RS232 Comms port on Casa controller

Paul Dorrell, Malcolm Law & Richard Dudley, B&W Loudspeakers SRE
Document revision I, 16 Oct 2000
Scope : Software revision 2.14 or later

Physical

9600 baud serial, 8 bits, no parity, 1 start bit, 1 stop bit.
No flow control - RTS/CTS tied together, no Xon/Xoff protocol.
9 pin D-type female connector, receive on pin3, transmit on pin2
Note : in installations with multiple networked controllers, each will need to be controlled over its own RS232 port. There is no provision in the protocol for accessing other networked controllers via RS232.

Flash EPROM updating

In order to update the on-board Flash memory, the CPU must be set into boot mode. This is done by setting Config switch 2 in the down position, with the power off, and then powering up. The DOS program 'bloader.exe' is provided to download revised software. The CPU also has another form of non-volatile storage in the form of battery-backed RAM. We strongly recommend that this is also purged after a software upgrade – this can be achieved by means of the Visual Basic program provided. Further instructions regarding downloading new software are provided with the boot loader and any revised software.
Note on controllers with serial numbers below 600, the config 2 switch is inoperable. Boot mode is engaged with a programming link on the CPU card. To access the CPU card, remove six screws in the underside of the lid and three along the top of the rear panel.

Operational communications

A bi-directional command and status channel is provided between the Casa controller and any external equipment according to the following definitions.

Structure

Data (in both directions) is transferred in 'packets'.
A packet is a sequence of 2-17 bytes with the following format
Byte 1 : Most significant nibble checksum, least significant nibble n = number of data bytes
Byte 2 : Type of packet. See list of valid packet types below.
Byte 3 to 2+n : Extra data.

The checksum is such that the binary sum of the nibbles is equal to 0xC modulo 0x10.

Types of Packet

0 Error. Byte 3 contains an error number, subsequent bytes may give additional info.

1 Is anybody out there? Just acknowledge if you hear me.

2 Set Linkages.
Used to define what information the Casa system transmits on the RS232 (default none), and to define if any internal data links (eg passing keypad keypresses though to user interface) are to be broken. The default condition is that all internal data links are intact. See below for further description of linkages.

3 Keypress.
4 extra bytes : Zone, Keyno, Age of keypress (2 bytes low, high).
Received from Casa signifies a key is pressed on the keypad.
Transmitted to Casa 'pokes' a keypress into the user interface.
An 'age' of -1 indicates 'key released' and is not essential.
A key may repeat (whilst held down), with strictly increasing ages which do not have to be consecutive. There should be around 20 'ages' to the second, and a 'long keypress' is deemed to be one with an 'age' of > 3 seconds. See appendix A1 for tabulation of key values.

4 Display.
Zone, 8 characters text.
Appendix B points to the Siemens datasheet which depicts the character set available, using 7-bit characters.
The MSB of each character can be set to indicate flashing.

5 Preamplifier hardware.
See below for additional packet structure.

6 Preamplifier user interface.
Zone no 0-3 (corresponding with zones A-D respectively)
Zone no.s 128-131 (i.e. MSB set) denote an enquiry and require the function only.
Function Bit 0=volume, Bit 1=source, Bit 2=balance, Bit 3=bass, Bit 4=treble, Bit 5=Preset local input volume
Values signed bytes. The specified values in order volume,...,treble.

Range for bal,bass,treb is [-7,+7] , +ve balance is 'panned right', or left channel attenuated.
Source is 0-3 for controller sources, 4 for local input.
The Preset local i/p volume is for applications where a fixed volume setting is required for the local i/p (the value given will be rounded to a valid level currently 10,15,...,80). If the normal variable volume level is required, it should be set to 0.

Example
0x84,0x06, 0x02,0x09,0x30,0xFD
Set the volume on zone 2 to 48, and the bass on zone 2 to -3

7 Erase Srctable in Flash - to amend supported source equipment
This function is not currently supported - so do not use.

8 Write Srctable Flash - for updating supported source equipment
This function is not currently supported - so do not use.

9 Configure Source
Source no. 0-3 (With bit 7 set denotes an enquiry : no further bytes needed)
Global id 0-15
Casa id 16 bits : low, high.
(0 if equipment is controlled by another Casa controller in the network)
The Global id identifies a particular item of equipment that is controlled by the network of Casa systems, whilst the Casa id is a reference into the Casa database of types of source equipment.
Example packet
0xD3,0x09, 0x00, 0x02, 0x01.
This says that the audio coming into this controller on channel 0 is from equipment 2. Equipment 2 is controlled by this controller (not any others), and is of type 1 (a Rotel Tuner).
There is a further complication in that equipment of global id 0xC-0xF (if present) must be locally controlled. If two separate controllers reference equipment 0xC they mean different pieces of equipment.

10 Set time
Hours (0-23)
Minutes (0-59)
Seconds (0-59)
Sets the time on the whole network, not just this controller. See appendix A3 for an example.

11 Alarm
Zone no 0-3
Zone no.s 128-131 (i.e. MSB set) denote an enquiry and need no further bytes.
enabled Bit 0=Alarm on enabled, 1=Alarm off enabled, 2=Clock display enabled
Minutes on 0-59
Hour on 0-23
Source on 0-3
Minutes off 0-59
Hour off 0-23

See appendix A2 for an example.

Error Codes

0 No Error : Acknowledgement.
Subsequent bytes (if present) are
Major version no.
Minor version number (if top bit set it is interim - should not be seen outside B&W).
Source Major version no.
Source Minor version number (top bit set is interim).
1 Timeout.

2 Checksum Error.
3 Bad command.
4 Can't do (eg attempt to erase flash without enabling linkage).
5 Flash not erased (when writing an area).
6 Casa Id not known (source set to something not defined in Flash)

Set Linkages

The principle here is that internally, the Casa control software is composed of several communicating subsystems.

Keypad (displays messages and generates keypresses)
|
User interface -- IR control of source equipment.
|
Preamp hardware

Any of these communications links can have information 'poked' into them which will be understood as if it came from the legitimate source. Further, any of these links can be set-up to output information to the RS232 interface, or 'peeked'. The direct links can also be completely severed and perhaps replaced with external connections in the driving software, thus completely changing the 'personality' of Casa. Be warned though that the responsiveness of the whole system will then depend on any latencies introduced by the controlling system.
It should also be noted that the RS232 communications are to a particular casa controller - if a network of them is required to be controlled this can only be accomplished by dealing with each controller individually over its RS232 port.

The user interface to IR control link cannot be hooked into as of yet.

Data format

Byte 3 : Type of linkage
Byte 4 : Enable/disable mask.

Linkage types :
1 Display information

2 Keypresses

3 Preamp

Mask :
Zones A-D correspond to bits 0-3 and 4-7 respectively.
Bits 0 through 3 are set for 'want to peek that zone'.
Bits 4 through 7 are set for 'cut internal link on that zone'

Preamplifier hardware

For flexibility, the link between the user interface and the preamp hardware is defined to be at quite a low level - at the level of the control bytes sent over an internal serial interface to the TDA7318 preamp chip. Moreover it is quite feasible

that an RS232 device might wish to control several preamp chips synchronously, for example to re-configure the controller to deal with 5.1 surround sources. Therefore this message contains a 'subpacket' structure - each containing the bytes to be sent to that particular preamp chip.

Header Bits 5-7 : Number of data bytes n
Bit 4 : =1 to control a local input preamp, =0 to control inbuilt 7318.
Bits 2-3 : Reserved - set to 0
Bits 0-1 : Zone number of preamp.

n x data bytes.

As many subpackets as desired (and will fit) may be contained in a packet - and they will be obeyed as synchronously as possible. See appendix C for low-level control information to TDA7318 (from the SGS datasheet).

Appendices

Appendix A1: internal keycodes

These codes are applicable when using packet type 3, sending or receiving keypresses.

Key	*Code (decimal)*	
Zone Off	0	
All Off	1	
Tuner	2	
CD	3	
Aux1	4	
Aux2	5	
Local	6	
Stop	7	
<	8	
>	9	
<<	10	
>>	11	
FavStn		12
Random	13	
Vol-	14	
Vol+	15	
Mute	16	
Casa	17	
Refresh display		18
Local present		19
On/Off	21	(small keypad only)

Example - to increase volume one step on zone B send the following six bytes

0x54, 0x03 , 0x01, 0x0F, 0x00, 0x00

Composed of :
Checksum = 0x5
Number of data bytes = 0x4

Packet type = 0x03
Zone B = 0x01
Vol+ = 0x0F
Age = 0x0000

Example - to select Tuner on zone D send the following six bytes

0x04, 0x03 , 0x03, 0x02, 0x00, 0x00

Composed of :
Checksum = 0x0
Number of data bytes = 0x4
Packet type = 0x03
Zone D = 0x03
Tuner = 0x02
Age = 0x0000

Example - a long (3 second) keypress on CASA to set timer on zone B send the following six bytes

0x04, 0x03 , 0x01, 0x11, 0x3F, 0x00

Composed of :
Checksum = 0x0
Number of data bytes = 0x4
Packet type = 0x03
Zone B = 0x01
Casa = 0x11
Age = 0x003F

Example - a very long (6 second) keypress on CASA to set clock send the following six bytes

0x64, 0x03 , 0x01, 0x11, 0x75, 0x00

Composed of :
Checksum = 0x6
Number of data bytes = 0x4
Packet type = 0x03
Zone B = 0x01 NB: this identifies the zone keypad, however the clock, once set, is common to all zones.
Casa = 0x11
Age = 0x0075

The above keycodes are also used for keypads assigned to SubzoneA in a zone configured for subzone operation. To generate keycodes for other subzones these basic keycodes need to be added to 32, 64, and 96 for Subzones B, C, and D respectively. For example, the keycode for "On/Off" from SubzoneB is (21 + 32 = 53) 0x35. Also, the keycode for "Vol+" from SubzoneC is (15 + 64 = 79) 0x4F.

Appendix A2 : setting alarm

This example uses packet type 11, high level command for setting an alarm, and sends the following nine bytes

0x57, 0x0B, 0x01, 0x04, 0x00, 0x08, 0x00, 0x00, 0x17

Composed of :
Checksum = 0x5
Number of data bytes = 0x7
Packet type = 0x0B
Zone B = 0x01
Enable = 0x04 enable clock, disable on time, disable off time.
Minute on = 0x00
Hour on = 0x08 on at 8:00 am
Source = 0x00 source 1 (tuner)
Minute off= 0x00
Hour off= 0x17 off at 11:00 pm

The hour parameter represents “hour of day” in a 24 hour format.

Appendix A3 : setting clock time

This example uses packet type 10, high level command for setting clock time, and sends the following five bytes

0xF3, 0x0A, 0x0F, 0x25, 0x19

Composed of :
Checksum = 0xF
Number of data bytes = 0x3
Packet type = 0x0A
Hour = 0x0F Decimal 15 which is 24 hour format for 3 pm.
Minute = 0x25
Second = 0x19 3:37:25 pm

Appendix A4 : calculating checksums

The very first "nibble" (half a byte) of any string sent is call the "checksum correction nibble". So in the example string:

0x54, 0x03, 0x01, 0x0F, 0x00, 0x00.

this has a value of 5. This nibble is calculated so that the sum of all the nibbles in the string equals hexadecimal C. So for the above string:

5 + 4 + 0 + 3 + 0 + 1 + 0 + F + 0 + 0 + 0 + 0 = 0x1C.

This sum modulo 0x10 (taking the last hexadecimal digit) should always equals hex C. So the "checksum correction nibble" is simply a means of ensuring that the real checksum always equals C. At the receiving end, if the calculated checksum is not C then the string is rejected.

Of course, when composing the string, the user will need to perform the calculation in reverse. So, in the context of the example, this would be as follows:

Checksum correction nibble = 0x0C - (4 + 0 + 3 + 0 + 1 + 0 + F + 0 + 0 + 0 + 0)

= 0x0C - 0x17
= 0xF5
= 0x5 (modulo 0x10)

Appendix B

(Siemens datasheet for DLG2416)
http://www.sci.siemens.com/pdf/opto/intelligent/dlr2416.pdf

Appendix C

(STM datasheet for TDA7318)
http://www.st.com/stonline/books/pdf/docs/1491.pdf

Revision History

Revision C 16 Dec 97

Optional version number added to Acknowledge.
Examples made into complete packets.

Revision D 10 Feb 98

Local input Preset volume added to Configure Source

Revision E 17 April 98

Acknowledge response extended to include source versioning

Revision F,G July/Sept 98

Further example packet added, keycodes identified

Revision H Jan 99

Code for local input present included, hyperlinks added to pdf files for appendices.

Revision I Oct 2000

Extensions to Appendix A1 to cover keycodes from small keypads in Subzones B, C, and D.

B&W CASA Controller
RS232 Controller Command List

Table: CASA Waveform format expected:

Baud Rate	Parity	Valid Data Bits	Stop Bit Value	Handshaking	Data Type
9600	N	8	1	None	String

Table: CASA expected format of a request by RS232 controller:

Standard Request:

Checksum / Count	Type	Zone	Command	Age
0xX4	0x03	0x0X	0xXX	0xXX 0xXX

NOTE: The values in the tables below show the exact byte sequence of all requests. The device will expect the bytes only - no spaces, delimiter, etc. The values in the first column are Hexadecimal.

Table 1: Type 10 Primary Command List – Main Zones / Subzone A

The following commands are the primary Zone commands. When a zone is configured for subzone operation, the main zone is considered Subzone A. Subzone commands for subzones B-D are provided in tables 2-4.

CASA HEX	Command	Command Description
54 03 00 00 00 00	Zone A Off	Zone A Off
44 03 00 01 00 00	Zone A All Off	Zone A All Off
34 03 00 02 00 00	Zone A Tuner	Zone A Source Tuner
24 03 00 03 00 00	Zone A CD	Zone A Source CD
14 03 00 04 00 00	Zone A Aux1	Zone A Source AUX1
04 03 00 05 00 00	Zone A Aux2	Zone A Source AUX2
F4 03 00 06 00 00	Zone A Local	Zone A Source Local
E4 03 00 07 00 00	Zone A Stop	Zone A Stop
D4 03 00 08 00 00	Zone A |<	Zone A Track |<
C4 03 00 09 00 00	Zone A >|	Zone A Track >|
B4 03 00 0A 00 00	Zone A <<	Zone A <<
A4 03 00 0B 00 00	Zone A >>	Zone A >>
94 03 00 0C 00 00	Zone A FavStn	Zone A Favorite Station
84 03 00 0D 00 00	Zone A Random	Zone A Random
74 03 00 0E 00 00	Zone A Vol-	Zone A Volume -
64 03 00 0F 00 00	Zone A Vol+	Zone A Volume +
44 03 00 10 00 00	Zone A Mute	Zone A Mute Toggle
34 03 00 11 00 00	Zone A CASA	Zone A CASA button
24 03 00 12 00 00	Zone A Refresh	Zone A Refresh Display
14 03 00 13 00 00	Zone A Local Present	Zone A Local Present
F4 03 00 15 00 00	Zone A On/Off	Zone A On/Off (Small Keypad)
44 03 01 00 00 00	Zone B Off	Zone B Off
34 03 01 01 00 00	Zone B All Off	Zone B All Off
24 03 01 02 00 00	Zone B Tuner	Zone B Source Tuner
14 03 01 03 00 00	Zone B CD	Zone B Source CD

CASA HEX	Command	Command Description
04 03 01 04 00 00	Zone B Aux1	Zone B Source AUX1
F4 03 01 05 00 00	Zone B Aux2	Zone B Source AUX2
E4 03 01 06 00 00	Zone B Local	Zone B Source Local
D4 03 01 07 00 00	Zone B Stop	Zone B Stop
C4 03 01 08 00 00	Zone B |<	Zone B Track |<
B4 03 01 09 00 00	Zone B >|	Zone B Track >|
A4 03 01 0A 00 00	Zone B <<	Zone B <<
94 03 01 0B 00 00	Zone B >>	Zone B >>
84 03 01 0C 00 00	Zone B FavStn	Zone B Favorite Station
74 03 01 0D 00 00	Zone B Random	Zone B Random
64 03 01 0E 00 00	Zone B Vol-	Zone B Volume -
54 03 01 0F 00 00	Zone B Vol+	Zone B Volume +
34 03 01 10 00 00	Zone B Mute	Zone B Mute Toggle
24 03 01 11 00 00	Zone B CASA	Zone B CASA button
14 03 01 12 00 00	Zone B Refresh	Zone B Refresh Display
04 03 01 13 00 00	Zone B Local Present	Zone B Local Present
E4 03 01 15 00 00	Zone B On/Off	Zone B On/Off (Small Keypad)
34 03 02 00 00 00	Zone C Off	Zone C Off
24 03 02 01 00 00	Zone C All Off	Zone C All Off
14 03 02 02 00 00	Zone C Tuner	Zone C Source Tuner
04 03 02 03 00 00	Zone C CD	Zone C Source CD
F4 03 02 04 00 00	Zone C Aux1	Zone C Source AUX1
E4 03 02 05 00 00	Zone C Aux2	Zone C Source AUX2
D4 03 02 06 00 00	Zone C Local	Zone C Source Local
C4 03 02 07 00 00	Zone C Stop	Zone C Stop
B4 03 02 08 00 00	Zone C |<	Zone C Track |<
A4 03 02 09 00 00	Zone C >|	Zone C Track >|
94 03 02 0A 00 00	Zone C <<	Zone C <<
84 03 02 0B 00 00	Zone C >>	Zone C >>
74 03 02 0C 00 00	Zone C FavStn	Zone C Favorite Station
64 03 02 0D 00 00	Zone C Random	Zone C Random
54 03 02 0E 00 00	Zone C Vol-	Zone C Volume -
44 03 02 0F 00 00	Zone C Vol+	Zone C Volume +
24 03 02 10 00 00	Zone C Mute	Zone C Mute Toggle
14 03 02 11 00 00	Zone C CASA	Zone C CASA button
04 03 02 12 00 00	Zone C Refresh	Zone C Refresh Display
F4 03 02 13 00 00	Zone C Local Present	Zone C Local Present
D4 03 02 15 00 00	Zone C On/Off	Zone C On/Off (Small Keypad)
24 03 03 00 00 00	Zone D Off	Zone D Off
14 03 03 01 00 00	Zone D All Off	Zone D All Off
04 03 03 02 00 00	Zone D Tuner	Zone D Source Tuner
F4 03 03 03 00 00	Zone D CD	Zone D Source CD
E4 03 03 04 00 00	Zone D Aux1	Zone D Source AUX1
D4 03 03 05 00 00	Zone D Aux2	Zone D Source AUX2
C4 03 03 06 00 00	Zone D Local	Zone D Source Local
B4 03 03 07 00 00	Zone D Stop	Zone D Stop
A4 03 03 08 00 00	Zone D |<	Zone D Track |<
94 03 03 09 00 00	Zone D >|	Zone D Track >|

CASA HEX	Command	Command Description
84 03 03 0A 00 00	Zone D <<	Zone D <<
74 03 03 0B 00 00	Zone D >>	Zone D >>
64 03 03 0C 00 00	Zone D FavStn	Zone D Favorite Station
54 03 03 0D 00 00	Zone D Random	Zone D Random
44 03 03 0E 00 00	Zone D Vol-	Zone D Volume -
34 03 03 0F 00 00	Zone D Vol+	Zone D Volume +
14 03 03 10 00 00	Zone D Mute	Zone D Mute Toggle
04 03 03 11 00 00	Zone D CASA	Zone D CASA button
F4 03 03 12 00 00	Zone D Refresh	Zone D Refresh Display
E4 03 03 13 00 00	Zone D Local Present	Zone D Local Present
C4 03 03 15 00 00	Zone D On/Off	Zone D On/Off (Small Keypad)

Table 2: Type 10 Primary Command List – Subzone B

The following commands are used to control subzones when a zone is configured for Subzone operation. For zones using one subzone the default configuration is Subzone B. Zones using more than one Subzone should refer to the Subzone C and D command lists for commands to control the additional subzones.

CASA HEX	Command	Command Description
34 03 00 20 00 00	Zone A Subzone B Off	Zone A Subzone B Off
24 03 00 21 00 00	Zone A Subzone B All Off	Zone A Subzone B All Off
14 03 00 22 00 00	Zone A Subzone B Tuner	Zone A Subzone B Source Tuner
04 03 00 23 00 00	Zone A Subzone B CD	Zone A Subzone B Source CD
F4 03 00 24 00 00	Zone A Subzone B Aux1	Zone A Subzone B Source AUX1
E4 03 00 25 00 00	Zone A Subzone B Aux2	Zone A Subzone B Source AUX2
D4 03 00 26 00 00	Zone A Subzone B Local	Zone A Subzone B Source Local
C4 03 00 27 00 00	Zone A Subzone B Stop	Zone A Subzone B Stop
B4 03 00 28 00 00	Zone A Subzone B |<	Zone A Subzone B Track |<
A4 03 00 29 00 00	Zone A Subzone B >|	Zone A Subzone B Track >|
94 03 00 2A 00 00	Zone A Subzone B <<	Zone A Subzone B <<
84 03 00 2B 00 00	Zone A Subzone B >>	Zone A Subzone B >>
74 03 00 2C 00 00	Zone A Subzone B FavStn	Zone A Subzone B Favorite Station
64 03 00 2D 00 00	Zone A Subzone B Random	Zone A Subzone B Random
54 03 00 2E 00 00	Zone A Subzone B Vol-	Zone A Subzone B Volume -
44 03 00 2F 00 00	Zone A Subzone B Vol+	Zone A Subzone B Volume +
24 03 00 30 00 00	Zone A Subzone B Mute	Zone A Subzone B Mute Toggle
14 03 00 31 00 00	Zone A Subzone B CASA	Zone A Subzone B CASA button
04 03 00 32 00 00	Zone A Subzone B Refresh	Zone A Subzone B Refresh Display
F4 03 00 33 00 00	Zone A Subzone B Local	Zone A Subzone B Local Present
D4 03 00 35 00 00	Zone A Subzone B On/Off	Zone A Subzone B On/Off
24 03 01 20 00 00	Zone B Subzone B Off	Zone B Subzone B Off
14 03 01 21 00 00	Zone B Subzone B All Off	Zone B Subzone B All Off
04 03 01 22 00 00	Zone B Subzone B Tuner	Zone B Subzone B Source Tuner
F4 03 01 23 00 00	Zone B Subzone B CD	Zone B Subzone B Source CD
E4 03 01 24 00 00	Zone B Subzone B Aux1	Zone B Subzone B Source AUX1
D4 03 01 25 00 00	Zone B Subzone B Aux2	Zone B Subzone B Source AUX2
C4 03 01 26 00 00	Zone B Subzone B Local	Zone B Subzone B Source Local

CASA HEX	Command	Command Description
B4 03 01 27 00 00	Zone B Subzone B Stop	Zone B Subzone B Stop
A4 03 01 28 00 00	Zone B Subzone B |<	Zone B Subzone B Track |<
94 03 01 29 00 00	Zone B Subzone B >|	Zone B Subzone B Track >|
84 03 01 2A 00 00	Zone B Subzone B <<	Zone B Subzone B <<
74 03 01 2B 00 00	Zone B Subzone B >>	Zone B Subzone B >>
64 03 01 2C 00 00	Zone B Subzone B FavStn	Zone B Subzone B Favorite Station
54 03 01 2D 00 00	Zone B Subzone B Random	Zone B Subzone B Random
44 03 01 2E 00 00	Zone B Subzone B Vol-	Zone B Subzone B Volume -
34 03 01 2F 00 00	Zone B Subzone B Vol+	Zone B Subzone B Volume +
14 03 01 30 00 00	Zone B Subzone B Mute	Zone B Subzone B Mute Toggle
04 03 01 31 00 00	Zone B Subzone B CASA	Zone B Subzone B CASA button
F4 03 01 32 00 00	Zone B Subzone B Refresh	Zone B Subzone B Refresh Display
E4 03 01 33 00 00	Zone B Subzone B Local	Zone B Subzone B Local Present
C4 03 01 35 00 00	Zone B Subzone B On/Off	Zone B Subzone B On/Off
14 03 02 20 00 00	Zone C Subzone B Off	Zone C Subzone B Off
04 03 02 21 00 00	Zone C Subzone B All Off	Zone C Subzone B All Off
F4 03 02 22 00 00	Zone C Subzone B Tuner	Zone C Subzone B Source Tuner
E4 03 02 23 00 00	Zone C Subzone B CD	Zone C Subzone B Source CD
D4 03 02 24 00 00	Zone C Subzone B Aux1	Zone C Subzone B Source AUX1
C4 03 02 25 00 00	Zone C Subzone B Aux2	Zone C Subzone B Source AUX2
B4 03 02 26 00 00	Zone C Subzone B Local	Zone C Subzone B Source Local
A4 03 02 27 00 00	Zone C Subzone B Stop	Zone C Subzone B Stop
94 03 02 28 00 00	Zone C Subzone B |<	Zone C Subzone B Track |<
84 03 02 29 00 00	Zone C Subzone B >|	Zone C Subzone B Track >|
74 03 02 2A 00 00	Zone C Subzone B <<	Zone C Subzone B <<
64 03 02 2B 00 00	Zone C Subzone B >>	Zone C Subzone B >>
54 03 02 2C 00 00	Zone C Subzone B FavStn	Zone C Subzone B Favorite Station
44 03 02 2D 00 00	Zone C Subzone B Random	Zone C Subzone B Random
34 03 02 2E 00 00	Zone C Subzone B Vol-	Zone C Subzone B Volume -
24 03 02 2F 00 00	Zone C Subzone B Vol+	Zone C Subzone B Volume +
04 03 02 30 00 00	Zone C Subzone BMute	Zone C Subzone B Mute Toggle
F4 03 02 31 00 00	Zone C Subzone B CASA	Zone C Subzone B CASA button
E4 03 02 32 00 00	Zone C Subzone B Refresh	Zone C Subzone B Refresh Display
D4 03 02 33 00 00	Zone C Subzone B Local	Zone C Subzone B Local Present
B4 03 02 35 00 00	Zone C Subzone B On/Off	Zone C Subzone B On/Off
04 03 03 20 00 00	Zone D Subzone B Off	Zone D Subzone B Off
F4 03 03 21 00 00	Zone D Subzone B All Off	Zone D Subzone B All Off
E4 03 03 22 00 00	Zone D Subzone B Tuner	Zone D Subzone B Source Tuner
D4 03 03 23 00 00	Zone D Subzone B CD	Zone D Subzone B Source CD
C4 03 03 24 00 00	Zone D Subzone B Aux1	Zone D Subzone B Source AUX1
B4 03 03 25 00 00	Zone D Subzone B Aux2	Zone D Subzone B Source AUX2
A4 03 03 26 00 00	Zone D Subzone B Local	Zone D Subzone B Source Local
94 03 03 27 00 00	Zone D Subzone B Stop	Zone D Subzone B Stop
84 03 03 28 00 00	Zone D Subzone B |<	Zone D Subzone B Track |<
74 03 03 29 00 00	Zone D Subzone B >|	Zone D Subzone B Track >|
64 03 03 2A 00 00	Zone D Subzone B <<	Zone D Subzone B <<
54 03 03 2B 00 00	Zone D Subzone B >>	Zone D Subzone B >>
44 03 03 2C 00 00	Zone D Subzone B FavStn	Zone D Subzone B Favorite Station

CASA HEX	Command	Command Description
34 03 03 2D 00 00	Zone D Subzone B Random	Zone D Subzone B Random
24 03 03 2E 00 00	Zone D Subzone B Vol-	Zone D Subzone B Volume -
14 03 03 2F 00 00	Zone D Subzone B Vol+	Zone D Subzone B Volume +
F4 03 03 30 00 00	Zone D Subzone B Mute	Zone D Subzone B Mute Toggle
E4 03 03 31 00 00	Zone D Subzone B CASA	Zone D Subzone B CASA button
D4 03 03 32 00 00	Zone D Subzone B Refresh	Zone D Subzone B Refresh Display
C4 03 03 33 00 00	Zone D Subzone B Local	Zone D Subzone B Local Present
A4 03 03 35 00 00	Zone D Subzone B On/Off	Zone D Subzone B On/Off

Table 3: Type 10 Primary Command List – Subzone C

The following commands are used to control additional subzones when a zone is configured for multiple Subzone operation.

CASA HEX	Command	Command Description
14 03 00 40 00 00	Zone A Subzone C Off	Zone A Subzone C Off
04 03 00 41 00 00	Zone A Subzone C All Off	Zone A Subzone C All Off
F4 03 00 42 00 00	Zone A Subzone C Tuner	Zone A Subzone C Source Tuner
E4 03 00 43 00 00	Zone A Subzone C CD	Zone A Subzone C Source CD
D4 03 00 44 00 00	Zone A Subzone C Aux1	Zone A Subzone C Source AUX1
C4 03 00 45 00 00	Zone A Subzone C Aux2	Zone A Subzone C Source AUX2
B4 03 00 46 00 00	Zone A Subzone C Local	Zone A Subzone C Source Local
A4 03 00 47 00 00	Zone A Subzone C Stop	Zone A Subzone C Stop
94 03 00 48 00 00	Zone A Subzone C |<	Zone A Subzone C Track |<
84 03 00 49 00 00	Zone A Subzone C >|	Zone A Subzone C Track >|
74 03 00 4A 00 00	Zone A Subzone C <<	Zone A Subzone C <<
64 03 00 4B 00 00	Zone A Subzone C >>	Zone A Subzone C >>
54 03 00 4C 00 00	Zone A Subzone C FavStn	Zone A Subzone C Favorite Station
44 03 00 4D 00 00	Zone A Subzone C Random	Zone A Subzone C Random
34 03 00 4E 00 00	Zone A Subzone C Vol-	Zone A Subzone C Volume -
24 03 00 4F 00 00	Zone A Subzone C Vol+	Zone A Subzone C Volume +
04 03 00 50 00 00	Zone A Subzone C Mute	Zone A Subzone C Mute Toggle
F4 03 00 51 00 00	Zone A Subzone C CASA	Zone A Subzone C CASA button
E4 03 00 52 00 00	Zone A Subzone C Refresh	Zone A Subzone C Refresh Display
D4 03 00 53 00 00	Zone A Subzone C Local	Zone A Subzone C Local Present
B4 03 00 55 00 00	Zone A Subzone C On/Off	Zone A Subzone C On/Off
04 03 01 40 00 00	Zone B Subzone C Off	Zone B Subzone C Off
F4 03 01 41 00 00	Zone B Subzone C All Off	Zone B Subzone C All Off
E4 03 01 42 00 00	Zone B Subzone C Tuner	Zone B Subzone C Source Tuner
D4 03 01 43 00 00	Zone B Subzone C CD	Zone B Subzone C Source CD
C4 03 01 44 00 00	Zone B Subzone C Aux1	Zone B Subzone C Source AUX1
B4 03 01 45 00 00	Zone B Subzone C Aux2	Zone B Subzone C Source AUX2
A4 03 01 46 00 00	Zone B Subzone C Local	Zone B Subzone C Source Local
94 03 01 47 00 00	Zone B Subzone C Stop	Zone B Subzone C Stop
84 03 01 48 00 00	Zone B Subzone C |<	Zone B Subzone C Track |<
74 03 01 49 00 00	Zone B Subzone C >|	Zone B Subzone C Track >|
64 03 01 4A 00 00	Zone B Subzone C <<	Zone B Subzone C <<
54 03 01 4B 00 00	Zone B Subzone C >>	Zone B Subzone C >>

CASA HEX	Command	Command Description
44 03 01 4C 00 00	Zone B Subzone C FavStn	Zone B Subzone C Favorite Station
34 03 01 4D 00 00	Zone B Subzone C Random	Zone B Subzone C Random
24 03 01 4E 00 00	Zone B Subzone C Vol-	Zone B Subzone C Volume -
14 03 01 4F 00 00	Zone B Subzone C Vol+	Zone B Subzone C Volume +
F4 03 01 50 00 00	Zone B Subzone C Mute	Zone B Subzone C Mute Toggle
E4 03 01 51 00 00	Zone B Subzone C CASA	Zone B Subzone C CASA button
D4 03 01 52 00 00	Zone B Subzone C Refresh	Zone B Subzone C Refresh Display
C4 03 01 53 00 00	Zone B Subzone C Local	Zone B Subzone C Local Present
A4 03 01 55 00 00	Zone B Subzone C On/Off	Zone B Subzone C On/Off
F4 03 02 40 00 00	Zone C Subzone C Off	Zone C Subzone C Off
E4 03 02 41 00 00	Zone C Subzone C All Off	Zone C Subzone C All Off
D4 03 02 42 00 00	Zone C Subzone C Tuner	Zone C Subzone C Source Tuner
C4 03 02 43 00 00	Zone C Subzone C CD	Zone C Subzone C Source CD
B4 03 02 44 00 00	Zone C Subzone C Aux1	Zone C Subzone C Source AUX1
A4 03 02 45 00 00	Zone C Subzone C Aux2	Zone C Subzone C Source AUX2
94 03 02 46 00 00	Zone C Subzone C Local	Zone C Subzone C Source Local
84 03 02 47 00 00	Zone C Subzone C Stop	Zone C Subzone C Stop
74 03 02 48 00 00	Zone C Subzone C |<	Zone C Subzone C Track |<
64 03 02 49 00 00	Zone C Subzone C >|	Zone C Subzone C Track >|
54 03 02 4A 00 00	Zone C Subzone C <<	Zone C Subzone C <<
44 03 02 4B 00 00	Zone C Subzone C >>	Zone C Subzone C >>
34 03 02 4C 00 00	Zone C Subzone C FavStn	Zone C Subzone C Favorite Station
24 03 02 4D 00 00	Zone C Subzone C Random	Zone C Subzone C Random
14 03 02 4E 00 00	Zone C Subzone C Vol-	Zone C Subzone C Volume -
04 03 02 4F 00 00	Zone C Subzone C Vol+	Zone C Subzone C Volume +
E4 03 02 50 00 00	Zone C Subzone C Mute	Zone C Subzone C Mute Toggle
D4 03 02 51 00 00	Zone C Subzone C CASA	Zone C Subzone C CASA button
C4 03 02 52 00 00	Zone C Subzone C Refresh	Zone C Subzone C Refresh Display
B4 03 02 53 00 00	Zone C Subzone C Local	Zone C Subzone C Local Present
94 03 02 55 00 00	Zone C Subzone C On/Off	Zone C Subzone C On/Off
E4 03 03 40 00 00	Zone D Subzone C Off	Zone D Subzone C Off
D4 03 03 41 00 00	Zone D Subzone C All Off	Zone D Subzone C All Off
C4 03 03 42 00 00	Zone D Subzone C Tuner	Zone D Subzone C Source Tuner
B4 03 03 43 00 00	Zone D Subzone C CD	Zone D Subzone C Source CD
A4 03 03 44 00 00	Zone D Subzone C Aux1	Zone D Subzone C Source AUX1
94 03 03 45 00 00	Zone D Subzone C Aux2	Zone D Subzone C Source AUX2
84 03 03 46 00 00	Zone D Subzone C Local	Zone D Subzone C Source Local
74 03 03 47 00 00	Zone D Subzone C Stop	Zone D Subzone C Stop
64 03 03 48 00 00	Zone D Subzone C |<	Zone D Subzone C Track |<
54 03 03 49 00 00	Zone D Subzone C >|	Zone D Subzone C Track >|
44 03 03 4A 00 00	Zone D Subzone C <<	Zone D Subzone C <<
34 03 03 4B 00 00	Zone D Subzone C >>	Zone D Subzone C >>
24 03 03 4C 00 00	Zone D Subzone C FavStn	Zone D Subzone C Favorite Station
14 03 03 4D 00 00	Zone D Subzone C Random	Zone D Subzone C Random
04 03 03 4E 00 00	Zone D Subzone C Vol-	Zone D Subzone C Volume -
F4 03 03 4F 00 00	Zone D Subzone C Vol+	Zone D Subzone C Volume +
D4 03 03 50 00 00	Zone D Subzone C Mute	Zone D Subzone C Mute Toggle
C4 03 03 51 00 00	Zone D Subzone C CASA	Zone D Subzone C CASA button

CASA HEX	Command	Command Description
B4 03 03 52 00 00	Zone D Subzone C Refresh	Zone D Subzone C Refresh Display
A4 03 03 53 00 00	Zone D Subzone C Local	Zone D Subzone C Local Present
84 03 03 55 00 00	Zone D Subzone C On/Off	Zone D Subzone C On/Off

Table 4: Type 10 Primary Command List – Subzone D

The following commands are used to control additional subzones when a zone is configured for multiple Subzone operation.

CASA HEX	Command	Command Description
F4 03 00 60 00 00	Zone A Subzone D Off	Zone A Subzone D Off
E4 03 00 61 00 00	Zone A Subzone D All Off	Zone A Subzone D All Off
D4 03 00 62 00 00	Zone A Subzone D Tuner	Zone A Subzone D Source Tuner
C4 03 00 63 00 00	Zone A Subzone D CD	Zone A Subzone D Source CD
B4 03 00 64 00 00	Zone A Subzone D Aux1	Zone A Subzone D Source AUX1
A4 03 00 65 00 00	Zone A Subzone D Aux2	Zone A Subzone D Source AUX2
94 03 00 66 00 00	Zone A Subzone D Local	Zone A Subzone D Source Local
84 03 00 67 00 00	Zone A Subzone D Stop	Zone A Subzone D Stop
74 03 00 68 00 00	Zone A Subzone D |<	Zone A Subzone D Track |<
64 03 00 69 00 00	Zone A Subzone D >|	Zone A Subzone D Track >|
54 03 00 6A 00 00	Zone A Subzone D <<	Zone A Subzone D <<
44 03 00 6B 00 00	Zone A Subzone D >>	Zone A Subzone D >>
34 03 00 6C 00 00	Zone A Subzone D FavStn	Zone A Subzone D Favorite Station
24 03 00 6D 00 00	Zone A Subzone D Random	Zone A Subzone D Random
14 03 00 6E 00 00	Zone A Subzone D Vol-	Zone A Subzone D Volume -
04 03 00 6F 00 00	Zone A Subzone D Vol+	Zone A Subzone D Volume +
E4 03 00 70 00 00	Zone A Subzone D Mute	Zone A Subzone D Mute Toggle
D4 03 00 71 00 00	Zone A Subzone D CASA	Zone A Subzone D CASA button
C4 03 00 72 00 00	Zone A Subzone D Refresh	Zone A Subzone D Refresh Display
B4 03 00 73 00 00	Zone A Subzone D Local	Zone A Subzone D Local Present
04 03 00 75 00 00	Zone A Subzone D On/Off	Zone A Subzone D On/Off
E4 03 01 60 00 00	Zone B Subzone D Off	Zone B Subzone D Off
D4 03 01 61 00 00	Zone B Subzone D All Off	Zone B Subzone D All Off
C4 03 01 62 00 00	Zone B Subzone D Tuner	Zone B Subzone D Source Tuner
B4 03 01 63 00 00	Zone B Subzone D CD	Zone B Subzone D Source CD
A4 03 01 64 00 00	Zone B Subzone D Aux1	Zone B Subzone D Source AUX1
94 03 01 65 00 00	Zone B Subzone D Aux2	Zone B Subzone D Source AUX2
84 03 01 66 00 00	Zone B Subzone D Local	Zone B Subzone D Source Local
74 03 01 67 00 00	Zone B Subzone D Stop	Zone B Subzone D Stop
64 03 01 68 00 00	Zone B Subzone D |<	Zone B Subzone D Track |<
54 03 01 69 00 00	Zone B Subzone D >|	Zone B Subzone D Track >|
44 03 01 6A 00 00	Zone B Subzone D <<	Zone B Subzone D <<
34 03 01 6B 00 00	Zone B Subzone D >>	Zone B Subzone D >>
24 03 01 6C 00 00	Zone B Subzone D FavStn	Zone B Subzone D Favorite Station
14 03 01 6D 00 00	Zone B Subzone D Random	Zone B Subzone D Random
04 03 01 6E 00 00	Zone B Subzone D Vol-	Zone B Subzone D Volume -
F4 03 01 6F 00 00	Zone B Subzone D Vol+	Zone B Subzone D Volume +
D4 03 01 70 00 00	Zone B Subzone D Mute	Zone B Subzone D Mute Toggle

CASA HEX	Command	Command Description
C4 03 01 71 00 00	Zone B Subzone D CASA	Zone B Subzone D CASA button
B4 03 01 72 00 00	Zone B Subzone D Refresh	Zone B Subzone D Refresh Display
A4 03 01 73 00 00	Zone B Subzone D Local	Zone B Subzone D Local Present
84 03 01 75 00 00	Zone B Subzone D On/Off	Zone B Subzone D On/Off
D4 03 02 60 00 00	Zone C Subzone D Off	Zone C Subzone D Off
C4 03 02 61 00 00	Zone C Subzone D All Off	Zone C Subzone D All Off
B4 03 02 62 00 00	Zone C Subzone D Tuner	Zone C Subzone D Source Tuner
A4 03 02 63 00 00	Zone C Subzone D CD	Zone C Subzone D Source CD
94 03 02 64 00 00	Zone C Subzone D Aux1	Zone C Subzone D Source AUX1
84 03 02 65 00 00	Zone C Subzone D Aux2	Zone C Subzone D Source AUX2
74 03 02 66 00 00	Zone C Subzone D Local	Zone C Subzone D Source Local
64 03 02 67 00 00	Zone C Subzone D Stop	Zone C Subzone D Stop
54 03 02 68 00 00	Zone C Subzone D |<	Zone C Subzone D Track |<
44 03 02 69 00 00	Zone C Subzone D >|	Zone C Subzone D Track >|
34 03 02 6A 00 00	Zone C Subzone D <<	Zone C Subzone D <<
24 03 02 6B 00 00	Zone C Subzone D >>	Zone C Subzone D >>
14 03 02 6C 00 00	Zone C Subzone D FavStn	Zone C Subzone D Favorite Station
04 03 02 6D 00 00	Zone C Subzone D Random	Zone C Subzone D Random
F4 03 02 6E 00 00	Zone C Subzone D Vol-	Zone C Subzone D Volume -
E4 03 02 6F 00 00	Zone C Subzone D Vol+	Zone C Subzone D Volume +
C4 03 02 70 00 00	Zone C Subzone D Mute	Zone C Subzone D Mute Toggle
B4 03 02 71 00 00	Zone C Subzone D CASA	Zone C Subzone D CASA button
A4 03 02 72 00 00	Zone C Subzone D Refresh	Zone C Subzone D Refresh Display
94 03 02 73 00 00	Zone C Subzone D Local	Zone C Subzone D Local Present
74 03 02 75 00 00	Zone C Subzone D On/Off	Zone C Subzone D On/Off
C4 03 03 60 00 00	Zone D Subzone D Off	Zone D Subzone D Off
B4 03 03 61 00 00	Zone D Subzone D All Off	Zone D Subzone D All Off
A4 03 03 62 00 00	Zone D Subzone D Tuner	Zone D Subzone D Source Tuner
94 03 03 63 00 00	Zone D Subzone D CD	Zone D Subzone D Source CD
84 03 03 64 00 00	Zone D Subzone D Aux1	Zone D Subzone D Source AUX1
74 03 03 65 00 00	Zone D Subzone D Aux2	Zone D Subzone D Source AUX2
64 03 03 66 00 00	Zone D Subzone D Local	Zone D Subzone D Source Local
54 03 03 67 00 00	Zone D Subzone D Stop	Zone D Subzone D Stop
44 03 03 68 00 00	Zone D Subzone D |<	Zone D Subzone D Track |<
34 03 03 69 00 00	Zone D Subzone D >|	Zone D Subzone D Track >|
24 03 03 6A 00 00	Zone D Subzone D <<	Zone D Subzone D <<
14 03 03 6B 00 00	Zone D Subzone D >>	Zone D Subzone D >>
04 03 03 6C 00 00	Zone D Subzone D FavStn	Zone D Subzone D Favorite Station
F4 03 03 6D 00 00	Zone D Subzone D Random	Zone D Subzone D Random
E4 03 03 6E 00 00	Zone D Subzone D Vol-	Zone D Subzone D Volume -
D4 03 03 6F 00 00	Zone D Subzone D Vol+	Zone D Subzone D Volume +
B4 03 03 70 00 00	Zone D Subzone D Mute	Zone D Subzone D Mute Toggle
A4 03 03 71 00 00	Zone D Subzone D CASA	Zone D Subzone D CASA button
94 03 03 72 00 00	Zone D Subzone D Refresh	Zone D Subzone D Refresh Display
84 03 03 73 00 00	Zone D Subzone D Local	Zone D Subzone D Local Present
64 03 03 75 00 00	Zone D Subzone D On/Off	Zone D Subzone D On/Off