CPU Link Protocol No. 1 (P1)

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Chapter 1 – Scope

This document details the message formats and protocol for interfacing to standard PESA Routing Switch Controllers over a CPU link. It covers the protocol used to send commands and status requests to PESA controllers. It details the commands that cause actions to be taken on the routing switcher, and commands that request status.

The PESA controllers supporting this protocol (with some limitations) are:

- 2400E Controller
- 3300 Controllers (including models EX, S, D, and SE)
- 3500 Controllers (including models EX, S, D, and SE)
- 3500Plus Controllers (including models EX, S, D, and SE)
- 6600E/EX Controllers
- Bobcat Control System
- Ocelot Control System
- LNS-8 Control System
- PCI Interface for RC5000 Systems
- RC5000 Controller
- RC5500 Controller

This is a protocol that has evolved over a number of generations of PESA controllers. As with all things that evolve, some conventions do not seem intuitive. Some commands listed here will have vestigial leftovers from earlier controllers.

Chapter 2 – Protocol

The CPU link is usually implemented as an RS-232 asynchronous serial interface, although some controllers also allow the use of an RS-422 asynchronous serial interface. The discussion that follows applies only to the RS-232 interface. Information on RS-422 interfaces may be found in the manual for equipment that offers this feature.

Data is transmitted bi-directionally at 9600 baud between the computer and the controller. The data stream consists of one start bit, eight data bits, and two stop bits. Parity is not used. Data transfer over the CPU Link is controlled by the state of the Ready To Send (RTS) and Clear To Send (CTS) lines. All controllers can be configured for these operating parameters. Some controllers allow for other configurations such as different baud rates and stop bits. Please refer to the controller manual for more information.

Communications originating from the controller to the external computer are governed by the state of the CTS line. When CTS is high, the controller sends data to the external computer. When CTS is low, the controller ceases transmission to the computer. The external computer controls this line and it must provide for receiving at least three characters after CTS goes low. The CTS line cannot be allowed to float, it must either be ON (asserted) or OFF (negated).

Communications originating from the external computer to the controller must obey the state of the RTS line. When RTS is high, the controller receives characters on the CPU link from the computer. When RTS is low, the external computer must cease transmission.

The CTS and RTS lines operate independently of one another.

The 3300, 3500, and 3500Plus require an additional connection to the Data Set Ready (DSR) input pin. This signal must be set active to indicate to the controller the presence of an active CPU link connection. Removal of this signal causes the CPU link port mechanism to reset.

The Bobcat, LNS-8, and Ocelot controllers do not utilize flow control in their serial port control. It is up to the interfacing machine to accept the output flow of characters from this equipment without regulating its flow.

The Bobcat Controller, LNS-8 Controller, Ocelot Controller, 3300, 3500, and 3500Plus support the RS-422 interface as well as the RS-232. Please refer to the equipment manual for further information.

The pin-out of the CPU port may vary from controller to controller. A common pin-out configuration from CPU link to PC is shown in Figure 1. Please refer to the equipment manual for detailed cabling information.

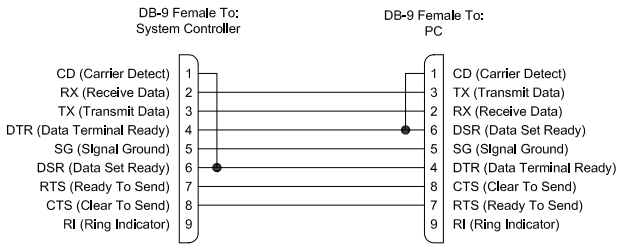

Figure 1. RS-232 Serial Cable

Chapter 3 – Message Formats

CPU link messages are constructed in ASCII characters. The characters are standard 7 bit ASCII with the eighth bit (most significant bit) set to 0. The communications between the controller and the external computer consist of a variable length buffer of characters containing the desired command (refer to Table 1), a string of data bytes, a checksum, and a terminator.

- Message Format: Command [<Data >]Checksum Terminator

There are no timing requirements on the transmission of characters into and out of the controller. The only flow restriction is dependent upon adherence to the RTS-CTS handshake. The controller looks for the termination characters in a message string and processes all information that has been sent since the last terminator was received, or since initialization of the CPU link communications port. This information is handled as one communications buffer.

CPU Link Command Summary

Standard Protocol No. 1 commands are one letter in length and are the first character encountered in the command string. Some commands have further qualifiers such as the letter “S” which denotes a command to change or display the status of the Switcher. See the command description for specific information.

This protocol has been extended for the 3300, 3500, and 3500Plus controllers. This protocol is often referred to as Protocol 1 with Extensions or P1E. These command extensions are listed as reserved commands in this document. The description of these extended commands is beyond the scope of this document.

The following discussion briefly describes each command available to the computer via the CPU Link. Refer to Table 1 for all of the CPU Link commands.

Table 1. CPU Link Command Summary

Command	Controller							
	3300, 3500, 3500Plus (RS-232/ RS-422)	6600 (RS-232)	2400 (RS-232)	Ocelot (RS-232/ RS-422)*	Bobcat (RS-232/ RS422)*	LNS-8 (RS-232/ RS-422)*	PCI-5000 (RS-232)	RC5000/ RC5500 (RS-232)
B Display Salvo	•	•					•	
C Change Salvo Entry	•	•					•	
D Delete Salvo Entry	•	•					•	
F De-Allocate Salvo Group	•	•					•	
H Change Switcher	•	•	•	•	•	•	•	•
J Switcher Status (no error info)	•	•	•	•	•	•	•	•
L Change Lock Status	•	•	•	•	•	•	•	•
P Change Protect Status	•	•	•				•	
R Restore All Call	•	•	•				•	
T All Call	•	•	•				•	
V Transmit Salvo Group	•	•					•	
W Display Lock/Protect Status	•	•	•	•	•	•	•	•
Y Switcher Status (1 dest. w/ error info)	•	•	•	•	•	•	•	•
Z Switcher Status (entire matrix w/ error info)	•	•	•				•	
* Bobcat, LNS-8, and Ocelot controllers may be configured for RS-422 multi-drop operation. See Chapter 6 for details.								

Table 2. Reply Responses

ASCII	REPLY RESPONSE
E	Error in Transmission
G	Good Transmission
L	Locked Destinations
N	Requested Function Not Allowed or Equipment Malfunction
P	Protected Destination

Checksum Computation

The checksum is a number derived from each data byte for the purpose of verifying data transmission on both sides of the transmission link. A data stream being transmitted computes a checksum that is sent with the data and the termination characters. The receiving equipment generates a checksum from the received data and compares the two checksums. The checksum is calculated as follows:

1. Add the ASCII decimal character codes for each character that precedes the checksum (see Figure 2 for ASCII character codes).
2. Take the sum calculated in Step 1, divide by 256 and retain the remainder (this will be the lowest 8 bits of the sum calculated in Step 1).
3. Take the value obtained in Step 2 and divide by 16:

Truncate the result to a whole number to obtain the upper four bits.

Take the remainder to obtain the lower four. bits.

4. Add 48 (the ASCII decimal character code for zero) to the number obtained in step 3a. The resulting sum is the ASCII decimal character code for the first checksum character. Consult Figure 2 to convert the code the character.
5. Add 48 (ASCII decimal character code for zero) to the number obtained in step 3b. The resulting sum is the ASCII decimal character code for the second checksum character. Consult Figure 2 to convert the code the character.

	Column	0		1		2		3		4		5		6		7	
Row	b8 b7 b6 b5 Bits b4 b3 b2 b1	0 0 0 0		0 0 0 1		0 0 1 0		0 0 1 1		0 1 0 0		0 1 0 1		0 1 1 0		0 1 1 1	
0	0 0 0 0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
1	0 0 0 1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
2	0 0 1 0	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
3	0 0 1 1	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
4	0 1 0 0	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
5	0 1 0 1	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
6	0 1 1 0	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
7	0 1 1 1	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
8	1 0 0 0	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
9	1 0 0 1	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
10	1 0 1 0	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
11	1 0 1 1	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
12	1 1 0 0	FF	14 12 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
13	1 1 0 1	CR	15 13 D	GS	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
14	1 1 1 0	SO	16 14 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
15	1 1 1 1	SI	17 15 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

Key

Character | ESC | 33 27 1B | Octal Decimal Hex

Figure 2. ASCII Character Codes

Sample Checksum Calculation

The command take Source 5 to destination 1 on a 1 level system is:

- **H 0 0 1 0 0 5 6 > CR LF** where **6 >** is the checksum.

Checksum calculation starts by adding the ASCII decimal character codes of the command characters:

Character	ASCII Decimal Character Code
H	72
0	48
0	48
1	49
0	48
0	48
5	53
Total:	366

The result then has the 8 bit overflow masked out and is divided into upper and lower 4 bits.

- 366 / 256 = 1 with a remainder of 110
- 110 / 16 = 6 (upper four bits) with a remainder of 14 (lower four bits)

These numbers are then converted to ASCII characters as follows:

- First checksum character: 6 + 48 = 54 which is the ASCII decimal character code for 6
- Second checksum character: 14 + 48 = 62 which is the ASCII decimal character code for >

NOTE

3300 v3.0 and later, and all 3500 and 3500Plus releases, allow for the use of a more standard hexadecimal checksum, as well as for the omission of the checksum. Please refer to the equipment manual for more information.

Terminator

The terminator is comprised of an ASCII Carriage Return (CR) (Hex 0D) followed by an ASCII Line Feed (LF) (Hex 0A). When these two characters have been received in correct order, the controller initiates processing of the CPU link command.

NOTE

6600E/EX v2.30 and later allow the user to drop the Carriage Return from the terminator. A single Line Feed serves its purpose. The 3300 v3.0 and later, and all 3500 and 3500Plus releases, allow the user to choose between carriage return only, linefeed only, or the standard terminator. These options are user configurable.

Chapter 4 – General

Inputs/Outputs vs. Source/Destination Groups

Some controllers use the concept of virtual matrix mapping. This allows the system to assign inputs to multiple source devices and to assign inputs and outputs to only those devices that need them.

Controllers that use virtual matrix mapping, and adhere to this CPU link protocol, do not specify inputs and outputs. Instead they specify source and destination groups. Status returned by the controller specifies groups as well.

For example the command:

- H001002003
    1. Switches the input assigned on level 1 of Source group 2 to the corresponding output of Destination group 1
    2. Switches the input assigned on level 2 of Source group 3 to the corresponding output of Destination group 1

This document uses the terms “source” and “destination” to refer to inputs/source groups and outputs/destinations respectively.

Virtual Matrix Mapping and Non-Existent Groups

In systems with matrix mapping such as the RC5000, RC5500, 3300, 3500, and 3500Plus controllers, there may be times when a number used in the CPU link does not refer to a valid source or destination. This may pose a problem for applications that coordinate actions with returned status.

The reason gaps are left in the CPU link numbering is that editing of sources and destinations is a dynamic occurrence. If a group is deleted, the controller leaves a gap in the numbering as opposed to renumbering all the groups to insure contiguous numbering.

If a command uses a non-existent source, that source will be ignored and the action of the command will not be taken for the specified level of control.

If a command uses a non-existent destination and that destination’s number is less than the highest valid destination number, the command will process the command as being valid but no actions will be taken on the router. Any status returned for a non-existent destination will be “000”.

Any command using a destination greater than the highest valid destination number will return an error.

For example, a system has destination groups defined for numbers 1-50 except for group 30, which is not defined. In this case, a switch specified for group 30 will return a good response. No action is taken on the router for this command and any status of the destination 30 will return sources of “000” since it is not defined. This must be accounted for in CPU link applications on controllers using virtual matrix mapping.

Using Change Commands

Controllers support a variety of “Change Switcher” commands on the CPU Link. These commands, when received by a controller, are acknowledged with a reply. The replies are “G” (good), “E” (error), “L” (locked), and “N” (not allowed). The acknowledgment replies indicate only that the command was correctly or incorrectly received, not whether the actual switch was successful.

When a controller receives a command to change the switcher, it acknowledges the command received from the computer. The act of the actual switch taking place may not be available until the next vertical interval of the video signal. The controller cannot interrogate the switcher during the time between loading the preset registers and the next vertical interval. For this reason, the controller cannot respond immediately with a current status to the external computer.

NOTE

For 6600E, RC5000, RC5500 and PCI5000 controllers, switcher status is sent to the external computer only in response to a switcher status request. To determine if a change switcher command has properly executed, the external computer must wait at least 32 milliseconds before requesting status. Switcher status is obtained directly from the crosspoints.

The other control systems send back the desired status instead of actual status of the router. If the desired status differs from the actual status, a readback error (where valid) is reported back in the status response.

Chapter 5 – Command Specifics

Command Description Conventions

Several abbreviations are used in the following discussions to signify the different portions of the communications buffers. Refer to Table 3 for a list of the abbreviations and the length of field for each buffer.

Table 3. Abbreviations and Field Lengths

TERM	LENGTH (ASCII characters in buffer)	DESCRIPTION
Lx	3	Level #x Input/Source Number
DST	3	Output/Destination number
SLV	2	Salvo group number
CS	2	Checksum
@	2	Termination characters (cr/lf)
S	1	Denotes switcher function

In the following command examples, the number of levels of control will depend on the configuration of the controller. If the controller is configured for 3 levels, 3 source numbers are included in the buffers; if the controller is configured for 1 level, only 1 source will be included in the buffer.

A command must, at least, specify the number of levels for which a system is configured. If it specifies more levels, the extra levels will be ignored. If it specifies fewer levels, an error response will be returned.

Many of the commands in the system specify a minimum of two levels in the feedback from the controller.

Command Source/Destination Numbering

The acceptable numbers for sources and destinations permitted by the controllers are:

- 0 -999

For controllers that exceed the 0-999 range, the following format is used to identify numbers from 1000-1999.

- A00-A99 for numbers 1000-1099
- B00-B99 for numbers 1100-1199
- C00-C99 for numbers 1200-1299
- D00-D99 for numbers 1300-1299
- E00-E99 for numbers 1400-1499
- F00-F99 for numbers 1500-1599
- G00-G99 for numbers 1600-1699
- H00-H99 for numbers 1700-1799
- I00-I99 for numbers 1800-1899
- J00-J99 for numbers 1900-1999

NOTE

All inputs/sources and outputs/destinations start at number 1. The value 0 is used as a NULL identifier. NULL identifiers specify no action.

Only the 6600E/EX controller allows the value 0 to be used as a silent source. All other controllers ignore 0 when used.

On commands that specify destinations in the command string, the destination number used must be within the configuration of the controller or an error will be reported. On commands that specify source numbers, a value that is not configured is handled as a NULL and no action is taken with respect to that source.

Command Salvo Group Numbering

Salvo commands use a two character field to specify salvo groups. The field consist of a decimal representation anywhere from “01” to “99”. For controllers that have in excess of 100 salvo groups, the following extension is used to allow access to all configured salvos:

- 01-99 for salvos 1-99
- A0-A9 for salvos 100-109
- B0-B9 for salvos 110-119
- C0-C9 for salvos 120-129
- D0-D9 for salvos 130-139
- E0-E9 for salvos 140-149
- ↓

For as many salvos as there are configurable in the controller.

Status Field

The “Y” (Send Switcher Status, single destination) and the “Z” (Send Switcher Status, all) commands contain a STAT field. The STAT field contains the readback/confidence error indicators for each level's crosspoint in the destination group. The STAT field consists of two ASCII characters in the range 30 to 3F Hex inclusive. The ASCII characters must be converted to an 8-bit binary value before use.

The lower four bits of each character represent information for two levels of the system. The more significant two bits are for the lower number level. The possible values for each level are (in binary):

- 00 = No Error
- 01 = Not Defined
- 10 = Readback Error
- 11= Confidence Error

For example, a STAT field of:

- “0 0 <” = 0x30 0x30 0x3C

Where the 1st character represents level 1 & 2, the 2nd character represents level 3 & 4, and the 3rd character represents level 5 & 6,

This breaks down into the following bit fields:

Lev1	Lev2	Lev3	Lev4	Lev5	Lev6
00	00	00	00	11	00

All levels except Level 5 are without error. Level 5 shows a Confidence error. The status returned on level 5 is indeterminate.

The 8-bit binary value represents the Readback/Confidence errors for the switcher destination. A Readback error occurs when the Controller switches the matrix but the data read back from the crosspoint is in error. A Confidence error occurs when the Controller detects a missing card in the system.

Restrictions

- All controllers will echo a minimum of four levels of status information at any time.
- The 2400E does not support Readback errors.
- The Bobcat, LNS-8, and Ocelot do not support Readback or Confidence errors.

Specific Command Descriptions

For illustration purposes only, most commands specified in the following sections use four levels in the examples given. Levels of control restrictions are based on specific controller limitations. Unique command restrictions are listed in the command descriptions.

Display Salvo

This command requests a salvo table be forwarded from the controller.

Table 4. Display Salvo

Command	B SLV CS @
Response	E @ - Salvo number out of range or transmission error G @ - Command accepted and performed, followed by: S DST L1 L2 L3 L4 S DST L1 L2 L3 L4 S DST L1 L2 L3 L4 ↓ S DST L1 L2 L3 L4 CS The length of the response is determined by the number of entries in the selected salvo.
Restrictions	Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

Change Salvo Entry

This command is used to add or change an entry in the specified salvo group.

Table 5. Change Salvo Entry

Command	C SLV S DST L1 L2 L3 L4 CS @
Response	E @ - Transmission error, invalid salvo number or invalid format G @ - command accepted and performed N @ - Invalid destination number
Restrictions	Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

Delete Salvo Entry

This command is used to remove an entry from a salvo group.

Table 6. Delete Salvo Entry

Command	D SLV S DST CS @
Response	E @ - Transmission error, invalid salvo number or invalid destination number G @ - command accepted and performed
Restrictions	Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

De-Allocate Salvo Group

This command removes an entire salvo group from the Controller's memory.

Table 7. De-Allocate Salvo Group

Command	F SLV CS @
Response	E @ - Transmission error or invalid salvo number G @ - command accepted and performed
Restrictions	Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

Change Switcher

This command is used to make a switch in the switching matrix.

Table 8. Change Switcher

Command	H DST L1 L2 L3 L4 CS @ The length of the buffer is dependent on the number of configured switching levels. All levels configured must be specified in the command buffer. For break-away switching, specify either a NULL source or out of range source on levels on which no switch is needed. Example: Using a 2 level 48x40 switch, to switch destination 1 to source 5 only on level 1, the following command can be used: H001005255
Response	E @ - Transmission error G @ - Command accepted and performed L @ - Destination was locked N @ - Invalid Destination Number
Restrictions	6600E/EX switchers do not support break away switching previous to version V2.20. The RC5000/RC5500 returns back a lock indication if any output in the destination group is locked. The switch request will take the switches on the destination group's unlocked outputs.

Display Switcher Status (No Error Information)

This command tells the switcher to send the current source/destination status of the switching matrix.

Table 9. Display Switcher Status (No Error Information)

Command	J CS @
Response	E @ - Transmission error N @ - Configuration is too large to support response L1 L2 L3 L4 L1 L2 L3 L4 L1 L2 L3 L4 ↓ L1 L2 L3 L4 CS @ The first group of sources correspond to destination 1 of the switcher, the second group to destination 2, etc. The length of each group of level status depends on the number of switching levels configured in the Controller. The length of the buffer depends on the total number of destinations configured in the routing switcher system. It is the responsibility of the requester to count the bytes and determine which bytes represent each switching level source for each destination.
Restrictions	The 3300 and 3500 controllers reject requests for systems that are configured with responses greater than 2KB in length. These systems respond back with a 'N' response.

Change Lock

This command is used to toggle the lock status of a specified destination. If the specified destination is already locked, receiving this command unlocks it. If the destination is unlocked, receiving this command will lock the destination. The ability to unlock a destination may be affected by the privilege of the user who placed the lock.

Table 10. Change Lock

Command	L S DST CS @
Response	E @ - Transmission error G @ - Command accepted and performed L @ - Destination was locked by an equal or higher priority device (3300, 3500, RC5000, RC5500 only) N @ - Invalid Destination Number P @ - Destination was protected by equal or higher priority device
Restrictions	Protect response is used only by 3300 and 3500 controllers. The RC5000/RC5500 will unlock any destination in which any of the outputs are locked. It will lock a destination if all the destination's outputs are unlocked.

Change Protect

This command is used to toggle the protect status of a specified destination. If the specified destination is already protected by the CPU Link, receiving this command clears the existing protect. If the destination is unprotected, receiving this command will protect the destination. The ability to remove a protect may be affected by the privilege of the user who placed the protect.

Table 11. Change Protect

Command	P S DST CS @
Response	E @ - Transmission error G @ - Command accepted and performed L @ - Destination was locked by equal or higher priority device N @ - Invalid Destination Number P @ - Destination was protected by equal or higher priority device
Restrictions	6600E/EX, RC5000, PCI-5000, Ocelot, LNS-8, and Bobcat do not support concept of Protect. This command is not supported by the RC5500. Protect response is used only by 3300, 3500 and 3500Plus controllers.

Restore System From All Call

This command is used to restore the switching matrix to the last status prior to receiving the All Call command.

Table 12. Restore System From All Call

Command	R CS @
Response	E @ - Transmission error G @ - Command accepted and performed
Restrictions	Not supported by the RC5000, RC5500, Ocelot, LNS-8, and Bobcat controllers.

All Call

This command is used to switch all destinations on the switching matrix to the sources designated in the command buffer (all level 1 destinations to the specified level 1 source, all level 2 destinations to the specified level 2 source, etc.). The switching matrix remains in the All Call condition until either a change switcher or restore command is sent.

If a source is out of range for a given level, no switches will be taken on the level.

Table 13. All Call

Command	T L1 L2 L3 L4 CS @
Response	E @ - Transmission error G @ - Command accepted and performed N @ - Format error
Restrictions	Not supported by the RC5000, RC5500, Ocelot, LNS-8, and Bobcat controllers.

Transmit Salvo Group

This command is used to fire a salvo that has been loaded in the Controller's memory.

Table 14. Transmit Salvo Group

Command	V SLV CS @
Response	E @ - Transmission error or invalid salvo number G @ - Command accepted and performed
Restrictions	Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

Display Lock Status

This command is used to find out which destinations are locked.

Table 15. Display Lock Status

Command	W S CS @
Response	E @ - Transmission error X X X ↓ X CS @ Where the lock/unlock/protect status display, "X" denotes: 0 - Destination is unlocked 1 - Destination is Locked 2 - Destination is Protected The first byte denotes destination 1, the second denotes destination 2, etc.
Restrictions	The S portion of this command is optional, i.e. the command can be sent W CS @. 6600E/EX, PCI-5000, RC5000, Ocelot, LNS-8, and Bobcat do not support concept of Protect. The RC5000/RC5500 returns back a lock indication if any output in the destination group is locked. The switch request will take the switches on the destination group's unlocked outputs. The 3300, 3500, and 3500Plus report destinations that are protected by devices of a different requester code as locked (see the specific controller manual for more details).

Send Switcher Status (Single Destination)

This command allows the computer to interrogate the controller and obtain the status of an individual destination.

Table 16. Send Switcher Status (Single Destination)

Command	Y DST CS @
Response	E @ - Transmission error N @ - Invalid Destination DST STAT L1 L2 L3 L4 CS @ The STAT field contains error information for each levels crosspoint in the transmission (refer to the section entitled STATUS FIELD for detail of this byte).
Restrictions	This command always sends a minimum of two levels of information (one level systems can disregard the second level data). A minimum of four levels of status in the STAT field is returned with each command.

Send Switcher Status (All)

This command allows the computer to interrogate the Controller to obtain the status of the entire switching matrix. It is similar to the Display Switcher Status (J) command, except this command sends destination and status information for each destination. The additional information indicates any readback or confidence errors at each crosspoint.

Table 17. Send Switcher Status (All)

Command	Z CS @
Response	E @ - Transmission error N @ - Configuration is too large to support response DST1 STAT L1 L2 L3 L4 DST2 STAT L1 L2 L3 L4 DST3 STAT L1 L2 L3 L4 ↓ DSTn STAT L1 L2 L3 L4 CS @ The data represents the status of the entire switching matrix. The first group of sources represents the first destination of the switcher. The second group represents the second destination of the switcher, etc. The STAT field contains error information for each VID/AUD crosspoint in the transmission (refer to the discussion of STATUS FIELD, below, for details of this byte).
Restrictions	The 3300 and 3500 controllers reject requests for systems that are configured with responses greater than 2KB in length. These systems respond back with a 'N' response. This command always sends a minimum of two levels of information (one level systems can disregard the second level data). A minimum of four levels of status in the STAT field are returned with each command. Not supported by the RC5000, RC5500, 2400E, Ocelot, LNS-8, and Bobcat controllers.

Chapter 6 – RS-422 Multi-Drop Operation

In addition to the standard point-to-point operation of the CPU link, the Bobcat, LNS-8 and Ocelot controllers support a multi-drop mode of operation for use when the serial port is configured for RS-422 operation. This allows for a single device to control the activity on many controllers through a single CPU link connection.

To facilitate the multi-drop connection, the CPU link message format is extended.

- Message Format: Controller ID Command [<Data >]Checksum, Terminator

The bussed mode of operation extends the previous protocol by adding an address field in front of each CPU link command. The address field consists of ASCII numeric characters (0-9). The address field specifies that the command is intended for the controller whose address matches the command. Each controller on the CPU link bus reads the address and only the one with the matching address acts on the command.

The command response from the bussed controller device is the same as for standard mode of operation commands. No address qualifier is added to the response. Only the controller to which the message is directed will respond to a valid command.

Bussed mode controllers handle detection of communications errors differently from standard mode controllers. When a bussed CPU link unit detects a communications error, it ignores the message and does not respond (a communications error detected by a standard mode unit responds back with an "E" response).

Bussed Mode Command Example

A command taking Input 3 to Output 1 on Controller Address #2 yields a command of:

- Controlling device: 2H001003003003<4 @
- Controller Unit No. 2: G @

NOTE

When the CPU link port is configured for RS-422 operation, the controller RS-422 transmitter is active only during character transmission. At all other times, the RS-422 transmit bus is tri-stated. It is the responsibility of the controlling device to be able to handle the high impedance bus (biasing resistors may be required).

During multi-drop operation, flow control is disabled. It is up to the external computer to ensure proper serial port timing.

Revision History

Rev.	Date	Description	By
1.0		Initial Release	D. Bailey
1.1	11-03-94	Corrected typos and some command omissions. Released to Documentation Department.	D. Bailey
1.2	01-20-95	Added information concerning Bobcat controller.	D. Bailey
1.3	06-22-95	Corrected a mistake in W command specification (added S to command sequence).	D. Bailey
1.4	08-03-95	Added information about 3300.	D. Bailey
1.5	06-19-96	Added information about RC5000/RC5500. Added command to controller reference chart and reformatted.	D. Bailey
1.6	10-14-96	Added v3.0 3300 information. Added RS-422 Bobcat information for RS-422 multi-drop operation.	D. Bailey
1.7	04-03-97	Added Ocelot controller information.	D. Bailey
1.8	09-18-97	Corrected some data misalignments	D. Bailey
1.9	11-06-97	Included LNS-8 and 3500 command references.	D. Bailey
A	09-01-99	Revised and updated. Document No. changed from 81-9059-0314-0 to 81-9062-0407-0. ECO-3247.	G. Tarlton
B	03-06-01	Deleted Printing Specification per ECO CE00113.	G. Tarlton
C	02-16-12	Changed corporate address and logo	RHS

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