

Bugs in the BOSS GS-10

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This document was sent to the Roland/BOSS distributor in the Low Countries in August 2005. However, I never got any response, so if anyone *can* get through to a Roland/BOSS distributor (in whatever country), please let me know!

The BOSS GS-10 Guitar Effects System is a great device. However, the GS-10 does seem to contain several bugs, which may have to be fixed by means of a firmware upgrade. This document describes these problems.

Test conditions

All the phenomena described in this document were tested using a computer whose CPU was an AMD Athlon XP 2100+. The motherboard was an ASUS A7V333 with 512 MB of RAM. The operating system was Windows XP Professional.

For the MIDI input/output communication between the GS-10 and the computer, two setups were tested:

1. The MIDI facility of the USB cable:
The GS-10's Driver Mode was 'Advanced.' On the computer, GS-10 USB device driver versions 1.0 and 1.0.2 were tested. The applications (GS-10 Editor etc.) used the 'BOSS GS-10 Control' MIDI input and output devices.
2. Standard MIDI cables, running from the standard MIDI input/output sockets on the GS-10 to a third-party sound card in the computer. (The USB cable was unplugged.)

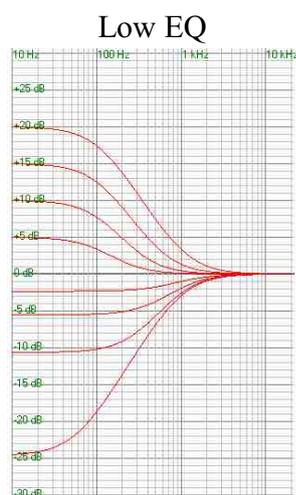
All MIDI-related problems occurred equally in both setups.

Values displayed on the GS-10 during the test sequence (started by holding the Tap and Chorus buttons while the unit is being switched on): Ver. 1.00 [D749]; EEPROM Check: V1.00 Sum[C548].

1 Invalid equalizer responses

The GS-10's frequency responses for the Low EQ and High EQ parameters of the Equalizer and Stereo Equalizer effects are wrong for values below 0 dB:

The frequency response plots below (generated by a third-party frequency sweep program) show the GS-10's actual responses for several values of the Low EQ parameter (where the Lo-Mid, Lo-High, High EQ and Level parameters are kept at 0 dB). The table (on the right) picks out a few relevant values. (Note: these values can even be estimated if one sends a 20 Hz signal to the GS-10 and then checks the values produced by the GS-10's own Meter.)



Low EQ parameter	Actual response at 20 Hz
+20 dB	+20.0 dB
+15 dB	+15.0 dB
+10 dB	+10.0 dB
+5 dB	+5.0 dB
0 dB	0.0 dB
-5 dB	-2.3 dB
-10 dB	-5.5 dB
-15 dB	-10.7 dB
-20 dB	-24.0 dB

Thus, for most values below 0 dB the actual cuts are substantially *less* than what they should be, but for -20 dB the cut is *deeper* than it should be!

The cause of this weird behavior must be a confusion between linear and logarithmic scales in the GS-10's algorithms for the Low EQ parameter: I have found that the GS-10's actual responses for the Low EQ values below 0 dB can be approximated by means of a formula like $20 \times {}^{10}\log(1 + 0.04705 \times x)$, where x stands for the Low EQ value.

The High EQ parameter's behavior is wrong in roughly the same way as described above for the Low EQ parameter.

Since it's just a matter of changing a few fixed parameter values in rather simple low- and high-frequency shelving filter algorithms, it should be relatively easy to fix this problem in the GS-10. (Obviously, current users would have to be warned that their patches might start to sound different if their GS-10s are upgraded, but personally I would *definitely* prefer the upgrade.)

2 Anomalous muting by inactive FX-2 effect

When the selected ('temporary') patch on the GS-10 contains 'FX-2: Flanger/On' (e.g. preset patches 127 or 164) and you then send any temporary patch containing 'FX-2: Off' (except if that patch's FX-2 'FX Select' parameter is *also* 'FL') from GS-10 Librarian (English Windows versions 1.00 and 1.10) to the GS-10, then the sound is anomalously completely cut off in the effect chain at the point of FX-2; sound is only restored when FX-2 is switched on again 'manually' by any means.

The following procedure demonstrates this problem:

1. On the GS-10 itself: select patch P101 ('POWER LEAD') via the 'PATCH/VALUE' knob.
2. In the GS-10 Librarian program: click on a 'Temporary Read' button. This should copy 'POWER LEAD' from the GS-10 into the Librarian.
3. On the GS-10: select patch P127 ('FLANGE ME OUT!') via the 'PATCH/VALUE' knob. (In this patch FX-2 is active as FL.)
4. In GS-10 Librarian: click on the 'Temporary Write' button next to the 'POWER LEAD' patch. You should then see 'POWER LEAD p127' on the GS-10 display. (In this patch FX-2's FX Select parameter is PH; however, FX-2 as such is switched *off*.)
5. Play something on your guitar. The result: *no* output from the GS-10's speakers/headphones at all! (Scrolling through the Meter Mode positions, one finds that the sound is cut off at 'fx-2(ph)' in the chain.)

The above procedure has been performed by several people on different GS-10s and computers, each time with the same result, so the problem is not restricted to any individual GS-10.

The problem is not specifically related to GS-10 Librarian: using any other MIDI message-sending program leads to the same result. For instance, in GS-10 Editor the problem occurs if we 'import' a Standard MIDI file (SMF, extension 'mid') containing P101 at a moment when the GS-10's patch is P127. (Note: the problem does *not* occur in GS-10 Editor if one opens a *gse* file containing P101. However, this is actually a totally different situation: opening such a *gse* file causes GS-10 Editor to first send the patch *number* 'P101' to the GS-10, so that the GS-10 itself switches to P101 first (without problems), after which GS-10 Editor sends the actual patch *data* (which is actually redundant in this case). In other words: the absence of the problem in this case is totally expected.)

The cause of the problem is probably not a MIDI message overflow: the problem persists even if long delays (e.g. 1 second!) are inserted between the different MIDI messages (making up the temporary patch) that are sent to the GS-10.

No GS-10 'System' setting (such as 'Assign Hold') appears to be able to remedy this problem, nor does it seem to have anything to do with Expression Pedal or Assign states; for one thing, sending the Assign parameters before the other temporary patch parameters doesn't fix it either.

The only ‘solution’ that currently *does* seem to work is an ugly fix: namely to send an extra MIDI message, setting FX-2’s FX Select to a different value (e.g. PH), before sending the ‘normal’ temporary patch messages. However, I’m not sure that even this works consistently.

My suspicion is that the cause of this problem is a fundamental flaw in the GS-10’s signal flow logic in relation with the reception of temporary patch MIDI messages, in particular FX-2 messages. (When I inserted long delays between the messages, I found that the sound is indeed cut off precisely at the moment when the FX-2 area of the temporary patch is received by the GS-10.)

3 Harmonist: key vs. user scales

After a change to an individual effect note in a Harmonist User Scale, the GS-10 incorrectly doesn't take the *key* into account when calculating the corresponding MIDI address used for notifying the computer of this change.

This can be demonstrated as follows:

We select Harmonist as the FX-2 effect, with the following parameters:

Voice	1-Voice
HR1 Harm	Scale1
Key	D (Bm)

Now suppose the selected Harmonist User Scale 1 has all values at 'unison' positions, i.e. all EFF values are equal to the corresponding DIR values (C ⇒ C, D ⇒ D, etc.).

We then select 'DIR' note C, so that the GS-10 display shows:

```
Key=D   DIR EFF
User1:  C   C
```

Now we turn the 'PITCH/VALUE' knob clockwise, so that the display becomes:

```
Key=D   DIR EFF
User1:  C  +Db
```

Turning the knob has also caused the GS-10 to send the following SysEx message to the computer:

```
F0 41 10 00 63 12 03 00 00 00 19 64 F7
```

So this reports that the value at MIDI address 03 00 00 00 has been set to 19 (meaning: 1 semitone up).

However, this MIDI address is incorrect here, because the key isn't C/Am, but D/Bm. The address whose value has *actually* changed on the GS-10 is 03 00 00 0A, since that is where the note C lies in the key of D/Bm.

This is confirmed by comparing User Scale 1's data before and after the change, via a data request from the computer to the GS-10:

Request (sent from a computer program):

```
F0 41 10 00 63 11 03 00 00 00 00 00 00 0C 71 F7
```


4 Inconsistent Tuner/Meter mode messages

There is an inconsistency in the GS-10's Tuner/Meter mode operation:

When the Tuner and Meter buttons on the GS-10 *itself* are pressed, the GS-10 sends totally consistent MIDI notification messages to the computer, as shown in the table below:

Current GS-10 mode	Button pressed on GS-10		
	Exit	Tuner	Meter
-	-	Tuner	Meter
Tuner	Exit	Exit	Exit + Meter
Meter	Exit	Exit + Tuner	Exit

However, when a *computer program* sends mode change requests to the GS-10 (via System Exclusive messages), the situation is very different: When Tuner mode is triggered from the computer to the GS-10, the GS-10 correctly echoes the Tuner mode back to the computer. However, when the *Meter* mode is triggered from the computer, the GS-10 *forgets* to echo the Meter mode back to the computer.

This is particularly problematic when the GS-10 was already in Tuner or Meter mode, since in that case the GS-10 *does* echo the 'Exit' status back to the computer: so in that case the last message sent from the GS-10 is indeed the Exit message, whereas the GS-10 has actually ended up in Meter mode! This is demonstrated by the following table, showing the GS-10's echoed responses to the different mode change requests sent from the computer:

Current GS-10 mode	New mode (sent from the computer)		
	Exit	Tuner	Meter
-	-	Tuner	- (!!!)
Tuner	Exit	Exit + Tuner	Exit (!!!)
Meter	Exit	Exit + Tuner	Exit (!!!)

It is debatable whether it would be worth correcting this inconsistency in the GS-10: the GS-10 Editor program seems to work around this inconsistency (and third-party programs may be able to do so too), but obviously it's a highly inconvenient situation.

5 USB vs. Patch Level

The position of the (Master) Patch Level parameter in the effect chain is undocumented, but it turns out to be situated after all the effects, i.e. immediately before the analog outputs:

Input \Rightarrow [\Rightarrow Patch Level] \Rightarrow Output

However, there is an inconsistency in the relationship between Patch Level and the USB tap:

1. When the USB tap is placed in any position except at the very end of the effect chain, the USB signal is *not* affected by Patch Level. This is just as expected. For instance:

Input \Rightarrow \Rightarrow USB \Rightarrow Reverb [\Rightarrow Patch Level] \Rightarrow Output

2. By analogy, when the USB tap is placed at the very end of the effect chain, we would expect the following order:

Input \Rightarrow \Rightarrow Reverb \Rightarrow USB [\Rightarrow Patch Level] \Rightarrow Output

However, it turns out that this order does *not* occur. Instead, Patch Level now *does* affect the signal sent from the GS-10 to the USB connection. In other words, it's as if Patch Level and the USB tap are *reversed* here:

Input \Rightarrow \Rightarrow Reverb [\Rightarrow Patch Level] \Rightarrow USB \Rightarrow Output

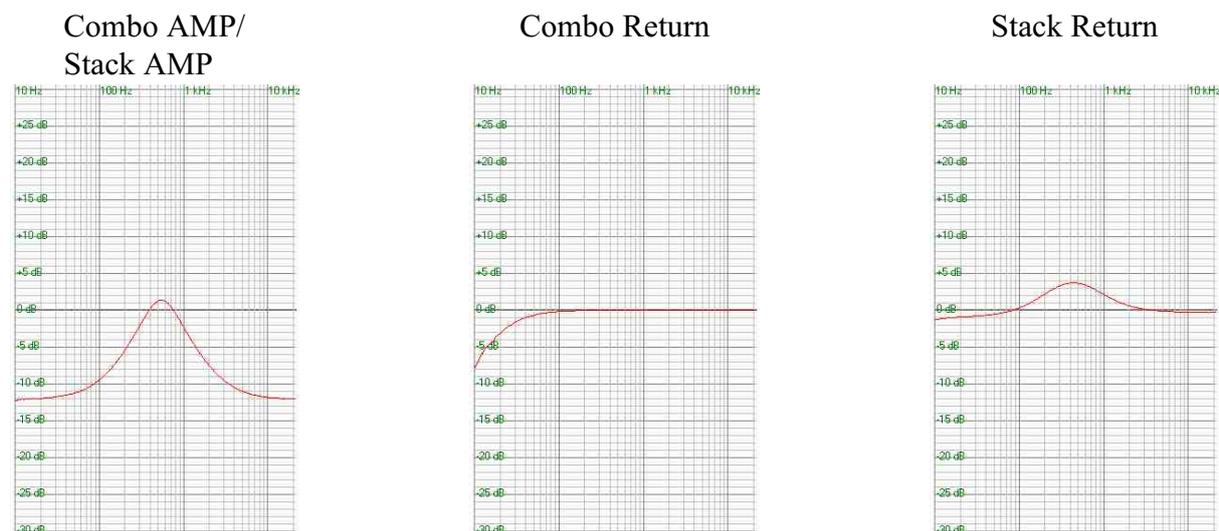
I don't know whether this contrasting behavior is intended or not. However, it is definitely very confusing when one is playing around with the USB tap's position in the chain.

Obviously there are two ways this behavior could be made consistent: to have Patch Level *never* affect the USB tap, or to have Patch Level *always* affect the USB tap. (The latter would of course require the application of a 'copy' of Patch Level within the USB tap itself – i.e. after the split-off point from the rest of the chain.) Which of these two solutions is preferable is open to debate; personally I would probably like Patch Level to *always* affect the USB tap.

6 Output Select responses

There may be something wrong with the Output Select parameter. I'm not sure whether there is actually a problem here, but I thought I would mention it anyway:

The GS-10's global 'Output Select' parameter has 5 values: Line/Phones, Combo AMP, Stack AMP, Combo Return and Stack Return. However, as far as I could tell, there is *no* difference between the responses for Combo AMP and Stack AMP, as shown in the frequency response plots below. (N.B. Line/Phones is not shown separately: it has a completely flat response.)



Several explanations for this seeming anomaly are possible:

1. There *is* no problem: The above frequency response plots are in fact incorrect or have missed some aspect of Combo AMP and Stack AMP in which these settings *do* differ.
2. The identical responses for Combo AMP and Stack AMP are intentional.
This would be very strange, in view of pp. 16 and 29 of the Owner's Manual, where Combo AMP and Stack AMP are mentioned separately in several pieces of setup advice.
3. The identical responses for Combo AMP and Stack AMP are caused by a design error in the GS-10. If this is the case, the problem should be corrected.