RS232 control of K1AV.

The DVD receiver K1AV is compatible to be controlled by a connected control-system having a RS232 serial output port (PC, CRESTRON home automation system etc.) through the RS232/R-Link interface adapter.

For details about connecting and operating the adapter see the user manual of the adapter “UM_RS232_Adapt.doc”.

Settings for the RS232 interface of the control device are as follows:

Baud rate:	115.200
Data bits:	8
Stop bits:	1
Parity:	none
Flow Control:	none

T+A RS_232 Protocol

The R-series devices use the standard T+A RS232 command protocol as described in detail in the documents “TA_RS232_protocol.doc” and “RS_232_Command_Codes.doc”.

Format of the command telegrams

A command telegram to the R-system master device consists of 6 bytes. The complete telegram should be sent without pauses between the bytes.

Example: SYSTEM_ON command

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
RS232 adapter Address (always 0x01)	**Telegram length** (R-Link address + R-Link command + R-Link flag byte = 0x03)	**R-Link Address** (0xC8=Amplifier/ master device → see also note below)	**R-Link command** (here: SystemON = 0x57) → see command table “appendix 1”	**R-Link flag byte** (always 0x02)	**Check sum** = sum of bytes 1..5 mod. 0x100
0x01	**0x03**	**0xC8**	**0x57**	**0x02**	**0x25**

Byte 1, 2, 3, 5 : these bytes have the fixed values as shown in the table above for all R-system master devices

Byte 4 : R-Link command according to the table of RCII commands (see “RS_232_Command_Codes.doc”)

Byte 6 : check sum == (byte1+byte2+byte3+byte4+byte5) modulo 0x100

Note:
The R-Link address **0xC8** is used for all standard amplifier commands.

There exist a few additional commands (system commands) for some special functions. For these commands the address **0xC4** has to be used. At this time there are non of these relevant for surround control.

Format of the acknowledge (ACK) telegrams

The R-System master device will process each received command telegram and it will send an acknowledge telegram approx. 25...35 ms after receiving the command.

The ACK telegram consists of 2 bytes:
Byte 1 is the RS232 address of the command telegram received before (=byte 1 of the command telegram = 0x01).
Byte 2 is the acknowledge byte. If this byte is equal to the check sum of the command telegram (byte_6 of the command) then the command was received correctly. If byte_2 has a value different from the check sum of the command, an error has occurred (see table below).

Format of the ACK telegram:

Byte 1	Byte 2	
RS232 address	**ACK byte**	
0x01	= check sum of command: = check sum –1: = check sum –2:	command correctly received command ignored (system busy) command not executed
	Note: If no ACK telegram is received within 35 milli-seconds after sending a command, there is either a hardware problem (cable etc.) or the telegram is erroneous (wrong address, wrong check sum ....)	

After the ACK telegram, the master device is ready for the next command.

Special System Commands

The K1AV automatically pushes the status information after it has changed. Additionally the status can be requested by sending the command 0x64 (Status_1) or 0x43 (Status_2) to the RLink-address **0xC4** but normally this should not be necessary. We strongly recommend to keep the number of status requests low to avoid unnecessary RLink-Bus load. The information given is different for each device and has to be decoded and displayed individually. For further information see the user manual 'Crestron T+A Macro'.

Responses of the K1AV are as follows:

Status 1:

The STATUS_1 is automatically pushed by the K1AV when any contained information has changed or the command STATUS_1 was sent to the K1AV. It is answered by a 9 byte long status telegram having the following format:

```
0x01, 0x06, 0xC4, 0x64, Stat_Byte_1, Stat_Byte_2, Stat_Byte_3, Stat_Byte_4, Checksum
-----------------------------------|-------------------------------------------------------------------------------|----------------
HEADER (4)                         STATUS BYTES (4)                                                                CHK-SUM (1)
```

The 4 header bytes (0x01/0x06/0xC4/0x64) are constant.
The 4 status bytes are defined as follows:

Stat_Byte_1	b0			
	b1	Speaker_A	1:= speaker A output is ON	
	b2	Speaker_B	1:= speaker B output is ON	
	b3			
	b4			
	b5			
	b6	STANDBY	1:= System is in STANDBY	
	b7	ON	1:= System is ON	
Stat_Byte_2	b0	Listen Source (0...15)	0:= not defined 1:= unused 2:= TUNER 3:= TAPE 4:= unused 5:= TV/Video 6:= AUX 7:= unused	8:= unused 9:= DISC 10:= unused 11:= unused 12:= unused 13:= unused 14:= unused 15:= not def. / future use
	b1			
	b2			
	b3			
	b4	Recording Source (0...15)		
	b5			
	b6			
	b7			
Stat_Byte_3	b0	LOUDness	1:= Loudness is ON	
	b1	FLAT	1:= FLAT is ON (= Tone defeat)	
	b2			
	b3			
	b4		1:= Stereo	
	b5			
	b6			
	b7			
Stat_Byte_4	b0		0:= analog	
	b1			
	b2			
	b3			
	b4		0:= None	
	b5			
	b6			
	b7			

Status 2:

The STATUS_2 is automatically pushed by the K1AV when the volume has changed or the command STATUS_2 was sent to the K1AV. It is answered by a 7 byte long status telegram having the following format:

0x01, 0x04, 0xC4, 0x43, **Status_Byte_1, Status_Byte_2,**	Checksum
HEADER (4) STATUS BYTES (2)	CHK-SUM (1)

The 4 header bytes (0x01/0x04/0xC4/0x43) are constant.
The 2 status bytes are defined as follows:

Status_Byte_1	b0	Volume of main room (0...63)	
	b1		
	b2		
	b3		
	b4		
	b5		
	b6		
	b7		
Stat_Byte_2	b0	Volume of 2nd room (0...63)	
	b1		
	b2		
	b3		
	b4		
	b5		
	b6		
	b7		

Appendix 1: List of Master (Amplifier) commands (Address 0xC8)

Command	Code (HEX)	toggle	Remark
Power Control			
System ON [1)]	0x57		Switch the K1AV ON
System Standby [1)]	0x77		Switch the K1AV to STANDBY
System OFF [1)]	0x7A		Switch the system to STANDBY
On/Standby [1)]	0x01	x	Toggle the K1AV between ON and STANDBY
Volume + Tone Control			
VOL_PLUS	0x00		Performs 1 volume step of the main room volume. **Hint**: Repeat these commands for continuous volume increase/decrease (command repetition rate = 100...110 ms)
VOL_MINUS	0x20		
VOL_B_PLUS [2)]	0x4E		Performs 1 volume step of the 2nd room volume (if enabled) **Hint**: Repeat these commands for continuous volume increase/decrease (command repetition rate = 100...110 ms)
VOL_B_MINUS [2)]	0x6E		
Balance_L	0x38		one step to the left (only main room)
Balance_R	0x18		one step to the right (only main room)
LOUDness	0x2C	x	
LOUDness ON	0x75		
LOUDness OFF	0x55		
FLAT	0x0C	x	
FLAT ON	0x7B		tone control defeat
FLAT OFF	0x47		tone control on
Speaker Control			
SPKR	0x13	x	Switches the speaker outputs in sequence: A -> B -> A+B **Hint**: better use the Speaker_A/B_ON/OFF commands
Speaker_A ON	0x68		Speaker A output ON
Speaker_A OFF	0x48		Speaker A output OFF
Speaker_B ON	0x58		Speaker B output ON
Speaker_B OFF	0x78		Speaker B output OFF
Speaker_A	0x1C	x	Speaker A on/off
Speaker_B	0x3C	x	Speaker B on/off
Off	0x2E		Speaker A and B off
Source selection (Group commands)			
CD	0x23	x	DISC
Tuner	0x17		Tuner
Tape	0x35		Tape
Video/TV	0x07	x	TV
AUX	0x3D	x	AUX
Source selection (discrete commands)			
SRC_CD	0x45		DISC
SRC_Tuner	0x46		Tuner
SRC_Tape-1	0x49		Tape
SRC_TV	0x59		TV
SRC_Aux	0x65		AUX
SRC_DVD	0x42		DISC
SRC_STB	0x62		STB
Main / Config - Menu			
AMP Menu (short)	0x40		Open Main Menu
AMP Menu (long)	0x41		Open Configuration Menu
Close AMP Menu	0x60		Close active Menu (Main or Configuration)
Hint: The Menu navigation is done by the keys NEXT (0x34), PREV (0x2A), FF (0x25), RW (0x1A) and OK (0x26) or with Cursor_UP/DOWN/LEFT/RIGHT and SELECT (0xD2,0xD3,0xD4,0xD5,0xD6) (which are normally forwarded to the active source device.			
Sound control			
SURND	0x37	x	toggle between Stereo / 3ch Music / 3ch Movie - Mode
Stereo Mode [3)]	0x4D		select Stereo Mode
3ch Music Mode [3)]	0x69		select 3ch Music Mode (only if center channel enabled)
3ch Movie Mode [3)]	0x7E		select 3ch Movie Mode (only if center channel enabled)

Command	**Code** (HEX)	**toggle**	**Remark**
Tuner control			
Tune UP (>>)	0x25		Frequency one step up (25 kHz) / cursor right
Tune DOWN (<<)	0x1A		Frequency one step down (25 kHz) / cursor left
STOP	0x24		Stop frequency scan / exit menu
PREV (|<)	0x2A		previous preset / cursor down
NEXT (>|)	0x34		next preset / cursor up
OK	0x26		temporary Preset display / cursor action
Rewin	0xCA		fast rewind
Fast Forward	0xCB		fast forward
Previous	0xCC		previous track/title/chapter
Next	0xCD		next track/title/chapter
Cursor UP [2)]	0xD2		cursor up
Cursor DOWN [2)]	0xD3		cursor down
Cursor LEFT [2)]	0xD4		cursor left
Cursor RIGHT [2)]	0xD5		cursor right
Select / Activate [2)]	0xD6		select / activate / enter
0	0x03		key "0"
1	0x3A		key "1"
2	0x06		key "2"
3	0x16		key "3"
4	0x02		key "4"
5	0x09		key "5"
6	0x3B		key "6"
7	0x31		key "7"
8	0x11		key "8"
9	0x39		key "9"
F3/4	0x0B	x	toggle Radiotext on/off
F3 [2)]	0x85	x	toggle Radiotext on/off
Open SRC Menu 1	0xC5		open Tuner setup menu
Close SRC Menu [2)]	0xC7		close Tuner setup menu

Command	Code (HEX)	toggle	Remark
DISC control			
Tune UP (>>)	0x25		context dependant fast forward / cursor right
Tune DOWN (<<)	0x1A		context dependant fast rewind / cursor left
STOP	0x24		STOP
PREV (|<)	0x2A		context dependant previous track/title/chapter / cursor down
NEXT (>|)	0x34		context dependant next track/title/chapter / cursor up
OK	0x26		PLAY / select/confirm
Rewind	0xCA		fast rewind
Fast Forward	0xCB		fast forward
Previous	0xCC		previous track/title/chapter
Next	0xCD		next track/title/chapter
Play	0x12		Play
Cursor UP 2)	0xD2		cursor up
Cursor DOWN 2)	0xD3		cursor down
Cursor LEFT 2)	0xD4		cursor left
Cursor RIGHT 2)	0xD5		cursor right
Select / Activate 2)	0xD6		select / activate / enter
PAUSE	0x05		PAUSE
OPEN/CLOSE	0xCE	x	OPEN / CLOSE
0	0x03		key "0"
1	0x3A		key "1"
2	0x06		key "2"
3	0x16		key "3"
4	0x02		key "4"
5	0x09		key "5"
6	0x3B		key "6"
7	0x31		key "7"
8	0x11		key "8"
9	0x39		key "9"
F1 2)	0x83	x	toggle Soundtrack
F2 2)	0x84	x	toggle Angle
F3 2)	0x85	x	toggle Subtitle
F5 2)	0x8E	x	REPEAT
F1/2	0x36	x	Audio track (F6-key F1/2)
F3/4	0x0B	x	Subtitle (F6-key F3/4)
F5/6	0x36	x	Repeat (F6-key F5/6)
Open SRC Menu 1	0xC5		Open Title menu
Open SRC Menu 2	0xC6		Open Player setup-menu
Close SRC Menu 2)	0xC7		Close Player setup-menu

1) Commands not available in software version prior to V1.11 (K1AV with older versions must be manually switched on before being operated through RS232.

2) added with V1.12

3) added with V1.20

Revision history:

16.03.2006 V1.00
27.03.2006 V1.10
06.04.2006 V1.11: - K1AV does not need to be switched ON manually before using RS232 commands anymore.
- changed Status_1 and Status_2 to match SR1535 status words.
29.05.2006 V1.12: - added commands:
- F1,F2,F3,F5
- discrete Cursor up,down,left,right
- discrete Select / Activate
- discrete Next,Previous,Rewind,Fast forward
- Close_Src_Menu
30.08.2006 V1.20: - added discrete commands for:
- Stereo Mode
- 3CH-Music Mode
- 3CH-Movie Mode

20.11.2012 V1.21 Checksum computation corrected (mod 0x100)