

RDL® SYS-CS1 AND RU2-CS1 MANUAL

Version 1.0

Table of Contents

1. Product Descriptions.....	1
2. Computer Communications and Connections.....	2
RS-232 Communication.....	2
RS-232 Connection.....	2
3. Programming.....	3
Command Protocol.....	3
External Inputs.....	3
Response Protocol.....	3
Power-Up Default Conditions.....	3
Computer Issues.....	3
Ramping.....	3
Sample Program.....	4
Baud Rate.....	4
Status Monitor.....	4
Windows Hyper Terminal.....	4
4. Command and Error Code Reference.....	5
5. Rear Panel Connections and Typical Performance.....	8

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1. Product Descriptions

SYS-CS1 System 84 Control Interface The SYS-CS1 model is intended to control the RDL System 84 Audio Mixing Matrix products.

RU2-CS1 Serial Controlled Interface The RU2-CS1 model is intended to control various RDL modules and other manufacturers' equipment equipped with open-collector control inputs.

Note: OEM product open-collector inputs must be compatible with current capability of RU2-CS1 control outputs.

Features Common to Both Models Both models include eight status input terminals to monitor external contact (switch or relay) closures or open-collector activations. These terminals are pulled high in the CS1 to 5 Vdc and are protected against damage by external equipment or modules that may pull these terminals as high as 30 Vdc.

There are also eight 0 to 10 volt DC outputs that have 256 steps of resolution. Each may be programmed to operate in the 0 to 5 volt DC range with no loss of resolution. These voltage outputs may also be programmed to ramp to any valid level at rates programmable from 0.5 seconds to 128 seconds full scale. The ramp rate may be individually set for each output.

Front-panel LEDs are provided to indicate power, command good/error, RS-232 communication and input/output activity. All electrical connections are on the rear panel and employ depluggable connectors. The RS-232 serial cable is not provided. Both products are in the same size chassis which is one RU (rack unit) high and two-thirds wide. Either CS1 model will occupy 2 of 3 bays in an available RDL RU-RA3 rack mounting accessory.

Note: References in this manual that apply to both SYS-CS1 and RU2-CS1 will use the term: CS1

2. Computer Communications and Connections

RS-232 Communication The CS1 communicates with a host controller using an RS-232 connection. It is a full duplex product, meaning it can receive and send data simultaneously. It does not employ any hardware handshaking but instead can use return communication codes to communicate properly. The baud rates available are: 2400, 4800, 9600 and 19200. The format is:

no parity bit
8 data bits
one stop bit
no hardware or software handshaking

RS-232 Connection The required cable to connect to a personal computer's 9 pin serial port is a straight through 9 pin male to 9 pin female cable. These are commonly referred to as extension cables and are usually available locally. For use on a 25 pin port, a 25 pin to 9 pin serial cable must be used. The pins used by the CS1 are 2 (RX data), 3 (TX data) and 5 (ground). All other pins on the CS1's RS-232 connector are wired only to the 6 pin depluggable header to the left of the RS-232 DB-9 connector as viewed from the rear. These are available for customer use in the event that the controller being used requires hardware handshaking. One such example may be RTS – CTS handshaking in which case installing a jumper wire between the pins labeled 7 and 8 may enable proper communication. When using the Windows terminal program Hyper Terminal or Visual Basic developed applications, jumpering these extra pins will not be required.

For long distance communication between the controller and the CS1 a pair of RDL RU-SC2s may be used. Refer to the RDL RU-SC2 Installation Instruction for wiring and cable diagrams.

Note: The RDL RU-SC1A is not recommended for long distance CS1 control. The RDL RU-SC1A model will not always work properly as it is a half duplex device, which will only communicate to another RU-SC1A one way at a time.

3. Programming

Command Protocol The CS1 is controlled by ASCII commands received via the RS-232 connector. A full listing and explanation of these commands is covered later in the Command Reference section. Each command must have a terminator character appended to the end of the command to enact it. This terminator may be the Line Feed character (ASCII 10) or the Carriage Return character (ASCII 13) or both in either order. The CS1 may be set up via the “REN” command to send a response back to the host upon receiving the terminator character, returning an error code. The error code will indicate a successful command was received or one of several different error conditions occurred, enabling the programmer to troubleshoot any erroneous command. By default the error code responses are disabled.

External Inputs External events may be set to cause spontaneous RS-232 communication from the CS1 to the host. These events are from changes to the STATUS INPUT pins if commands have been issued to the CS1 to enable these alerts. By default no input alerts are active upon power up or after an “INIT” initialization command has been sent.

Response Protocol All responses from the CS1 can have an optional terminator added which may be a Carriage Return (ASCII 13) or Line Feed (ASCII 10) or both (CR + LF). The default power-up condition is “no terminator”. Terminators are activated using the “Tn” commands covered later in the Command Reference section.

Power-up Default Conditions The CS1 powers up ready to accept any command and to not provide responses back to the computer. The power-up default sets the CS1 to include no terminators (see Response Protocol above) with any responses. If user equipment or software requires a terminator, the CS1 must be programmed first with the correct “Tn” command to enable outgoing terminators. If responses are required, they should be programmed next by sending the “REN” command. Additionally, “ramp complete” responses may be enabled by sending the “RER” command to the CS1.

Computer Issues During computer boot up, the electrical levels on the RS-232 serial port pins may vary. This may produce a communication error on the CS1 as evidenced by the flashing **ERROR** LED. This can be cleared by sending any terminator character (or command with terminator) to empty the CS1’s receive buffer followed by sending any valid command with a terminator. One suggestion for the valid command would be “INIT” which puts the CS1 into the power-up default state.

Ramping The ramp rates are programmable for each voltage output. Each ramp is adjustable for a nominal 0.5 to 127.5 seconds full scale. The default time for all channels is 0.5 seconds full scale. To calculate a specific ramp completion time use the following formula:

$$\frac{|\text{end value} - \text{beginning value}|}{256} \times \text{full scale ramp time}$$

where: **end value** and **beginning value** are command suffixes in the range from 0 to 255, and **full scale ramp time** is the total time required to ramp from 0 (off) to 255 (fully on).

Sample Program There is sample Visual Basic (Ver. 6, Professional) source code posted on the RDL website, www.rdlnet.com (available through both the SYS-CS1 and RU2-CS1 HTML pages). The code is for a demonstration program that uses most of the features of either the SYS-CS1 or the RU2-CS1. The code may work in other versions of Visual Basic. See the Microsoft Visual Basic section below for more information.

Baud Rate Any of the four available baud rates may be used. It is preferable to use the highest rate possible to minimize response times due to communication time.

Status Monitor When using the SYS-CS1 model a convenient aid to the programmer is the RDL SYS84SM remote status monitor. This monitor is rack mountable using the RDL RU-RA3 rack-mounting accessory. It may be left permanently mounted to visually indicate the current program setup of the System84 audio switching matrix that the SYS-CS1 is controlling.

Windows Hyper Terminal The Windows Hyper Terminal program can be used to control the CS1 and is a convenient way to learn programming techniques. It can usually be found under the Start button menu at: All Programs, Accessories, Communication. If it is not installed it can be added from the Windows installation CD or CAB file. With Hyper Terminal active, the CS1 can be directly controlled by sending commands listed in the Command and Error Code Reference section of this manual.

To set up Hyper Terminal, start the program and give it any desired name in the *New Connection* dialog. In the following *Connect To* dialog, select the COM1 or COM2 setting corresponding to the port connected to the CS1. In the subsequent *COM1/2 Properties* dialog, select the baud rate that is set on the CS1 rear panel switches. The data bits should be "8", the parity setting should be "None" and the Stop bits "1". The Flow control must be set to "None". Click *OK* when ready.

Hyper Terminal is now configured and the setup should be saved for convenient use later. The info bar at the bottom should have a *Connected...* message. If not, click on the telephone icon on the menu bar to connect.

It is convenient to see typed characters on the screen. To enable this, first disconnect by clicking on the icon of the telephone with the raised handset. Then click on the *Properties* icon and click on the *Settings* tab. Click the ASCII button and click the box labeled *Echo typed characters locally*. Click on *OK* buttons until done; then reconnect. If this mode is preferred, save the setup.

For an easier to visualize screen it is recommended to set the CS1 outgoing terminator to CR+LF. Type *T3* and press the *Enter* key to do so. Send the "V" command to test it out by typing *V* and *Enter*. A line should appear below the *V* that was typed in the format "**V**n", where the "n" will be a number indicating the firmware version installed in the CS1.

It's also a good idea to send the "REN" command to see the error code returned.

Microsoft Visual Basic Downloading the source files for the demo sample program as a reference is highly recommended. The demo program was developed using Version 6, Professional Edition. Other versions may work but may need some modification. The version used must include the serial communication control (MSCommControl). This control may not be in "Standard" or "Learning" editions. This control must be activated in the Integrated Development Environment by using menu choice *Projects, Components* and clicking on the checkbox for Microsoft *Comm Control*. The slider controls used in the demo program were from the Microsoft Windows Common Controls components group. All other controls used are standard Visual Basic controls (in Ver.6).

The use of return codes from the CS1 (*REN* command) is highly recommended in conjunction with the OnComm event as used in the demo program. The alternative is to use delays after all commands are sent. This technique is used in the demo program in the start up code in the Form, Load event in the automatic baud rate setting code, where it is a necessity.

If the application being developed will make use of ramping the 0 to 10 (or 0 to 5) volt outputs it is recommended but not necessary to use ramp end reporting, activated with the *RER* command. This method is useful when the application needs to know when the ramp is complete to initiate another action.

4. Command and Error Code Reference

All commands are case insensitive. Commands can be upper or lower case.
(Commands are for both models unless otherwise specified)

REN: Enables response codes. With response codes enabled, one of the following codes is returned to the computer each time the CS1 receives a command:

E0: Command was okay, requested action taken.

E1: Framing error. Usually caused by an incorrect baud rate or number or data bits or start or stop bits.

E2: RS-232 hardware buffer overrun. Could be caused by an excessive incoming baud rate.
Check parity and start/stop bit settings as well.

E3: Internal receive buffer overrun. Too many characters with no terminator were received.
Possibly caused by an incorrect baud rate.

E4: Command not understood. An unknown command was received.

E5: Argument incorrect. Command was recognized but an invalid value parameter was detected.

Note: An argument containing more characters than required may not trigger an "E5" error code. The CS1 will process the command characters first, followed by processing the parameter until the correct number of characters needed are found. Any excess characters will be ignored up to a valid terminator (CR, LF, CR+LF or LF+CR).

RDIS: (default mode) Disables response codes. With response codes disabled, the only communication sent from the Sys84IF results from a STATUS INPUT terminal change (if enabled; see IC commands below) or an input alert (if enabled; see IA command below).

Tn: (n = 0 to 3) Selects what terminator character(s) is/are sent from the CS1 after any/all responses.

- 0 = no terminator (Default)
- 1 = Carriage Return (ASCII 13)
- 2 = Line Feed (ASCII 10)
- 3 = Both CR and LF

V: Returns the software Revision level. The response is "**Vn**" where 'n' is the revision level, starting with 1. Only whole numbers are used for 'n'.

INIT: Initializes unit. All output pins are set off and all 0 to 10V outputs are set to 0 Vdc. Clears all input alerts set from ICE, ICEALL and IA commands. Ramp rate will default to 1 (0.5 sec. full scale ramp time). Resets outgoing terminator to 'none' (same as T0 command). Sets CS1 to send back no responses (same as RDIS command).

STATUS INPUT TERMINAL COMMANDS

ICE*n*: (*n* = 1 to 8) Enables alert upon change in **STATUS INPUT** terminal. For **STATUS INPUT** terminal '*n*' send a response from the CS1 to the computer for a change in status from active (grounded) to inactive (open) and vice versa. The response is "IC*n**b*" where *n* = user input terminal # and *b* = 0 for inactive and 1 for active.

ICEALL: Enables input state change alerts on all 8 **STATUS INPUT**s.

ICD*n*: (*n* = 1 to 8) Disables input change alert, i.e. undo ICE command.

ICDALL: Disables all ICE commands. No responses sent from CS1 for **STATUS INPUT** terminal changes.

In: (*n* = 1 to 8) Returns state of **STATUS INPUT** terminal '*n*'. The response is "I*n**b*" where *n* = **STATUS INPUT** terminal # and *b* = 0 for inactive and 1 for active.

IALL: Returns state of all **STATUS INPUT** terminals. The response is "I**bbbbbbbbb**" where *b* = 0 for inactive and 1 for active. The first character after "I" is **STATUS INPUT** #8, then #7, etc.

IA**bbbbbbbbb**: Returns alert for **STATUS INPUT** terminal pattern 'bbbbbbbbb' where *b*=0 for inactive, 1 for active and X for don't care. The first character after "IA" is terminal #8, then #7, etc. The response is "IA" when the user input terminals match the defined pattern. The alert response is sent even if the CS1 is in "no response" mode which is the default mode or if an RDIS command was invoked. This command does not affect any prior or future ICE or ICEALL commands.

CONTROL COMMANDS FOR MODEL SYS-CS1 TO CONTROL A SYSTEM 84

C1IxOy: Turns on (ground) pin for input channel *Ix* (*x* = 1 to 8) to output channel *Oy* (*y* = 1 to 4).

C0IxOy: Turns off (open) pin for input channel *Ix* (*x* = 1 to 8) to output channel *Oy* (*y* = 1 to 4).

CONTROL COMMANDS FOR MODEL RU2-CS1

ON*n*: (*n* = 1 to 8) Turns output terminal '*n*' on (grounded).

OALL: Turns all output terminals on.

OFF*n*: (*n* = 1 to 8) Turns output terminal '*n*' off (open).

PUL*n*: (*n* = 1 to 8) Pulses open-collector output terminal for 100 mS.

CONTROL COMMANDS FOR BOTH MODELS

OCLR: Turns all output terminals off.

0 TO 10 VOLT OUTPUT COMMANDS

VOmxxx: (m = A to H, xxx = 0 to 255) Sets **0 TO 10V OUTPUT** 'm' to level 'xxx'. A level of 255 corresponds to 10 Vdc (or 5 Vdc for 5 V range) and a level of 0 produces an output of 0 Vdc. A level of 128 would correspond to 5 Vdc (or 2.5 Vdc for 5 V range). Leading zeroes in the 'xxx' part of the command are optional, i.e. for level 52 the command may be "VA52" or "VA052". No 'xxx' value is considered to be an error.

VALLxxx: (xxx = 0 to 255) Sets all **0 TO 10V OUTPUT**s immediately to level 'xxx'. This command follows the leading zero rules as in **VO** command above. No value for 'xxx' will set the output off to 0 Vdc.

VRmn: (m = A to H, n = 0 or 1 to set Output Voltage Range) Default value of 'n' is 0 which is the 0 to 10Vdc range; a value of 1 sets the range to 0 to 5 Vdc.

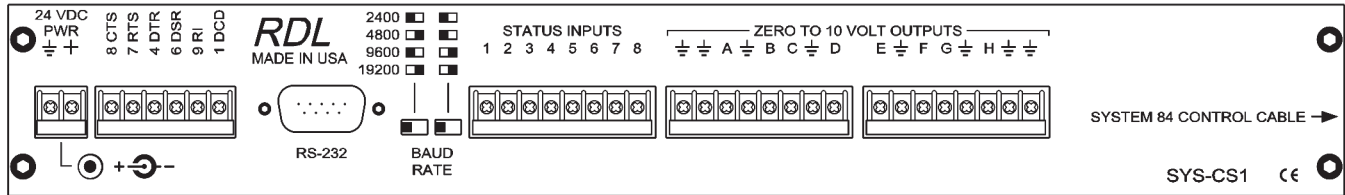
RMPmxxx: (m = A to H, xxx = 0 to 255) Ramps 0 to 10V output 'm' to level 'xxx' using rate set by **RR** command.

RRmxxx: (m = A to H, xxx = 1 to 255) Sets the time required for a full scale ramp (0 to 10 V or 0 to 5 V). The number xxx is a multiplier of 0.5 seconds, i.e. a xxx numeric value of 10 would yield a ramp rate of 5 seconds (10 x 0.5 seconds). An entry of 0 is reported as an error (if reporting is enabled) and the ramp rate is not changed.

RALLxxx: (xxx = 1 to 255) Sets all ramp times to xxx as described in **RR** command.

5. Rear Panel Connections and Typical Performance

SYS-CS1



TYPICAL PERFORMANCE:

Control Input / Output: RS-232 (DB-9 female jack)
 Control Outputs (32): Open-collector on 64-pin header
 Status Inputs (8): Low = active (internally pulled high to 5 V);
 MAX input 24 Vdc
 0 to 10 VDC Outputs (8): 22 Ω ground-referenced, 20 mA, 256 steps
 Ramp Rate 0 to 10 V Outputs: 0.5 to 120 seconds (for full scale change);
 individually programmable
 Power Requirement: GROUND-REFERENCED
 24 to 33 Vdc @ 150 mA

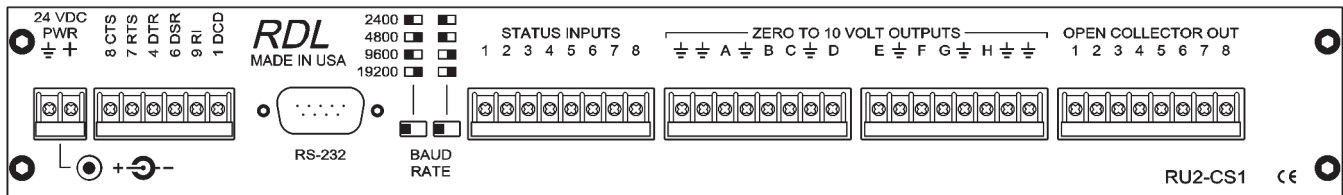
Mounting:

Mounts in 2 bays of RU-RA3 Rack
 Adapter or operates Free-standing

Dimensions:

Height: 1.75 in 4.40 cm
 Depth: 3.98 in 10.10 cm
 Width: 11.60 in 29.50 cm

RU2-CS1



TYPICAL PERFORMANCE:

Control Input / Output: RS-232 (DB-9 female jack)
 Control Outputs (8): Open-collector, 50 mA
 Status Inputs (8): Low = active (internally pulled high to 5 V);
 MAX input 24 Vdc
 0 to 10 VDC Outputs (8): 22 Ω ground-referenced, 20 mA, 256 steps
 Ramp Rate 0 to 10 V Outputs: 0.5 to 120 seconds (for full scale change);
 individually programmable
 Power Requirement: GROUND-REFERENCED
 24 to 33 Vdc @ 200 mA

Mounting:

Mounts in 2 bays of RU-RA3 Rack
 Adapter or operates Free-standing

Dimensions:

Height: 1.75 in 4.40 cm
 Depth: 3.98 in 10.10 cm
 Width: 11.60 in 29.50 cm

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