SAC Control Surface Protocol

This is a proposal for a generic SAC control surface protocol that would allow interfacing SAC with a middle-layer piece of software that communicates with various real-world control surfaces. The theory is that if SAC supports this protocol, then anyone with sufficient programming knowledge can write a program to interface SAC with a control surface of their choice.

My proposal is to use TCP/IP sockets to communicate between SAC and the CS middleware software (hereafter "CS"). Two sockets would be used, one for transmissions between SAC and the CS and one socket for transmissions between the CS and SAC.

The first byte of each transmission would identify the type of transmission. The following tables specify the various transmission types:

Table 1: SAC to CS Transmission Types

First Byte of Transmission (type)	Meaning
1	SAC to CS input channel strip transmission (I1-I72)
2	SAC to CS aux/return channel strip transmission
3	SAC to CS hardware output channel strip transmission (O1-O8)
4	SAC to CS group output channel strip transmission (O9-O24)
5	SAC to CS hot channel change
6	SAC to CS meter value transmission
7	SAC to CS set input channel label
8	SAC to CS set aux/return channel labels
9	SAC to CS set output channel labels

Table 2: CS to SAC Transmission Types

First Byte of Transmission (type)	Meaning
1	CS to SAC input channel strip transmission
2	CS to SAC aux/return channel strip transmission

Table 2: CS to SAC Transmission Types

First Byte of Transmission (type)	Meaning
3	CS to SAC hardware output channel strip transmission (O1-O8)
4	CS to SAC group output channel strip transmission (O9-O24)
5	CS to SAC hot channel change
6	(unused)
7	CS to SAC set input channel label
8	CS to SAC set aux/return channel labels
9	CS to SAC set output channel labels

The type byte will specify the number of parameter bytes following the type byte. See the specific sections that follow for a description of these parameter bytes.

Most parameter values are byte-sized values. However, some values are 16 bits; for 16-bit objects, the L.O. byte is transmitted first and the H.O. byte is transmitted second (standard little endian format for Intel x86 processors).

SAC->CS input channel strip transmission data packet

SAC sends a channel transmission data packet to the CS whenever some value of an input channel strip changes at the SAC host (unless this change is a direct consequence of a CS to SAC channel strip transmission data packet). Note that meter updates (which are very frequent) are not transmitted as part of the SAC to CS transmission data packet (to reduce network congestion). Only changes to actual SAC user-input controls are transmitted in this data packet.

Table 3: SAC to CS Input Channel Strip Transmission

Byte	Purpose	
0	1	Identifies this as a SAC to CS input channel strip transmission.
1	Current Hot Channel	0 if an input channel is not the current hot channel, 1-72 if an input channel is the current hot channel.
2	Channel number	1-72

Table 3: SAC to CS Input Channel Strip Transmission

Byte	Purpose	
3	Flags #1	Bits: 0:Chan disable, 1:mono, 2: Phs Rvs, 3: Swap L/R 4: Hi Cut, 5: Lo Cut, 6: EQ In 7: Key Listen (Note: no bit for reset flat, not needed)
4	Flags #2	Bits: 0: Key Listen, 1:Gate Rvs, 2: Gate On 3:Comp On 4: PreFader FX enabled, 5: PostFader FX enabled 6: aux 1 in 7: aux 1 post
5	Flags #3	Bits: 0: Aux 2 in 1: Aux 2 post 2: aux 3 in 3: aux 3 post 4: Aux 4 in 5: Aux 4 post 6: aux 5 in 7: aux 5 post
6	Flags #4	Bits: 0: Aux 6 in 1: Aux 6 post 2: XY Pan in 3: Mute 4: solo
7	Assign Flags #1	Bits 0-7: Out Assign 1-8
8	Assign Flags #2	Bits 0-7: Out Assign 8-16
9	Assign Flags #3	Bits 0-7: Out Assign 17-24
10	Input Source	0..145 provides an index into 72 mono sources + 72 stereo sources + FX Source + Off)
11	Mono Mode	0..6 selects the seven possible mono modes
12-13	Attenuator level	-79.75 to +20.00 dB in 1/4 dB steps
14	EQ Band 1 BW.	0-29 selecting 0.1 to 3.0 octaves in 0.1 octave steps.
15-16	EQ Band 1 Freq.	Selects EQ frequency.
17	EQ Band 1 gain.	-15 to +15 in 0.5 dB steps.
18	EQ Band 2 BW.	0-29 selecting 0.1 to 3.0 octaves in 0.1 octave steps.
19-20	EQ Band 2 Freq.	Selects EQ frequency.
21	EQ Band 2 gain.	-15 to +15 in 0.5 dB steps.
22	EQ Band 3 BW.	0-29 selecting 0.1 to 3.0 octaves in 0.1 octave steps.
23-24	EQ Band 3 Freq.	Selects EQ frequency.
25	EQ Band 3 gain.	-15 to +15 in 0.5 dB steps.
26	EQ Band 4 BW.	0-29 selecting 0.1 to 3.0 octaves in 0.1 octave steps.

Table 3: SAC to CS Input Channel Strip Transmission

Byte	Purpose	
27-28	EQ Band 4 Freq.	Selects EQ frequency.
29	EQ Band 4 gain.	-15 to +15 in 0.5 dB steps.
30	EQ Band 5 BW.	0-29 selecting 0.1 to 3.0 octaves in 0.1 octave steps.
31-32	EQ Band 5 Freq.	Selects EQ frequency.
33	EQ Band 5 gain.	-15 to +15 in 0.5 dB steps.
34	Key (dynamics)	0-72 selects self + ch 1..ch 72
35-36	Key Eq Hi	Selects one of the high EQ frequencies for the key listen
37-38	Key Eq Low	Selects one of the low EQ frequencies for the key listen.
39	Gate attack	0-119 selects one of the attack times.
40	Gate release	0-73 selects one of the release times.
41-42	Gate Floor	79.75 dB to +0.0 dB in 1/4 dB increments.
43-44	Gate Threshold	inf, -79.75 to +0.0 dB in 1/4 dB increments.
45	Comp attack time	
46	Comp release time	
47	Compression ratio	
48-49	Comp threshold	(byte 47 is L.O. byte, byte 48 is H.O. byte) inf, -79.75 to +0.0 dB in 1/4 dB increments.
50-51	Comp gain	(byte 48 is L.O. byte, byte 50 is H.O. byte), -79.75 to +20.0 dB in 1/4 dB increments.
52-53	Aux 1 mix	(byte 51 is L.O. byte, byte 52 is H.O. byte), inf, -79.75 to +20.0 dB in 1/4 dB increments.
54	Aux 1 pan.	-127..-1 is left, 0 is centered, +1..+127 is right.
55-56	Aux 2 mix	(byte 54 is L.O. byte, byte 55 is H.O. byte), inf, -79.75 to +20.0 dB in 1/4 dB increments.
57	Aux 2 pan.	-127..-1 is left, 0 is centered, +1..+127 is right
58-59	Aux 3 mix	(byte 57 is L.O. byte, byte 58 is H.O. byte), inf, -79.75 to +20.0 dB in 1/4 dB increments.
60	Aux 3 pan.	-127..-1 is left, 0 is centered, +1..+127 is right.

Table 3: SAC to CS Input Channel Strip Transmission

Byte	Purpose	
61-62	Aux 4 mix	inf, -79.75 to +20.0 dB in 1/4 dB increments.
63	Aux 4 pan.	-127..-1 is left, 0 is centered, +1..+127 is right.
64-65	Aux 5 mix	inf, -79.75 to +20.0 dB in 1/4 dB increments.
66	Aux 5 pan.	-127..-1 is left, 0 is centered, +1..+127 is right.
67	XY Pan X-pan.	Negative values pan left, positive pan right.
68	XY Pan Y-pan.	negative values pan down positive pan up.
69	XY Pan S-pan	
70	XY Pan C-pan.	
71	Pan.	Negative values pan left, positive values pan right
72-73	Gain/volume	inf, -79.27 to +20.00 dB in 1/4 dB increments.

SAC->CS aux/return channel strip transmission data packet

SAC sends a channel transmission data packet to the CS whenever some value of an aux/return channel strip changes at the SAC host (unless this change is a direct consequence of a CS to SAC aux/return channel strip transmission data packet). Note that meter updates (which are very frequent) are not transmitted as part of the SAC to CS aux/return channel strip transmission data packet (to reduce network congestion). Only changes to actual SAC user-input controls are transmitted in this data packet.

Table 4: SAC to CS Aux/Return Channel Strip Transmission

Byte	Purpose	
0	2	Identifies this as a SAC to CS aux/return channel strip data transmission.
1	Current Hot Channel	0 if the current hot channel is not an aux/return channel, 1-6 if it is an aux/return channel.
2	Channel number	1-6
3	Out Assign	0=Virtual, 1-up is hardware
4-5	Input Pan	Negative numbers pan left, 0 is centered, positive numbers pan right.

Table 4: SAC to CS Aux/Return Channel Strip Transmission

Byte	Purpose	
6-7	Input Gain	inf, -79.75 to +20.0 dB in 1/4 dB increments.
8-9	Return Input Source	0=virtual, 1-72=mono sources, 73-109=stereo sources, 110-up = SSLINK sources.
10	Mono input source	0:stereo, 1-6= L+R, etc.
11-12	Return attenuator	inf, -79.75 to +20.0 dB in 1/4 dB increments.
13	Phase Reverse	0: off, 1:both, 2: L only, 3: R only
14	Flags	Bits: 0: swap LR 1: Prefader FX enabled 2: Postfader FX enabled 3: Solo 4: Mute 5: XY Pan in
15	Assign Flags #1	Bits 0-7: Out Assign 1-8
16	Assign Flags #2	Bits 0-7: Out Assign 8-16
17	Assign Flags #3	Bits 0-7: Out Assign 17-24
18-19	XY Pan X-pan.	Negative values pan left, positive pan right.
20-21	XY Pan Y-pan.	Negative values pan down positive pan up.
22-23	XY Pan S-pan	inf, -79.75 to +20.0 dB in 1/4 dB increments.
24-25	XY Pan C-pan.	inf, -79.75 to +20.0 dB in 1/4 dB increments.
26-27	Pan.	Negative values pan left, positive values pan right
28-29	Gain/volume	inf, -79.27 to +20.00 dB in 1/4 dB increments.

SAC->CS hardware output channel strip (O1-O8) transmission data packet

SAC sends a hardware output channel transmission data packet to the CS whenever some value of a hardware output channel strip changes at the SAC host (unless this change is a direct consequence of a CS to SAC hardware output channel strip transmission data packet). Note that meter updates (which are very frequent) are not transmitted as part of the SAC to CS hardware output channel strip transmission data packet (to reduce network congestion). Only changes to actual SAC user-input controls are transmitted in this data packet.

Table 5: SAC to CS Hardware Output Channel Strip Transmission

Byte	Purpose	
0	3	Identifies this as a SAC to CS hardware output channel strip data transmission.
1	Current Hot Channel	0 if the current hot channel is not a hardware output channel, 1-8 if it is a hardware output channel.
2	Channel number	1-8
3	Out Assign	0=Virtual, 1-36 is hardware output channel pair
4	XY Pan Assign, solo, & mute	Bit: 0:LR Front 1:LR Center 2:LR Rear 3:FB Center 4:Sub 5:Center 6:Solo 7:Mute
5-6	Pan	Negative values pan left, zero is centered, positive pan right.
7-8	Gain/volume	inf, -79.27 to +20.00 dB in 1/4 dB increments.

SAC->CS group output channel strip (O9-O24) transmission data packet

SAC sends a group output channel transmission data packet to the CS whenever some value of a group output channel strip (O9-O24) changes at the SAC host (unless this change is a direct consequence of a CS to SAC group output channel strip transmission data packet). Note that meter updates (which are very frequent) are not transmitted as part of the SAC to CS group output channel strip transmission data packet (to reduce network congestion). Only changes to actual SAC user-input controls are transmitted in this data packet.

Table 6: SAC to CS Group Output Channel Strip Transmission

Byte	Purpose	
0	4	Identifies this as a SAC to CS group output channel strip data transmission.

Table 6: SAC to CS Group Output Channel Strip Transmission

Byte	Purpose	
1	Current Hot Channel	0 if the current hot channel is not a group output channel, 9-24 if it is a group output channel.
2	Channel number	9-24
3	Mono	0:stereo 1: L+R -6dB 2: L + R 3: L Only 4: R Only 5: L - R (-6dB) 6: L - R
4	Prefader FX enable	0: disabled, 1:enabled
5	Postfader FX enable	0: disabled, 1:enabled
6	Out Assign	0: group latch, 1-8: Master 1-8
7	XY Pan Assign, solo, & mute	Bit: 0:LR Front 1:LR Center 2:LR Rear 3:FB Center 4:Sub 5:Center 6:Solo 7:Mute
8-9	Pan	Negative values pan left, zero is centered, positive pan right.
10-11	Gain/volume	inf, -79.27 to +20.00 dB in 1/4 dB increments.

SAC->CS Hot Channel Change

SAC sends a hot channel change transmission data packet to the CS whenever the hot channel changes, unless this channel change is the result of a CS to SAC hot channel change command.

Table 7: SAC to CS Hot Channel Change Transmission

Byte	Purpose	
0	5	Identifies this as a SAC to CS hot channel change data transmission.
1	New Fader Group	0: Input group, 1: Aux/Return group, 2: Output group
2	New hot channel number	Input: 1-72 Aux/Return: 1-6 Output: 1-24

SAC->CS Meter Value Transmission

SAC sends a meter value transmission data packet to the CS whenever any one of the meter values changes. Note that SAC will frequently send this data transmission package.

Table 8: SAC to CS Meter Value Transmission

Byte	Purpose	
0	6	Identifies this as a SAC to CS meter value data transmission.
1-72	Meter values for input channels	Value indicates the height of the meter bar graph
72-77	Meter values for aux/return channels	Value indicates the height of the meter bar graph
78-101	Meter values for output channels	Value indicates the height of the meter bar graph

SAC->CS Set Input Label Transmission

SAC sends a string specifying a label for one of the input channels.

Table 9: SAC to CS Input Channel Label Transmission

Byte	Purpose	
0	7	Identifies this as a SAC to CS input label data transmission.
1	Channel number	1-72. Value indicates the input channel to which the label is applied.
2	Character count	Value indicates the number of characters in the label (n)
3 .. (n+1)	Characters	Characters in the label

SAC->CS Set Aux/Return Label Transmission

SAC sends two strings specifying the labels for one of the aux/return channels.

Table 10: SAC to CS Aux/Return Label Transmission

Byte	Purpose	
0	8	Identifies this as a SAC to CS aux/return label data transmission.
1	Channel number	1-72. Value indicates the input channel to which the label is applied.
2	Character count #1	Value indicates the number of characters in the top label (n)
3	Character count #2	Value indicates the number of characters in the bottom label (m)
4 .. (n+1)	Characters	Characters for the top label
(n+2) .. (n+m -1)	Characters	Characters in the bottom label

SAC->CS Set Output Label Transmission

SAC sends a string specifying a label for one of the output channels.

Table 11: SAC to CS Output Channel Label Transmission

Byte	Purpose	
0	9	Identifies this as a SAC to CS output label data transmission.
1	Channel number	1-24. Value indicates the output channel to which the label is applied.
2	Character count	Value indicates the number of characters in the label (n)
3 .. (n+1)	Characters	Characters in the label