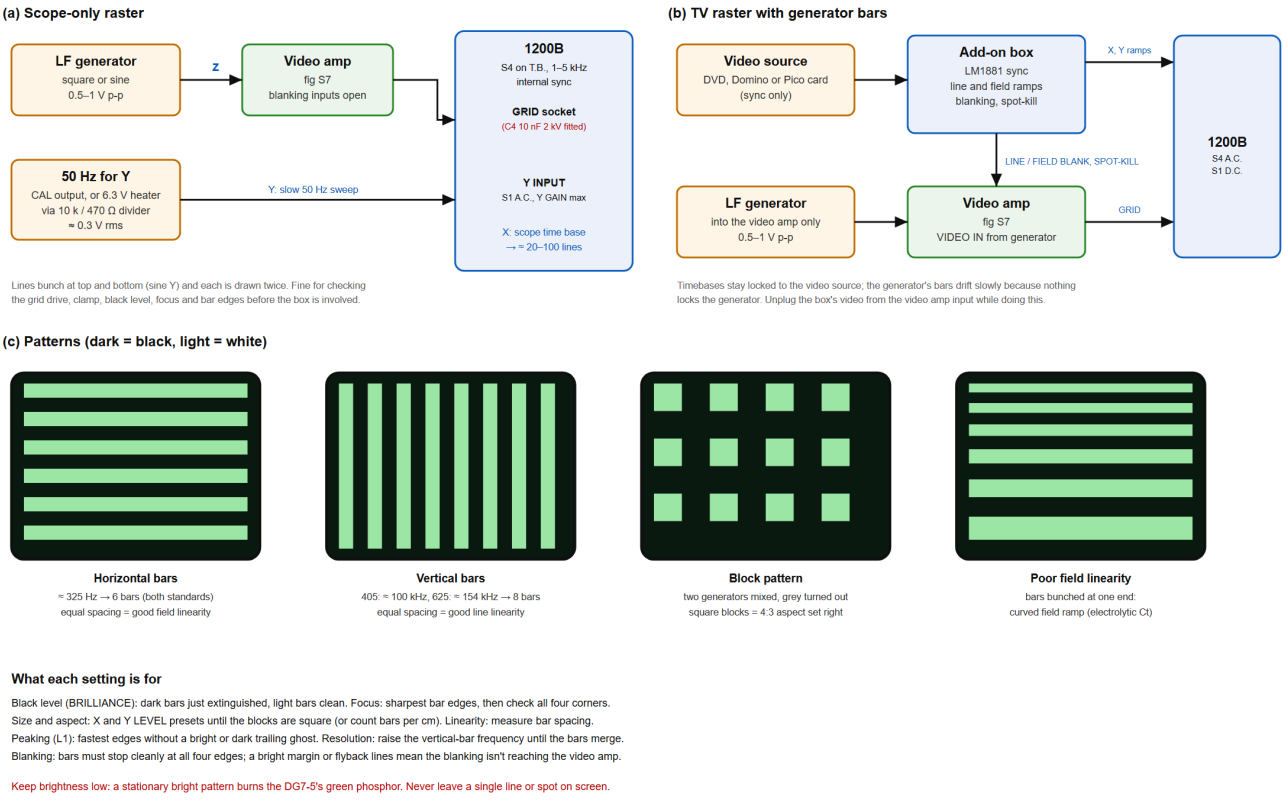
1200B scope: Addendum C, test rasters from the signal generator

12 October 2026. This addendum explains how to use your **LF signal generator** to put test patterns on the 1200B, and how those patterns help line up the video amplifier and the picture. You don't need a pattern generator: a sine/square audio generator was the TV service engineer's standard bar generator.

Status: a procedure. The figures are worked out from the 405 and 625 timings and the circuit values; none has been tried on this scope yet.

Figure S8: test rasters from the LF signal generator

(a) scope-only raster: no add-on box needed (b) the real TV raster with generator bars (c) the patterns and what they show



What each setting is for

Black level (BRILLIANCE): dark bars just extinguished, light bars clean. Focus: sharpest bar edges, then check all four corners.
Size and aspect: X and Y LEVEL presets until the blocks are square (or count bars per cm). Linearity: measure bar spacing.
Peaking (L1): fastest edges without a bright or dark trailing ghost. Resolution: raise the vertical-bar frequency until the bars merge.
Blanking: bars must stop cleanly at all four edges; a bright margin or flyback lines mean the blanking isn't reaching the video amp.

Keep brightness low: a stationary bright pattern burns the DG7-5's green phosphor. Never leave a single line or spot on screen.

1 The idea

A television picture is just a bright spot swept across the screen in lines (X), and the lines are stacked down the screen (Y). The video signal turns the brightness up and down as the spot moves. The CRT doesn't care where that brightness signal comes from.

Feed a plain square wave into the video amplifier and it switches the spot between black and white at a steady rate:

- **If that rate is a multiple of the line frequency,** each line is cut into the same number of light and dark pieces, so they stack up into **vertical bars**.
- **If it's a multiple of the field frequency (50 Hz),** whole groups of lines go light or dark together, giving **horizontal bars**.

© 2026 Project405 · project405.co.uk · CC BY-NC-SA 4.0: free for non-commercial use with credit; selling boards or kits by permission only

Because the generator's frequency is steady, the bars are **evenly spaced in time**. Any unevenness you see on the screen is the deflection's fault, and that's what makes them useful for alignment.

2 Method A: a raster from the scope alone

This needs no add-on box. Use it to prove the video amplifier and the grid drive before the box is connected.

Connections (figure S8a):

Signal	From	To	Setting
X sweep	The 1200B's own time base	—	S4 on T.B., about 1–5 kHz, X GAIN for about 48 mm
Y sweep	50 Hz: the CAL output, or the octal's 6.3 V heater pin through a **10 k / 470 Ω divider** (about 0.3 V rms)	Y INPUT	S1 on A.C., Y GAIN for about 36 mm
Brightness	LF generator, 0.5–1 V p-p, through the video amp (fig S7)	GRID socket	Blanking inputs open; R10 holds Q3 off

- **Lines:** each 20 ms cycle of the 50 Hz sweep contains (time-base frequency ÷ 50) lines, half drawn going up and half coming down. At 2 kHz that's about 20 lines each way; at 5 kHz, about 50.
- **The sine sweep bunches the lines** at the top and bottom, and the scope's flyback may show faintly. That doesn't matter for these tests.
- **Before you start:**
  - Replace C4 with 10 nF 2 kV (fig S2b), and fit the 1N4007 clamp diode if it isn't already fitted.
  - Supply the +12 V from the bench PSU and the +250 V from the octal regulator.

What to do:

1. Set the generator to a square wave of about 1 kHz. Turn BRILLIANCE down until the raster just goes out, then bring it up until the light parts show. You should see broken lines and blocks of light and dark.
2. Change the generator's frequency and the pattern changes: higher frequencies cut each line into more pieces.
3. **Polarity:** the high half of the square wave must be the light half. If light and dark are the wrong way round, the video input is inverted somewhere.
4. **Clamp:** vary the generator's level. The dark parts should stay dark, at the BRILLIANCE setting, while the light parts get brighter. Without the clamp diode the whole raster's brightness shifts as you turn the level.

3 Method B: generator bars on the real TV raster

This is the useful one for alignment. The add-on box makes the proper 405- or 625-line raster, locked to a video source. The generator replaces the picture.

Connections (figure S8b):

- **The video source** (DVD, Domino converter or Pico test card) feeds the box as usual, but only for sync. The LM1881 locks the line and field timebases to it.
- **Unplug the box's video from the video amp's VIDEO IN,** and connect the LF generator there instead: square wave, 0.5–1 V p-p.
- **LINE BLANK, FIELD BLANK and SPOT-KILL stay connected,** so the edges are blanked as in a real picture.

© 2026 Project405 · project405.co.uk · CC BY-NC-SA 4.0: free for non-commercial use with credit; selling boards or kits by permission only

- The scope is set as for TV: S4 on A.C., S1 on D.C., both gains at maximum.

Generator settings:

Pattern	405 lines	625 lines	Notes
Horizontal bars, 6 light + 6 dark	**≈ 325 Hz**	**≈ 325 Hz**	Field rate is 50 Hz on both. About 92 % of each field is picture, so 6 ÷ 18.5 ms ≈ 325 Hz
Vertical bars, 8 light + 8 dark	**≈ 100 kHz**	**≈ 154 kHz**	The visible part of a line is about 81 µs at 405 and 52 µs at 625. 8 ÷ 81 µs ≈ 100 kHz
1 bar (left half dark, right light)	10.125 kHz	15.625 kHz	The line frequency itself

- **The bars won't stand still,** because nothing locks the generator to the timebases. Horizontal bars roll slowly up or down. Vertical bars drift sideways, and they may tilt slightly. Turn the frequency slowly to make them crawl as slowly as possible.
- **Block pattern, with both generators:**
  - The LF generator gives the horizontal bars (about 325 Hz). The Marconi or Advance gives the vertical bars (about 100 kHz at 405 lines, 154 kHz at 625), on CW with modulation off.
  - Mix them into the video amp's VIDEO IN through **1 k from each generator**, each set to about 0.8 V p-p. Never connect a generator to the GRID socket or the X/Y inputs.
  - The sum has three levels: white where both are high, grey where one is high, and black where both are low. **Turn BRILLIANCE down until the grey just goes out,** leaving light blocks on black. That's one block for every other row and every other column.
  - If the RF generator won't tune that low, use about twice the frequency. You get finer bars, but they still work.

```
LF generator (≈ 325 Hz) ──────────────── 1 k ──┐
                                               ├──→ video amp VIDEO IN
Marconi / Advance (≈ 100–154 kHz, CW) — 1 k ──┘
```

4 What the patterns tell you: alignment

Work through these in order. Each step builds on the one before.

4.1 Black level (BRILLIANCE)

Use any bar pattern. Turn BRILLIANCE up until the dark bars just begin to glow, then back it off until they are just black. The light bars should stay clean and bright. Thanks to the grid clamp, this one control sets black for every picture afterwards.

4.2 Focus

- **Use vertical bars:** their edges are the hardest test. Adjust FOCUS (VR7) for the sharpest edges at the centre.
- **Then look at the four corners.** The DG7-5 focuses slightly differently at the edges. If the corners are soft, set FOCUS for the best compromise across the screen, not the sharpest centre.
- If focus won't come sharp anywhere, recheck the EHT bleeder chain (R17, R23, VR7, VR8), as in §4 of the main report.

4.3 Size and aspect ratio

© 2026 Project405 · project405.co.uk · CC BY-NC-SA 4.0: free for non-commercial use with credit; selling boards or kits by permission only

- The picture should be **4:3**, about 48 × 36 mm.
- **With the block pattern:**
  - Set 6 rows of horizontal bars (325 Hz) and 8 columns of vertical bars (100 kHz at 405).
  - Adjust the box's X LEVEL and Y LEVEL presets until **the blocks are square**. Then the aspect ratio is right whatever the overall size.
- **Without a second generator:**
  - Show 8 vertical bars (100 kHz at 405) and set the width so they span 48 mm, which is 6 mm per light + dark pair.
  - Then show 6 horizontal bars (325 Hz) and set the height so they span 36 mm, again 6 mm per pair.

4.4 Linearity

Bar generators are mostly used for this check.

- **Horizontal bars test the field (vertical) linearity, and vertical bars test the line (horizontal) linearity.**
- **Measure it:** with a ruler or the graticule, measure the pitch (one light plus one dark bar) at the top, middle and bottom, or the left, middle and right. Then work out the non-linearity:

non-linearity = (largest pitch − smallest pitch) ÷ average pitch × 100 %

- **Under about 10 % looks right;** domestic sets of the period were about 5–10 %.

The two problems already known on this scope:

1. **Field ramp slightly curved** (noted on 11 October). The cause is the electrolytic timing capacitor Ct in the field timebase. Horizontal bars show it as bars bunched at one end, like the fourth screen in figure S8c. Measure the pitch now, swap Ct for a film capacitor, and measure again: the before and after figures show the improvement.
2. **Raster width short, and a bend at the top left.** Bar patterns tell you whether the cause is the ramp or the scope's EF36 amplifiers:
   - **Shrink the picture** with X LEVEL to about half width and look at the vertical bars.
   - If they are now evenly spaced, the bunching only happens at full width. That means the **amplifier is running out of swing** at the edges, which was the main risk named in the report.
   - If they are still bunched, the **ramp itself is curved**. Look at the line timebase, fig 02.
   - Do the same for the bend: if it disappears when the picture is smaller, it's the scope's amplifiers.

4.5 Peaking (L1 in the video amp)

- **Use vertical square-wave bars at about 100–150 kHz,** and look closely at the right-hand edge of each light bar, where the spot changes from white to black.
- **A soft grey smear trailing to the right means too little peaking:** screw L1's slug in, or fit a larger coil.
- **A thin bright or dark outline just after the edge means too much:** screw the slug out, fit a smaller coil, or put 4.7 k across it. Expect the best setting at about 0.4–0.8 mH.
- Aim for the sharpest edge with no outline.

4.6 Resolution

- **Raise the vertical-bar frequency** steadily until the bars merge into an even grey. The number of picture elements across a line is about **2 × frequency × visible line time**.

© 2026 Project405 · project405.co.uk · CC BY-NC-SA 4.0: free for non-commercial use with credit; selling boards or kits by permission only

    - At 405 lines, bars that merge at 300 kHz mean about 2 × 300 k × 81 µs ≈ **49 elements** across.
    - At 625 lines, merging at 450 kHz means about 2 × 450 k × 52 µs ≈ 47 elements.
- That figure is set by the spot size and the video bandwidth together. The report estimated 45–60 lines of real resolution for this tube, and this measures it.
- **Do the same with horizontal bars** to see how many rows the raster can show before the lines blur together.

4.7 Blanking

- With any bar pattern, **the bars must stop cleanly at all four edges.**
- **A bright margin down one side, or faint diagonal lines,** means the line or field flyback isn't blanked. Check that LINE BLANK and FIELD BLANK reach the video amp and that Q3 switches. With 12 V on its base, Q2's collector should drop about 20 V.
- **Stop one of the box's timebases briefly** (or unplug its ramp). Spot-kill should blank the picture straight away. Don't keep this up for long.

5 Safety and care of the tube

- **Keep the brightness low.** A bar pattern that stays still, at full brightness, for minutes will mark the DG7-5's green phosphor. Keep BRILLIANCE just high enough to see the pattern, and turn it down between tests.
- **Never leave a single line or a spot on the screen.** In method A there is no spot-kill, so if either sweep stops, turn BRILLIANCE down at once.
- The GRID OUT lead carries about 150–180 V, and the +250 V supply about 250 V. The scope's GRID socket connects through C4 to the cathode side of the tube, at about −850 V. Work with one hand, and power off and discharge before changing connections.
- The 6.3 V heater pin is only low voltage, but it shares the octal with HT+ at about 415 V. Use a covered plug and check the pin numbers with a meter.

6 Record your results

Test	Result
Method A: raster seen, polarity right (high = light)	
Clamp: dark parts stay dark as the level changes	
BRILLIANCE black-level setting	
Focus: centre / corners	
Size: 8 vertical bars span ___ mm; 6 horizontal bars span ___ mm	
Field linearity, pitch top / middle / bottom (mm)	___ / ___ / ___ → ___ %
Field linearity after changing Ct to film	___ / ___ / ___ → ___ %
Line linearity, pitch left / middle / right (mm), full width	___ / ___ / ___ → ___ %
Line linearity at half width	___ / ___ / ___ → ___ %
L1 value chosen	
Vertical bars merge at ___ kHz → ___ elements per line	
Blanking clean on all four edges	

© 2026 Project405 (project405.co.uk). Licensed under CC BY-NC-SA 4.0: free to copy, build and adapt for non-commercial use, with credit to Project405, sharing changes on the same terms. Selling boards, kits or built units is by permission only (workshop@project405.co.uk). Material from others, credited where it appears, remains theirs.