RS232 control of SR1535.

The surround receiver SR1535R with software version *1.13* or higher 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. With versions from *1.40* or higher there is the additional possibility to receive status information from the SR1535R.

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:	command correctly received
	= check sum –1:	command ignored (system busy)
	= check sum –2:	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.
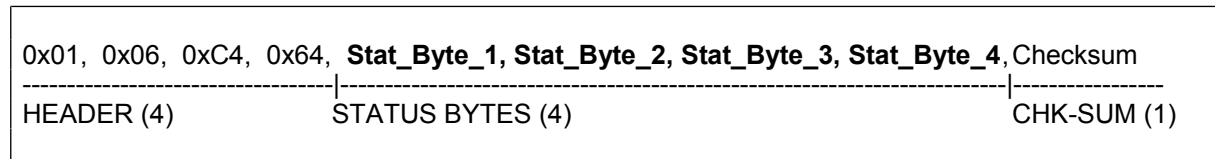

Special System Commands

Beginning with version 1.40 the SR1535R 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 SR1535R are as follows:

Status 1:

The STATUS_1 is automatically pushed by the SR1535R when any contained information has changed or the command STATUS_1 was sent to the SR1535R. It is answered by a 9 byte long status telegram having the following format:
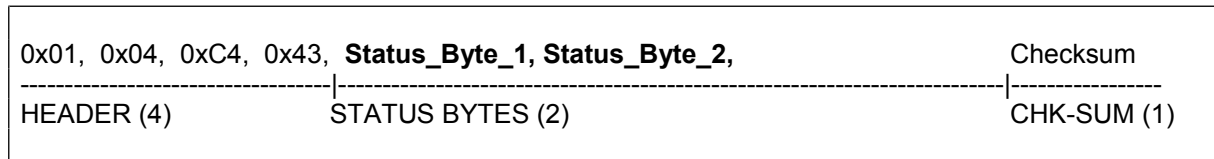
```
0x01, 0x06, 0xC4, 0x64, Stat_Byte_1, Stat_Byte_2, Stat_Byte_3, Stat_Byte_4, Checksum
----------------------------------|-------------------------------------------------------------------------------|----------------
HEADER (4)                        STATUS BYTES (4)                                                   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	Protection	1:= Amplifier is in protection mode (overload / overheat)	
	b1	Speaker_A	1:= speaker A output is ON	
	b2	Speaker_B	1:= speaker B output is ON	
	b3	Speaker_C	1:= speaker C output is ON	
	b4	Speaker_D	1:= speaker D output is ON	
	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	8:= AUX 3
	b1		1:= CD	9:= DVD
	b2		2:= TUNER	10:= STB
	b3		3:= TAPE 1	11:= VCR
	b4	Recording Source (0...15)	4:= TAPE 2	12:= AUX/AV 1
	b5		5:= TV/Video	13:= AUX/AV 2
	b6		6:= AUX 1	14:= DBR (Digital Radio)
	b7		7:= AUX 2	15:= not def. / future use

Stat_Byte_3	b0	LOUDness	1:= Loudness is ON		
	b1	FLAT	1:= FLAT is ON (= Tone defeat)		
	b2	DirectStereo	1:= High Quality stereo mode		
	b3				
	b4	SurroundMode (0...15)	0:= Surnd (5.1)	5:= Disco	10:= Church
	b5		1:= Stereo	6:= Hall	11:= MCH-Input
	b6		2:= Mono	7:= Opera	15:= Surnd EX/ES
	b7		3:= Mono I	8:= Arena	(7.1)
			4:= Mono II	9:= Club	

Stat_Byte_4	b0	SourceFormat (0...4)	0:= analog	4:=AAC
	b1		1:= PCM	
	b2		2:= Dolby Digital	
	b3		3:= DTS	
	b4	DecodingMode (0...10)	0:= None 1:= Dolby Pro Logic II Movie Mode 2:= Dolby Pro Logic II Music Mode	
	b5		3:= Dolby Pro Logic II Matrix Mode 4:= Dolby Pro Logic IIx Movie Mode	
	b6		5:= Dolby Pro Logic IIx Music Mode 6:= Dolby Pro Logic IIx Matrix Mode	
	b7		7:= Dolby Pro Logic IIx EX compatible Mode 8:= DTS Neo:6 Cinema Mode 9:= DTS Neo:6 Music Mode 10:= DTS ES	

Status 2:

The STATUS_2 is automatically pushed by the SR1535R when the volume has changed or the command STATUS_2 was sent to the SR1535R. 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	Command Code (HEX)	toggle	Remark
System ON	0x57		Switch the master device ON
System Standby	0x77		Switch the system (master and source devices) to STANDBY
System OFF	0x7A		Switch the system completely OFF
Volume + Tone Control			
VOL_PLUS	0x00		Performs 1 volume step of the main room volume.
VOL_MINUS	0x20		**Hint**: Repeat these commands for continuous volume increase/decrease (command repetition rate = 100...110 ms)
VOL_B_PLUS	0x4E		Performs 1 volume step of the 2nd room volume (if enabled)
VOL_B_MINUS	0x6E		**Hint**: Repeat these commands for continuous volume increase/decrease (command repetition rate = 100...110 ms)
Balance_L	0x38		one step to the left
Balance_R	0x18		one step to the right
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 insequence ON and OFF: A -> B -> A+B -> OFF **Hint**: better use the "discrete" Speaker_A/Speaker_B ON + OFF commands
Speaker_A ON	0x68		Speaker A output ON
Speaker_A OFF	0x48		Speaker A output OFF
Hint: Although the SR1535R has no Speaker B/C/D outputs itself it reacts to the commands and switches external amps. When 2nd room functions are enabled the speakers C/D are mapped to 2nd room speakers A/B (2nd room amp needs special software).			
Speaker_B ON	0x58		Speaker B output ON
Speaker_B OFF	0x78		Speaker B output OFF
Speaker_C ON	0x6C		Speaker C output ON
Speaker_C OFF	0x4C		Speaker C output OFF
Speaker_D ON	0x5C		Speaker D output ON
Speaker_D OFF	0x7C		Speaker D output OFF
Surround control			
Surround EX/ES	0x6F		Surround EX/ES mode
Surround 5.1	0x6D		Surround 5.1 mode
Stereo	0x4D		Stereo mode
Mono	0x5D		Mono mode
Mono I	0x7D		use left channel for Mono
Mono II	0x53		use right channel for Mono
Disco	0x63		SoundField: Disco
Hall	0x76		SoundField: Hall
Opera	0x7E		SoundField: Opera
Arena	0x71		SoundField: Arena
Club	0x69		SoundField: Club
Church	0x79		SoundField: Church
MCH-Input	0x67		Use Multichannel-Input if assigned to active source
SURND	0x37	x	toggle between Surround- and Preamp-Mode
PRE	0x0E		switch to HQ-Stereo-Mode

Source selection (Group commands)			
CD	0x23	x	CD ←→ DVD
Tuner	0x17		Tuner
Tape	0x35		Tape
DAT/Tape-2	0x15	x	VCR-1 ←→ VCR-2
Video/TV	0x07	x	TV ←→ STB
AUX	0x3D	x	AUX/P → AUX-AV-1 → AUX-AV-2 ...
MC/Aux-2	0x27		AUX/P
MM/Aux-3	0x1D	x	AUX-AV-1 ←→ AUX-AV-2
Source selection (discrete commands)			
SRC_CD	0x45		CD
SRC_Tuner	0x46		Tuner
SRC_Tape-1	0x49		Tape
SRC_TV	0x59		TV
SRC_Aux-2	0x65		AUX/P
SRC_Aux-3	0x61		CAM
SRC_DVD	0x42		DVD
SRC_STB	0x62		STB
SRC_VCR-1	0x52		VCR-1
SRC_Aux-AV-1	0x72		Aux-AV-1
SRC_Aux-AV-2	0x4A		Aux-AV-2
SRC_VCR-2	0x66		VCR-2
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) which are normally forwarded to the active source device.			

Revision history:

01.09.2005	release
07.09.2005	added STATUS_BYTE_4 – DecodingMode – Message "DTS ES" for value=10. (without this the DTS ES operation is falsely indicated as "DTS" "PLIIx...") (supported by SR1535R V1.41 and later).
14.05.2007	corrected code for Surround-Mode 'Mono I' from 0x3D to 0x7D.
20.11.2012	Checksum computation corrected (mod 0x100)