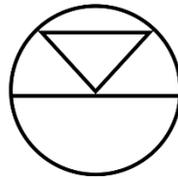


Crestron Linn Lite Driver for SIMPL Windows

Installation Guide

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Contents

Introduction	3
Requirements.....	4
Driver Overview	4
Demo Project	6
Control Point GUI Setup.....	7
Making Modifications to Driver	7
<i>LinnLiteDriver</i> Signal List	7
Preface Section	7
Control Point Communications Section	8
Room Section	8
Module Parameters	9
<i>LinnLiteControlPoint</i> Signal List.....	9
Signal Suffix Types.....	10
Section A – Driver Communication, Room/Source Selection & Standby	10
Section B – Volume & Transport Control.....	11
Section C – Pins & Metadata.....	13
Section D – Room & Source Selection Menu Info.....	14
Design Tips	14
Room Selection Menu.....	14
Source Selection Menu	15
Pin Usage.....	15
External Source Invisibility	15
Multi-Byte and International Fonts	16
Driver Enable and Refresh Buttons.....	16
Single Room Setups.....	16
Macro Commands.....	16
Glossary.....	17

Introduction

This document aims to provide guidance for setting up a Crestron project that utilises the Crestron Linn 'Lite' driver for SIMPL Windows. This set of SIMPL modules is capable of offering an interface for basic network control over several Linn DS/DSM devices including the Linn Kustom DSM. The driver operates by utilizing Linn's custom install **gateway API***. Rather than handling one-to-one communication between Crestron processor and (potentially several) Linn devices the gateway API arranges all Linn products on a local network into a **house topology** and manages control. The maximum number of **rooms** allowed by this driver in a setup is 20. This API is available through Linn Kazoo Server software or on any Core4 Linn device (only 1 instance is required). The gateway API will be automatically discovered within the local network on start-up. A setup using this driver can support up to 8 **Crestron control points** (CCPs) A list of available features is given below:

- Room selection - each CCP has an actively selected room within the house topology that can be changed via the CCP itself.
- Grouping - the current **grouping** of rooms set via Kazoo/LinnApp will be reflected in the room selection menu and automatically update whenever a change in grouping occurs. The standby states and volumes of listening rooms can be set individually
- For each room in the topology the user has control over the following DS functionalities:
 - Standby control - each room can be individually toggle between standby states
 - Volume control - step up/down, set absolute, mute toggle
 - Toggle shuffle and repeat states for appropriate sources
 - Transport control over any active playlist - play, pause, play/pause toggle, skip previous, skip next
 - Source selection - capable of selecting any visible external source
 - Metadata - retrieves basic metadata for currently playing item including artwork
 - Pin selection - as on physical Linn DSM devices, 6 customizable buttons can be setup using a Linn control point (Kazoo/LinnApp) to provide easy access to a favourite radio station, playlist, or external source
 - Pin metadata - the name and associated artwork for each pin can also be accessed via the module and displayed on a CCP interface
- Standby states of all rooms within the house can be changed quickly and directly from a room selection menu without having to select the room as the active room of a CCP first
- Through SIMPL Windows, a CCP can be set to lock onto a certain room if that room is found through the gateway API
- For more advanced macro functionality, a command serial input optionally allows programmers to run **LPEC** commands directly to devices in the house from the Crestron processor

This module is named 'Lite' to express the condensed feature set it contains. By limiting its feature set to basic network control and functionality the setup and installation process is greatly simplified. A more feature rich module which allows for browsing and searching of music from local and cloud services (Tidal, Qobuz, TuneIn, Kazoo Server) and other features such as control over room groupings is expected in the future.

Note: this driver is designed for use in SIMPL Windows and is not a *Crestron Driver* designed for use with the Crestron Home OS.

*definitions/explanations of terms given in bold font are provided in the glossary section

Requirements

Access to Crestron’s pool of software (SIMPL Windows, Toolbox, Vision Tool Pro-e etc) is required for setting up a system. A Crestron 4-series control processor (CP4) is also required: this driver is untested on a Crestron 3-series processor and hence not recommended. Earlier Crestron control processors are also unsuitable for use with this driver.

An intermediate level of Crestron installation experience is required for the setup and integration of this module into a project; particularly in working with SIMPL Windows and Vision Tools Pro-e. No SIMPL+ or SIMPL# programming experience is required for a basic installation.

A good knowledge of Linn DS product functionality is also assumed including the Kustom DSM with its stream and zone architecture. The Kustom DSM is a product by Linn designed for use within custom installs and will therefore commonly be used in conjunction with this driver (for further information see: https://docs.linn.co.uk/wiki/index.php/Kustom_DSM)

Driver Overview

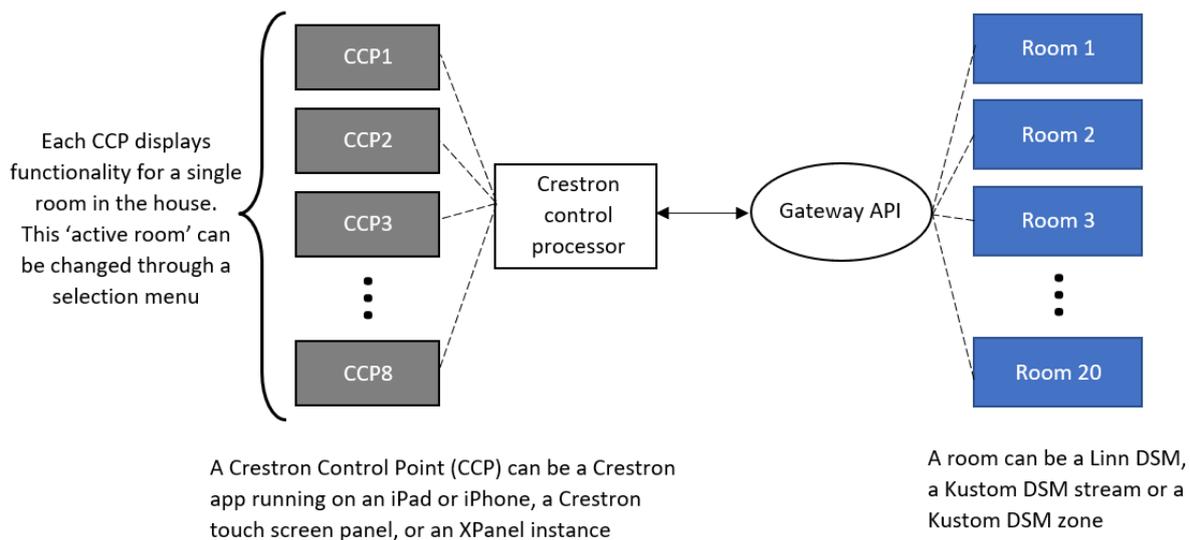


Fig. 1 – Overview of a setup using the Crestron Linn Lite Driver for SIMPL Windows. There can be up to 20 Linn ‘rooms’ on the local network that the Gateway API will organise and communicate with. The Crestron control processor will communicate and receive any changes that occur with these devices. There can be up to 8 Crestron control points (CCP) located around the house which are used to control the functionality of these rooms. Each CCP will have one active room selected at any time that can be changed through the room selection menu.

An overview of the basic structure of a setup incorporating this driver can be seen in Fig. 1. The driver itself has two core constituent SIMPL modules/symbols (and one optional) that need to be incorporated in a SIMPL Windows project:

- **LinnLiteDriver**
 - This is the ‘brain’ of the driver that is responsible for establishing communication with the Gateway API and managing information received from it to update CCPs accordingly.

- The SIMPL symbol's interface is shown in Fig. 2. The module is headed by essential inputs and outputs. The macro command input that allows for more advanced scripting of macros also appears here.
- The following section of the symbol contains serial input and outputs for communication with each of the 8 possible CCPs. A CCP may have one room selected within the house topology at any time and allows the same control. Two or more control points are capable of selecting the same room simultaneously and changes induced by one of these CCPs will result in all other CCPs updating accordingly. If using less than 8 CCPs simply comment out the inputs/outputs of the unused sections, using a double forward slash, as shown in Fig. 2.
- The final section contains information shared across all CCPs about the rooms within the house. This information is used by the room selection menu which contain the names of every room and individual, toggleable standby control buttons.
- The module/symbol contains several parameters. Some of these are optional such as overriding the discovery mechanism by entering the gateway API IP/port manually and device locking. The processor IP and image paths are required for the image files of source types. All these are explained in greater detail in the section 'Module Parameters'.

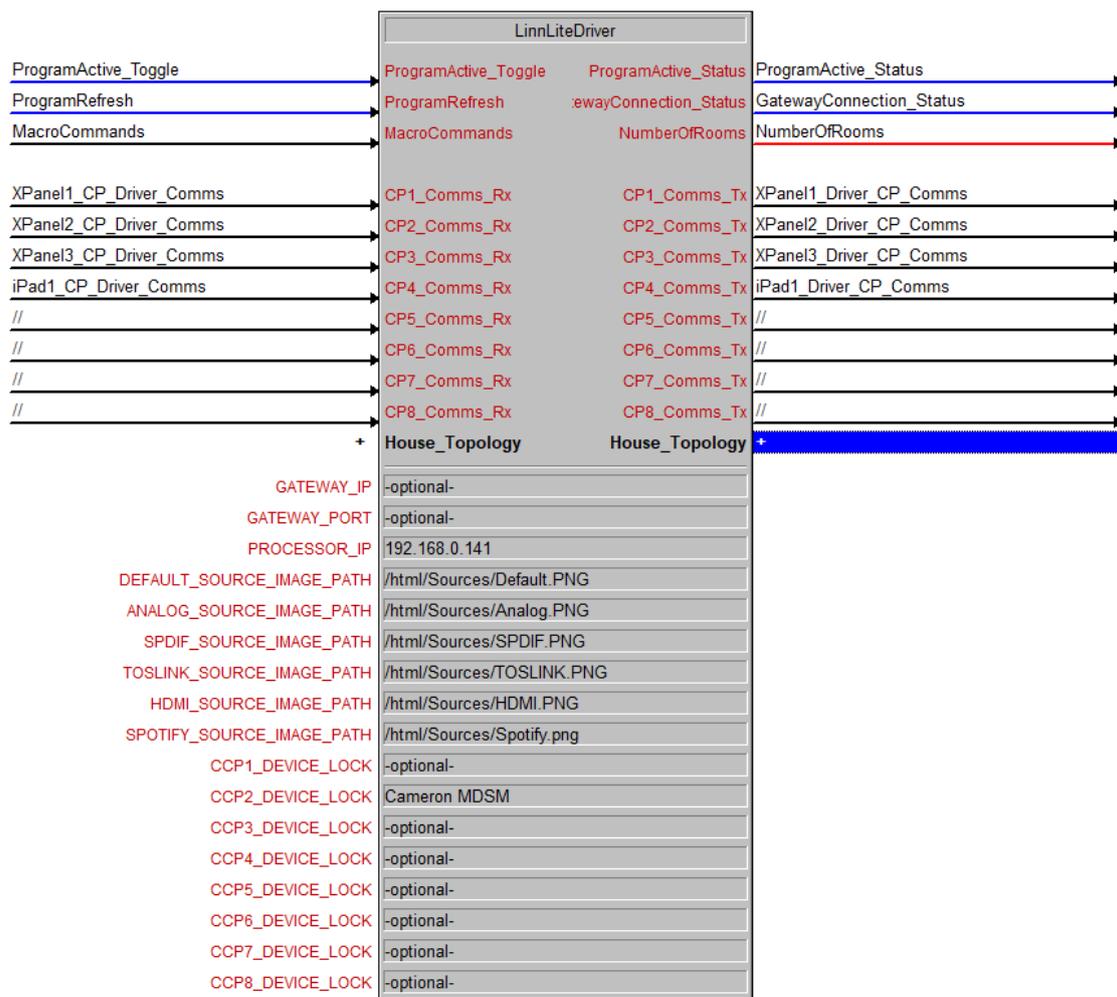


Fig. 2 – Overview of the LinnLiteDriver SIMPL module. Some basic information about program and gateway connection states as well as the macro command input and number of rooms in the active topology are given at the top. This is followed by 8 serial inputs and outputs for communication with the 8 possible corresponding control points (in the

example 4 out of 8 are in use) and finally a section containing shared topology data. At the bottom, a number of parameter fields are also visible which will be explained in detail.

- *LinnLiteControlPoint*
 - This symbol's purpose is to provide all the unique input and output signals required within a CCPs GUI. One of these must be added for each CCP used in the house setup as shown in Fig. 3.
 - The top line contains the input and output serial signals which are to be connected to the corresponding input and output signals on the main driver module for each of the CCPs. Following this is a list of input and output signals covering all the functionality outlined in the introduction. A description of all these input and output signals is given in Section (!!!)

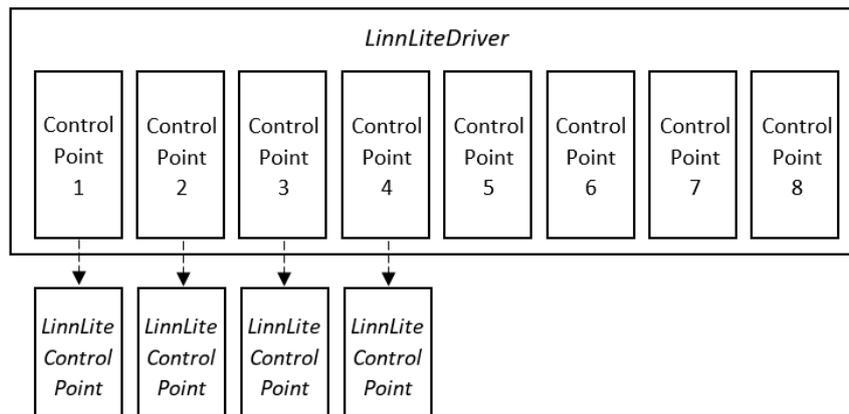


Fig. 3 – Structure and connection between the two core modules that make up the LinnLite driver. Control Point modules only need to be added if they are necessary in the project setup: for example, the above setup only contains 4 control and therefore only uses 4 instances of the *LinnLiteControlPoint* symbol.

- *RoomSelectionTool*
 - This brief symbol is a utility used in the demo project. Depending on implementation this may not be required.
 - This symbol takes in the range of digital inputs from the room selection GUI menu list and outputs an analog number indicating the room number selected and simultaneously pulses a digital output to toggle the room selection visibility (close the room selection menu).

Demo Project

A demo project is provided alongside this driver's basic components. The example GUI design file is not intended to be used in a Crestron customers setup but rather to be a point of reference and for helping understand how to implement this product in a project. It is fully expected that other home automation aspects unique to the customer will also be included in the project and controlling Linn products will not be the sole function of the Crestron system. Therefore, the Linn Lite driver is designed to work alongside these other features.

One particular facet of the demo project that it is highly recommended to follow is the use of digital, analog and serial joins from the VisionTools Pro-e project. These numbers match up with particular signals in the SIMPL Windows program and should be adhered to in any installation. A non-exhaustive list of examples where following the demo project signal joins becomes useful:

1. Transport controls will become greyed out when an external source is selected.
2. All room control buttons will be unavailable when a room is not selected.
3. Standby buttons on the room selection menu will be hidden where they are irrelevant.
4. Loading processes will be made significantly cleaner visually.

The demo contains a setup which includes 4 CCPs under ethernet devices: the first 3 of these being XPanel instances and the final one being an iPad. These all utilise identical GUI projects (*LinnLite_Demo_XPanel.vtp* and *LinnLite_Demo_iPad.vtp* for respective device types) however this of course does not have to be the case in a customer project.

Control Point GUI Setup

A GUI will have to be designed for use with this driver. This is completely customisable and should be tailored to the Crestron customers unique requirements but will generally feature a similar structure. There will a primary page within the GUI project on which Linn DS control presides. This page may be opened from a main menu amongst other functionalities. This page will contain two smaller pop-up subpages which contain room selection and source selection options. This can be used in other ways. For example, you may wish for certain controls, metadata, or room selection info to always be present on screen. These buttons/text can be attached to objects on the main menu page or on a footer that permanently shows on screen. Some tips towards building a GUI project that includes this driver in are detailed later in this document.

Making Modifications to Driver

The source code to the module is password protected as small, uninformed changes will likely cause serious problems in the user experience. For further information, advice or to request modifications, please contact: cameron.smith@linn.co.uk.

LinnLiteDriver Signal List

Preface Section

Beginning at the top of the symbol there are signals for the general operation of the driver

Inputs

Name	Type	Description
ProgramActive_Toggle	Digital	Toggles the driver between being in a disabled or active state. Defaults to be in a disabled state on loading onto the Crestron processor. Once enabled will start searching for a gateway API connection.
ProgramRefresh	Digital	If program is active, this will refresh the program. All known data about Linn devices and their states will be reset and the current Gateway API session will be closed and re-established.
MacroCommands	Serial	Used for sending LPEC commands directly to rooms within the house. Optional advanced feature, explained in greater detail in <i>Macro Commands</i> section

Outputs

Name	Type	Description
ProgramActive_Status	Digital	Indicates the current active state of the driver. If active this will be high in value, else it will be low.
GatewayConnection_Status	Digital	Indicates the current state of the connection with the gateway API. If a connection is open this will be high in value, else it will be low.
NumberOfRooms	Analog	Once a connection to the gateway API is established this signal will output the number of rooms (more specifically, the number of lines required in a list of rooms within the house).

Control Point Communications Section

The following sets of signals allow communication with up to 8 CCPs.

Inputs

Name	Type	Description
CP[1-8]_Comms_Rx	Serial	Connects to the corresponding CP_DriverComms_Tx output on the <i>LinnLiteControlPoint</i> symbol. Used to communicate input changes on the CCP. Optional, only required for the CCPs slots that are in use for the setup.

Outputs

Name	Type	Description
CP[1-8]_Comms_Tx	Serial	Connects to the corresponding CP_DriverComms_Rx input on the <i>LinnLiteControlPoint</i> symbol. Used to communicate output changes to the CCP. Optional, only required for the CCPs slots that are in use for the setup.

Room Section

The following sets of signals provide information about the rooms within the house that is universal across all CCPs. These signals will be used in the room selection menu of every CCP

Inputs

Name	Type	Description
Room[1-20]_Standby_Toggle	Digital	Directly toggle the standby state of the corresponding room

Outputs

Name	Type	Description
Room[1-20]_Standby_Status	Digital	Must be used to define the availability of the corresponding pin buttons. For cases when a pin is empty, loading or no room is currently selected

Room[1-20]_Standby_Visible	Digital	Must be used to set the visibility of the room standby buttons. In some cases, with the Kustom DSM, a standby button will not be visible
Room[1-20]_Text	Serial	The names of the rooms in the current house setup.

Module Parameters

Name	Description
GATEWAY_IP	Optional: By entering a valid IPv4 address into this field, the automatic discovery mechanism will be overridden, and this address will be used instead.
GATEWAY_PORT	Optional: By entering a valid port number (integer 1025-65536) into this field, the default gateway port number of 4100 will be overridden.
PROCESSOR_IP	Enter the IPv4 address of the Crestron control processor used in the project that is also hosting source images files
DEFAULT_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for source that don't conform to any of the following types.
ANALOG_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for external sources of the analog type.
SPDIF_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for external sources of the SPDIF type.
TOSLINK_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for external sources of the TOSLINK type.
HDMI_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for external sources of the HDMI type.
SPOTIFY_SOURCE_IMAGE_PATH	Enter the local path for the image that will be used for the Spotify source.
CCP[1-8]_DEVICE_LOCK	Optional: By entering a UDN or name of a room that appears in the house topology, the associated CCP will lock to that room and room selection will become unavailable.

The set of parameters for source image paths are used to provide appropriate images on-screen for the various external source categories. For the external sources of a Linn DSM there is no standard metadata artwork image that is used. This is left up to the installer to choose with the aim that images are chosen that fit with the theme of the Crestron project GUI.

The first step is to take the image files and host them locally on the Crestron processor using FTP or Crestron Toolbox. Once transferred the paths for these image files can be obtained. These will take the form of "/html/Sources/Analog.PNG" depending on their location. These paths can now be inserted in the parameter fields.

LinnLiteControlPoint Signal List

As outlined earlier, this secondary module acts to modularise the functionality that is common across CCPs. All inputs from buttons and feedback to the GUI is made available through this SIMPL symbol. This keeps the primary module's interface clean and free of repeated signals. One of these should be added for each CCP that is used in the project configuration. The signal list will be detailed

in full here. Firstly, some general conventions for suffixes used in the naming of module inputs and outputs are outlined

Signal Suffix Types

Suffix	Type	Description
_Toggle	Digital Input	An input which will toggle a functionality.
_Selected	Analog Input	An integer number input to the module used to invoke changes to room/source selection.
_Status	Output (Any type)	An output which gives feedback of the current state of a GUI feature. For example, the digital high or low state of a mute button, or a string containing track metadata.
_Available	Digital Output	Must be used to make buttons controlling corresponding inputs unavailable. For example, depending on the current source of a DS features like transport control may not be relevant and hence should not be available for selection in the CCP.
_Visible	Digital Output	Must be used to make buttons controlling corresponding inputs invisible in certain situations.

Section A – Driver Communication, Room/Source Selection & Standby

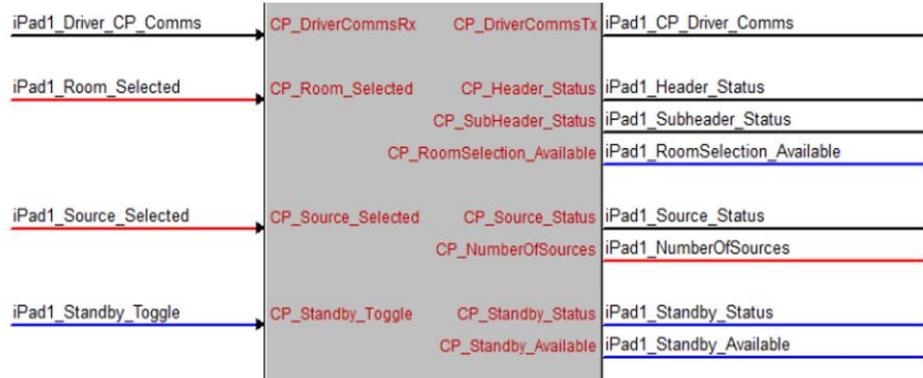


Fig. 4 – Screenshot of the first portion of signals in the *LinnLiteControlIPoint* symbol

Inputs

Name	Type	Description
CP_DriverCommsRx	Serial	Connects to the corresponding CP_Comms_Tx input on the <i>LinnLiteDriver</i> symbol, filling one of the CCP slots. Receives output changes for the CCP from the driver symbol.
CP_Room_Selected	Analog	Takes an integer number between 1 and the number of rooms within the house. When changed will invoke an update to the CCP to display the information of the corresponding room.
CP_Source_Selected	Analog	Takes an integer number between 1 and the number of sources available for the currently selected room. When changed will invoke a change in source for the selected rooms DS device
CP_Standby_Toggle	Digital	Toggle the standby state of the room currently selected by the CCP

Outputs

Name	Type	Description
CP_DriverCommsTx	Serial	Connects to the corresponding CP_Comms_Rx input on the <i>LinnLiteDriver</i> symbol, filling one of the CCP slots. Send inputs changes from the CCP to the driver symbol.
CP_Header_Status	Serial	This text output will give primary information about the current state of the CCP. It will display text when searching for the gateway connection or loading and give information about which room within the house topology is currently selected by the CCP.
CP_Subheader_Status	Serial	This text output is used for secondary information about the current state of the CCP. Used when a listening room is selected, the listening room name will be output through this signal.
CP_RoomSelection_Available	Digital	
CP_Source_Status	Serial	This text output shows the current source selected by the active room of the CCP.
CP_Number_Of_Sources	Analog	Updated with the number of sources for the room currently selected by the CCP. Used by the source selection menu subpage to determine the number of items in a list.
CP_Standby_Status	Digital	Gives feedback for the standby state of the room currently selected by the CCP. Note: Digital signal high for standby off (i.e., room turned on), low for standby on.
CP_Standby_Available	Digital	Must be used to define the availability of the standby control button. For cases where no room is actively selected the standby button in the CCP should become unavailable.

Section B – Volume & Transport Control

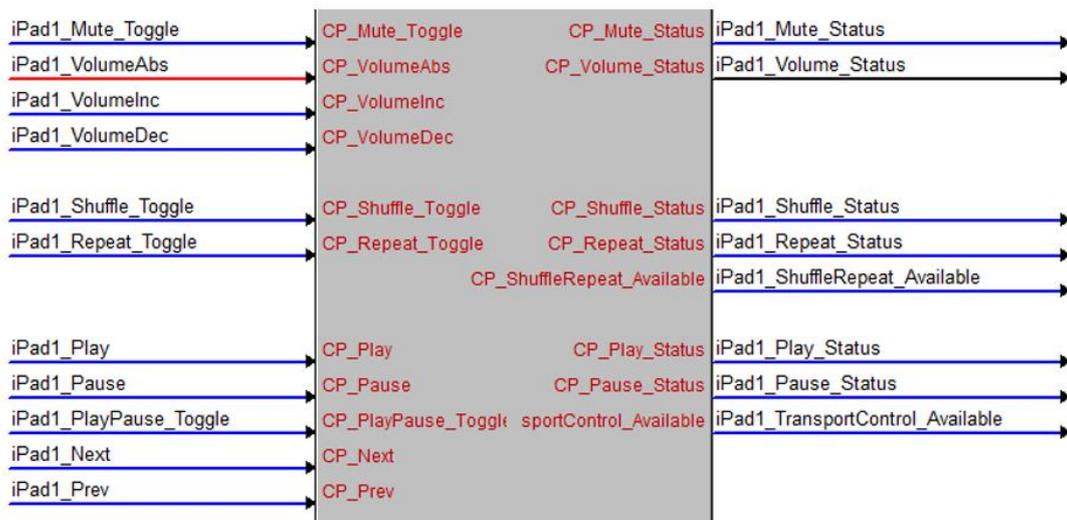


Fig. 5 – Screenshot of the second portion of signals in the *LinnLiteControlPoint* symbol

Inputs

Name	Type	Description
CP_Mute_Toggle	Digital	Toggle the mute state of the room currently selected by the CCP.
CP_VolumeAbs	Analog	Sets the volume using the absolute value of the analog input. Any time a change in the analog value is made the room's volume will be set to that value.
CP_VolumeInc	Digital	Increase the volume of the room currently selected by the CCP by a defined step size (default 1).
CP_VolumeDec	Digital	Decrease the volume of the room currently selected by the CCP by a defined step size (default 1).
CP_Shuffle_Toggle	Digital	Toggle the shuffle state of the room currently selected by the CCP.
CP_Repeat_Toggle	Digital	Toggle the repeat state of the room currently selected by the CCP.
CP_Play	Digital	Set the transport state of the room currently selected by the CCP to play.
CP_Pause	Digital	Set the transport state of the room currently selected by the CCP to pause.
CP_PlayPause_Toggle	Digital	Toggle the transport state of the room currently selected by the CCP between play and pause. Alternative to individual play and pause buttons.
CP_Next	Digital	Skip forward to the next item in the active playlist.
CP_Prev	Digital	Skip backward to the previous item in the active playlist.

Outputs

Name	Type	Description
CP_Mute_Status	Digital	Gives feedback for the mute state of the room currently selected by the CCP. Note: Digital signal high for mute on, low for mute off.
CP_Volume_Status	Serial	This text output shows the current volume level of the active room of the CCP.
CP_Shuffle_Status	Digital	Gives feedback for the shuffle state of the room currently selected by the CCP.
CP_Repeat_Status	Digital	Gives feedback for the repeat state of the room currently selected by the CCP.
CP_ShuffleRepeat_Available	Digital	Must be used to define the availability of the shuffle and repeat toggle buttons. For cases where these buttons are irrelevant for the actively selected room's source these will become unavailable in the CCP.
CP_Play_Status	Digital	Gives feedback for the play state of the room currently selected by the CCP.
CP_Pause_Status	Digital	Gives feedback for the pause state of the room currently selected by the CCP.
CP_TransportControl_Available	Digital	Must be used to define the availability of the transport control buttons. For cases where these buttons are irrelevant for the actively selected room's source these will become unavailable in the CCP.

Section C – Pins & Metadata

Fig. 6 – Screenshot of the third portion of signals in the *LinnLiteControlPoint* symbol

Inputs

Name	Type	Description
CP_Pin[1-6]	Digital	Select the corresponding pin for playback for the room currently selected by the CCP

Outputs

Name	Type	Description
CP_Pin[1-6]_Available	Digital	Must be used to define the availability of the corresponding pin buttons. For cases when a pin is empty, loading or no room is currently selected
CP_Pin[1-6]_Name	Serial	This text output contains the name of the item the pin contains for the active room of the CCP.
CP_Pin[1-6]_ArtworkUri	Serial	This text output contains the artwork URI of the item the pin contains for the active room of the CCP.
CP_Metadata_Line1	Serial	This text output contains the first line of metadata for the active room of the CCP. Usually, a track title, radio station name, or external source name.
CP_Metadata_Line2	Serial	This text output contains the second line of metadata for the active room of the CCP. Usually, an artist name or radio metatext.
CP_Metadata_Line3	Serial	This text output contains the third line of metadata for the active room of the CCP. Usually, an album name or the audio bitrate.
CP_Metadata_ArtworkUri	Serial	This text output contains the artwork URI metadata for the active room of the CCP.
CP_Metadata_Visible	Digital	Must be used to define the visibility of the metadata. Used to hide metadata during standby and loading.

Section D – Room & Source Selection Menu Info

These final sets of signals provide feedback for the room and source selection menus

Outputs

Name	Type	Description
CP_RoomSelected_Any	Digital	Used to indicate if any room is actively selected on the CCP. Digital high if so, low if not.
CP_RoomSelected_[1-20]	Digital	Whichever room in the topology is currently active on the CCP will be shown in this set of digital outputs. Gives feedback for the room selection menu by allowing it to highlight the active room.
CP_SourceSelected_[1-20]	Digital	Whichever source is currently selected for the active room of the CCP will be shown in this set of digital outputs. Gives feedback for the source selection menu by allowing it to highlight the active source.
CP_Source[1-20]_Text	Serial	A set of serial signals which are populated with the names of the sources for the currently active room on the CCP. Used by the source selection menu.

Design Tips

Room Selection Menu

The room selection subpage from the demo project is shown in Fig. 7. This subpage built in VisionTools Pro-e is laid out with a simple label and a button to close the subpage at the top. Below this is a 'Crestron Subpage Reference List' item. This useful object takes in a reference to another subpage (a list item) and forms a list of these. This is required in this case to allow for standby buttons for each room in the house topology to be present next to the room names. Care must be taken when designing a similarly presented room selection feature to a customer project. Pay specific attention to the way that digital join increments are used and how the formatted text labels contain the serial joins.

It can also be seen in Fig. 7 that rooms are presented in a list with any existing groupings shown via use of indentation. Rooms within the house topology are ordered automatically and these indentations are prepended to the output strings. Also note the invisibility of standby buttons for Kustom streams within a group led by itself. This is simply to avoid multiple buttons which serve identical functionality.



Fig. 7 – Screenshot of the room selection menu/sub-page for the demo project with an example house topology. The first item is a standalone Majik DSM. Following this is a large group led by a Kustom DSM stream named 'Downstairs'. Note the ordering and use of indentation to indicate group arrangements.

Source Selection Menu

The source selection menu subpage in the demo project is similar in design to the room selection counterpart however with the exclusion of standby buttons. Because of the lack of standby button functionality, a Smart Graphics Button List object could simply be used instead. A Subpage Reference List object is used in this case for consistency with the room selection menu.

Pin Usage

Because of the lack of full local and cloud browsing capabilities for music and radio stations, pins play an important role in a Crestron project utilising this driver. The digital inputs exposed through the module work in the same manner as the physical pins on Linn Majik/Selekt/Klimax DS devices and causes them to load a media item set through a Linn control point (Linn Kazoo, Linn App, different from the Crestron control point terminology used frequently in this document).

These can be set to be external sources, radio stations, playlists, or albums. External sources and radio stations will likely be the most common use cases, however. This allows the customer to quickly change between a set of favourite media items directly through a CCP. These pins should be configured during the setup process however a customer is free to reconfigure these themselves if they wish to and they will be automatically updated for the Crestron system.

External Source Invisibility

Linn DS/DSM devices have a vast range of external ports available however only a small amount may actually be used. It is recommended that unused ports are hidden via the configuration settings in Linn Konfig software. Ports can also be given more relevant names as to what they contain (i.e.,

'HDMI1' could be renamed to 'PS5'). These settings will be reflected in the source selection menu of the CCP using the Linn Lite driver and keep the interface tidy.

Multi-Byte and International Fonts

Working with metadata for music from streaming services will mean the occasional encountering of text which contains characters outside the ASCII character set (for example Chinese, Russian or Korean characters). There is support built into the driver to allow for these to be displayed. For this to work the theme "Standard Theme International.xml" must be used in a VisionTools Pro-e project. The font "Arial Unicode MS" must also be used for the text labels where this is relevant. This is demonstrated in the demo project included with this driver. For more information see the official Crestron guide: https://support.crestron.com/app/answers/detail/a_id/5264/kw/utf-8.

Driver Enable and Refresh Buttons

The *ProgramActive_Toggle* digital input does not need to be available in the CPP. It is a good idea however to have the *ProgramRefresh* digital input attached to a button somewhere on the CCP. If your project contains a generic settings page, it could prove useful to include this button as an easy method for resetting the driver in the case of unexpected problems.

Single Room Setups

For Crestron projects that implement this driver where there is only one Linn device in the setup there are additional advisory steps. For these setups there is no reason to utilise room selection and it is recommended that the device lock parameter for all CCPs is set to the single room's name (or UDN). The result of this is that the device will be automatically selected on start up and room selection is disabled.x

Macro Commands

The serial input *MacroCommands*, is included as a simple way to allow for more direct control of DS functionality. This input utilises the LPEC protocol that can be used to control Linn DSMs over a Telnet connection. Upon loading the house, telnet sessions are automatically opened and setup for all available rooms and can then be used at any point to send LPEC commands. The format of messages sent to this serial input should be of the form:

<Room Name> LPEC Command

For example, to set the volume of a DS:

<Living Room> Action Ds/Volume 2 SetVolume "45"

The driver will search for room that matches the name in the chevrons (angle brackets). If the room is found the LPEC command will be forwarded to that device, else it will be discarded.

The protocol does included scope for eventing (ie. service's events can be subscribed to and subsequent changes in the evented variables will cause unsolicited event messages to be sent from the device). This should not be used however as there is no handling of responses over the socket connection. Any changes caused by actions will cause a response from the gateway API that will correctly update the values within the setup.

A SIMPL+ module could be written to allow for macro a series of commands to be sent out. A single button press could result in a series of commands being sent out to multiple devices. If doing so it is recommended that a small DELAY is placed between each setting of the serial input. For example:

```
soMacroCommands = "<Living Room> Action Ds/Volume 2 SetVolume \"45\"";
DELAY(5); // a 50ms delay
soMacroCommands = "<Dining Room> Action Ds/Volume 2 SetVolume \"65\"";
```

Glossary

Crestron control point (CCP) – A device through which the Crestron system is controlled (eg. Touch panel, iPad, Phone, XPanel application) with a GUI designed through Crestron’s software tools.

Gateway API – Linn’s own API for managing Linn devices across a local network. A WebSockets connection is established between the Crestron control processor and the gateway API and is used to learn about the devices within the network and control features on them. Comes included with Kazoo server software and on Core4 Linn DSM products.

Grouping – Linn devices are capable of being grouped together to allow two or more system to play the same music in perfect synchronisation. One device will lead the group and all listening devices will play the same output audio.

House Topology – The topology of Linn devices found by the Gateway API within a local network. Contained within this will also be information about groupings of devices, i.e., if there are devices on the local network that are listening to another devices. For the Kustom DSM there will be additional information about the arrangement of streams and zones.

LPEC – Linn Protocol for Eventing and Control, an existing protocol for direct control over Linn devices: <https://docs.linn.co.uk/wiki/index.php/Developer:LPEC>

Room – A room in Linn DS/DSM products refers to a single playable device. The majority of products Majik/Selekt/Klimax are equivalent to a single room. This is not as simple in the case of Kustom DSM where there are multiple devices contained within the one box. For more info on how streams and zones operate see https://docs.linn.co.uk/wiki/index.php/Kustom_DSM. More specifically, in this driver, a room refers to anything that could occupy a line on the room selection menu which could be a standalone Linn DS or a Kustom stream or zone.