'Clearly Better Sound'

Version 1

CDI-S100 SERIAL INTERFACE CARD

Cloud Electronics Limited

CDI-S100

Installation & Setup Guide

CLOUD ELECTRONICS LIMITED

CDI-S100 Installation and Setup Guide

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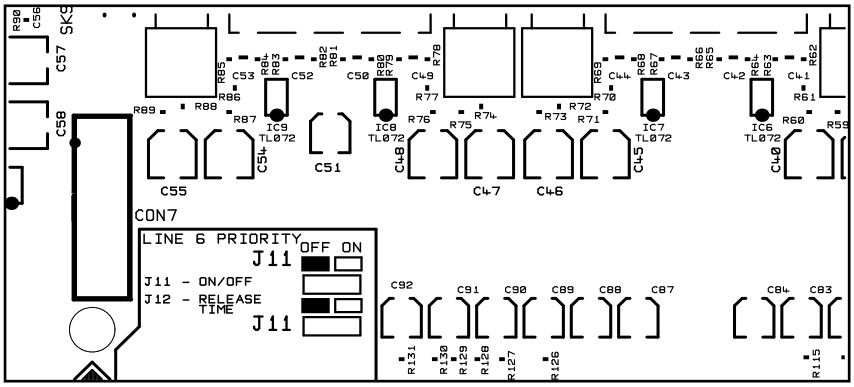
1 Introduction

The CDI-S100 is an optional module that fits inside the CX462 Audio System Controller to allow serial control of:

- **Music Source select, Level control and Muting**
- **Individual Microphone Muting**
- **Master Microphone Level and Muting**

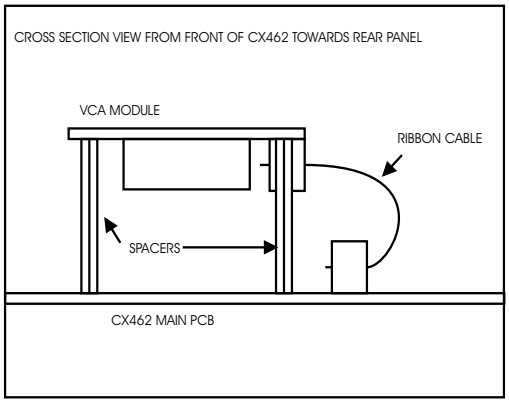
2 Installation

The CDI-S100 should be configured before being installed (see section 3 for configuration details). The CDI-S100 is supplied with two 25mm hex spacers and a 9-pin sub-D plug. The module is connected to the CX462 main board via a connector located at the rear of the mixer, close to the output terminals. The connector is marked 'CON 7'.



Location of CON7 on CX462

Instructions:



1. Disconnect mains supply from CX462.
2. Remove top panel from CX462.
3. Remove the panel that blocks the serial interface terminal space when no interface module is installed.
4. Locate connector CON7 (16-pin box header)
5. Remove M3 screw adjacent to CON7 and M3 screw next to C96. Keep to one side.
6. Remove hex spacers from 9-pin sub-D socket.
7. Screw 25mm hex spacers into screw holes in step 5.
8. Connect ribbon cable attached to module to CON7 terminal.
9. Place module in an inverted position over the spacers, making sure to line up the interface socket and spacers with their respective holes.
10. Use M3 screws, saved from step 5, to firmly affix the module to spacers.
11. Reattach hex spacers to the 9-pin sub-D socket through holes in rear panel.
12. Check and set internal jumpers J7-10 to configure the modules effect on music signals (see section 4.2).
13. Check and set the internal jumpers J1-4 to configure the modules effect on microphone muting (see section 4.1).
14. Fit the top panel back on to the CX462, using the original screws.
15. Set rear panel 'REMOTE TYPE' switch to 'DIGITAL' position.
16. Set front panel 'LOCAL/REMOTE' switch to 'REMOTE'.

3 CDI-S100 Configuration

The CDI-S100 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 itself, with a more detailed description of each set in the following paragraphs. Settings for the module should be configured to match the controlling equipment capabilities. 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-S100 uses a serial data packet consisting of one start bit, eight data bits and one stop bit. The CDI-S100 does not support parity, so the controlling device 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-S100 processes and 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-S100 to be set to a baud rate of 9600 bits-per-second.

3.2 Flow Control

Setting jumpers J4 and J5 on the CDI-S100 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-S100 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`.

No handshaking mode means the module uses neither of the two 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.

Mode	J4	J5
No handshaking	Low	Low
Xon/Xoff	Low	High
RTS/CTS	High	Low

Table of jumper settings for J4 and J5

4 CX462 Configuration

To install the CDI-S100 in the CX462, the CX462 needs to be correctly configured. To allow the module to have full control of the unit there is a set of internal jumpers which need to be checked and set. In all configurations the module will have control over the master microphone level.

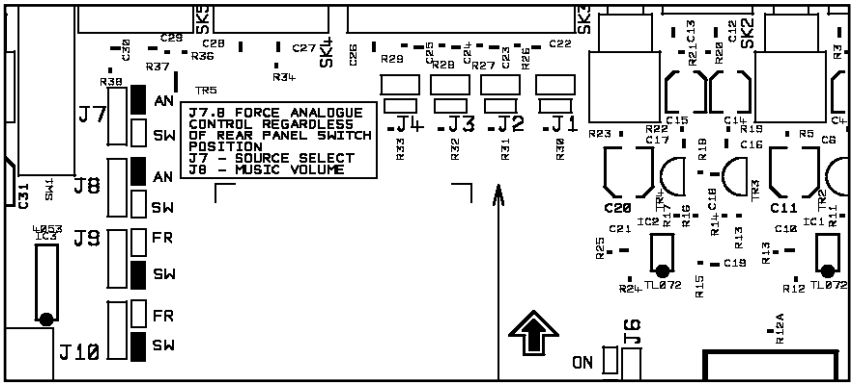
4.1 Microphone Access controls

To allow the CDI-S100 to mute individual microphone channels, internal jumpers J1-4 in the CX462 need to be present and connecting the header pins. If one of these jumpers is disconnected it will mute the correspondingly numbered channel until the access pin is pulled to 0V.

4.2 Music source select and volume

In order for the CDI-S100 to control the music source select and volume controls, internal jumpers J7-10 in the CX462 need to be in the 'SW' position. This allows control of the signals to be switched by the 'ANALOGUE/DIGITAL' switch on the rear panel (SW1).

Jumpers J7 and 8 switch the music controls between front panel and switchable control, ‘FR’ and ‘SW’ positions respectively. Jumpers J9 and 10 switch the music controls between forced analogue and switchable controls, ‘AN’ and ‘SW’ positions respectively. The controls must be switchable to allow the CDI-S100 to control them, as any other setting will effectively disable CDI-S100 control over that particular function.



Location of Jumpers J1- 4 and J7- 10

5 Cloud SP v1: Communications protocol

Messages are sent to the CDI-S100 using the Cloud SP1 protocol. The protocol is designed to be human readable where possible, to enable easy debugging and to allow system testing by typing commands into a terminal emulator program such as HyperTerminal.

5.1 Message Structure

All messages *to* the CDI-S100 use upper case letters, all messages *from* the CDI-S100 are in lower case. Commands are enclosed within a header character (“<”) and a terminator sequence ("/>"). The CDI-S100 will reset its message decoding software upon reception of a header character, discarding any previously un-decoded partial messages. The CDI-S100 will decode a message upon reception of the terminator sequence. If the decoded message is valid it is executed and a response message returned. 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 CX462, there are three possible destinations, the module itself, the microphone channel and the music channel. Destination field values are:

- **Music:** MU
- **Microphone:** MI
- **Module**: SY

Where there is the possibility of multiple destinations, such as the CX462 microphones, a sub-destination is appended to specify the number of the destination. A dot is used to separate the destination from the sub destination, e.g. 'MI.3' addresses microphone 3.There are four individual microphones numbered 1 to 4. Individual microphones can only accept 'Mute' and 'Open' commands.

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. In this example the music section is identified.

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' and 'Open' commands, 'M' and 'O', no parameters are required, since the purpose is just to set the mute or open state .

The other commands set a parameter for the source or level on a particular channel. 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 range 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 will 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 channel or an individual microphone.
- **Open, 'O':** Opens (un-mutes) a channel or an individual microphone.
- **Level, 'L':** Manipulates the level on a channel 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 music channel. 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.

The type field identifies how a command is to be performed. Available types for signal manipulation are absolute (shown here), up and down. All signal manipulation types accept a parameter value which indicates the number of steps in the action.

5.5 System Commands and Defaults

It is possible to modify the behaviour of the CDI-S100 by sending the appropriate system commands to the unit. 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-S100 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 to 10dB below the maximum music level.

5.6 Data Formats

To provide for a broad range of controllers, the CDI-S100 will accept two different parameter formats in level commands. The two formats supported are ASCII characters and byte codes. Default is for the CDI-S100 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!

Factory power on defaults for the CDI-S100 are to set all volume controls to -∞, all microphone channels to 'Open' and the music source 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.

5.7 Table of Commands

Command		Identifier	Example Messages		
			MusicChannel	Microphone Channel	Individual Microphone
Mute		M	<MU,M/>	<MI,M/>	<MI.1,M/>
Open		O	<MU,O/>	<MI,O/>	<MI.1,O/>
Source Select	Up	SU	<MU,SU/>	N/A	N/A
	Down	SD	<MU,SD/>		
	Absolute	SA	<MU,SA3/>		
Level	Up	LU	<MU,LU5/>	<MI,LU1/>	N/A
	Down	LD	<MU,LD5/>	<MI,LD1/>	
	Absolute	LA	<MU,LA35/>	<MI,LA46/>	
DEFAULT COMMANDS					
Level		D[dest],LA	<DMU,LA35/>	<DMI,LA46/>	N/A
Source		D[dest],SA	<DMU,SA3/>	N/A	N/A
Mute/Open		D[dest],M	<DMU,M/>	<DMI,M/>	<DMI.1,O/>
SYSTEM COMMANDS					
Reset		R	<SY,R/>		
Previous		IP	<SY,IP/>		
Default		ID	<SY,ID/>		
Level ASCII		LC	<SY,LC/>		
Level Byte		LB	<SY,LB/>		

5.8 Response Messages

Response messages are returned by the CDI-S100 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 unit settings. Response messages always return the resulting parameter value if successfully executed. For system, mute and open commands, this will be a lower case mirror of the message sent to the module; for level and source commands a lower-case absolute message type is always returned.

5.9 Example commands

1. Absolute Music Level

We would like to set the music level on a unit to 0dBu. In order to do this we need to recognise the units highest output level, for this example 20dBu, so we need to decrease the level by 20dB to achieve the desired output. This gives us 40 ½-dB steps. Since 00 corresponds to the maximum value, we set the level value to 40. The command required to do this is:

ASCII: <MU,LA40/>
Byte: <MU,LA(/>

The modules response should then be:

ASCII: <mu,la40/>
Byte: <mu,la(/>

2. Increment Music Source

To increment the music source on a unit, we need to send to the music destination using the Source Up command:

```
<MU,SU/>
```

The response will be:

```
<mu,sa#/>
```

where # is the number of the line input selected.

5.10 Testing with a Terminal Emulator

Any terminal emulation program should be able to communicate with the CDI-S100, 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-S100 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-S100, the CDI-S100'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-S100 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 lowest possible output voltage. 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: