'Clearly Better Sound'

Version 1

CDI-S200 SERIAL INTERFACE CARD

Cloud Electronics Limited

CDI-S200

Installation & Setup Guide

CLOUD ELECTRONICS LIMITED

CDI-S200 Installation and Setup Guide

140 Staniforth Road • Sheffield S9 3HF • England
Phone +44 (0)114 244 7051 • Fax +44 (0)114 242 5462
E-mail technical@cloud.co.uk • WebSite www.cloud.co.uk

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1 Introduction

The CDI-S200 serial interface module is an optional module designed to fit inside the CX263 Stereo/Mono zone mixer to allow RS-232 control of:

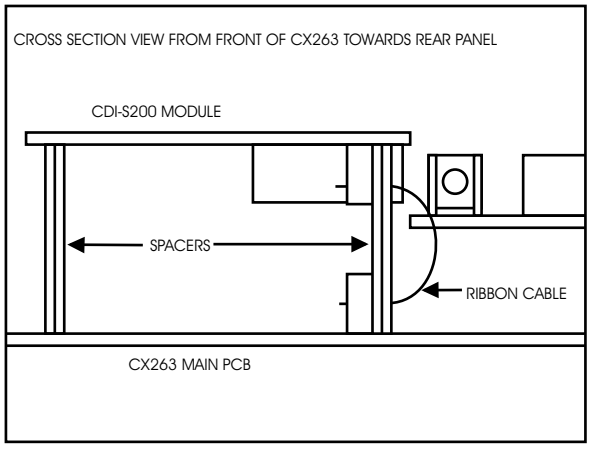
- **Music source and level control for each independent zone**
- **Microphone 1 paging access**
- **Individual microphone mute**
- **Total music mute**

2 Installation

The jumpers on the CDI-S200 should be configured before it is installed in the CX263 (see section 3 for configuration details). The CDI-S200 is supplied with two 25mm hex spacers and a 9-pin sub D plug. The module is connected to the mainboard of the mixer via a ribbon cable. The mainboard connector for this ribbon cable is marked CON 2 and located close to the output connectors of the CX263.

Instructions

1. Switch off the mains supply to the CX263 and remove the CX263's power lead.
2. Remove the units top panel.
3. Remove the blanking plate covering the hole for the serial interface card in the rear panel.
4. Remove the hex pillars connected to the 9-pin sub-D socket.
5. Configure the CDI-S200 to operate at the correct baud rate and flow control. It is simplest to do this before the module is fully installed.
6. Locate and remove the M3 screw in front of CON 2 and the M3 screw directly to the left of it, closest to the small network of diodes. Both screws are indicated on the silk screen with large arrows. Keep the screws.
7. Install a 25mm hex pillar into each of the screw holes from the previous step.
8. Connect the module ribbon cable to CON 2 on the mainboard.
9 Install the CDI-S200 in the inverted position, such that the 9-pin sub socket fits snugly through the hole in the rear panel, and the two holes at the back of the card are in line with the hex pillars rising up from the main board.
10. Re-attach the hex spacers to the 9-pin sub-D socket through the holes in the rear panel.
11. Use the M3 screws saved from step 6 to affix the rear of the board to the hex pillars rising from the mainboard.
12. Configure jumpers J19-24 and the rear panel switches to set the module's effect on music signals. In order for the CDI-S200 to control the music functions in a zone, the rear panel switches need to be in the 'REM' (in) position and the 'DG' (out) position.
13. Configure jumpers J4-6 to enable/disable serial control of the microphone 1 access switching. For the CDI-S200 to control access to a zone, the bypass jumper for that zone must be disconnected.
14. Replace the top panel

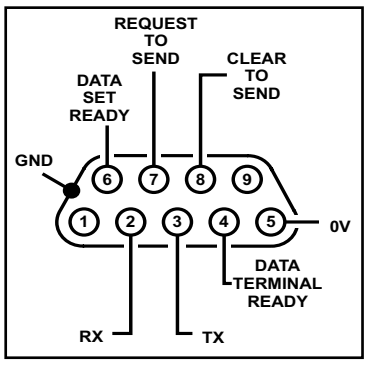


NOTE: PCB jumper markings indicate the position of the link as a filled box.

Current Consumption:

The CX263 can provide up to 80mA of power to internal modules. If this limit is exceeded, the unit will eventually overheat and then shutdown. The current consumed by a CDI-S200 card is 34mA.

Installation continued



When the module is configured to use Xon/Xoff or No-Handshaking flow controls, the only connections required are to the 0V, RX and TX pins. For the module to operate with RTS/CTS flow control, the Request and Clear to Send pins must also be connected.

In RS232 terminology, the CDI-S200 is a DCE device. The connection labels on DCE devices can be deceptive, as in serial communications the connections are labelled with respect to the Data Terminal (controller). The TX pin on this diagram carries messages to the module, and the RX pin carries response messages from the module.

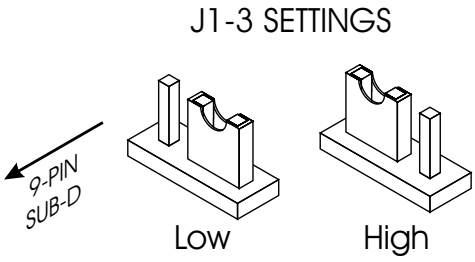
3 CDI-S200 Configuration

The CDI-S200 has several modes of operation, configurable through a series of jumpers located on the module itself. The settings of these jumpers are clearly marked on the board, with a more detailed description of each set in the following paragraphs. Settings for the module should be configured to match the capabilities of the controller. In the factory default mode, the module should be capable of working satisfactorily without further configuration. The module should only be reconfigured if there are communications problems between the controller and the module.

The CDI-S200 uses a serial data packet consisting of one start bit, eight data bits and one stop bit. The CDI-S200 does not support parity, so the controller should be configured to operate without parity checking.

3.1 Baud Rate

Setting jumpers J1-3 on the module can alter the speed at which the CDI-S200 receives information. The available settings for this are:



Baud Rate	J1	J2	J3
300	Low	High	High
1200	High	Low	Low
2400	High	Low	High
4800	High	High	Low
9600	High	High	High

Table of jumper settings for J1-3

The factory default is for the CDI-S200 to be set to a baud rate of 9600 bits-per-second.

3.2 Flow Control

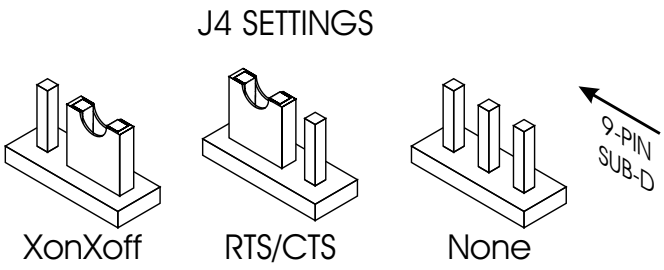
Setting jumper J4 on the CDI-S200 changes the communications mode between hardware handshaking, software handshaking and no handshaking modes.

Hardware handshaking utilises the two dedicated lines Clear-To-Send (CTS) and Request-To-Send (RTS) on the 9-pin sub-D connector. The controller uses the RTS line to indicate that there is some data to be sent. The module then uses the CTS line to indicate that it is ready to receive the data.

In software handshaking mode, the CDI-S200 will send two specific bytes to the controlling terminal. The system used for this is called Xon/Xoff where X represents transmitter, so an Xoff signal is sent when the data flow should pause, and a Xon signal is sent for the data flow to resume. The Xon byte, 0x11, is equivalent to ctrl-Q in ASCII encoding: `DC1`. The Xoff byte, 0x13, is equivalent to ctrl-S in ASCII encoding: `DC3`.

Flow Control continued

No handshaking mode means the module uses neither of the aforementioned methods to indicate readiness. This is the factory default setting since in most systems, the module will be ready to receive data constantly and will not need to indicate readiness to the terminal.



4 CX263 Configuration

Once the CDI-S200 has been installed within the CX263, the mixer needs to be configured to allow the CDI-S200 to control it. Configuration of the CX263 allows the installer to limit the functions which are controllable from the CDI-S200 module.

4.1 Microphone 1 Access Contacts

In order for the CDI-S200 to be able to control microphone 1 access (for paging applications), internal jumpers J4-6 in the CX263 must be disconnected from the headers. The factory default setting is for these jumpers to be in place, so that microphone audio is always routed through the mixer.

4.2 Music Source selection and level control

For the CDI-S200 to have any control over the music functions in a zone, the rear panel switches for that zone need to be in the following configuration:

- **'FR/REM' switch should be in the 'REM' position (in)**
- **'DIG/AN' switch should be in the 'DIG' position (out)**

It is possible to allow the CDI-S200 control of only one of these functions, by setting internal jumpers J19-24 and the rear panel switches to the appropriate position. See the table below to determine the configuration required for your application.

FR/SW Jumper	DG/SW Jumper	DIG/AN Switch	FR/REM Switch	Source Control	Level Control
N/A	N/A	N/A	FR	Front panel	Front panel
SW	SW	AN	REM	RSL-6	RSL-6
SW	N/A	DIG	REM	CDI-S200	CDI-S200
SW	DG	AN	REM	CDI-S200	RSL-6/RL-1
FR	N/A	AN	REM	Front panel	RSL-6/RL-1
FR	N/A	DIG	REM	Front panel	CDI-S200

Table of jumper settings and switch settings for music functions on the CX263

Default configuration is for all jumpers to be in the 'SW' position.

Level control for the CX263 will always follow the switch configuration on the unit, and it is worth noting that there is no way to have an analogue remote control of source selection while keeping the level control under CDI-S200 command.

5 Cloud SPv1: Communications Protocol

5.1 Message Structure

All messages to the CDI-S200 use upper case letters, all messages from the CDI-S200 are in lower case. Commands are enclosed within a header character ("<") and a terminator sequence ("/>"). The CDI-S200 will reset its message decoding software upon reception of a header character, discarding any previously un-decoded partial messages. The CDI-S200 will decode a message upon reception of the terminator sequence. If the decoded message is valid it is executed and a response message returned. If the message is not valid, an error message is returned (details in section 5.8). The message has two fields separated by a comma, the destination field and the command field.

```
<destination,command[type][value]/>
```

5.2 The Destination Field

The destination field is an abbreviated description of the mixer section the command is intended to effect. In the CX263, there are four possible destinations; music circuitry, the microphone circuitry, the output zones and the CDI-S200 module itself. Destination field values are:

Zone:	`Z1, Z2, Z3`
Microphone:	`MI, M1, M2`
Music:	`MU`
Module:	`SY`

The destination field is at the start of the message, immediately after the header character ("<"). There should be no whitespaces or other characters between this field and the header character.

The destination indicates which section the module should act on. For composite zones, a specific aspect can be addressed using a sub-destination. In this example the zone 1 output is identified and the music sub-destination is highlighted.

Sub-destinations

Sub-destinations are indicated by putting a full stop between the parent destination and the sub. On the CX263 and CDI-S200, the only composite destinations are the zones, which have sub-destinations for the Music functions and for Microphone 1 muting.

To access the music functions in a particular zone, the music sub-destination is accessed as follows:

```
<Z2.MU,LA120/>
```

This command sets the music level in Zone 2 to -60dBu, where the value 120 indicates how many ½dB steps below the maximum level are required. The music destination can also be used globally, but this will change the associated parameter in *all* zones on the CX263.

Microphone 1 on the CX263 can be used as either a paging microphone or as a general microphone input. The CDI-S200 reflects this by allowing both ordinary microphone commands and paging commands to be sent to the Microphone 1 destination (`M1`). As a consequence, Microphone 1 can be muted on a per-zone basis. It is recommended that only one set of commands be used in a system, and that the paging command is only used in applications where Mic 1 is used as a paging microphone.

```
<Z3.M1,M/>
```

This command mutes Microphone 1 in Zone 3 only.

5.3 The Command Field

A command field identifies the command to be performed, followed by any parameters, if required. In the case of the 'Mute', 'Open' and 'Page Release' commands, 'M', 'O' and 'PR', no parameters are required, since the purpose is just to set a state.

The Paging Access command has a three character field which determines which of the three zones are selected for paging. An alphabetic character 'O' indicates the zone is not selected, the character 'X' indicates the zone is to be selected. The characters represent zones one, two and three in that order from left to right.

```
<M1,PAOXX/>
```

This command selects zones two and three for paging from microphone 1 only. Note that on the CX263, Mic 2 is not a valid destination for the paging command.

The other commands set a parameter for the source or level on a particular zone. Three command types are available to do this, Absolute ("A"), Up ("U") and Down ("D"). For source select commands, only the absolute command requires a value; for level commands all command types require a parameter. Using the absolute command type sets the appropriate parameter to that value. The ranges of possible values are:

Level: 0-180 where 0 is the highest gain setting.

Source: 0-6 where 0 is off and 1-6 specify line inputs.

The Up and Down command types require a value only if the parameter being changed is a level control. The value denotes the number of half dB steps that the level should be changed by. It is important to note that the level value represents a gain reduction so a step down in the level parameter will increase the audible output.

The command field is separated from the destination field by a comma, which it should immediately follow.

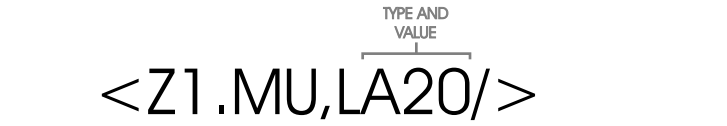
The command field identifies the action to be performed by the module. In this example, a level control is being executed.

5.4 The Command Set

Mute, 'M':	Mutes a destination.
Open, 'O':	Opens (un-mutes) a destination.
Page, 'P':	Paging command for microphone (only Mic 1 on CX263).
Level, 'L':	Manipulates the level on a zone using the present data format. The level represents gain reduction in half dB steps from the output level of the attached unit.
Source, 'S':	Manipulates the source of the zone. Values of 0 to 6. Zero is off; values of 1 to 6 are line inputs.

Commands that require an absolute value in either byte or ASCII form must have the value immediately following the command type. The command type should immediately follow the command itself.

Command Set continued



The type field identifies how a command is to be performed. Available types for signal manipulation are absolute (shown here), up and down.

5.5 System Commands and Defaults

It is possible to modify the behaviour of the CDI-S200 by sending the appropriate system commands to the module. System commands are sent to the system destination, identified as 'SY'. System commands are available for the following: data formatting, initialisation mode and reset to factory defaults.

The CDI-S200 has two different 'power on' initialisation modes, Default or Previous, these are only used when the module is powered up. In 'Default' mode, the interface will use the default parameters for each of the available controls. In 'Previous' mode the interface will use the settings active at power down. Sending a message of the following syntax will set the default settings:

The default identifier is only inserted if the value to be set is an initialisation default.

This message sets the default music level on zone 2 to -10dB.

Factory power on defaults for the CDI-S200 are to set all level controls to -∞, microphone 2 channel to 'Open', microphone 1 channel to ‘Mute’ and the zone sources to Line 1. Music level data format is set to ASCII character format. The system reset command reverts the module to the factory default settings and reasserts all the factory defaults as the power-on defaults. The unit will then behave as it did when it was fresh from the box. The Microphone 1 channel default is ‘Mute’ because this microphone can be considered as a paging microphone, and in a paging application it is not desirable for the microphone to be routed to all zones on power-up of the unit. This default can be changed via the following command:

```
<DM1,O/>
```

5.6 Data Formats

To provide compatibility with a broad range of controllers, the CDI-S200 will accept two different parameter formats in level commands. The two formats supported are ASCII characters and byte codes. Default is for the CDI-S200 to accept ASCII characters as data, since this is human readable. It is recommended that the byte data format only be used for controllers which will send values only in byte form. To set the data type for level commands, a system command must be sent to the module in the following format:

```
<SY,Lformat/>
```

where format identifies the desired data type. Values for the format field are:

'C' (0x43):- ASCII character format
'B' (0x42):- Byte format

Responses to commands in byte format may not be human readable since the bytes being returned may not correspond to a displayable ASCII character. EG a value of 0x41 (65) maps to ASCII 'A' and so could be printable; a value of 0x7 maps to the ASCII BELL control character and would cause the terminal to beep!

5.7 Table of Commands

Command		Identifier	Example Message		
			Zone Music	Microphone	Global Music
Mute		M	<Z1.MU,M/>	<MI,M/>*	<MU,M/>
Open		O	<Z2.MU,O/>	<MI,O/>*	<MU,O/>
Source Select	Up	SU	<Z1.MU,SU/>	N/A	<MU,SU/>**
	Down	SD	<Z2.MU,SD/>		<MU,SD/>**
	Absolute	SA	<Z3.MU,SA4/>		<MU,SA3/>
Level	Up	LU	<Z1.MU,LU6/>	N/A	<MU,LU10/>**
	Down	LD	<Z2.MU,LD6/>		<MU,LD10/>**
	Absolute	LA	<Z3.MU,LA20/>		<MU,LA60/>
Page	Access	PA	N/A	<M1,PAOXX/>$	N/A
	Release	PR		<M1,PR/>$	
DEFAULT COMMANDS					
Level		D[dest],LA	<DZ1.MU,LA12/>	N/A	<DMU,LA12/>
Source		D[dest],SA	<DZ2.MU,SA4/>		<DMU,SA3/>
Mute/Open		D[dest],M	<DZ3.MU,M/>	<DMI,O/>*	<DMU,M/>
SYSTEM COMMANDS					
Reset		R	<SY,R/>		
Previous		IP	<SY,IP/>		
Default		ID	<SY,ID/>		
Level ASCII		LC	<SY,LC/>		
Level Byte		LB	<SY,LB/>		

* This command will work with all possible microphone destinations; `MI`, `M1` and `M2`

** Up/Down commands sent to a global destination will return a lower case copy of the message.

$ This command works with Microphone 1 only

5.8 Response Messages

Response messages are returned by the CDI-S200 to help system programmers in debugging the system, to provide a means of error checking for the system and to supply feedback to controllers that need to update their display based on the mixer settings. Response messages always return the resulting parameter value if successfully executed unless the command is sent to a global destination. For system, mute, open, default and global destination commands, the result is always a lowercase mirror of the message sent to the module; for output specific source and level commands, the result is always a lowercase absolute value message containing the resulting value.

If the module recieves a message which it cannot execute, an error message is returned. Error messages are always valid, i.e. started and ended correctly and the first character is always an exclamation mark. This is immediately followed by a type identifier showing the fault condition.

<!`error_id[constructed_response]`**/>**

Some error messages will contain a constructed response message to indicate where the failure occurred in the process.

Response Messages continued

Error Type	I.D.	Fault Condition	Example Messages	
			Faulty Message	Response
Parser	P	Message syntax error or extra characters.	<MG,M/>	<!Pm^g,m/>
Buffer overflow	B	Message too long	<GGGGGGGGG...	<!B/>
Interruption	I	Message was interupted before termination.	<MU.<MI.O/>	<!I/><mi.o/>
Validation	V	Variable out of scope	<Z6.MU,SU5/>	<!Vz6.mu,su5/>
Execution	E	Destination and command incompatible	<M1,LU5/>	<!Em1,lu5/>
Abbreviation	A	Message prematurely terminated	<M1./>	<!A/>

5.9 Example Messages

1. Absolute Zone Music Level
The target is to set the Music level in Zone 3 to -30dBu.
Message sent
`<Z3.MU,LA60/>`
Expected response
`<z3.mu,la60/>`
Destination is Zone 3 (`Z3`) and we are only operating on music, so specify the music sub-destination (`MU`). A level command is to be executed (L) and it is an absolute (A) value that is required. Level values are given as +1 corresponding to -½dB starting with value 0 as 0dBu which means -30dBu requires a value of 60.

2. Muting an individual microphone
The target is to mute Microphone 2 across all zones of the CX263.
Message sent
`<M2,M/>`
Expected response
`<m2,m/>`
Destination is Microphone 2 (`M2`) across all zones and the command to be executed is a mute (`M`).

3. Paging Access command
The target is to page Zones 1 and 3
Message sent
`<M1,PAXOX/>`
Expected response
`<m1,paxox/>`
Destination is Microphone 1 (`M1`) across all zones, and the command to be executed is a paging access command (`PA`). Zones in which the microphone should be active are indicated by 'X' and those where it should not be active are indicated by 'O' (alphabetical character, not numerical). The Paging command will only work for the microphone inputs that will support paging on the base mixer, in the case of the CX263 this is microphone 1 only.

4. Increment Music Source
The target is to increment the music sources across all zones.
Message sent
`<MU,SU/>`
Expected response
`<mu,su/>`
Destination is the global music destination (`MU`). The command to be executed is a source command (`S`) and the source should go up by one (`U`). The response message is a lower case reflection of the original command. With the global destinations, it is not possible to return absolute values, as resulting values may differ from output to output.

5.10 Testing with a Terminal Emulator

Any terminal emulation program should be able to communicate with the CDI-S200, but the recommended choice is HyperTerminal. This may be installed on your computer anyway, but is also distributed with the Windows ™ CD.

Connect the CDI-S200 to a serial port on the computer using a standard D type 9 pin male to 9 pin female cable.

Open HyperTerminal and make a new connection. At the 'Connect Using' option choose 'Direct to Com1' or Com2 depending which serial port you are using. Set the 'Bits per Second' and the 'Flow Control' according to the jumper settings on the CDI-S200, the CDI-S200's default settings are '9600 and 'No Flow Control'.

Ensure 'Data bits' is set at '8', 'Parity' is set at 'none' and 'Stop bits' is set at '1'.

You may have to set HyperTerminal to 'Local Echo' in order to see what you are typing. From the File menu select 'Properties' to open the Properties dialog box. Click the 'Settings' tab on and press the 'ASCII setup…' button to open the Ascii setup dialog box. Set the checkbox labelled 'Echo typed characters locally '. Close the Ascii setup and the Properties dialog boxes by pressing their 'Ok' buttons. You should now be able control the CDI-S200 by typing commands into the HyperTerminal window.

5.11 Cable Lengths

The RS232C standard recommends a maximum cable length of 50 feet (approximately 15.25m), however this can be considered a very conservative estimate based on the worst case conditions. Below are some recommended maximum cable lengths for serial communications (all lengths shown are in feet and (metres)):

Baud Rate	Shielded Cable Length	Unshielded Cable Length
300	4000’ (1219m)	1000’ (305m)
1200	3000’ (914.5m)	500’ (152.5m)
2400	2000’ (610m)	500’ (152.5m)
4800	500’ (152.5m)	250’ (76m)
9600	250’ (76m)	100’ (30.5m)

The lengths shown above should only be considered as guidelines, since it is possible to run longer lengths using well-shielded, high-quality cable in an electrically quiet environment. However, it is also possible that these cable lengths will be too long for electrically noisy environments, so the length of cable should be tailored to the installation environment.

Notes: