get commands

The get command is used to obtain the current setting information of and data saved in the projector.

The parameter part of a get command contains the '?' character, which identifies itself as a get command.

If the obtainment of info/data by the get command is successfully completed, the corresponding values are saved into the parameter part of the response based on the specifications of each command.

If the get command fails, generally any of the response codes listed below will be saved into the parameter part of the response. Detailed specifications of each command are given in Chapter 4.

If the command cannot be received when stand-by, the same error response as Unavailable Time will be returned. Detail information can be obtained from specifications of each projector.

The undefined command (ERR1) will be returned when received the unsupported commands by projectors.

Definitions	Response codes
Undefined command	ERR1
Unavailable time	ERR3
Projector failure	ERR4

2.5. Format

■Set command

1 byte	1 byte	4 bytes	1 byte	Variable length	1 byte
%	Class	Command	Space	Transmission parameter	Carriage return code (CR)

[Successful execution] response

1 byte	1 byte	4 bytes	1 byte	2 bytes	1 byte
%	Class	Command	=	OK	Carriage return code (CR)

[Undefined command] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR1	Carriage return code (CR)

[Out of parameter] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR2	Carriage return code (CR)

[Unavailable time] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR3	Carriage return code (CR)

[Projector failure] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR4	Carriage return code (CR)

■Get command

1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte
%	Class	Command	Space	?	Carriage return code (CR)

[Successful execution] response

1 byte	1 byte	4 bytes	1 byte	Variable length	1 byte
%	Class	Command	=	Response parameter	Carriage return code (CR)

[Undefined command] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR1	Carriage return code (CR)

[Unavailable time] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR3	Carriage return code (CR)

[Projector failure] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR4	Carriage return code (CR)

3. Protocol

The TCP/IP protocol is used for communication between the adaptable projector and the controlling PC.

The projector is set as the server and the CONTROLLER as the client. In other words, establishment and termination of communication are determined by the client CONTROLLER (hereinafter, “CONTROLLER”).

Port name pjlink	TCP 4352 port

To operate multiple projectors, the CONTROLLER creates a TCP/IP session per projector. The CONTROLLER identifies each projector by its IP address.

The CONTROLLER controls the projector by sending PJLINK commands. Upon receiving a command, the projector returns a predetermined PJLINK response. Such sending and response attains the smallest unit of controlling communication. Details of PJLINK commands and the responses to them are given in Chapter 4.

4. Command Descriptions

4.1. Power control instruction POWR

Power-on (lamp-on) instruction

Character code in hexadecimal	25	31	50	4f	57	52	20	31	0d
Character	%	1	P	O	W	R	(SP)	1	(CR)

Power-off (standby) instruction

Character code in hexadecimal	25	31	50	4f	57	52	20	30	0d
Character	%	1	P	O	W	R	(SP)	0	(CR)

Response

Successful execution (including power-on instruction under power-on status and power-off instruction under power-off status)

Character code in hexadecimal	25	31	50	4f	57	52	3d	4f	4b	0d
Character	%	1	P	O	W	R	=	O	K	(CR)

Out-of-parameter

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	32	0d
Character	%	1	P	O	W	R	=	E	R	R	2	(CR)

Unavailable time

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	33	0d
Character	%	1	P	O	W	R	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	34	0d
Character	%	1	P	O	W	R	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.2. Power status query POWR ?

Power status query

Character code in hexadecimal	25	31	50	4f	57	52	20	3f	0d
Character	%	1	P	O	W	R	(SP)	?	(CR)

Response

Power-off (standby) status

Character code in hexadecimal	25	31	50	4f	57	52	3d	30	0d
Character	%	1	P	O	W	R	=	0	(CR)

Power-on (lamp-on) status

Character code in hexadecimal	25	31	50	4f	57	52	3d	31	0d
Character	%	1	P	O	W	R	=	1	(CR)

Cooling status

Character code in hexadecimal	25	31	50	4f	57	52	3d	31	0d
Character	%	1	P	O	W	R	=	2	(CR)

Warm-up status

Character code in hexadecimal	25	31	50	4f	57	52	3d	30	0d
Character	%	1	P	O	W	R	=	3	(CR)

Unavailable time

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	33	0d
Character	%	1	P	O	W	R	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	34	0d
Character	%	1	P	O	W	R	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.3. Input switch instruction INPT

Instruction to switch input to RGB

Character code in hexadecimal	25	31	49	4e	50	54	20	31	*1	0d
Character	%	1	I	N	P	T	(SP)	1	*2	(CR)
*1: values 31–39 *2: values 1–9										

Instruction to switch input to VIDEO

Character code in hexadecimal	25	31	49	4e	50	54	20	32	*1	0d
Character	%	1	I	N	P	T	(SP)	2	*2	(CR)
*1: values 31–39 *2: values 1–9										

Instruction to switch input to DIGITAL

Character code in hexadecimal	25	31	49	4e	50	54	20	33	*1	0d
Character	%	1	I	N	P	T	(SP)	3	*2	(CR)
*1: values 31–39 *2: values 1–9										

Instruction to switch input to STORAGE

Character code in hexadecimal	25	31	49	4e	50	54	20	34	*1	0d
Character	%	1	I	N	P	T	(SP)	4	*2	(CR)
*1: values 31–39 *2: values 1–9										

Instruction to switch input to NETWORK

Character code in hexadecimal	25	31	49	4e	50	54	20	35	*1	0d
Character	%	1	I	N	P	T	(SP)	5	*2	(CR)
*1: values 31–39 *2: values 1–9										

Response

Successful execution

Character code in hexadecimal	25	31	49	4e	50	54	3d	4f	4b	0d
Character	%	1	I	N	P	T	=	O	K	(CR)

Nonexistent input source

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	32	0d
Character	%	1	I	N	P	T	=	E	R	R	2	(CR)

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	33	0d
Character	%	1	I	N	P	T	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	34	0d
Character	%	1	I	N	P	T	=	E	R	R	4	(CR)

* Commands are case-insensitive.

4.4. Input switch query INPT ?

Input selection query

Character code in hexadecimal	25	31	49	4e	50	54	20	3f	0d
Character	%	1	I	N	P	T	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	49	4e	50	54	3d	*1	*2	0d
Character	%	1	I	N	P	T	=	*3		(CR)
*1: values 31–35 *2: values 31–39 *3: values 11–59										

Unavailable time (input switch underway, standby, etc.)

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	33	0d
Character	%	1	I	N	P	T	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	34	0d
Character	%	1	I	N	P	T	=	E	R	R	4	(CR)

* Commands are case-insensitive.

4.5. Mute instruction AVMT

Video mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	31	31	0d
Character	%	1	A	V	M	T	(SP)	1	1	(CR)

Video mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	31	30	0d
Character	%	1	A	V	M	T	(SP)	1	0	(CR)

Audio mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	32	31	0d
Character	%	1	A	V	M	T	(SP)	2	1	(CR)

Audio mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	32	30	0d
Character	%	1	A	V	M	T	(SP)	2	0	(CR)

Video and audio mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	33	31	0d
Character	%	1	A	V	M	T	(SP)	3	1	(CR)

Video and audio mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	33	30	0d
Character	%	1	A	V	M	T	(SP)	3	0	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	41	56	4d	54	3d	4f	4b	0d
Character	%	1	A	V	M	T	=	O	K	(CR)

Out-of-parameter

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	32	0d
Character	%	1	A	V	M	T	=	E	R	R	2	(CR)

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	33	0d
Character	%	1	A	V	M	T	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	34	0d
Character	%	1	A	V	M	T	=	E	R	R	4	(CR)

*Commands are case-insensitive.

In addition, “ERR2”(Out-of-parameter) will be returned if the mute ON/OFF instruction of audio/video-only has been specified towards the product without audio/video-only mute function.

4.6. Mute status query AVMT ?

Video mute instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	3f	0d
Character	%	1	A	V	M	T	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	41	56	4d	54	3d	*1	*2	0d
Character	%	1	A	V	M	T	=	*3		(CR)

*1 Values 31– 33 *2: values 30–31

*3

Video mute ON: 11

Audio mute ON: 21

Video and audio mute ON: 31 (models without audio function included)

Video and audio mute OFF: 30

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	33	0d
Character	%	1	A	V	M	T	=	E	R	R	3	(CR)

Projector failure

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	34	0d
Character	%	1	A	V	M	T	=	E	R	R	4	(CR)

* Commands are case-insensitive.

4.7. Error status query ERST ?

Error status query

Character code in hexadecimal	25	31	45	52	53	54	20	3f	0d
Character	%	1	E	R	S	T	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	45	52	53	54	3d							0d
Character	%	1	E	R	S	T	=	*1	*2	*3	*4	*5	*6	(CR)

*1 Fan error; any of 0–2
*2 Lamp error; any of 0–2
*3 Temperature error; any of 0–2
*4 Cover open error; any of 0–2
*5 Filter error; any of 0–2
*6 Other errors; any of 0–2

0: No error detected or no error detecting function
1: Warning
2: Error

Unavailable time (lamp ignition underway, etc.)

Character code in hexadecimal	25	31	45	52	53	54	3d	45	52	52	33	0d
Character	%	1	E	R	S	T	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	45	52	53	54	3d	45	52	52	34	0d
Character	%	1	E	R	S	T	=	E	R	R	4	(CR)

* Commands are case-insensitive.

4.8. Lamp number/ lighting hour query LAMP ?

Lamp number and lighting hour query

Character code in hexadecimal	25	31	4c	41	4d	50	20	3f	0d
Character	%	1	L	A	M	P	(SP)	?	(CR)

Response

Projector with one lamp

Character code in hexadecimal	25	31	4c	41	4d	50	3d		• • •	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		0d
Character	(SP)	*2	(CR)

*1 Cumulative lighting time of the lamp: 0–99999 (variable length of one- to five-digit number)
*2 Lamp turned on: 1 Lamp turned off: 0

Projector with two lamps

Character code in hexadecimal	25	31	4c	41	4d	50	3d		• • •	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		20		• • •		20		0d
Character	(SP)	*2	(SP)	*3			(SP)	*4	(CR)

*1 Cumulative lighting time of lamp 1: 0–99999 (variable length of one- to five-digit number)
*2 Lamp 1 turned on: 1 Lamp 1 turned off: 0
*3 Cumulative lighting time of lamp 2: 0–99999 (variable length of one- to five-digit number)
*4 Lamp 2 turned on: 1 Lamp 2 turned off: 0

Projector with n lamps

Character code in hexadecimal	25	31	4c	41	4d	50	3d		• • •	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		20		• • •		20		20		• • •	
Character	(SP)	*2	(SP)	*3			(SP)	*4	(SP)	• • •		

Character code in hexadecimal		20		• • •		20		0d
Character	• • •	(SP)	*n			(SP)	*m	(CR)

*1 Cumulative lighting time of lamp 1: 0–99999 (variable length of a one- to five-digit number)
*2 Lamp 1 turned on: 1 Lamp 1 turned off: 0
*3 Cumulative lighting time of lamp 2: 0–99999 (variable length of a one- to five-digit number)
*4 Lamp 2 turned on: 1 Lamp 2 turned off: 0
• • •
*n Cumulative lighting time of lamp n: 0–99999 (variable length of a one- to five-digit number)
*m Lamp n turned on: 1 Lamp n turned off: 0
Maximum value of n is 8. Maximum length of the parameter is [1 + 8 x n = 65] bytes.

* Cumulative lighting time of lamp is always 0 when it is not counted by the projector.

Unavailable time for any reason

Character code in hexadecimal	25	31	4c	41	4d	50	3d	45	52	52	33	0d
Character	%	1	L	A	M	P	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	4c	41	4d	50	3d	45	52	52	34	0d
Character	%	1	L	A	M	P	=	E	R	R	4	(CR)

4.9. Input toggling list query INST ?

Input toggling list query

Character code in hexadecimal	25	31	49	4e	53	54	20	3f	0d
Character	%	1	I	N	S	T	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	53	54	3d
Character	%	1	I	N	S	T	=

Character code in hexadecimal			20				20			0d
Character	*1		(SP)	*2		• • •	(SP)	*n		(CR)

*1 Number of the first input source available: 11–59
*2 Number of the second input source available: 11–59
• • •
*n Number of the n-th input source available: 11–59
Maximum value of n is 50. Maximum length of the parameter is 95bytes

Unavailable time for any reason, such as being on standby

Character code in hexadecimal	25	31	49	4e	53	54	3d	45	52	52	33	0d
Character	%	1	I	N	S	T	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	49	4e	53	54	3d	45	52	52	34	0d
Character	%	1	I	N	S	T	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.10. Projector name query NAME ?

Projector name query

Character code in hexadecimal	25	31	4e	41	4d	45	20	3f	0d
Character	%	1	N	A	M	E	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	4e	41	4d	45	3d
Character	%	1	N	A	M	E	=

Character code in hexadecimal	*1	*2	• • •	• • •	• • •	• • •	• • •	• • •	*n	0d
Character			• • •	• • •	• • •	• • •	• • •	• • •		(CR)

*1 Any character (20 to ff in hexadecimal)
*2 Any character (20 to ff in hexadecimal)
• • •
*n Any character (20 to ff in hexadecimal)
It is necessary to use UTF-8 for the character code set.
The value of n is 0–64
If there is no projector name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	4e	41	4d	45	3d	45	52	52	33	0d
Character	%	1	N	A	M	E	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	4e	41	4d	45	3d	45	52	52	34	0d
Character	%	1	N	A	M	E	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.11. Manufacture name information query INF1 ?

Manufacture name information query

Character code in hexadecimal	25	31	49	4e	46	31	20	3f	0d
Character	%	1	I	N	F	1	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	31	3d
Character	%	1	I	N	F	1	=

Character code in hexadecimal	*1	*2	• • •	• • •	• • •	• • •	• • •	• • •	*n	0d
Character			• • •	• • •	• • •	• • •	• • •	• • •		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
• • •
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
If there is no manufacture name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	31	3d	45	52	52	33	0d
Character	%	1	I	N	F	1	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	49	4e	46	31	3d	45	52	52	34	0d
Character	%	1	I	N	F	1	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.12. Product name information query INF2 ?

Product name information query

Character code in hexadecimal	25	31	49	4e	46	32	20	3f	0d
Character	%	1	I	N	F	2	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	32	3d						
Character	%	1	I	N	F	2	=						
Character code in hexadecimal	*1	*2	• • •	• • •	• • •	• • •	• • •	• • •	*n	0d
Character			• • •	• • •	• • •	• • •	• • •	• • •		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
• • •
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
If there is no product name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	32	3d	45	52	52	33	0d
Character	%	1	I	N	F	2	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	49	4e	46	32	3d	45	52	52	34	0d
Character	%	1	I	N	F	2	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.13. Other information query INFO ?

Other information query

Character code in hexadecimal	25	31	49	4e	46	4f	20	3f	0d
Character	%	1	I	N	F	O	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	4f	3d
Character	%	1	I	N	F	O	=

Character code in hexadecimal	*1	*2	• • •	• • •	• • •	• • •	• • •	• • •	*n	0d
Character			• • •	• • •	• • •	• • •	• • •	• • •		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
• • •
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
Other information of the projector described by the manufacture.
If there is no model information, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	4f	3d	45	52	52	33	0d
Character	%	1	I	N	F	O	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	49	4e	46	4f	3d	45	52	52	34	0d
Character	%	1	I	N	F	O	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.14. Class information query CLSS ?

Class information query

Character code in hexadecimal	25	31	43	4c	53	53	20	3f	0d
Character	%	1	C	L	S	S	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	43	4c	53	53	3d	*1	0d
Character	%	1	C	L	S	S	=	*2	(CR)

Class-2-compatible projector
*1: 32
*2: 2
Class-2-incompatible projector
*1: 31
*2: 1

Unavailable time for any reason

Character code in hexadecimal	25	31	43	4c	53	53	3d	45	52	52	33	0d
Character	%	1	C	L	S	S	=	E	R	R	3	(CR)

Projector failure with no error status returned

Character code in hexadecimal	25	31	43	4c	53	53	3d	45	52	52	34	0d
Character	%	1	C	L	S	S	=	E	R	R	4	(CR)

*Commands are case-insensitive.

5. Authentication

5.1. Authentication procedure

To enter into communication with each other using PJLINK commands, both the projector and the CONTROLLER must carry out the authentication procedure in advance. The method used for skipping the authentication procedure is explained in Chapter 5.2.
An authentication procedure is executed once after each establishment of TCP/IP connection. Without passing through the authentication procedure, the projector will not accept PJLINK commands and subsequent operations.
The authentication procedure involves a password verification process. A password message sent to the network will be converted into a 32-byte encrypted message with a random number assigned by the projector, and the MD5 algorithm.

The password and other parameters to be used in authentication must meet the following requirements:

Parameter	Requirement
Password	32 or fewer ASCII alphanumeric characters
Random numbers	4-byte integer numbers (8 ASCII lowercase characters in hexadecimal notation)
Encrypted message	32-byte ASCII string

The steps of the authentication procedure are as follows:

1. The CONTROLLER connects to the projector.
2. The projector returns a response in the form of (1-1). The response includes the header 'PJLINK', a '1' indicating authentication procedure, and a random number sequence.
3. After receiving the response, the CONTROLLER transmits a PJLINK command line, at the beginning of which the encrypted password is presented in the form of (1-2). The encryption procedure is described in (1-3).
4. The projector verifies the received encrypted password against the password encrypted by the projector itself. If verified, it will be able to receive PJLINK commands in the TCP/IP session. If the projector fails to receive the password within 30 seconds after the (1-1) response transmission, the projector forcibly terminates the connection through the timeout procedure and returns to a standby state.
5. If the password is verified, the projector sends a response to the PJLINK command, and keeps the TCP session alive. If the password is invalid, the projector will send an error response in the form of (1-4) to the CONTROLLER and will wait until the CONTROLLER terminates the connection. If the CONTROLLER fails to disconnect, the projector will automatically terminate the connection 30 seconds after sending the error response.

The following are examples using the password and random number:

Password	JBMIAProjectorLink
Random number	0x498e4a67

(1-1) Response from the projector

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	31	20	34	39	38	65	34	61	36	37	0d
Character	P	J	L	I	N	K		1		4	9	8	e	4	a	6	7	(CR)

(1-2) Encrypted password

Character code in hexadecimal	35	64	38	34	30	39	62	63	31	63	33	66	61	33	39	37
Character	5	d	8	4	0	9	b	c	1	c	3	f	a	3	9	7

34	39	34	33	34	61	61	33	61	35	63	33	38	36	38	32
4	9	4	3	4	a	a	3	a	5	c	3	8	6	8	2

25	31	50	4f	57	52	20	31	0d
%	1	P	O	W	R		1	(CR)

(1-3) Encryption procedure

The password string “JBMIAProjectorLink” is added to the end of the random sequence “498e4a67” issued by the projector. The digest of the resultant string “498e4a67 JBMIAProjectorLink” is carried out with the MD5 algorithm.

In hexadecimal notation, the result will be “5d8409bc1c3fa39749434aa3a5c38682”.

(1-4) Invalid password error message

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	45	52	52	41	0d
Character	P	J	L	I	N	K		E	R	R	A	(CR)

ERRA represents ERR or Authorization)

Note that in the PJLINK authentication procedure the password and the first command are transmitted at the same time.

The resultant data to be sent is as shown in (1-2). When the projector receives the data shown in (1-2), it checks only the first 32 bytes for password verification. If the password is verified, the projector accepts the 33rd byte and the following bytes as a PJLINK command. If the password is invalid, it will send an invalid password error message in the form shown in (1-4) and ignore the 33rd and following bytes.

5.2. No authentication procedure (Security nullification)

The password authentication procedure may be skipped upon such user setting (security nullification).

If the projector does not have a password saved or the security function of the projector is turned off, the projector transmits (1-5) as the first response after communication. Upon receipt of this response, the CONTROLLER skips the authentication procedure. Also, the CONTROLLER can transmit the first PJLINK command without adding an encrypted password.

Note that in the case of no random number issued by the projector, the execution of user authentication is disabled.

(1-5) Response from projector (security OFF)

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	30	0d
Character	P	J	L	I	N	K		0	(CR)

5.3. Continuous command transmissions on the same connection

The CONTROLLER is able to transmit PJLINK commands continuously within 30 seconds after the transmission of the projector's last response, as long as the TCP connection is alive. The CONTROLLER can transmit a command any number of times within 30 seconds after transmission by the projector of each response to command.

However, if multiple commands are transmitted before receiving the projector's response, the projector's response to and execution of these commands are not guaranteed.

As for the transmission of the second or subsequent PJLINK commands, the encrypted password string to be presented to the command for the authentication procedure may be omitted, although there is no problem adding the encrypted password to the second or subsequent command transmission.

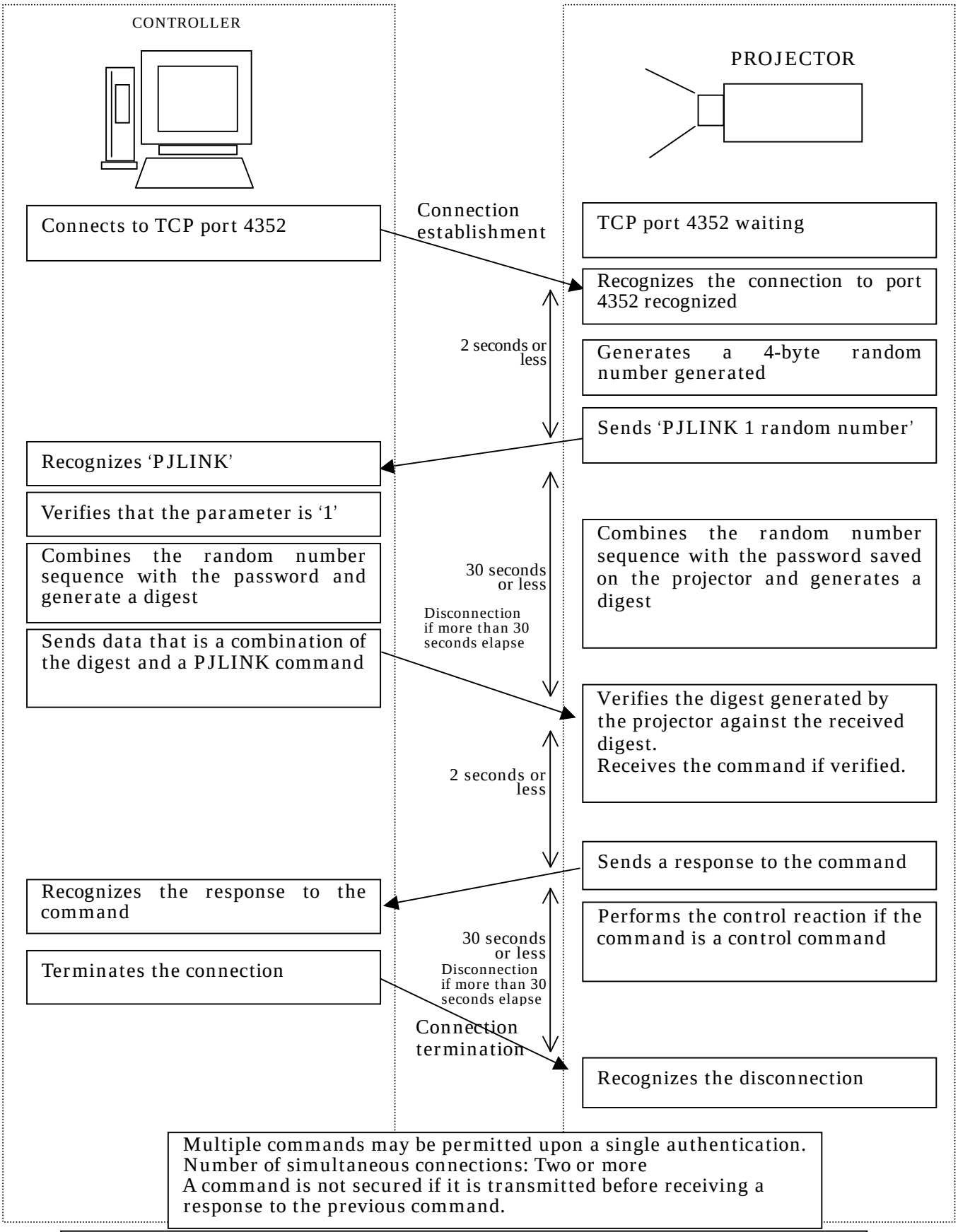
5.4. Disconnection

The CONTROLLER must terminate the TCP connection as soon as the required command transmission is completed. If somehow the CONTROLLER terminates the connection or the projector fails to receive a new PJLINK command within 30 seconds after the transmission of the projector's last response, the projector is to time out.

By timing out, the projector forcibly terminates the TCP connection, releases the resources, and returns to a standby state.

Examples of the connection sequence are shown in Figs. 1 to 3 below.

Fig. 1: Projector security is active】



The digest is obtained by applying the MD5 (Message Digest5) algorithm [RFC1321]

Fig. 2: Power ON with the projector's authentication procedure applied (Security ON)】

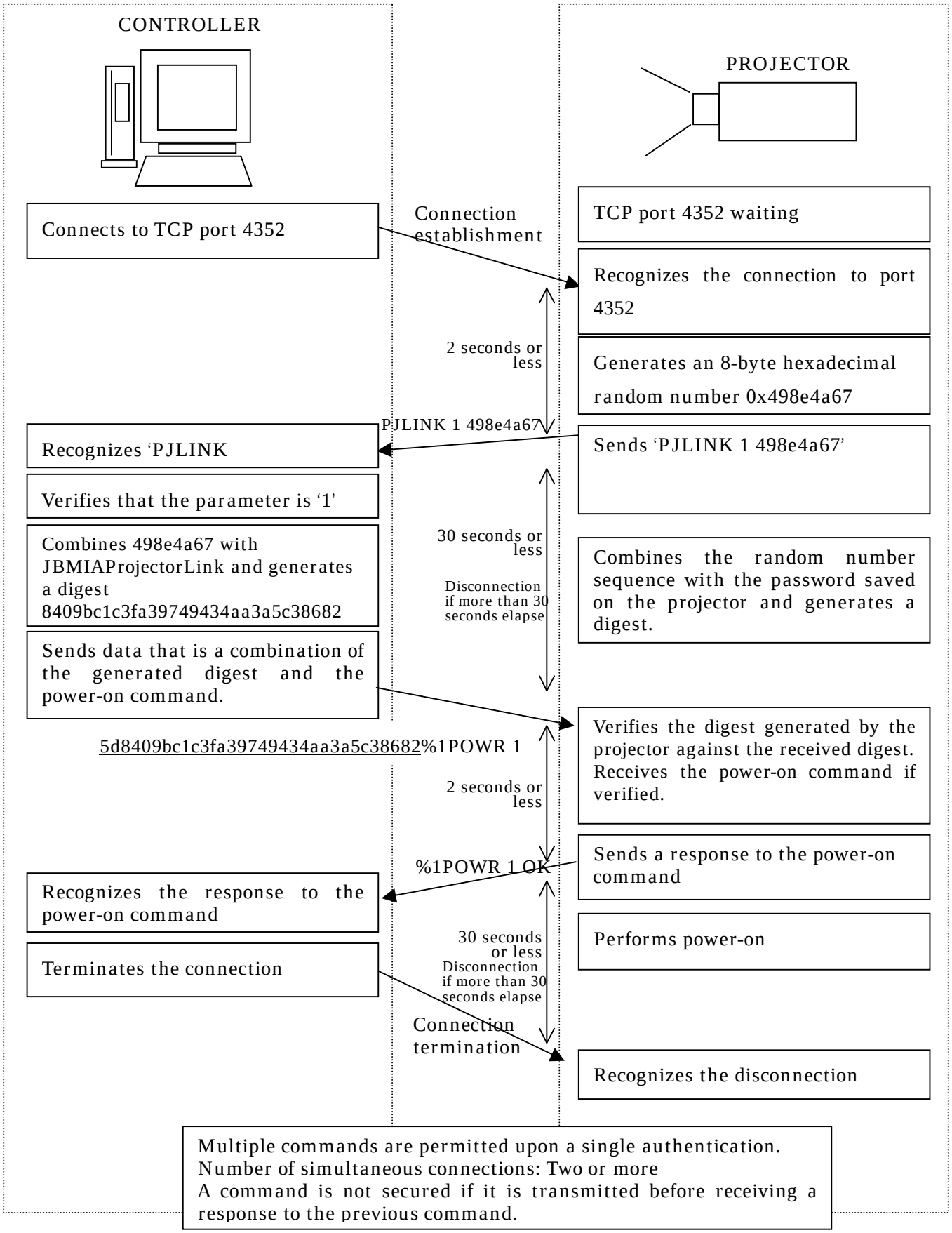
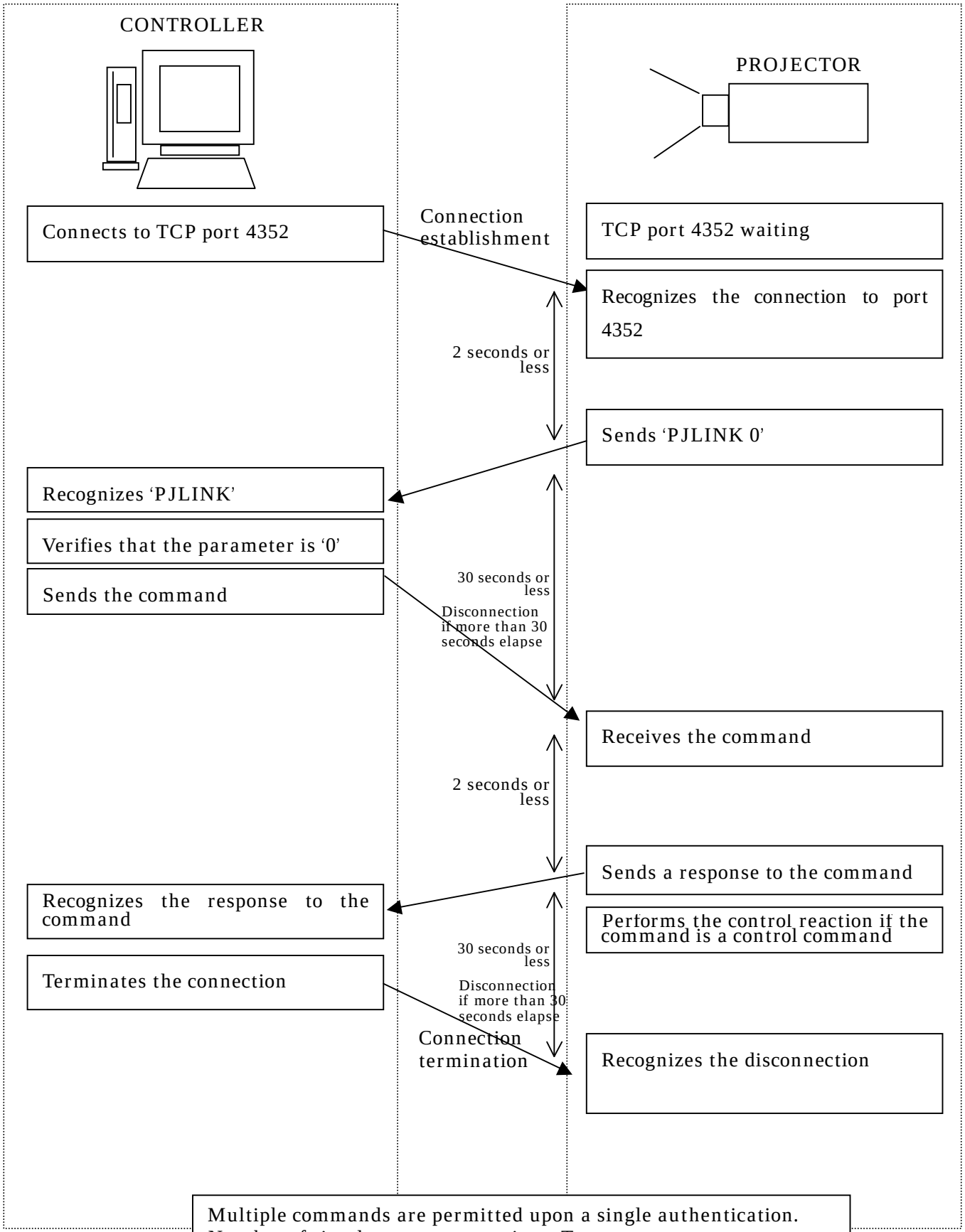


Fig. 3: No authentication procedure of the projector (Security OFF)】



6. Application Conventions

Constraints on the use of PJLink are as follows:

Connection method】

This command is for network connection only and does not support other connections such as serial port and USB connections.

【Authentication】

When the security mode of the projector is active, it is necessary to perform the authentication procedure. Without successful authentication, none of the commands can be used. For details of the authentication procedure, refer to [5. Authentication].

【Receiving time】

Commands sent within the following periods of time are not guaranteed to transmit successfully:

Approximately 10 seconds (*2) immediately after the projector starts power-on (*1)

When the projector switches the signal (*3)

Time interval between the projector's reception of a command and its issuance of a response command

Time interval between the projector's completion of lamp cooling and its change of status to standby

*1: The timing of the projector's status change from standby to video projection

*2: Refer to the specification of the projector.

*3: Signal switching due to input terminal switch and input signal change included.

【Simultaneous connection】

・The number of controllers to be connected simultaneously varies with the projector model. Refer to the specifications of the projector.

- Simultaneous commands from multiple controllers are not guaranteed to transmit successfully.
- As for commands transmitted from multiple controllers, the last received command will be effective.

【Automatic disconnection】

The projector terminates the connection if it does not receive a command within 30 seconds after establishment of the connection or after the issuance of a response command.

【Response method】

The projector issues a response command within 2 seconds (*1) after receiving a command. However, it will not issue a response command when it receives a command that does not meet command format requirements. See Chapter 2 for the command format requirements.

*1:Refer to the specifications of the projector.