

GRACE DESIGN



M102

Optical Compressor

Owner's Manual Rev A

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Welcome and thanks for purchasing the Grace Design m102 optical compressor. We build all of our products to be completely reliable and easy to use, so you can concentrate on making great recordings, not struggling with complicated equipment or difficult product manuals. While you will find the m102 is completely straightforward to use, we do ask that you spend a little time reading this manual to help avoid any common user difficulties.

In the event that you do encounter any technical difficulties with this or any of our products, feel free to call us at 303-443-7454. Our office hours are 9:00 to 5:00, Monday through Friday, MST, or you may e-mail any technical questions to: info@gracedesign.com. Also, please check out our web site for complete product information, owner's manuals and technical documents.

Grace Design has been building audiophile quality products for the recording industry for over 18 years. The technology in the m102 is the result of extensive listening, field-testing and careful refinement. Your m102 represents a combination of absolutely pristine audio performance, robust mechanical construction and bombproof reliability at a reasonable price.

We sincerely hope our products help you achieve a new level of excellence in your work!

- The Grace Design Team

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Important Safety Information

GENERAL

- Indoor use only
- Ordinary Protection: This equipment should not be exposed to dripping or splashing.
- Avoid placing objects filled with liquids, such as vases or glasses, on this equipment.
- Class I Equipment (grounded type)
- Electrical rating: 100-240V~ 50-60Hz 14W
- Mains supply voltage fluctuations are not to exceed $\pm 10\%$ of the nominal supply voltage.
- Pollution Degree 2
- Installation (Overvoltage) Category II for transient overvoltages.
- Maximum Relative Humidity: $< 80\%$
- Operation temperature range: $10\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$
- Storage and transportation temperature range $-40\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$
- Maximum altitude: 3000m (9843 ft)
- Equipment suitable for continuous operation
- Weight: - 1.1kg (2.4 lbs)

Safety Marking Symbols



CAUTION: READ ACCOMPANYING DOCUMENTS

This symbol, located on the equipment and in this manual, refers to important instructions. Read this manual thoroughly before operating this equipment.



WARNING: ELECTRICAL SHOCK HAZARD

This symbol, located on the equipment and in this manual, indicates the potential for electrical shock hazard.

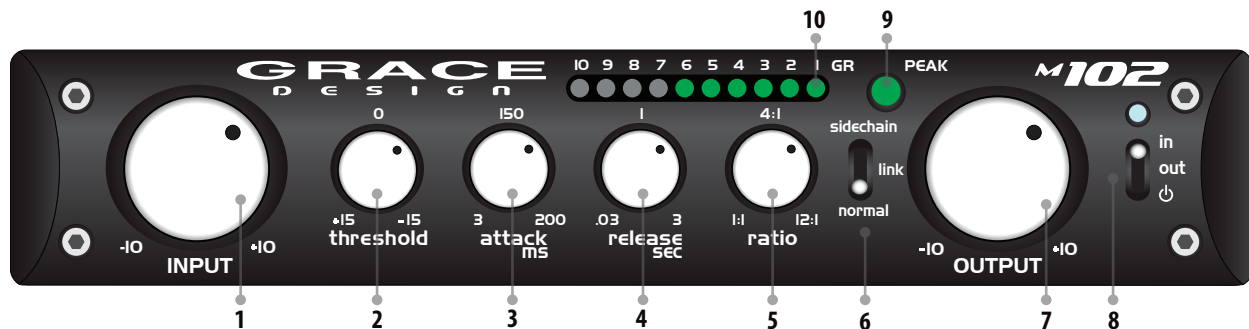
SERVICE INFORMATION

The Grace Design m102 contains no user serviceable components. Contact Grace Design for repair and upgrade information. In the event that your Grace Design m102 needs to be returned to the factory, please contact us for a return authorization number.

Features

- Elegantly simple, purist feedback design optical compressor for signal leveling with a minimum of sonic artifacts
- Subtle dynamic control to heavy compression, the sonic character of the source remains intact
- Comprehensive control set includes input level, threshold, attack, release, ratio and makeup gain
- Bright, easy to read 10 segment LED gain reduction meters
- Bi-color output peak LED lights green with signal present and red 6dB before clipping
- Dual balanced inputs and outputs on XLR and 1/4" TRS
- Bombproof laser-etched black anodized frontpanel
- Built in universal power supply
- Five year transferable warranty on parts and labor
- Made in the USA

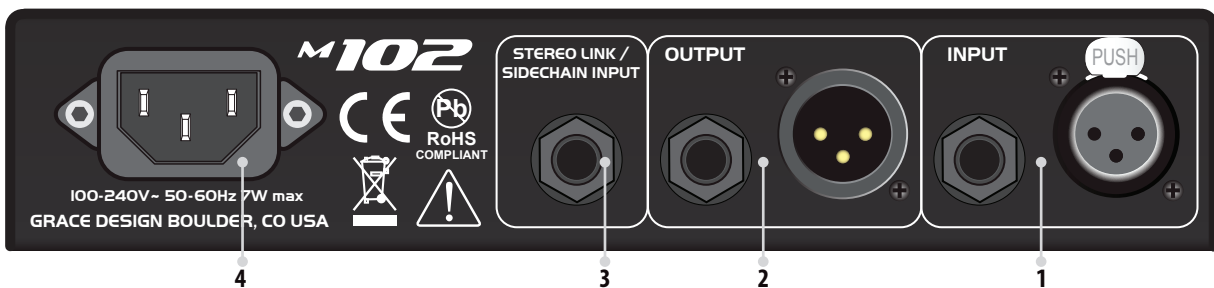
Front Panel Controls / Features




1. **INPUT** - This knob adjust the input level of the m102, from -10 to +10dB.
2. **THRESHOLD** - This knob sets the minimum level at which the compressor circuit is activated, with a range of +15dB to -15dB.
3. **ATTACK (milliseconds)** - This knob sets how quickly (or slowly) the compressor circuit attenuates the incoming signal.
4. **RELEASE (seconds)** - This knob sets how quickly (or slowly) the compressor circuit releases its attenuation of the incoming signal.
5. **RATIO** - The ratio control determines the input/output ratio for signals above the threshold level. Higher ratios result in more aggressive gain reduction while lower ratios will result in more gentle gain reduction.

6. **SIDECHAIN / LINK / NORMAL** - This switch is to activate either a) linking of two m102's for use in stereo compression scenarios, or b) to activate external side chain control of the compressor for ducking, de-essing etc, or c) for normal compressor operation.
7. **OUTPUT** - The output control provides 20dB of variable level control at the output of the m102, from -10dB to +10dB. This control is useful for small level adjustments during tracking or for compression gain makeup.
8. **POWER / OUT / IN SWITCH** - This 3 position switch activates the power supply circuitry and engages the compressor circuitry.
9. **PEAK INDICATOR** - The LED peak indicator, which monitors the signal at the output of the compressor, illuminates green at -10dBu and red at +20dBu (6dB before clipping).
10. **GR METER** - This 10 segment meter displays the amount of gain reduction being applied to a signal in the compression circuit.

Rearpanel Connections



1. **LINE INPUT** - Balanced line inputs, XLR wired pin 2 positive, pin 3 negative and pin 1 ground, TRS wired tip positive, ring negative, and sleeve ground.
2. **LINE OUT** - Balanced line outputs, XLR wired pin 2 positive, pin 3 negative and pin 1 ground, TRS wired tip positive, ring negative, and sleeve ground.
3. **STEREO LINK/ SIDECHAIN** - This 1/4" input accepts either the connection from another m102 for linking compressor controls for stereo use, or an external side chain signal source to control the compressor for ducking or de-essing applications. In sidechain mode, the connection is unbalanced with only the tip connected, so simply use an unbalanced 1/4" connector. Link mode requires a TRS 1/4" inch cable.
4.  **POWER SUPPLY** - A universal input AC supply provides mains power to the m102. A standard three prong AC power cable is included with the m102. For safety, the power supply cord must be connected to a grounded outlet. The Disconnect Device for the m102 is the Mains plug or the Appliance Coupler on the power supply cord. The Disconnect Device must remain accessible and operable.

Installing and Connecting

UNPACKING

Your m102 box includes the m102, an AC power cable, this owner's manual, a warranty card, a set of 4 adhesive rubber feet, and a #10-32 x 3/8" machine screw. If any of these items are missing, let your dealer or us know and we will expedite the missing item to you. We strongly encourage you to save the box supplied with your m102. It is specially designed to properly protect its valuable contents, and in the unlikely event that you need to return it for service, only these OEM shipping materials will ensure their safe return to our factory.

Also, we ask you to register your unit with us as soon as possible. We provide a 5 year warranty on all of our products, but if you don't register your system it's hard for us to help you, if and when help becomes necessary. So please take a few minutes to complete the enclosed warranty registration card and mail it in, or simply fill out the warranty registration form on our web site. Thank you!

INSTALLING

The m102 can sit on any flat surface or be installed in a standard 19" equipment rack tray. The m102 does not run hot and requires no ventilation, so it can be installed with equipment directly above and below it. If leaving to sit on your desktop or monitor shelf, install the 4 rubber feet to the bottom of the chassis to prevent scratching your chassis and surface.

RACKMOUNTING THE M102

The m102 chassis has a #10-32 threaded insert mounting hole on the bottom towards the back. Two m102s can be mounted side by side in a standard 1U rack tray. Use the supplied (or any) #10-32 x 3/8" machine screw. Do not use a screw longer than 3/8".

CONNECTING

The m102 is easy to connect. Simply plug a line source into either of the line inputs on the rear (TRS or XLR). This can be the output of a mic preamp or any other piece of equipment sending signal you wish to compress. Then connect either of the outputs of the m102 to your recorder, converter, insert etc... The outputs are parallel and both active, so you can send identical signals to two separate pieces of gear downstream.

The 1/4" sidechain input accepts either the connection from another m102 for linking compressor controls for stereo use, or an external side chain signal source to control the compressor for ducking or de-essing applications. If you are inserting a sidechain signal, use an unbalanced 1/4" cable. Link mode requires a balanced TRS 1/4" inch cable.

Operation

The compressor circuit is based on an optical attenuator - the purest, high fidelity gain control mechanism available. It provides gentle to fairly heavy compression, while remaining neutral and transparent. This compressor is not designed for "brick wall" limiting.

Similar to an eq, dynamic range compression is a subjective tool – there is no wrong way to use it.

However, using a compressor in a way that produces the best results can be complicated, and the more you know, the better it will work. If you are unsure about how a compressor works, we highly recommend some reading:

http://en.wikipedia.org/wiki/Dynamic_range_compression

It will pay greatly to understand the mechanism of dynamic range compression *BEFORE* you begin to record keeper tracks with the compressor on.

SETTING THE THRESHOLD

The threshold is the level at which the compressor begins to attenuate the incoming signal. This control can also be loosely thought of as *compression amount*, as a high threshold setting (counterclockwise) will result in only the dynamically highest passages of signal to be attenuated, while everything below that threshold is unaffected by the circuit. Conversely, a lower threshold means more of the signal at the input of the circuit will be attenuated resulting in *more compression*.

Begin with the knob fully counterclockwise and the compressor switched ON, then slowly begin turning clockwise until you begin to compress the signal. You will hear the signal compress, and you will begin to see the GR meter light up. The lower the threshold setting, the more the incoming signal will be attenuated and the more lights will light up on the GR meter.

SETTING THE ATTACK RATE

The rate at which you want the compressor to start the attenuation of the signal (*attack phase*) depends on the character, or envelope, of the signal entering the compressor. If the signal has sharp or fast attack (percussive sounds, snare drum) that you wish to attenuate, select a fast attack rate to sense the initial impulse of the signal and attenuate it in time. If you want the compressor to react slower and not attenuate the initial impulse of the signal, select a longer attack time. Using a slower attack time may be more appropriate with signals with a slower, more gradual envelope (strings, woodwinds).

SETTING THE RELEASE RATE

The rate at which you want the circuit to release its attenuation of the signal (*release phase*) is set with the release control. This is the functional opposite of the attack control. If the signal has a shorter decay, it may be best to set a shorter release time. A helpful approach to setting the attack and release time may be to consider the basic pulse of the signal you're compressing. To avoid the typical artifact known as 'pumping', where you can clearly hear the compressor working, it is important to set the attack and release times to match the signal to where they are moving naturally with the dynamic fluctuations of the signal.

SETTING THE RATIO

The compressor's ratio control is used to set input/output ratio of signals above the threshold. For instance, a setting of 3:1 means that if the incoming signal is 3dB over the threshold level, that signal will leave the compressor around 1dB over the threshold level. The highest setting of this control is 12:1, meaning that signals far over the threshold setting are reduced by a much higher ratio – more compression. So lower ratio settings mean lighter compression amounts. We recommend starting with lower ratios and working upward as necessary.

SIDECHAIN CONTROL

Normally, the compressor's sidechain circuit uses the internal audio signal to trigger its response. But in sidechain mode, the sidechain circuit uses an external signal input (from the SIDECHAIN / LINK IN jack on the rearpanel) to determine how the compressor responds. Examples of using an external sidechain signal include *ducking* and *de-essing*.

Ducking is an effect used to automatically reduce the level of one signal when another signal is present. Think of a DJ's microphone automatically reducing the level of the music when they are speaking. It involves routing a separate signal from a microphone (or any other source) into the sidechain input of the m102. This signal is what the compressor reacts to and thereby would typically reduce (or duck) the level of the main signal in the m102. You would use the compressor controls to determine the amount, rate and duration that incoming signal ducks the main signal.

De-essing is used to decrease excessive sibilant ('s' or 'sh') sounds in a voice. This is accomplished by inserting a copy of the signal into the sidechain input which has been equalized (by an external equalizer) to emphasize the frequency where the sibilance lies (usually 6-9k). This inserted signal makes the compressor react to and thereby reduce only the places in the signal where troublesome sibilance lies.

There are many other functional and creative ways to use sidechain input, more than can be illustrated here. Again, the more you know, the more powerful it can be.

LINK CONTROL

This feature is used to link two m102 compressors together for stereo bus compression. To use this feature, simply run a standard 1/4" TRS cable between two m102's rear panel link/sidechain jacks. Both units' sidechain / link switches must set to link. In this mode, the sidechain signals of both units are summed together into one. With two units linked, one is the master and the other the slave, with the master's controls setting the compression threshold, attack and release of both units. The slaved unit's threshold control must be set to the highest, full counterclockwise position.

NOTE: The RATIO controls are not summed, and must be set the same on both units. Due to the slight, unavoidable variances in the opto coupling devices, completely summing the sidechain signals may result in a subtle shift in the stereo field one direction or the other. So the RATIO controls remain independent to allow you to make final, subtle corrections to the centering of the stereo image by ear.

GR METER

This meter shows the amount of gain reduction being applied by the compressor. The LED's illuminate right to left, with one LED representing 1dB of gain reduction and ten LED's representing 10dB's of gain reduction or more. Selecting a lower threshold setting will activate the compressor with relatively lower signal levels and will be reflected on the GR meter as more gain reduction. Selecting a faster ATTACK time will show on the meter as the LED's turning on faster, selecting a slower RELEASE will show on the GR meter as the LED's staying lit longer. There is no correct setting for this meter – it is simply displaying how the compressor is working. If all the lights are on, you are probably SQUASHING IT! If only the first three are lighting up, you are applying gentle compression. The meter is a good place to start in getting the proper setting, but it doesn't necessarily mean that it sounds right. As always, let your ears be your guide.

SETTING THE OUTPUT CONTROL

The OUTPUT control provides 20dB of variable level control at the output of the m102. After setting your desired input and threshold levels, you can set the over all output of the m102 with this control. Use the OUTPUT to properly match to the input of your converter, interface or whatever is next in your signal path. Also, your signal level may have been reduced by heavy compression settings, so the OUTPUT control can also be used to provide *makeup gain*.

PEAK LED

The PEAK LED is used to monitor any peaks within the m102. It turns green at -15dBu and red at +20dBu. The m102's internal headroom is +26dBu, so occasional red is fine, just a warning that you are 6dB away from clipping. If the light is mostly red, then you are probably clipping the unit all your gear downstream.

Technical Specifications

GAIN RANGE	
Input Trim	-10 - +10dB
Output Trim	-10 - +10dB
Compression	
Threshold Range	-15 - +15 dBu
Attack Range	3 – 200 ms
Release Range	0.03 – 3 s
Ratio Range	1:1 – 12:1
Gain Reduction	0 – 20dB
THD+N 1kHz, 22Hz-22kHz BW	
@ 0dB Gain +10dBu out	<0.002%
INTERMODULATION DISTORTION	
@ 0dB Gain +20dBu out	
SMPTE/DIN 4:1 7kHz/50Hz	<0.007%
OUTPUT NOISE 22Hz-22kHz BW	
@0dB Gain	<-84dB
CMRR @0dB Gain, 3.5Vcm	
100Hz	>75dB
1kHz	>75dB
10kHz	>75dB
FREQUENCY RESPONSE	
@0dB Gain -3dB	0.016Hz-150kHz
IMPEDANCE	
Line In	24k Ω
Main Out balanced	350 Ω
Main Out unbalanced	150 Ω
Link In – side chain mode	100k Ω
LEVEL METERS	
Output Peak Indicator	Green: -15dBu / Red: +20dBu
Gain Reduction Meter	0 -10dB Gain Reduction
MAXIMUM OUTPUT LEVEL	
100k Ohm load, 0.1% THD	+26dBu
WEIGHT and DIMENSIONS	
2.4 lbs	H1.7" x W8.5" x D9.0"
1.1 kg	H4.3cm x W21.6cm x D22.8cm
POWER CONSUMPTION	
100-240VAC	5 Watts Max

Warranty Information

1. Grace Design warrants all of our products to be free of defective parts and workmanship for a period of five years.
2. This warranty period begins at the original date of purchase and is transferable to any person who may subsequently purchase the product during this time.
3. This warranty excludes the following conditions: normal wear and tear, misuse, customer negligence, accidental damage, unauthorized repair or modification, cosmetic damage and damage incurred during shipment.
4. During the time of this warranty, Grace Design will repair or replace, at its option, any defective parts or repair defective workmanship without charge, provided the customer has appropriate proof of purchase and that the product has its original factory serial number.
5. Customers within the US are responsible for all inbound freight charges to Grace Design's facility, while Grace Design will pay for return freight charges via ground service. Customers outside the US must contact their distributor for warranty / product return details.
6. In order for Grace Design to provide efficient and timely warranty service, it is important that you mail the completed warranty registration card enclosed with all of our products within 10 days of the original date of purchase. You may also register your product directly with Grace Design by telephone (303-443-7454 Monday-Friday 9:00am to 5:00pm MST), or you can register your product online at www.gracedesign.com.
7. This warranty is in lieu of all other warranties whether written, expressed, or implied, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. In no event will Grace Design be liable for lost profits or any other incidental, consequential or Exemplary damages, even if Grace Design is aware of the possibility of such damages.
8. In no event will Grace Design's liability exceed the purchase price of the product. This warranty gives the customer specific legal rights. The customer may also have other rights, which vary from state to state. Some states do not allow limitations on implied warranties or consequential damages, so some of the limitations of the above may not apply to a particular customer.

Manual Revisions

Revision	Page	Change	Date	Initials
A	all	Initial release	11/30/2011	edg