

## **NextGen Studer A80 Repro Card - Key Features & Characteristics:**

Finally: a "Plug & Play" Studer A80 Repro Card that transforms the legendary Studer A80 Master Recorder into the world's finest Magnetic Tape Music Reproducer.



## I. Key Design Elements & Features:

- All direct-coupled discrete transistor class A circuitry, Repro head input to Front Panel single-ended (RCA) output for the purest possible sound;
- Two precision balanced transformerless (TI DRV134) outputs:
  - Front Panel Repro-only output, entirely separate from the regular A80 un-buffered VU meters/Bridge/Balanced output for lowest distortion and best possible balanced sound; and
  - "Standard" A80 output for the legacy VU Meter Bridge, Input- or Repro- selection, Record and Playback volume controls, using existing A80 XLR connectors;
- No capacitors anywhere in the signal path except for a single high quality precision polypropylene capacitor (Dielectric Absorption <0.05%) to set LF and HF EQ turnover characteristics (NAB/CCIR/AES/OTHR), a single similar polypropylene capacitor to set Repro Head-/Wavelength- Model correction at the Low Speed, and a single similar polypropylene capacitor used in the DC servo; time-smear effects all but eliminated;
- NO shelving or parametric Bass and Treble corrections (i.e. "Tone Controls") employed for EQ adjustment and calibration, realizing near-ideal time domain response;
- Available in 15/30 ips and 7.5/15 ips models, each with Four Switch-Selectable wavelength-optimized Equalizations built-in:
  - 15/30 ips NextGen A80 Repro Card:
    - 15 ips: NAB, CCIR,
    - 30 ips: AES,
    - OTHR: CCIR (30ips), or 10uS (15 or 30 ips), or FLAT (15 & 30 ips)
  - 7.5/15 ips NextGen Repro Card:
    - 7.5 ips: NAB,
    - 15 ips: NAB, CCIR, AES,
    - OTHR: 10uS (15ips), or FLAT (7.5 & 15 ips)
- "OTHR" offers 15 ips AES, 10uS turnover, or speed independent FLAT (i.e. UNEQUALIZED) characteristics as standard offerings; please contact us if you have other EQ requirements.
- HS Gain, LF- and HF- EQ calibration adjustments for High Speed (30 or 15ips), with modeled Bass and Treble corrections applied for Low Speed (15 or 7.5ips) linked to the High Speed calibration settings, and LS Gain

## II. Specifications<sup>1</sup>:

- Exceptionally low-noise:
  - 2.5nV/VHz EIN with 200 ohm source, 20Hz-20Khz; 83dB wideband SNR and 95dB A-wtd SNR re 355nW/m 0.5Vrms single-ended or 1.0Vrms balanced output
  - 80 dB SNR A-wtd re 355 nW/m in the deck, tape stopped and capstan running (15 ips NAB), better than -69 dB A-wtd re 355nW/m playing virgin unrecorded blank tape at 15 ips NAB, -71dB at CCIR, -73 dB at AES (Studer A80 butterfly stereo repro head, 1/4" tape);
  - repro card A-wtd noise floor is 15 dB below deck A-wtd noise floor, and 22-26 dB A-wtd below virgin tape for 1/4" tape (about 1.3 dB less for 1/2 track 1/4" tape)
  - repro card A-wtd noise floor is about 12 dB below deck A-wtd noise floor, and 19-23 dB A-wtd below virgin tape for 1/2 track 1/2" tape at same output operating level
  
- Accurate equalization conformance, extended frequency response, and superior time domain performance, optimized for the Studer-supplied A80 Butterfly or 1/2 track heads; when set at recommended output operating levels relative to tape fluxivity<sup>2</sup>:
  - 30 ips AES: typically achieves equal or better than  $\pm 0.75$ dB 125Hz - 20 KHz, and less than 1.5 dB error at 32 Hz and 63 Hz, according to MRL 250nW/m (full-track) calibration tape, applying standard (McKnight published) low frequency fringing corrections<sup>3</sup>; -1 dB at 25Khz record/repro response;
  - 15 ips NAB, CCIR (also 15 ips AES & 10us with calculated corrections): typically achieve equal or better than  $\pm 0.75$ dB 63Hz - 20 KHz at 15ips, and less than 1.5 dB error at 32 Hz according to MRL 250nW/m full track calibration tapes applying standard (McKnight published) low frequency fringing corrections<sup>3</sup>; -3 dB at 25Khz record/repro response;
  - 7.5 ips NAB: typically achieves equal or better than  $\pm 1$  dB 50Hz - 16 KHz according to MRL 250nW/m fringing compensated NAB full track calibration tape<sup>3</sup>.
  
- Exceptionally low THD and IMD distortion:
  - at least 30 dB (30x) improved over stock Studer A80 Repro card 20Hz - 20 KHz at all operating levels;
  - THD at 1.0Vrms single-ended output/2.0Vrms balanced output NAB:
    - 1Khz better than 0.001% (100 dB down), typical -106 dB (0.0005%) single-ended;
    - 32Hz better than 0.01%
    - 10Khz better than 0.01%
  - 10+11 KHz IMD 1:1 at -3 dB re 1.0Vrms sum power NAB: better than 0.01%, -102 dB re sum 2nd IM product, -112 dB re sum 3rd IM products

<sup>1</sup> All in-deck specifications based on properly-operating/well-regulating Audio Stabilizer Card.

<sup>2</sup> See following "Recommended Settings"

<sup>3</sup> Please see the Note following about calibrating/adjusting LF Equalization, below

- Outstanding headroom:
  - Equal or better than 0.01% (-80 dB) THD 20Hz - 20Khz at output level corresponding to +19 dB above 355nW/m (4.5Vrms single-ended/9Vrms Balanced outputs), +13 dB above 355nW/m (Balanced to single-ended output); rated maximum output is 7Vrms single-ended or 14Vrms Balanced (equivalent to +22 dB above recommended 355nW/m output at -6dBv rms/-3.9dBm)
- Improved Ch-Ch crosstalk better than -70 dB 300Hz - 3Khz (typically -75 dB at 1 Khz) and -55 dB 100Hz - 8Khz (Butterfly Stereo Record and Repro Heads) using the built-in XTLK canceller
- Front-panel single-ended RCA output (from 4-pin mini-XLR breakout cable) for highest possible performance in short single-ended cabling conditions where hum and noise pickup is not a problem.
- Front-Panel balanced transformerless output (from 4-pin mini-XLR breakout cable) entirely separate and independent of the standard Studer balanced output and VU meters/Bridge for exceptional balanced output performance.

### III. Recommended/Nominal Settings

The NextGen A80 Repro card uses internal repro head- and wavelength- modeling for the Lower Speed corrections linked to the Higher Speed EQ and gain settings; consequently, for most accurate equalization conformance across *all* supported EQs, please observe the following recommendations regarding setting operating output levels versus tape fluxivity (levels refer to the Front Panel balanced XLR or single-ended RCA breakouts respectively):

- For the 7.5/15 ips model: set HS Gain trimpot at 15ips for 0.7 Vrms (-3 dBVrms) XLR balanced (or balanced to single ended) output, or 0.350 Vrms (-9 dBVrms) RCA single-ended output, at 250nW/m fluxivity; set LS Gain trimpot at 7.5 ips for +3dB relative the 15 ips setting at the same fluxivity, that is 1Vrms (0 dBVrms) XLR balanced (or balanced to single ended) output, or 0.5 Vrms (-6 dBVrms) RCA single-ended output at 250nW/m fluxivity

Note that VU meter indications are *entirely separate* from indicated output levels *versus* tape fluxivity, and can be set independently for desired VU meter indication, e.g. the meters can be set for 0 VU at 250 nW/m at 7.5ips and 355 nW/m at 15ips, or whatever indicated fluxivity is desired, with however a given indication corresponding to 3 dB lower fluxivity at 7.5 ips versus 15 ips.

- For the 15/30 ips model: set the HS Gain trimpot at 30 ips for approximately 0.64 Vrms (-4 dBVrms) XLR balanced (or balanced to single-ended) output, or 0.32 Vrms (-10 dBVrms) RCA single-ended output at 250nW/m fluxivity; set the LS Gain trimpot for about +1.5 dB relative the 30 ips setting at the same fluxivity, that is 0.77 Vrms (-2.3 dBVrms) XLR balanced (or balanced to single-ended) output, or 0.385 Vrms (-8.3 dBVrms) RCA single-ended output at 250nW/m.

As to meter indications, once again VU meters can be set for any desired fluxivity (often 400 or 500nW/m for 30ips) indicating 0VU, with however a given indication corresponding to 1 dB lower fluxivity at 15 ips versus 30 ips.

(Of course, and notwithstanding the above recommendations, the EQ can be fine-adjusted as required for any single speed and selected characteristic supported at that speed using the HF EQ and LF EQ trimpots, and HS- and LS- Level controls.)

Regarding indicators: if using the stock Studer A80 Record Cards and/or Bias oscillator, and plan to do recording as well as reproducing, we generally recommend VU meters set for 0 VU at 400 nW/m fluxivity 30 ips/355 nW/m at 15 ips for the high speed machine, and 0 VU at 355 nW/m fluxivity at 15 ips/250nW/m at the lower 7.5ips<sup>4</sup>. (If you are using the NextGen A80 Record Card with 2-stage tape linearizer and Group delay equalizer you can generally use 500nW/m fluxivity or even higher as standard operating level at 15/30ips while still maintaining 12 dB or more of tape headroom for 3% third harmonic at midband with modern tapes.)

355nW/m is +3dB output re 250nW/m 15ips/7.5ips 250nW/m calibration tapes.

Finally, please take note of Maximum rated outputs, Headroom, and Recommended user loads:

- 7Vrms at RCA (Front Panel breakout) output = +17 dBv = +19 dBm; Headroom is 23 dB above 355nW/m at recommended output level vs. fluxivity; Recommended Loading  $\geq 10K\Omega$ .
- XLR Balanced Output (Front Panel breakout or A80 XLR):  $\pm 7Vrms = +23 dBv$  or +25 dBm; Headroom is 23 dB above 355nW/m at recommended output level vs. fluxivity; Recommended Loading  $\geq 600\Omega$ <sup>5</sup>.
- Single-ended from Balanced Output: +17 dBv = +19 dBm; Headroom is 17 dB above 355nW/m at recommended output level vs. fluxivity; Recommended Loading  $\geq 600\Omega$ .

Please further NOTE that with the recommended settings, the indicated playback levels on the VU meters, as well as the actual playback output levels may be below what you are accustomed to from the stock Studer A80 repro cards (this may be particularly the case with the Front Panel Single-ended outputs which are 6 dB below the Front Panel balanced outputs, but depends as well on whether the balanced line receiver is 2:1 or 1:1). This reduction is due in part from elimination of the Studer 2.5:1 output transformer, for significant sonic gains in reproduction, as well the lower noise floor allowing the design to be set for greater headroom and dynamic range.

<sup>4</sup> In particular, we strongly recommend 250nW/m operating level at 7.5 ips, see **Setup and Adjustments**, below.

<sup>5</sup> Includes both Audio and VU Meter loads if any

We strongly recommend that if additional playback level is needed, this be corrected by adjusting the System Preamplifier/Amplifier Playback volume control, just as you would do for any other source input, rather than by adjusting the HS Gain trimpot for the reasons outlined above; similarly, playback indication on VU meters can be adjusted using the *Bridge's* Repro Volume pots, or adjusting the Repro Gain Calibration pots in the Bridge when selecting "Calibrated" Repro Gain.

**The important point is that the on-card HS- and LS- Gain trimpots are NOT designed to serve as a deck volume control;** in general, we recommend that the gain trimpots on the NextGen A80 Repro Card should be adjusted from the delivered calibration settings in only very limited circumstances:

- (1) Where small adjustments are needed to correct for Repro Head channel imbalances (typically less than +/- 0.5 dB);
- (2) Where heads other than the stock Studer Repro Heads are in use, with levels requiring an output level adjustment (gain either up or down), and any corresponding reduction in Headroom from increasing gain can be tolerated;
- (3) Where single speed operation only is what is required, and any corresponding reduction in Headroom from increasing gain can be tolerated along with adjustments if any in the HF and LF Equalization.

(User Adjustments and Setup below)

#### IV. NOTES on Setup and Adjustment:

- Please check the documentation supplied with your NextGen A80 Repro cards for verification of preset parameters, in particular operating output levels versus fluxivity, the "OTHR" EQ implementation(s), and/or custom implementations.
  
- As the NextGen Repro card is normally received:
  - The bias trap has been preset for the A80's 150Khz bias frequency<sup>6</sup>
  
  - Operating output levels versus fluxivity have been set according to the Recommended/Nominal Settings information given above.
  
  - The HF- and LF- EQ trimpot settings will have been preset at 15ips NAB and conformance verified as well for 15 ips CCIR, 30 ips AES (high-speed model) or 7.5 ips NAB (low speed model) EQs with STUDER-supplied Stereo or 1/2 track Repro Heads; Normally this setting will achieve correct response on your deck within +/- 1 dB or so without further adjustments (based on MRL 250nW/m 15ips full-track NAB calibration tape, with low-frequency fringing corrections applied), and often better, as well as similar conformance to CCIR (35uS) and AES(17.5uS), assuming your repro head is in good condition, exhibiting minimal wear, and properly aligned for head height, zenith, and azimuth; if you do not have access to a highly accurate calibration tape (or tapes) and test equipment we recommend you do not readjust the calibration trimpots from their presets. (Note the preset HF EQ trimpot settings in the supplied documentation with your boards in the event a reset to original settings is needed).
  
- If you do have access to a high-quality Repro cal tape, you can fine-trim the HF- and LF- EQ for NAB, CCIR, AES, or whatever EQ choice is your preference (all supplied equalizations - except FLAT - track with the HF- and LF- EQ trimpot adjustments); use the highest speed on your deck

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<sup>6</sup> In the (unlikely) event your Bias frequency is off by more than  $\pm 3\%$  or so from 150Khz and you are planning to record as well as playback you should check residual bias leakage with the deck placed in record with zero inputs (i.e. erasing tape), repro head shield in place, and a suitable scope or spectrum/FFT analyzer; levels 50dB or more below output reference levels should generally pose no issue to external electronics, with 56dB or better typical. Otherwise, consider tuning your Bias oscillator, or adjusting the repro card bias trap - which will require either an extender card, or on-bench adjustment to the measured bias frequency; the bias trap can be slug-tuned from approximately 135Khz to 220Khz (contact the factory for further information).

when adjusting the HF- and LF- EQ trimpots and a suitable accurate AC rms voltmeter; please note that VU meter indications are of questionable accuracy and poor resolution outside of a narrow range of approximately -3 to +2dB about 0 VU.

- Always perform adjustments (HS Gain, HF EQ, and LF EQ) on the *Highest operating tape speed* (30 or 15 ips) *before* adjusting the Low Speed Gain; the LS gain setting controls the modeled low speed EQ adjustments for best conformance, and increases gain at the lower speed (in particular 7.5ips) relative to the higher speed, corresponding to a lower indicated fluxivity for the same output level and VU meter indication.

Once you have performed calibration with good conformance for any supported High Speed equalization, and set as required the HS gain and LS Gain trimpots as recommended regarding output operating levels versus fluxivity, the other supported Equalizations (for both speeds) will also achieve good conformance if you are using the Studer-supplied Butterfly Stereo or 1/2 track Heads.

- As a general rule, you can expect to require several passes of the calibration tape for an accurate final setup and verification because of certain unavoidable interactions between adjustments; in your first pass we recommend that you make a written record at least of the 1Khz, 8Khz, 16 KHz, 32Hz, 63 Hz, and 125Hz output levels for each channel, before beginning any adjustments. Generally, adjust first the HF EQ for best flatness from 1 KHz to 20 KHz based on the noted *existing* 1 KHz output and gain setting; then the LF equalization, and finally adjust the HS Gain as recommended. Following the High Speed adjustments, set the LS gain level as recommended and verify Low speed EQ conformance.
- In general, for technical reasons, the repro LF EQ is best set not using pre-recorded spot-tone calibration tapes, but by recording and reproducing swept test tones (or white noise) on the deck in question from 32-250 Hz for flattest record/repro response, and settings will generally differ depending on whether 1/2 track or stereo butterfly heads are used, and tape speed. Our own experience with the A80 indicates it is possible with heads in good condition to achieve +2/-2dB record/repro response or better from below 32Hz - 125Hz.

For this reason, it is a good idea to verify or complete Low Frequency calibration by recording appropriate spot tones or white noise on well-erased tape at both speeds, and if needed make final LF EQ adjustments.<sup>7</sup>

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<sup>7</sup> Considering all the various uncertainties of loudspeaker low bass performance, loudspeaker placement within the listening environment, listener location, and the room characteristics itself, it is rarely worth the effort to achieve better from the recorder, as the recorder bass errors are generally swamped by these aforementioned issues; in the event of a critical application external bass correction or equalization can be applied.



- Adjust the crosstalk trimpot by recording a 1 KHz tone at operating level on the *opposite channel* and adjusting the XTLK for minimum output using an FFT-analyzer, real-time analyzer, or narrowband filter on the non-recorded channel output. Check as well a 3 KHz tone (which should give very similar readings).
- If you have ordered the NON EQUALIZED ("FLAT") option for "OTHR" (used for non-standard equalizations implemented externally, direct dubbing, and other special applications), please note the following:
  - A constant recorded magnetic flux (independent of frequency) on the tape will result in a Repro output rising at +6dB per octave frequency increase (+20dB per decade); similarly, at some turnover frequency where recorded magnetic flux declines at -6dB/octave (-20dB/decade) produces a flat repro output with increasing frequency; what this means, for example, is (ideally):
    - if reproducing a CCIR (35us) equalized tape using the FLAT EQ the constant flux portion of the spectrum (approx 25Hz - 4550Hz) will rise at 6dB/octave, then transition to flat about 4550Hz (-3dB) with frequency (equi-amplitude) through 20 KHz; similarly for AES (17.5us) with constant flux portion/rising repro output of the spectrum approximately until 9.1KHz (-3dB) then flat until 20 KHz.
    - For NAB there are two turnover frequencies: 50 Hz (3183us) and 3185Hz (50us): ideally the repro output should be approximately flat from below 25Hz - 50Hz (+3dB), rising at +6dB/octave from 50 Hz (+3dB) to 3185Hz (-3dB), then flat again until 20 KHz.
    - NOTE the 1 KHz reproduce output level in FLAT will be about 15 dB below usual output level in NAB, CCIR, or AES, in order to maintain ample high-frequency headroom.
- LS gain setting is for increasing gain (reducing indicated fluxivity at a given output level) at the lower speed (in particular 7.5ips) relative to the higher speed, e.g. for setting the output operating levels corresponding to 250nW/m at 7.5 ips versus 355nW/m at 15 ips, or corresponding to 355nW/m at 15ips versus 400nW/m at 30ips for the same output level.
- XLR outputs from the supplied Front Panel breakout cables are as follows (North American Standard):
  - Pin 2: +
  - Pin 3: -
  - Pin 1: Studer A80 chassis ground

As a general rule, avoid connecting BOTH the Front Panel Single-Ended (RCA) outputs and

A80 standard Balanced Outputs (or BOTH Front Panel Single-Ended and Balanced outputs if you are building your own breakout cables) to your system (even if the unused outputs are deselected) for avoidance of chassis ground loops (hum); if you must do so consider lifting (isolating) pin 1 (Chassis Ground) on the XLRs.