

The z-CL6 Six-Channel Mastering Dynamics Processor

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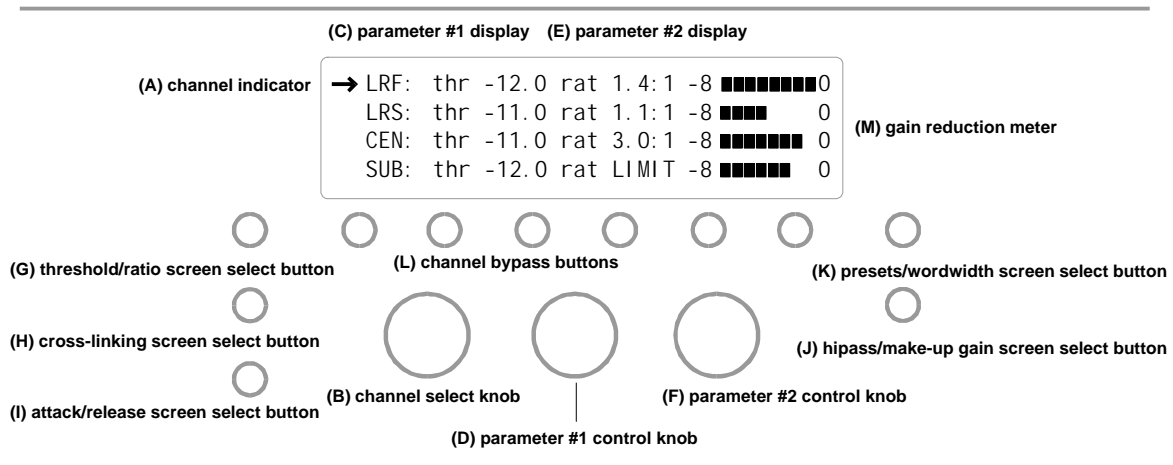


Figure 1 - z-CL6 front panel controls

Using the z-CL6 is very simple once you understand its display and control methodology. Because there are so many channels and so many parameters for each channel, only a few things can be displayed at a time. We have chosen to display the same parameters for all channels rather than all of the parameters for a selected channel; this is the basis for our display/control model.

To begin, the z-CL6 partitions the channels into four groups:

- LRF – left and right front channels
- LRS – left and right surround channels
- CEN – the center channel
- SUB – the subwoofer channel

Referring to Figure 1, there are four parameter control screens, each selected by one of the screen-select buttons (G, H, I, and J). These screen-select buttons each invoke a different mode in which the parameters associated with that mode can be controlled by the parameter #1 and parameter #2 control knobs (D and F). These four modes are:

- Attack/release mode (invoked by button I)
- Threshold/ratio mode (invoked by button G)
- Hipass/make-up gain mode (invoked by button J)
- Compressor cross-linking mode (invoked by button H)

The parameters associated with these modes are displayed in the parameter #1 display (C) and the parameter #2 display (E). Within any of the modes, use the channel select knob (B) to choose which channel group is affected by the parameter control knobs. As you turn the channel select knob, the channel indicator (A) will point to the corresponding channel.

There is a gain reduction meter (M) which is visible from any of the four mode screens. The gain reduction meter gives a simultaneous visual display of the amount of gain reduction being performed on all four of the channel groups. The meter continues to function while you are changing the values of the parameters, which gives useful visual feedback about your parameter choices.

Each of the channel groups is endowed with a channel bypass button (L). When this button is pressed, the corresponding compressor is disengaged and there is a direct signal path from input to output for that channel group; output is bit-for-bit identical to input. When the bypass button is pushed, the gain-reduction meter for that particular channel vanishes and is replaced with a bypass indicator. While a channel is bypassed, its parameters can still be adjusted. These new parameters will be in effect when the channel is taken out of bypass.

Finally, there is a button (K) for invoking a system mode where you can control the wordwidths of the different channel groups and you can save and load presets.

Controlling Attack and Release Times

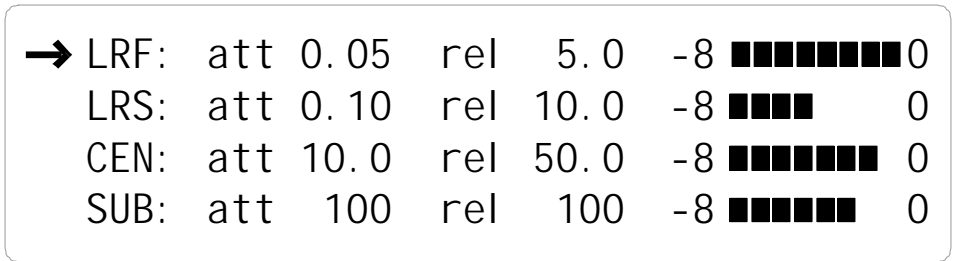


Figure 2 - attack/release screen

Press the **attack/release screen select button**. The display will appear as in Figure 2. Use the **channel select knob** to move the arrow to the desired channel. The **parameter #1 knob** controls the attack time and the **parameter #2 knob** controls the release time. Both the attack time and the release time are calibrated in milliseconds. The gain reduction meters will continue to function when the z-CL6 is in attack/release mode, as will the individual channel bypass buttons.

Attack times range from instant to 950 milliseconds. Release times range from instant to 950 milliseconds. A typical rule of thumb is to set the release time to ten times the attack time. Notice that the z-CL6 has more attack time choices than release time choices, with a higher density of values below 10 milliseconds.

Controlling Threshold and Compression Ratio

```

→ LRF: thr -12.0 rat LIMIT -8 ██████████ 0
  LRS: thr -18.0 rat 1.1:1 -8 ██████ 0
  CEN: thr -14.0 rat 3.0:1 -8 ██████████ 0
  SUB: thr -12.0 rat 2.0:1 -8 ██████████ 0

```

Figure 3 - threshold/ratio screen

Press the **threshold/ratio screen select button**. The display will appear as in Figure 3. Use the **channel select knob** to move the arrow to the desired channel. The **parameter #1 knob** controls the threshold and the **parameter #2 knob** controls the compression ratio. The threshold is calibrated in decibels relative to full-scale digital (dBFS) and the compression ratio is to be determined as the number of decibels the input level must rise above the threshold in order to produce a one-decibel increase in output level. The gain reduction meters will continue to function when the z-CL6 is in threshold/ratio mode, as will the individual channel bypass buttons.

The threshold ranges from 0.0 dB to -95 dB. The ratio can be made to vary from 1.1:1 to 8.0:1. Turning the ratio knob one click past 8.0:1 turns the compressor for that particular channel into a limiter, with a ratio of 100:1.

Controlling Hipass Filters and Make-up Gain

```

→ LRF: hp 100 Hz mkg +1.00 -8 ██████████ 0
  LRS: hp 100 Hz mkg +0.00 -8 ██████ 0
  CEN: hp 100 Hz mkg +0.60 -8 ██████████ 0
  SUB: hp 10 Hz mkg +0.00 -8 ██████████ 0

```

Figure 4 - hipass/make-up gain screen

Press the **hipass/make-up button**. The display will appear as in Figure 4. Use the **channel select knob** to move the arrow to the desired channel. The **parameter #1 knob** controls the corner frequency of the hipass filter (explained below) and the **parameter #2 knob** controls the compressor make-up gain. The make-up gain is calibrated in decibels relative to full-scale digital (dBFS). The gain reduction meters will continue to function when the z-CL6 is in hipass/make-up gain threshold/ratio mode, as will the individual channel bypass buttons.

The purpose and function of the hipass filters require a bit of explanation. In essence, a compressor consists of two blocks: a level detection block and a gain control block. The level detection block senses the level of the input signal and compares it to the user-determined threshold. When the input level exceeds the threshold, the detection block tells the gain control block to decrease the output level by the amount specified by the compression ratio. We have provided a hipass filter that goes before the level control block. This allows you to remove a desired amount of the low-frequency energy from the input signal so that the low frequencies don't trigger the compressor. This may prove to be useful for previewing different bass management modes for Dolby and DTS surround mastering.

The corner frequency parameter specifies the - 3 dB point for the hipass filter. Below the corner frequency, the filter has a slope of 12 dB per octave. The corner frequency can be varied from 10 Hz to 990 Hz. The 10 Hz setting is useful simply for blocking DC level from the level detector. Do not be alarmed by the presence of these hipass filters; remember - they are not in the audio path, but rather in the level detection path.

The make-up gain function serves two purposes. The first is to allow you to increase the overall signal level, post-compression. The second is as a digital volume control for controlling relative levels between the various surround groups. The make-up gain has a range from -95 dB to +12 dB referenced relative to full-scale digital (dBFS).

Saving and Loading Presets

The entire state of the z-CL6 can be saved and recalled. Press the **presets button** once. This will bring the z-CL6 to the state shown in Figure 8. To save a preset, use the **middle knob** (as prompted by the display) to choose a preset number then press the button beneath the SAVE indication. This will then bring the z-CL6 to the state shown in Figure 9, which confirms that the SAVE operation took place.



Figure 5 - preset mode



Figure 6 - confirmation of preset save

There is one special preset that can not be over-written. This preset is given number 00 and stores the z-CL6's "flat" settings. This is the preset you will want to use in order to return the z-CL6 to a "blank" setting. If you attempt to over-write preset 00, the display will appear as in Figure 7, which tells you that the preset was not saved and that you should choose another preset number.

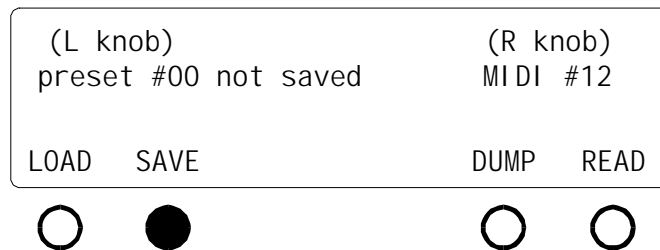


Figure 7 - indication that preset has not been saved

To recall a preset, from the screen in Figure 5 press the button beneath the LOAD indication. The preset indicated in the display will be loaded and the z-CL6 will jump to the mode from which the preset mode was invoked.

MIDI Automation

The z-CL6 can be automated via MIDI commands; it supports MIDI program change commands and also uses system exclusive commands to allow the unit's entire collection of presets to be sent to and restored from a MIDI sequencer.

The z-CL6's MIDI controls are on the same screen as the preset LOAD and SAVE screen. Simply press the **presets button** once, which brings the z-CL6 to the state shown in Figure 8.

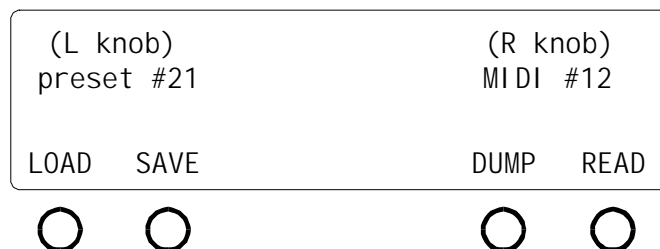


Figure 8 – MIDI control screen

To set a MIDI channel number, use the right knob, as prompted by the screen. This sets the MIDI channel the z-CL6 will use for both its MIDI program change commands and for system exclusive messages.

To save all 50 of the z-CL6's presets, put your MIDI sequencer into record mode with the channel set to the z-CL6's MIDI channel. Press the button below the DUMP message on the screen. You will see the preset counter on the left part of the z-CL6's screen count backwards from 50 down to 01. This lets you know that the z-CL6 is sending its entire bank of presets, one at a time, to the MIDI sequencer via MIDI system exclusive commands. When the system exclusive dump is finished, the z-CL6 will return to the preset number that was displayed before the DUMP command was executed.

To retrieve a collection of 50 presets from a MIDI sequencer, again make sure you have the z-CL6's MIDI channel number set to the same channel as the MIDI sequencer. Press the button below the READ message and then begin to play the MIDI system exclusive stream from your MIDI sequencer. The preset counter will again count backwards, letting you know that the z-CL6 is indeed receiving and decoding the system exclusive commands. When the z-CL6 has decoded the last preset from the MIDI sequencer, it will jump to normal operating mode and will be ready for either normal user input via the knobs and buttons or for MIDI program change commands.

To execute MIDI program change commands, simply make sure the MIDI sequencer is set to the same MIDI channel as the z-CL6 and begin sending program change commands. The z-CL6 will jump to the preset number indicated by the program change, with the display updated to show the parameter changes. If an invalid program number is sent to the z-CL6, it will be ignored.

Adjusting Wordwidth

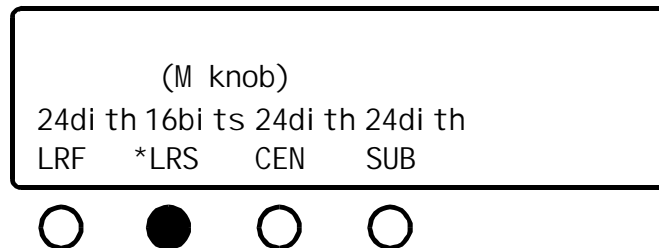


Figure 9 - wordwidth/sample rate mode

From the preset mode, press the **preset/dither button** to get to the wordwidth mode. The display will appear as in Figure 9. As prompted by the display, the wordwidths are controlled by the **middle knob**. Use the button below the indicated channel group names to select the group of interest, and an asterisk will appear to indicate the selection, as in Figure 9.

The wordwidth for each channel group can be controlled independently. There are six settings for each wordwidth:

- 24 bits dithered
- 24 bits undithered
- 20 bits dithered
- 20 bits undithered
- 16 bits dithered
- 16 bits undithered
- 16 bits POW-r #2
- 16 bits POW-r #3

The dither used is a variant of flat TPDF dither, while POW-r #2 and #3 are noise shaping curves.

Press any of the other **mode select buttons** to exit from the wordwidth rate mode.

Controlling Compressor Linking

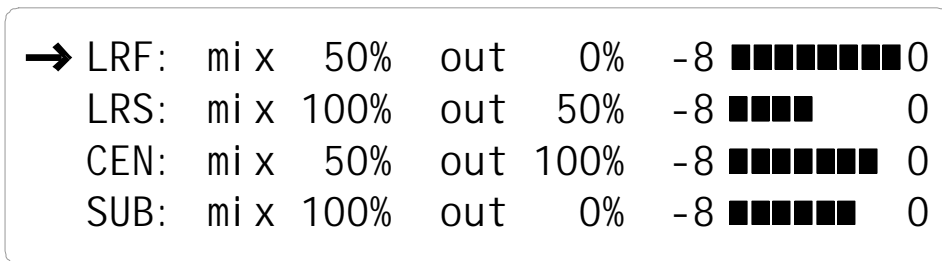


Figure 10 - compressor linking screen

One of the z-CL6's most powerful features is its ability to link the level detection and compression action across multiple channels. At first, it may seem slightly awkward to control the linking but we are confident you will quickly find the controls to be intuitive and easy to use.

There are four channel groups on the z-CL6: the fronts, the surrounds, the center, and the subwoofer. Each of these groups is endowed with two controls: a **mix** control and an **out** control. The purpose of these controls is to allow you to vary the amount of interaction each of the channel groups has with the other groups.

Internally, the z-CL6 generates four "sums of levels" They are:

$$\begin{aligned} \text{Sum}_{\text{LRF}} &= \text{outlevel}(\text{LRS}) + \text{outlevel}(\text{CEN}) + \text{outlevel}(\text{SUB}) \\ \text{Sum}_{\text{LRS}} &= \text{outlevel}(\text{LRF}) + \text{outlevel}(\text{CEN}) + \text{outlevel}(\text{SUB}) \\ \text{Sum}_{\text{CEN}} &= \text{outlevel}(\text{LRF}) + \text{outlevel}(\text{LRS}) + \text{outlevel}(\text{SUB}) \\ \text{Sum}_{\text{SUB}} &= \text{outlevel}(\text{LRF}) + \text{outlevel}(\text{LRS}) + \text{outlevel}(\text{CEN}) \end{aligned}$$

Notice that each of these sums is simply the sums of three of the four group levels with one of the groups omitted.

The value of "outlevel" for a channel group is nothing more than the group's actual level multiplied by the percentage indicated by the **out** parameter for that group.

Next, the **mix** parameter controls how much of the Sum in question gets added in to the compressor's level detector along with the level from that channel group. For example, the mix parameter for the LRF channel group determines what percentage of Sum_{LRF} gets added into the LRF group's level detector along with the level contributed by the LRF group itself. A value of 100% for the mix parameter means that the compressor sees all (100%) of the level from its own channel group and 0% of the Sum level. A mix parameter of 75% means that the compressor sees 75% of the level from its own channel group and 25% of the Sum level. This is shown schematically in Figure 11.

As shown in Figure 9, the LRF group contributes nothing to any of the Sums, the LRS group's level is weighted by 50%, the center level is weighted by 100%, and the subwoofer level contributes nothing to the Sums. Then, the front group compressor uses a mixture of 50% of the LRF level and 50% of Sum_{LRF} (which is equal to 50% of the LRS level plus 100% of the center level).

The subwoofer compressor gets 100% of its level from the subwoofer level and nothing from the other channels.

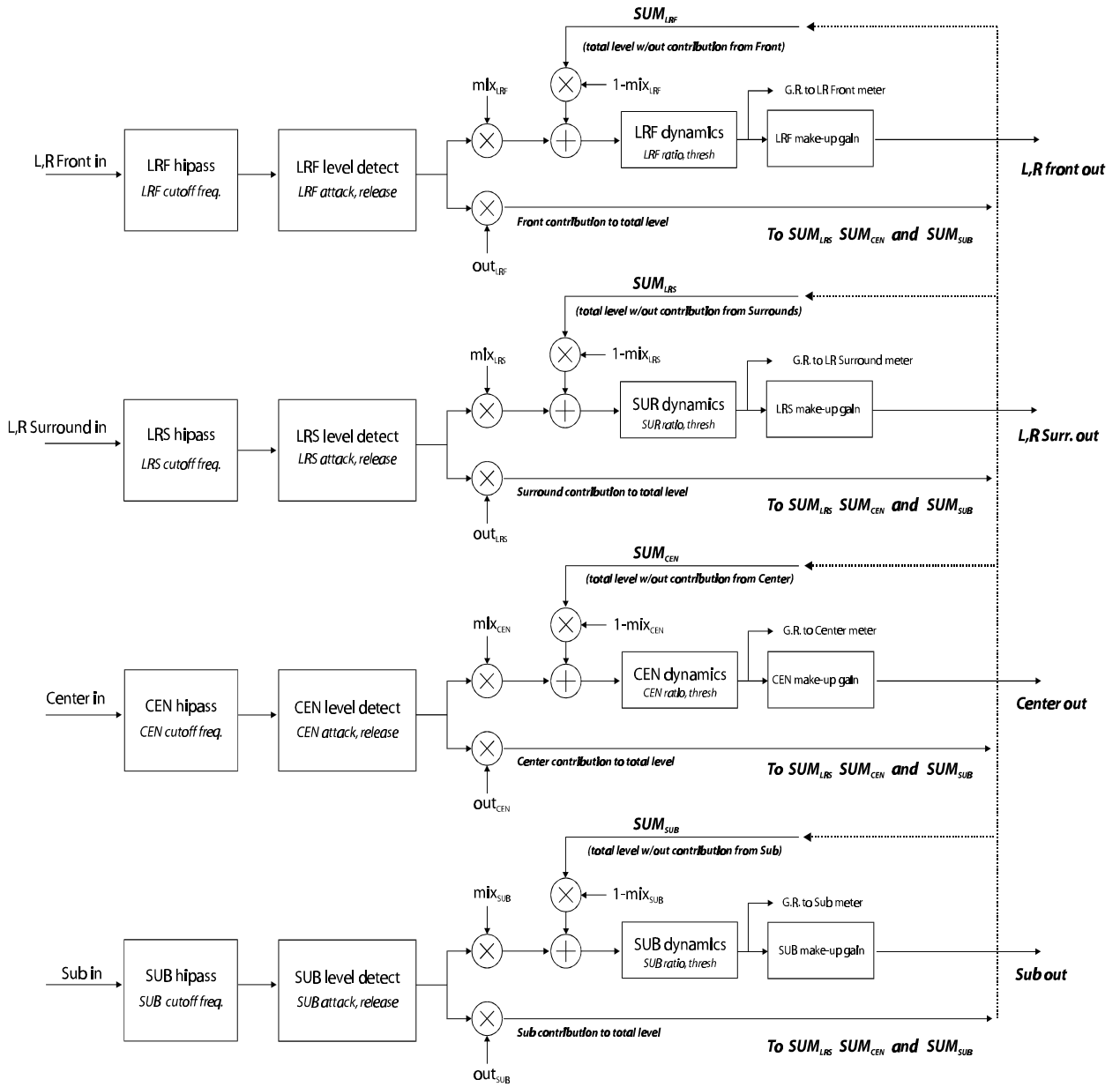


Figure 11 - z-CL6 block schematic

Specifications

- Inputs and outputs: Transformer-isolated, 110- ϕ terminated AES/EBU (3 inputs, 3 outputs)
- Sample rates supported: 32 kHz – 96 kHz
- Input resolution: up to 24 bits
- Output resolution: 16, 20, or 24 bits undithered or TPDF dithered
- Compression ratios: 1.1:1 to 8.0:1
- Limiter ratio: 100:1
- Threshold: from -95.0 dBFS to 0.00 dBFS
- Attack time: from 5.0 μ s to 950 ms.
- Release time: from 5.0 μ s to 950 ms.
- Highpass filters in detector chains: -12 dB/octave slope w/corner frequency from 10 Hz to 990 Hz
- Dynamic range: better than 130 dB
- THD + Noise: less than -130 dB
- AC Power: 110/220 volts @ 50/60 Hz