

Revisiting the amp that gave "*Solid-State*" a bad name: the

Fender Solid-State Twin Reverb

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Part 3

Plugging in: playability and sound



7. Plugging in

Finally, after all this theory and talk, we get to playing the amp and assessing the sound. We checked out the Solid-State Twin Reverb (abbreviated with "**SS TR**" in the following) with a number of guitars (mostly Gibson and Fender). We also made some recordings; here, we mostly used a 2004 Gibson Firebird V fitted with Lemme Pickups to find some middle ground between Fender- and Gibson-type sounds. To drive the amp harder for some audio-samples, we used a 1981 Gibson Explorer E2/CMT fitted with Dirty Fingers Humbuckers. Last not least, we compared the SS TR to a "blackfaced" 1974 tube Twin Reverb.

7.1 First Impression of the SS TR's sound

For us, a typical first reaction when first playing through the SS TR was: "this amp doesn't sound that bad - at all!". In fact we were surprised how much we liked the amp right away. The controls respond nice and relatively evenly (except for the reverb control, see above), and there are no crackling pots - not a small feat after 50 years. As expected, the effect of the "Bright"-switch (in the form of wonderful smooth rocker switches!) is very much like what we are accustomed to from the tube amps, the "Style"-switch offers a welcome if undramatic modification possibility for the sound-character in the treble range, and the Treble control is clearly more effective than any treble control in our Fender tube amps could ever be. It also offers darker tones that we can get with our Fender tube amps only by turning down the **tone control of the guitar**. Unfortunately, the Bass control is a let-down - it just doesn't do much, only adding or removing a bit of fullness to the sound. Certainly nothing to phone home about. As already mentioned, the tremolo-effect, although not very strong, is really nice and can add a nice shimmer to chords. The reverb, on the other hand, is of brutal strength and hard to control - it is not at all as nice as the reverb on Fender tube amps (at least not in our amp).

7.2 Design background

When assessing the sound, we of course do this from today's perspective on guitar amps; however, it might be interesting to consider the point of view that existed for the engineers working the design of an amp at the time.

We are aware that the Fender design-intentions both under Leo Fender's original management and under CBS-Management (at least during the first 8 years or so) were focused on getting a loud, undistorted, clear sound. CBS took over Fender on January 1, 1965, and the new management must have very soon after made the decision to design solid-state amplifiers, because these were made available already in 1966. In 1965, the sound of the distorted electric guitar was only just appearing on the horizon, if we look at the record albums that are acknowledged as the first to clearly feature distorted guitar and have a mass appeal:

- John Mayall's "Bluesbreaker with Eric Clapton"-album came out only in July 1966
- Cream formed in mid-1966 and released their debut album "Fresh Cream" only in December, 1966,
- "Are you experienced" (Jimi Hendrix debut record) was released only as late as May 1967.

The amps that artists like Eric Clapton and Jimi Hendrix used to get the heavily distorted sound were not originally designed to distort. They were designed to be loud and let the guitarist get heard. That these amps distorted like they did was more a happy accident than anything else - irrespective of what Jim Marshall states about his targeting the rich harmonic distortion of tubes as early as 1962 /7/.

While distortion was certainly always happening when Fender tube amps had to be turned up very loud (in cases where this indeed was required, because sound levels at music events normally were still comparably tame), and while surely many guitarists liked what they heard, distortion was not yet cultivated in early and mid 60's. Distortion boxes had yet to appear in significant numbers, and in recording studios, the "effect" was - if anything - a novelty item. It would have been almost impossible for an engineer working in the music industry in Southern California at that time to be confronted with the issue that an amplifier should distort (and distort in a certain way). The objective still very much was to avoid distortion.

Now, what most of us like about Fender tube amps (whether it's a Deluxe Reverb, a Super Reverb, or a Twin Reverb) so much is that they start to go into overdrive operation once the volume is turned up beyond 5 (or even only 3 with a strong humbucking pickup). Again, Leo Fender did not intend the overdrive operation but he built a significant gain reserve into the amps so that even weak signals (like those of a microphone) could be amplified decently. This gain reserve made the amp more versatile for more musical situations (Leo Fender's objective) - that the amp possibly distorted a lot with stronger signals was a side effect Leo Fender didn't target but also apparently did not consider detrimental (as long as the amp was loud enough in "clean" operation-mode).

7.3 Playability and comparison to a tube Twin Reverb

The behavior of Fender tube amps as just described is where the SS TR has a very different feel compared to its tube-carrying cousins. The solid-state amp is of overall lower gain, i.e. on the one hand it is less loud compared to a Fender tube amp at the same volume-control setting, and on the other hand even fully turned up it will not distort as much. In particular the former aspect might have been an unwelcome and all too unfamiliar feature because as a guitar player, you *feel* that much more "powerful" with the desired sound level already reached at e.g. position "4" of the volume control, compared to the same sound level only happening at "7" with another amp. This is a psychological effect - it will not help here that neither amplifier is louder when further turned up yet still remaining in the "clean" mode.

While remaining in the "Clean" domain, playing the SS TR does not feel very different at all compared to a tube amp. To compare, we put together a setup where the **SS TR** and a **blackfaced 1973 Twin Reverb** (abbreviated with "**BF TR**" in the following) could be switchably played through the same speaker arrangement (a pair of **Jensen C12K** 's). The tone controls on both amps were set to give a similar sound (SS TR: "Bright" off, "Style" normal, "T" +1.5, "B" flat; BF TR: "Bright" off, "T & B" at "0", "Middle" at "10"), and approximately even loudness was reached with a volume setting of "3" on the SS TR and of "2" on the BF TR. With these settings it was rather quite difficult for us to sound-wise distinguish between the two amps.

This changes dramatically as the amps are turned up. The BF TR starts to break up at volume "5" (with the Firebird), while the SS TR remains clean until about volume "8". The SS TR can never reach the kind of distortion that the BF TR will offer at "10". Still the slight break-up that the SS TR *can* muster is a pleasant surprise: it results in a nice, edgy AC/DC-kind-of-rhythm tone. We would not have minded working with this in a suitable setting - however we were wary of playing the amp flat-out for any extended periods of time, because we were concerned about damaging it (due to the two-power-transistor-with-very-limited-cooling issue, see 5.6 above).

By the way: the solid-state Twin Reverb is relatively noisy when compared to its tube-driven relative. This noise persists even with the volume turned down – but it does not have an annoying level. At high volume settings, the Blackface Twin reverb "catches up", and both amps are similarly noisy.

8. Recordings of the Solid-State Twin Reverb, and of the tube Twin Reverb in comparison

We recorded the above arrangement of the two amps (both fed into one and the same speaker setup of 2 Jensen C12K's) with a Shure SM57 microphone connected to Apple Logic X via a Focusrite Saffire Pro 40 interface. The SM57 was 12 cm from the speaker membrane of one of the two speakers and slightly off the speaker-axis by 5 cm (see also the introductory picture to Part 3 above). No EQ-ing, effects- or dynamic- processing was added in the DAW.

We recorded 2 sound samples using the guitars and the high impedance input of the interface, and played these samples back into the amps, making sure we fed them with the signal levels that would have occurred with the guitars connected to the amps. The playing was done by author TZ so do not expect a professional grade performance.

Please note that we did not strive or made any effort to get a particularly good sound for our recordings. We set positioned the microphone such that differences between the amps could be heard well. Also, we keep one and the same "neutral" control setting for most of the recordings, only turning down the bass when the Explorer was fed to the amp.

The various sound samples can be downloaded or directly listened to via the web-addresses give for each example.

Although the different recordings and sound files are address individually below, here's the consolidated webpage with all sound files: <http://www.gitec-forum-eng.de/soundfiles-for-part-3-of-the-article-on-the-fender-solid-state-twin-reverb/>. It turns out to be convenient when listening to have that page open when listening and comparing.

8.1 Recordings using the Firebird

8.1.1 A little guessing-game

Why don't we start with a little game: can you identify which amp is which?

For the sound sample given here:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_bf_ss_guess_which.mp3

We have set both the SS TR and the BF TR to sound similar and to have a similar loudness (see the settings given above). You can hear the clicking noise as the switching occurs, at the following time stamps (in seconds): 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 50, 52, 54, 56, and 58.

You decide which of the two amps you hear at any given time. Be aware, though, that not always is the switching done "to the other" amp - it might be the same amp that is active after a switching noise occurs ...

Can you hear which is the solid-state amp and which is the tube amp?

The solution? ... no, not yet. **Why don't you contact us at GITEC (dr.t@gitec-forum-eng.de) and tell us your results**, and we shall see ...

8.1.2 Direct comparison: clean, both amps set to similar and loudness

Well, we have just done that - the two amps can be set to sound quite similar.

The BF TR is actually really difficult to tame at this low volume setting ("2") ... every little move of the volume control makes for a huge difference in loudness. The SS TR, however is very comfortably adjusted (set at "3") with the shape of the knobs helping (so they are not that bad, after all ;-)). In terms of SPL, we measured between 95 and 103 dB (A-weighted) in the room (living-room environment) for this example.

8.1.3 Direct comparison, both amps set to volume "5"

Here we can hear how at the same volume setting, the BF TR is much louder than the SS TR. The former is at full (clean) blast and just starts to break up while the latter is nowhere near its clean volume limit:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_bf_ss_5_firebird.mp3

8.1.4 SS TR at "10"

Turning up the SS TR with the Firebird (having not much more output than regular Fender pickups) just pushes the amp into a bit of overdrive, indicating that it was really intended to work at "clean" operation with Fender-type guitars. The degree of distortion is in fact similar to what the BF TR offered at "5":

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_ss_10_firebird.mp3

The sound of the distortion is a bit different compared to the BF TR, and whether one likes it is of course a matter of taste. We would have no trouble using this kind of sound in a rock setting, since it is by no means a kind of distortion that we would have associated with the "bad transistor sound" but quite agreeable (as distortion goes ;-). It should be noted that with the very effective treble control turned up, the amp would have been overdrive more and sooner. In order to be able to best compare with the BF SS, we choose not investigate further in that direction.

8.1.5 The BF TR at "10"

Cranked to the max, the BF TR becomes quite badass even with the level-wise tame Firebird pickups, and it distorts quite heavily, much more than the SS TR:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_bf_10_firebird.mp3

Sidenote: turning a good, powerful guitar amp with speakers to match up to "10" results in an almost religious experience, as we all know. We were once more amazed just how deafeningly loud both Twin Reverbs can be. The SPL-meters clearly showed in excess of 125 dB in our listening room, and we immediately resorted to hearing-protection measures ...

8.1.6 Controls and Effects of the SS TR

This sound sample explores in one go the controls and the effects of the amp:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_ss_controls_effects.mp3

Sequence:

- the first hybrid-picked riff (up to 0:04) has all effects off, and the control on neutral
- for the second riff (up to 0:08), we bring in the reverb (only at "1,5") and leave it on for a few riffs
- the third riff (up to 0:12) has Treble turned all the way up and the forth (up to 0:16) turned all the way down
- for the fifth riff (up to 0:20) it's back to neutral
- riff six (up to 0:24) brings the Bass turned all the way up, and riff seven (up to 0:28) has it turned all the way down
- riff eight (up to 0:32) has everything to neutral again
- the first strummed chords (up to 0:40) have the Bright toggled on - and off
- the further chords (up to 0:50) have the Style control turned to different positions
- the ascending arpeggio at the end has the tremolo brought in.

8.2 Recordings using the Explorer

To get more drive level, we plugged in the Explorer that – even for a Gibson – has quite a strong signal (Dirty Fingers humbuckers). It turns out that – when played hard – it even overdrives the input stages of both amps a bit i.e. it is not possible to get a totally clean sound even when turning down the amps. This was o.k. for us since we wanted to see the behavior of the amps under such circumstances. We however turned down the bass control on the SS TR to "lighten the load" a bit when driving the amp hard ... yes, having checked out the power amp design, we indeed were a bit scared ...

8.2.1 The SS TR at "1" ... "5" ... "10"

As mentioned, we experienced some (mild) overdrive from the preamp. The first two sound examples contained in the following file are all recorded while the volume control of the amp was turned up from 1 - 5 and then to "10" so that various degrees of distortion can be heard for different chords. For the lead playing in the third example in the file, we started at "5" and then turned further up:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_ss_1_5_10_explorer.mp3

The amp takes the additional drive level quite well up to about "7" - indeed it just further increases the distortion we already heard with the Firebird further in quite an acceptable fashion. Only at the volume turned up further it seems the amp loses some stability and some coherence in the sound when hit with chords (especially if they include low notes). Probably the power supply is exhausted. Still even this somewhat "uglier" sound could be useful.

8.2.2 The BF TR at "5"

Just to compare, we also recorded the BF TR at "5" - no surprise there. It's a great amp:

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_bf_5_explorer.mp3

8.2.3 The BF TR at "10"

To round off the recording series, the BF TR got the full treatment also - turn to "10". No further comment ... :

http://www.gitec-forum-eng.de/wp-content/uploads/2019/03/sstr_bf_10_explorer.mp3

9. Overall assessment and conclusions

So, it is time to come to a verdict. Unfortunately, we have to agree with the overall gist of hearsay: the Fender Solid-State Twin Reverb is not an attractive amp. In some aspects it is actually a really problematic amp, at best ... and even simply a bad amp, at worst. Where we cannot agree: **the generally accepted opinion – that the bad qualities are due to the fact that it is a transistor amp – is NOT TRUE.** Any tube amp with the same kind of flaws would be just a bad or problematic.

a) Appearance and operation

The amp has an unfamiliar look and feel to it, both in terms of cosmetic appearance, and in the way many of the controls work. It takes some getting used. However, while this may not be the very best starting point for sales, it is not necessarily a bad thing but more a matter of taste. Had the amp been brilliant otherwise, it may have set the standard for all amps coming after it - we all would have gotten used to the "refrigerator" design and "TV-tray" control panels. But that was not to be.

b) Electronic design

The preamplifier design is rather conducive and makes for a pretty versatile amplifier not just for guitar but potentially also for other instruments. The input stage has just the right characteristic, and the various stages and controls are effective with merely the quality of the overly strong reverb, and the background noise possibly raising some eyebrows.

The power amplifier is where we see the main issue and at least half the reasons that give the amp its catastrophic reputation. Even when trying to see the situation through the eyes of an engineer working on such a project in the mid-1960's, it is unforgivable to include such an inadequate, make-shift pseudo short-circuit protection, and at the same time think that a single pair of output transistors on a puny little heat sink would be adequate for Fender's highest-power amp. There is almost zero reserve or fault tolerance built into this amp, and with musicians likely to having to push some limits, the course for crossing a line and entering the disaster area is set.

Having said that: if we draw up a scenario with corresponding design mistakes in a tube amplifier, we arrive at the same problems. A tube amp pushing small output tubes way to hard and having bad cooling, plus having a bad wiring prone to leaving the output open, would have inevitably had a rather short life-span, as well. This is not a matter of transistors vs. tubes. Both work well in a well-designed, appropriate environment, and both fail otherwise.

c) Sound

In contrast to many statements we read elsewhere, we have to say that this amp actually sound really good. Like all Fender amps from pre-1970, it was explicitly designed to sound loud and clean, and that it does. It has less input sensitivity than the typical Fender tube amp, but again this is just a matter of getting used to. The tone controls (in particular the very effective Treble control that seems to be more a "style" control than the switch with that name) give a lot of variation possibilities – more so than the Fender tube amps.

Even when pushed into breakup (as far as that goes given the lesser input sensitivity), the amp does not sound bad but generates a quite pleasant distortion that would have been really usable e.g. in a hard-rock rhythm-section or for Blues - if there weren't the danger to overheat the output stage (see b) above). It is not advisable to stay in this nice sound-area of distortion for long – but it should be noted that this solid-state amp is sounding quite nice even when overdriven. We cannot follow at all the opinion that these amps sounded crappy due to the use of transistors.

d) Dependability and serviceability

We have seen that, compared to the classical Fender tube amp, the build quality leaves something to be desired. However, the build quality of the tube amps produced at the same time also deteriorated. We have a "Drip-Edge" Bandmaster Reverb from ca. 1968 here that shows a much more feeble wiring than earlier (and later) Fender tube amps. Again, this is not an issue of transistors vs. tubes, but a universal "build quality" issue.

In our SS TR, an example for the build quality (or rather lack thereof) is given by the too short pins of the "style" switches that are highly likely to sooner or later break free from the solder connection. Adding to this the problematic design of the power amplifier, the likelihood of the amp breaking down one way or another is high. This is not a very dependable amp at all.

Once it has broken down and comes in for repairs, it is quite difficult to repair. To replace (or at least re-solder) the "Style" switch, the amp needs to be taken apart *completely*. To change the output transistors, the power-amp module needs to be taken apart, the heat-sink assembly needs to be disassembled and connections to the circuit board opened. Comparing this process of possibly several hours to the one required for Fender tube amps which are VERY serviceable (and where the corresponding repairs would have taken about 15 minutes) will make every service-person shudder.

In /3/ and /4/, Bob Rissi – who was at the time involved with the production of the Solid-State Fenders - makes a number of interesting, quite nuanced observations on these amps and their history. In many ways they tie in very well with our own findings.

In (final) conclusion:

we would not advise to use the Fender Solid State Twin Reverb amplifier other than for light, careful operation around the house and the studio (with some consideration that - like all amps from that era, it might not be up to today's electric safety standards), and for the occasional, low volume gig. It sounds great given its design intentions but is utterly untrustworthy in terms of both design and build-quality.

The amp deserves its reputation as a being problematic (at best), but "Solid State" should not be thrown in the same bin. The term has nothing to do with the bad reputation other than that it was printed in unfortunately large red letters onto the front these amps that broke down or sounded bad for entirely different reasons. It is unfortunate that due to this superficial connection, "Solid State" and transistors got such a bad name when it comes to guitar amplification.

Still, as an historic object, the Fender Solid-State Twin Reverb is most interesting, and makes for a good story with a lot of drama!

Appendix; Literature:

- /1/ Fender Amps - The first fifty years; John Teagle and John Sprung, Hal Leonard, 1995
- /2/ The Fender Amp Book; John Morrish, Balafon, 1995
- /3/ The Soul of Tone; Tom Wheeler, Hal Leonard, 2007
- /4/ Fender - The inside Story; Forrest White, Miller Freeman, 1994
- /5/ Electric Guitar - Sound Secrets and Technology, Helmut Lemme, Elektor, 2012
- /6/ Physik der Elektrogitarre Manfred Zollner,
<https://gitec-forum.de/wp/gitec-community/buch/>;
Translation: Physics of the Electric Guitar: <https://www.gitec-forum-eng.de/the-book/>
- /7/ Jim Marshall - The Father of Loud, Rich Maloof, United Entertainment Media, 2004
- /8/ Solid State Amplifier, and Control Panel Assembly incorporated therein, Paul Spranger (Inventor),
Patent US-A-3 462 553A, 1969
- /9/ Fender Musical Instruments ... ON THE GO!, 1968 Catalog, Fender, 1967
- /10/ Fender lovin' care, 1969 Catalog, Fender, 1968