ELECTRONIC SCHEMATIC

A regenerator CRT

Gradually, as the TV picture tube ages, it loses its brightness. The device we propose to build can regenerate any CRT (television, computer, oscilloscope) and to restore almost all its original qualities.

Today we no longer talk than LCD or plasma screens, overhead projectors or DLP projectors and we forget that 90% of people have and continue to buy the conventional CRT TV that, depending on the brand or age presents the quality characteristics more or less good. But whatever model you own, your CRT suffers from a "disease" manifested by a progressive decrease in brightness and a degradation of image sharpness. Indeed, given that its duration is not unlimited, the cathode ray tube or CRT (Cathode Ray Tube) in operation degrades slowly and cathode-ray emission decreases gradually.
This phenomenon is perceived by the viewer as a loss of brightness and image quality, this phenomenon worsened over the years.

Our achievement

Since the CRT is the most expensive component of a TV, we decided to propose to build a CRT Rejuvenator: This device is able to make the reversible phenomenon (or cure "disease" we talked above). You will be able to delay the scrapping of your CRT extending its life. If you are a collector, you can restore the old cathode ray tube television sets which are no longer available (or difficult and expensive prices) parts. On the other hand you can give back to people who do not want or can not afford to be equipped with an LCD or plasma and would prefer to keep their TV a few years, especially if he has acquired a second youth.

CRT

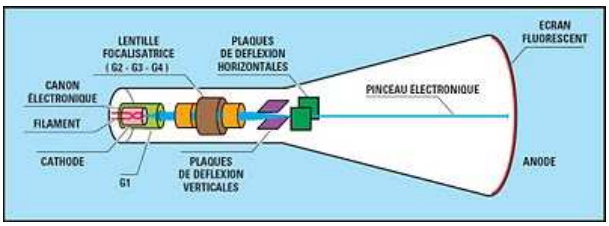


Figure 1: internal constitution of a CRT. The warming of the cathode through the filament produces the emission of an electron beam, the electronic brush which, appropriately deflected, excites the fluorescent material that covers the inside of the screen (anode). The focusing lens (grate) improves the efficiency of electron beam and therefore the brightness of the screen.

How it is done

All cathode ray tubes operate on the same principle as other thermionic lamps: an impregnated cathode oxide is heated by a filament material highly resistive (see Figure 1). Warming up the glow of the cathode stimulates by thermionic effect, the emission of an electron beam (the brush-mail) appropriately deflected by the pairs of deflection plates (horizontal and vertical) located in the neck tube. Thanks to the high potential difference between cathode and anode (screen), ranging from 10 to 20 kV (depending on the size of the CRT), the electronic brush excites the fluorescent material (phosphors) filed the front of the tube inside the glass wall, behind which is that the surface of the screen itself and the image will be formed. P * which is what excited by the energy of electrons from the strike, has the ability to emit light (the phenomenon of phosphorescence).
Not far from the cathode are the control gates (their number depends on the type of cathode ray tube): their role is to correct, modify and optimize quality and focused electron beam emitted by the cathode and hence the brightness screen.
Unlike CRT TVs or monitors B & W, color CRTs use different types of phosphors capable of emitting red, green and blue. CRTs are also three color cathodes and therefore three filaments to heat them, because they have to produce three electron beams, one for each color corresponding to excite the phosphor.

The disease develops

All the electrons emitted by the cathode, however, does not go feed the electron beam, as some who have not acquired the necessary speed, that is to say that lack the energy required, return to the cathode. Similarly, a rocket that can reach speeds of up to its release into orbit, falls to earth. These microscopic particles ("nano") eventually form a layer micrometer (that is to say, very thin, about one micron) prevent the emission of electrons and weakening the electron beam. Now the screen brightness is a function of the intensity of brush-mail that excites phosphors: Phosphorus is not struck with sufficient intensity produces a lower brightness and the resulting image will be less bright and less clear less defined.

Towards Healing

The use of certain expedients such as increasing the voltage applied to the filament, determines the posting of this "film" pathogen, but it is not recommended. This indeed gives a boost and the image is first improved, but this start is short, however then the degradation process becomes much faster because the material that surrounds the cathode off very quickly and that it is soon able to make the electron beam. Above the market risk of burning the filament (hopelessly, because it is then cut and the CRT no longer serviceable) is important.
In designing our regeneration we preferred to use a high voltage adjustable at will. There are many in the trade, devices which intend to revive or rejuvenate the CRT and, in most cases, we obtain satisfactory results which extend the life of the CRT for months or even years. But these are very expensive devices and, in our opinion, somewhat obsolete because they appeared when CRTs ruled the roost in the world of television. Our device, however, is simple, inexpensive and modern in design.

wiring diagram

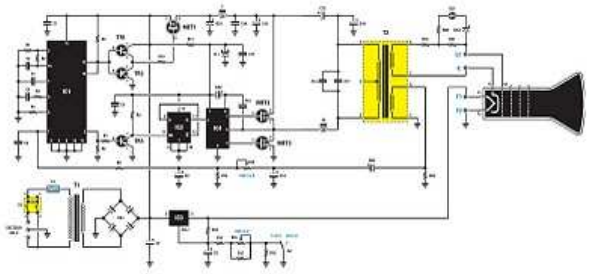


Figure 2: Diagram of the regenerator CRT EN1659. This circuit provides voltage and current needed to stimulate the emission of electrons from the cathode to the anode, and it simultaneously provides high voltage spikes to clean up the cathode layer of micrometer electrons n were unable to reach the screen.

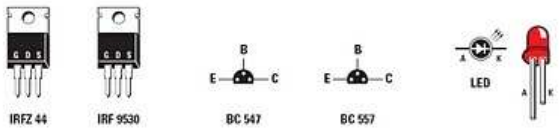


Figure 3: MOSFET pinout as viewed from front, seen from beneath the transistors and LED front view.

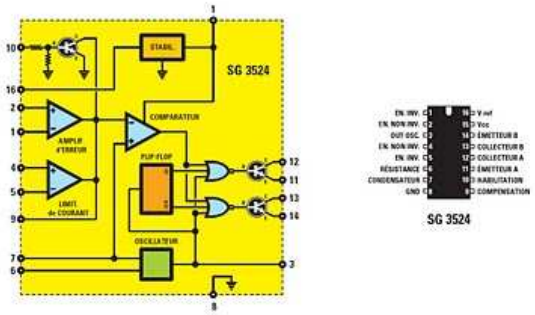


Figure 4: Block diagram and pin internal top view of the driver switching SG3524 implemented to achieve a diet" step down ".
The internal oscillator generates a square wave at about 80 kHz which, taken on pins 12-13, the MOSFET driver MFT1 (see diagram in Figure 2).

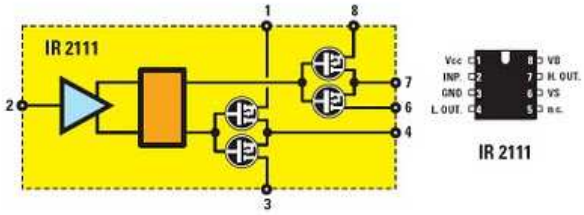


Figure 5: Block diagram and pin internal top view of the IR2111 integrated circuit (IC 4, see Figure 2) driving two MOSFET MFT2-MFT3.

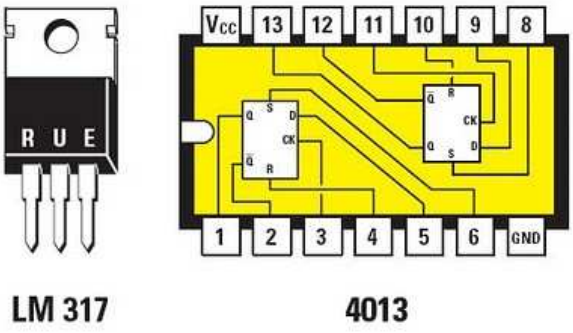


Figure 6: Pinouts of the LM317 regulator from the front of the CMOS 4013 and viewed from above. The

latter (IC2 in the circuit diagram of Figure 2) halves the frequency output pin 3 of SG3524 to control the IR2111.

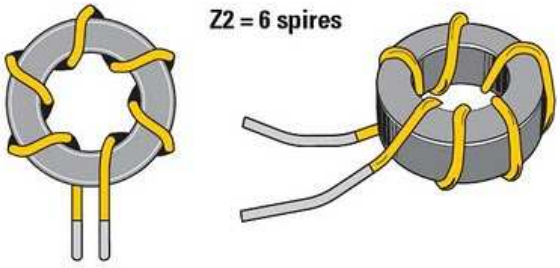


Figure 7: To build self Z2 (see diagram in Figure 8), winding 6 turns of enameled wire 1 mm in diameter on the toroidal core.

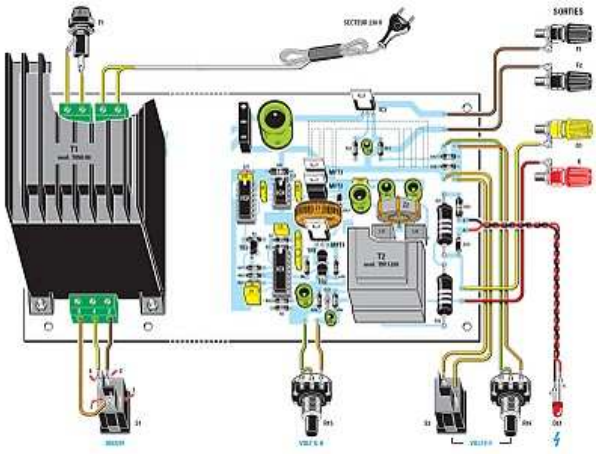


Figure 8a: Schematic implementation of the components of regenerative CRT EN1659. To dissipate the heat produced, the voltage regulator IC3 is to be mounted on a heatsink with fins (not shown here not to hide the components).
Note: set the processor by means of four bolts before welding outputs.

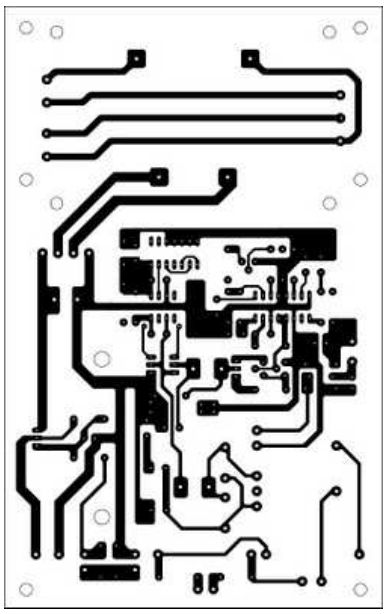
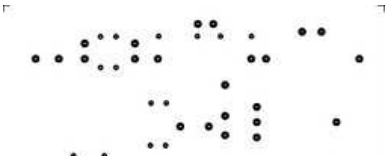


Figure 8b-1: Drawing to scale 1, double-sided PCB with plated through holes of plate regenerator CRT EN1659 side seams.



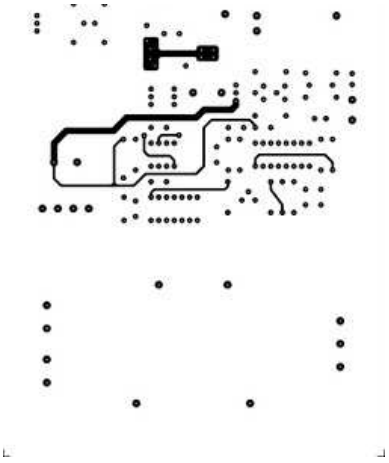


Figure 8b-2: Drawing to scale 1, double-sided PCB with plated through holes of the plate regenerator CRT EN1659 side components.

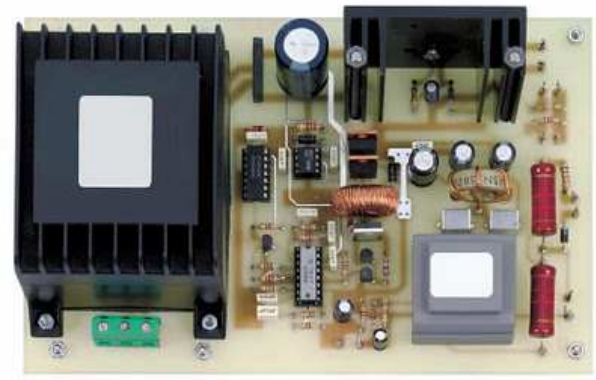


Figure 9: Photograph of a prototype of the regenerator plate CRT EN1659. The heatsink of the regulator IC3 has been mounted (it is attached to it by two bolts). Pay much attention to the direction of insertion of the integrated circuits that support and do not install after mounting the plate in its housing (see Figures 10 and 11).

Figure 10: Photograph of a prototype of the regenerator plate CRT EN1659 installed in its case, to the back (top) and front view (bottom). These photos show what elements up front and the back panel, and they also show how to realize the interconnections between the plate and the two panels.

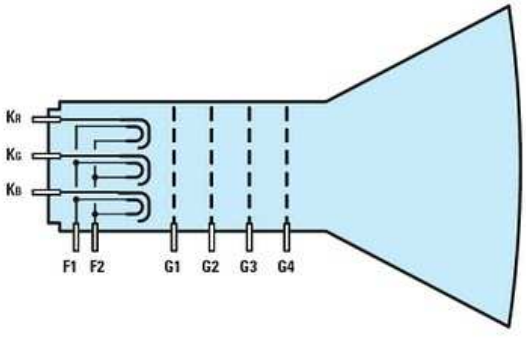


Figure 11: Simplified diagram of the outputs to connect to our regenerator.
Here there is a color picture tube because he has three cathodes KR-KG-KB, one for each RGB (red / green / blue).

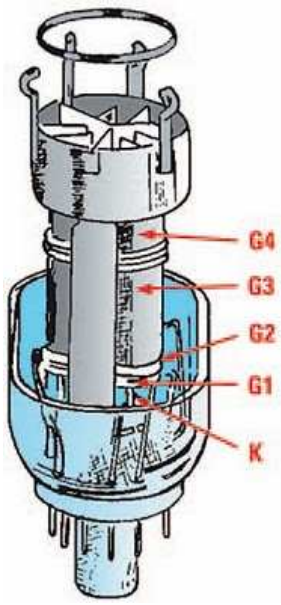


Figure 12: Schematic of the structure of a CRT. The tubes have a color cathode per color RGB (red / green / blu), hence their designation KR-KG-KB.

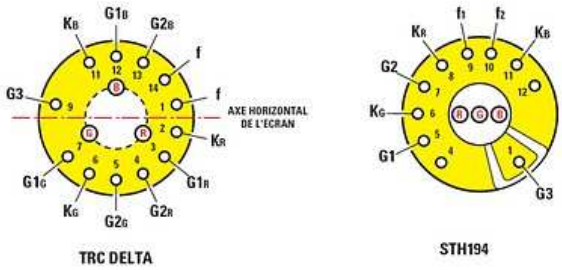


Figure 13: To regenerate a CRT without incurring the risk of damaging it beyond repair, it is essential to know its pinout. Since the TV manufacturers have adopted their own tubes, to help you, we give the pinout of the two types of cathode ray tubes mounted on the more conventional televisions. Usually on the circuit board that supports the base, the designations are etched out.

Figure 14: Photograph of a prototype of the regenerator CRT EN1659 in its case with anodized aluminum front and screenprinted . The article says clearly how to use this device, but in the absence of sufficient training in TV, get professional help (a television repairman).

list EN1659

R1 ..... 4.7 kO
R2 ..... 2.7 kO
R3 ..... 10 kW
R4 ..... 15 kO
R5 ..... 1 kO
R6 ..... 1 kO
R7 ..... 1 kO
R8 ..... 4.7 kO
R9 ..... 4.7 kO
R10 .... 39 O
R11 .... 220 O 1 / 2 W

R12 .... 4.7 kO
R13 .... 220 O
R14 .... 680 O
R15 .... 10 kW pot. flax.
R16 .... 1 kO pot. flax.
R17 ..... 3.9 kO
R18 .... 1 kO
R19 .... 1.2 kO 2 W
R20 .... 15 kO 1 / 2 W
R21 .... 1.2 kO 2 W
R22 .... 470 O
C1 ..... 100 nF polyester
C2 ..... 100 nF polyester
C3 ..... 1 nF polyester
C4 ..... 470 nF polyester
C5 ..... 3.3 nF polyester
C6 ..... 100 nF polyester
C7 ..... 4700 µF/35V electrolytic
C8 ..... 100 µF/63V electrolytic
C9 ..... 10 µF/63V electrolytic
C10 ..... 100 nF polyester
C11 ..... 100 nF polyester
C12 .... 100 nF polyester
C13 ..... 470 µF/63V electrolytic
C14 ..... ?F/63V an electrolytic
C15 ..... 220 µF/100V electrolytic
C16 ..... 1 uF 100 V polyester
C17 ..... 1 uF 100 V polyester
C18 ..... 220 µF/100V electrolytic
DZ1 .... 12 V 1 / 2 W
DL1 .... LED
DS1 .... BYW100
DS2 .... BYX100
DS3 .... 1N4150
DS4 .... 1N4007
RS1 .... Bridge rectifier 800 V 4 A
Z1 ..... 600 uH choke
Z2 ..... 6 turns on ferrite core (see Figure 7)
TR1 .... NPN BC547
TR2 .... PNP BC557
TR3 .... NPN BC547
MFT1 ... MOSFET IRF9530
MFT2 ... MOSFET IRFZ44
MFT3 ... MOSFET IRFZ44
IC1 ..... SG3524
IC2 ..... CMOS 4013
IC3 ..... LM317
IC4 ..... IR2111
T1 ..... transformer 50 VA 230 V/15 V 3 A mod. T050.06
T2 ..... transformer mod. TM1298
F1 ..... 5 A fuse
S1 ..... switch
S2 ..... switch

Note: All resistors whose power is not specified are quar t W.

To return to the CRT's original properties, we need a device that can perform essentially two things. Above all he must supply the voltage and current needed to power the filament so as to induce heat with stimulated emission of electrons to the anode of the CRT. Secondly it should provide high peak voltage between the cathode and the grid to remove the "film" of electrons deposited.
As shown in the wiring diagram in Figure 2, processor 230 V T1 (bottom left), the bridge rectifier and electrolytic capacitor RS1 smoothing C7, we take the necessary voltage to power the integrated circuits and all other circuit components.
The regulator LM317 (TO220 case in classic) provides the necessary tension to the filaments F1, F2,

depending on the type of CRT that tension must be 6.3 V nominal (supplied voltage when S2 is closed) or 12 V nominal (supply voltage when S2 is opened). These tensions can be adjusted using potentiometer R16: S2 closed it adjusts a voltage between 5.1 V and 10 V with S2 open and about a voltage between 10.8 V to 15.7 V approx.
For this circuit we used the IC SG3524 which, by its universality, is ready again to marvel at our specifications. In this case we have chosen to implement a power-type "step down". If you take a look at its internal block diagram, shown in Figure 4, you see that collects on pins 12 and 13 a square wave of about 80 kHz, produced by the internal oscillator to drive the MOSFET MFT1. The latter, with DS1, self Z1 and C13, form a switching power supply capable of supplying a variable voltage and stabilized 8 to 20 V, depending on the position of the potentiometer R15. This voltage is used to modify the amplitude of the square wave produced by IC4, present on the node between the source and drain MFT2 MFT3, the MOSFET constituting the power stage.
On pin 3 of IC1 (SG3524) we take a direct signal of frequency equal to that of the internal oscillator. This signal is inverted and brought to the proper amplitude by TR3 so he can fly IC2, and the latter's role is to halve the frequency of the oscillator and to approximately 40 kHz. This signal then attacks the pilot stage IC4 which, we said, driver alternately turn the grid MFT2 MFT3 and two power MOSFET connected to the primary of transformer T2. Secondary of this transformer is used as a voltage step we take to empty a signal of about 400 V peak / peak which, through the filter formed by capacitors C16-C17 and the inductance Z2 becomes almost sinusoidal.
Whenever a discharge occurs, DL1 comes and this happens as persistent conduction between the gate and cathode, ie as the voltage between gate and cathode did not remove all " crust "of electrons. When this ceases conduction, the CRT is refreshed.

The practical realization

The practical realization of this regenerator CRT is very easy even for a beginner, you will, as usual, be particularly attentive to the values ??of all components and orientation of polarized components, and the quality welds.
Rest assured, the only self winding is Z2 (6 turns on ferrite core, see Figure 7), gold is a snap and the other self Z1, already wound its ferrite core is available ready for use.

The platinum

To achieve this deck, you need to double-sided PCB plated through holes EN1659. When you have achieved (Figure 8b-1 and 2 give the drawings to scale 1:1) or you you have purchased, first solder the many barbs that come to weld up son to the front at the time of installation in the housing. Weld also supports the three integrated circuits but do not insert the ICs (see Figures 8a and 9 and the list of components).
Check out these first welds (or short-circuit between tracks or pads or cold solder joints).
Now mount all components remaining starting with the resistors, diodes, zener, then polyester capacitors electrolytic transistors boxes half moon, MFT1, MFT2 MFT3 and the bridge RS1, the two chokes and toroidal transformers T1 and T2. As usual, hold the power resistors (R19-R21) to one or two millimeters of the surface to provide ventilation.
Take then the regulator IC3 LM317, secure it with a small bolt on the heatsink fins, push its three legs in all three holes and press the heatsink base profile on the surface of the PCB, attach it to the using two small bolts so long and solder the three legs (see Figures 8a and 9-10-11).
Finally mount the three terminals on either side of the transformer T1 supply 230 V (before soldering the output of the latter to the circuit board, attach it with four bolts).
Attention to the orientation (in the sense of mounting) polarized components: the ring is to Z1 DS1, DS2 to that of C12, C14 to that of DS3, DS4 to that of R20, R11 to that of DZ 1; the flats of three transistors are down or to the left to the sole of MFT1 TR1, that of MFT2-MFT3 to the sink, the IC3 to the interior of the plate; + of RS1 is outwardly of the plate ; for electrolytics, be careful in Figure 8a. One mistake and your installation will not work, however if you get everything right it will be usable immediately.
You do not insert the ICs in their sockets that once the installation in the housing run: the three-cue notches U will then head up.
When done, verify the correct orientation of all components polarized and quality of all welds. The deck is finished, you can install into the case.

installation in the box

Take the plastic housing with front and rear panel in anodized aluminum and etched (Figures 10, 11 and 14) and attach the plate to the bottom with six metal struts. Then wire the front and back panel.
Let's start from the front. Montez, from left to right, the S1 switch, potentiometer R15, the LED DL1 (in its holder chrome), the four sockets yellow-red-black-black, the switch S2, the potentiometer R16. To the terminal front, three-terminal screw the son is going to weld the S1 switch on / off. For the pins to solder two son from the potentiometer R15 (Remember the little "jumper" between the pod left and the center).
The two pins located in two solder R18 son is going to weld the switch S2 V FF. The two pins located above R17 solder two solder son is going to the potentiometer R16 (Remember the little "jumper" between the pod left and the center).

The two pins KA, between R20 and DS4, solder a twisted black / red going to the LED (red + A anode / Black K - cathode). Finally, almost R19, solder spikes two son going to the red and yellow sockets (follow the order of pins, bushings and son of: the bottom pin-thread-sleeve red) spikes near IC3 two solder son up to two sockets black F1 and F2 (again follow the order of the pins and sockets: socket-pin top F1). Check several times what you just wire in case of error, correct.
Moving to the rear panel is much simpler. Mount the fuse holder on the left. Install the grommet into the hole below.
Bring the cord three son (phase-neutral-ground) and screw the phase and neutral terminals right tail, solder the ground wire (yellow / green) to a connector screwed to the chassis.
On the left terminal screw two son is going to weld fuse. Put a 5 amp fuse inside.
If you had removed, attaching the front and back panel, as shown in Figures 10 and 11 (2 x 4 bolts) and do a final check.
You can now drive the integrated circuits in Arms: I repeat, three notches mark-U is upward. Mount the two buttons on the sliders.
Before closing the lid, follow the trials.

Tests

Plug the cord into a grounded 230 V and turn the machine: the LED is off.
Take your multimeter set to Vcc and put the probes into sockets black F1 and F2 filaments.
Turn potentiometer R16, you should read a voltage from 10.8 V to 15.7 V when S2 is opened or a voltage of 5.1 V to 10 V when S2 is closed.
To check the high voltage output, connect a light bulb filament 15-25 W 230 V sockets for G1-K.
Turn the R15, you should see the light bulb change, but it will not reach its maximum brightness for, being charged, this output has a lower voltage than empty.
Warning: Although this is not normally dangerous, do not touch with fingers the points of the circuit under high voltage.
If everything works as we just said, you can close the lid of the box and you will make, with wire-wrapped, the banana plug and crocodile clips, probes universal connecting the outputs of the CRT monitor to regenerate.

Use

Above all we must clarify one point: our camera can not resurrect a CRT whose filament is cut or having a screen grid or anode is no longer connected to their output pin! In these cases, you can recycle your CRT or keep it, if you are a collector, for decoration. This device should only be used if the above contingencies were previously open and if you have not diagnosed a malfunctioning power stage of the tube (high voltage and / or filament). CRTs are fed with very high voltages can remain present in the TV long after it was turned off and even unplugged the AC 230 V.
Avoid, therefore, to open the TV if you are not trained for this type of intervention (the television is not radio): the risks of electrocution are very important, especially if the TV is open and turned on. Only a professional (a repairman) in his workshop will take that risk.
Therefore adopt the following precautions:
- Off the TV.
- Disconnect the mains 230 V.
- Hold to the CRT and capacitors have had time to discharge.
- Do not touch the high voltage on the tube.

Above all, turn the knob of potentiometer R15 GK scored at least the high voltage. Set S2 depending on the voltage range corresponding to the tube filament on which you want to act and, with the button marked potentiometer R16 FF, put the filament voltage 20% above the nominal value. Either 7.5 V to 6.3 V filament or 15 V to 12.6 V filament
Hang the crocodile clips on the outputs F1 and F2 (filaments) of the tube and see the light emitted from the filament will glow (this confirms that it is well fed and there is no cut).
Wait a minute, then put the clamps on crocs and Grille1 DL1 Cathode and LED starts flashing at a rate of discharge you see inside the CRT: all this means that the regeneration work is being done .
Gradually, as the flash decreases, increase tension with the GK button until the LED stops flashing DL1, even at maximum voltage. As you can see it's very simple. If you have to deal with a color picture tube, you must repeat the operation for the three cathodes (cathode per color RGB or RGB in English).
Replace the cathode ray tube in the television and restore all the connections back (re-insert the pins of the tube into the original media) and reconnect all power standard, put the protective rear plug and turn on the TV and check that the regeneration was successful. With a TV B & W effect is immediate and the brightness is proof named the correct result. With a color TV, there may be differences in the "clean" found three cathodes give a dominant color.
The explanation is simple: one of cathodes is cleaned better than the other two. You have one thing to do, see the wiring diagram for your TV and locate the trimmer control of the grid corresponding to the color became dominant set it until you have reduced this dominance and the three colors have the same importance in the chromatic composition of the image.

Conclusion

If you are interested in the collection and thus the restoration of old televisions, you'll be keen to give you more of this unit that are indispensable, because CRTs parts, particularly the very old, are not very easy to find. Also, whenever possible, you can regenerate them. The other circuit components of an old TV, the lamps in particular, are easier to provide.

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ENREGISTRER UN COMMENTAIRE

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  Gradually, as the TV picture tube ages, it loses its brightness. The device we propose to build can regenerate any CRT (television, compu...
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  Thermometer -50 to +150 ° C Wheatstone bridge
  Capable of measuring ambient temperature of -50 ° to +150 ° C, it is not only suitable for home or office, but also for air-conditioned room...
- An electric scooter or "Electric Scooter"
  Convenient, friendly, green: it is our proposal for an electric motor scooter with a range of 30 kilometers at a speed exceeding 20 km ...
- A circuit for driving the stepper motors
  Stepper motors-by-step, also known as a "stepping motor", can turn and stop with an accuracy of about one hundredth of a millimeter. This...
- 
  Transmitter Receiver 27 MHz amplitude modulation
  I) Presentation : The problem of signal transmission by audio frequency electromagnetic wave led in recent years of practical arrangements w...
- 
  A proximity detector
  This device detects the approach and the displacement of persons or things within its range and is particularly appropriate to protect the e...
- A radio control of power on 433 MHz
  Figure 1: Photograph of the transmitter. Figure 2: Photograph of the receiver. A number of readers, after completing the 4-channel...

- A variable speed DC motor
  With a PWM controller, this board allows very fine adjustment of the energy supplied (and thus the speed of rotation of the axis) to an e...