INTRODUCTION

This publication on Tuning Aids is aimed at that dwindling number of home constructors. Most of the projects have appeared in Datacom and I have tried where possible, to include suggestions and modifications that arose after the publication of the original article.

Other than BARTG's own circuits, the constructional details and circuit accuracy is the responsibility of the respective author, however every effort has been made to check the details of each project.

PLEASE NOTE: The original Toni - Tuna Carried mains voltage on the pcb, extreme care should be taken in construction. Later versions had the mains voltage removed from the pcb.

Whilst some of the circuits are complex, others are extremely simple, so there should be something for everyone.

This publication hopefully, is the first in a continuous series of projects aimed at the home constructor. Not all project books will be aimed at Data Modes, some will feature general constructional projects which should be of interest to everyone.

I would be grateful to hear from anyone who can contribute to further publications or, who may have suggestions for updates to this book - i.e. amendments modifications etc..

BARTG is a not-for-profit organisation and as such no payment is made for articles published, however full recognition of the author where applicable will be given.

Peter Adams G6LZB

BARTG CONSTRUCTIONAL PROJECTS

TUNING AIDS
Vol. 1.

Produced for the British Amateur Radio Teledata Group by

Peter Adams, G6LZB

CONTENTS

RTTY SCOPE - G4KDZ

Here is a simple circuit for a CROSS MONITOR RTTY SCOPE.

I have no doubt that it probably has been published before, but I obtained this from a ham some years ago from whom I purchased a Creed 7ERP printer.

I only got around to building this RTTY SCOPE a few months ago as I already possess a 'Black Box' MONITOR SCOPE. However it is now built and working a treat and I am sure that there must be a lot of hams out there who would like to put this thing together as the cost is nominal, and really depends on just how much you have to pay for the 1CP1 (DH3-91) cathode ray tube. But they are around and cost between £5 and £15. I have used this monitor in conjunction with an ST5, though I am sure it could be used with any TU, the principle of the circuit is as follows:

By picking up the output of the Mark (1445) and Space (1275) tuned circuits after IC1 the 709 limiter, and these are conveniently available on all ST5's at pins 3 and 4. These are connected to the "X" and "Y" inputs and so cause a deflection on the face of the scope. When tuning a RTTY signal will cause two elipses which ought to be at right angles, but often aren't especially if screen cables have not been used. But one soon gets used to it.

For a correctly tuned RTTY signal the two elipses will be at right angles, have the same length and the same width and enclose the same amount of area. If one tone is louder then that elipse will be larger in every respect. Thus the RTTY SCOPE can indicate:-

1. The station is on tune.
2. The stations tones are not correct.
3. The stations tones are reversed.

Once one has used a RTTY SCOPE for tuning RTTY in this way it is difficult to imagine how you managed without it.

The actual circuit layout is not critical though I would advise from experience, that the constructor uses screened cable on the wires connecting the inputs to the ECC83, and also from pins 3 and 4 to the phono sockets on the ST5. This valve is very sensitive and may well pick up hum or interference on these lines and so distort the display.

The transformer is standard surplus with a 250-0-250 and a 6.3-0 winding at 1 amp for the valve heater. The current from the 250 winding is very small only around 5mA. to 10mA.

The connections within the ST5 are in any copy of "RTTY the Easy Way", but if the trace is small reduce the value of the 1M resistors leading to pins 3 and 4 by soldering 100k's across the 1M ones.

The whole circuit can be made on a piece of veroboard. To avoid stray magnetic fields from the transformer from affecting the scope it is usual to mount this item behind the CRT rather than next to it and on one side.

Mount the CRT with pin 5 uppermost. This will give the correct 'X' and 'Y' Orientation. When the project is completed setting up is simple:-

1. With the TU switched off, switch on the supply to the RTTY SCOPE and allow the monitor to warm up for a few minutes. Within a few seconds a small spot will have appeared on the screen, and after allowing the warm up period use the two "SHIFT" controls to 'centre' the spot. That is adjust until you have the spot in the centre of the screen

2. Adjust the brightness control as desired.

3. Switch on the TU and you should see 'MUSH' appear on the display, tune your radio into a good RTTY signal say on 145.300 and adjust the gain control so that the display just fills the screen.

A few minutes playing with the scope will convince you just how valuable this instrument can be.

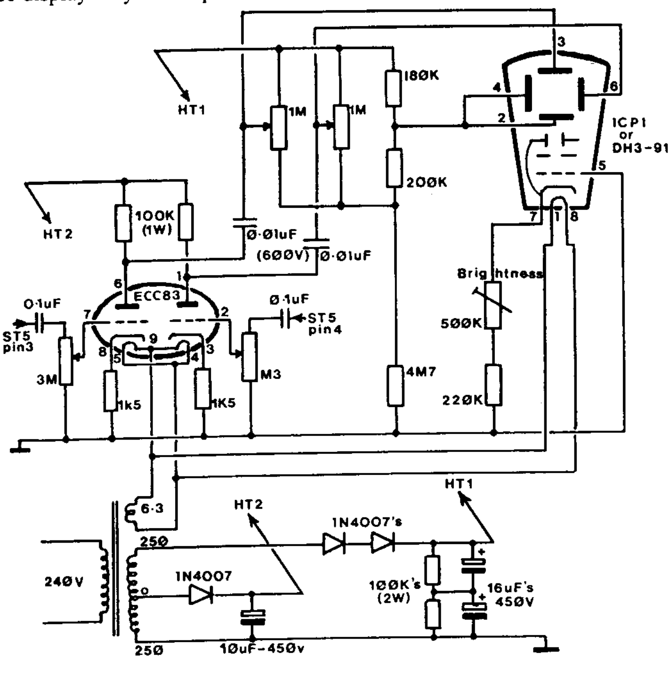
4. Now tune around 14.090 for a RTTY signal, this time slowly alter the tuning until the elipses are of the same size and shape. You will soon get the hang of it.

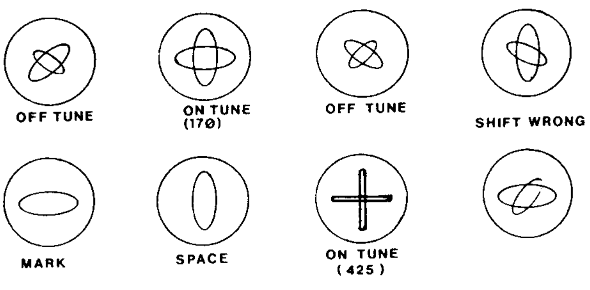
5. You can use your RTTY SCOPE for setting up your own tones, simply feed your outgoing AFSK signal back into the input of the ST5 and watch the screen on the ST5MC where the tunable RM10's are set up to within 3 or 4 Hz, you can obtain the same sort of accuracy by (unplugging the printer and the interface leads) With the machine/ computer switch in the computer position you will transmit a MARK tone so adjust the 10K multiturn for the correct display, then move the machine/computer switch to the machine position and so transmit a SPACE tone and now adjust the 5K multiturn for the correct space display on your scope.

Of course if you have a signal generator and frequency meter to play with you can calibrate the scope exactly. Tuning a 425Hz shift signal on commercial RTTY will give you an almost perfect narrow cross shape on the scope.

I think that the originator of this scope was a Mr A Benham, G8FSL and although slight modification is included, this circuit is basically unaltered.

A. Clements





RTTY SCOPE SCREEN BLANKER - G3ISD

When my good friend G4KDZ decided to build the scope he described in the WINTER 85 issue of Datacom, he first advertised for the requite 1-inch diam, self-focussing tube. Fortunately more than one was forthcoming, which is why I was able to build one too. There is no doubt that the scope is the "Rolls-Royce" of tuning devices, beating even the very ingenious Toni-Tuna. I built the latter as soon as it came out in Radcom in August 1982, and although it is far better than a pair of Led's, it is not as good as the scope in the presence of heavy QRM, especially when copying AMTOR. As it happens, mine quickly developed a barely discernible burn in the centre of the screen due to the spot not being deflected during the periods when my TU was in the transmit state. So some thing has to be done. The result was a small addition as shown in the diagram below:-

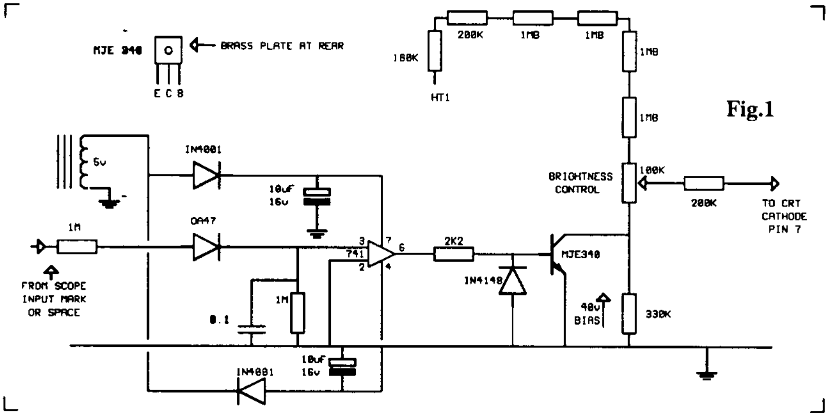


Fig.1

As soon as there is any signal appearing on the input to the 741 comparator, its output switches the MJE340 transistor on, which now shorts out the 330K resistor across which was about 40V or so, and this is enough to bias-off the CRT.

Note that a small rearrangement of the cathode circuit is required, which puts the brightness control into the HT1 bleeder chain. If desired, the 100K brightness control can consist of the original 500k control with a fixed resistor of 120K in parallel with it. The three 1.8M resistors in series were used because I did not have a 4.7M resistor.

Supply voltages for the 741 IC, were taken from an unused 5V heater winding on the transformer. The merest trace of input will turn it on, whether noise, QRM. etc., and cause random movement of the beam in the absence of a signal.

Conversely, the transition to TRANSMIT, or the switching off of the terminal unit or the transceiver will douse the beam, and protect the CRT screen from burns.

I use mine with an ST5, the 1M resistors in series with the scope leads (to terminals 3 and 4 on the ST5) being shunted in both cases with a 470K resistor (to increase the scope signal output from the ST5).
With this arrangement, the 1M resistor in series with the input is necessary, as anything smaller will load the source and distort the trace.

However, if you find that the beam stays on all the time, even with the transceiver and/or the terminal unit switched off, a small positive bias on pin 2 of the 741, using the arrangement shown below, should overcome this.

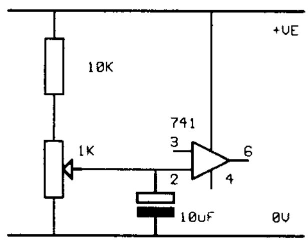


Fig. 2.

SOME NOTES ON THE RTTY SCOPE - G3EGG

I have recently completed the construction of this little unit according to the article by G4KDZ in the Winter, 1985 issue of DATACOM, (p34), the official journal of BARTG, and then again by the same author in the March, 1986 issue of MERCURY, (p12), the official journal of the Royal Signals Amateur Radio Society. It is one of those devices which makes you wonder how you managed without it. It is an excellent instrument and works beautifully.

It is my practice, when undertaking a building project like this, to do a bench-top "lash-up" for experimental and "bug-chasing" purposes before putting it into its final form. As a result , I have come up with a few ideas which I would like to pass on for the interest of others.

I first looked at the power supply. When one realises that the TOTAL current requirement for my unit is less than 2mA, it is very much a case of using a steam hammer to crack a nut to employ a 250-0-250 transformer, no matter how small. Furthermore, the circuit as shown produces almost 700v for HT1 - far in excess of the 500v recommended for the ICP1. No doubt, many are doing this and getting away with it but I decided to stick to the book and I set out to produce a 500v power supply. In the junk box I found a small mains transformer out of a TV distribution amplifier. It has single 200v winding and a 6.3v heater

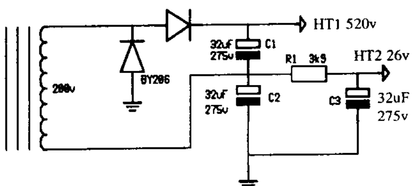


Fig. 1

winding. After a little bench-top work, I came up with the circuit as shown in Fig 1.

It is a voltage doubling circuit and the 200v AC produces 520v DC for HT1. This type of circuit can be expected to produce a DC approximately 2.5 times the AC input. Furthermore, at the junction of C1 and C2, 260v is available exactly right for the ECC 83. The DC at this point looked rather spikey on the station oscilloscope and I decided to provide extra filtering and smoothing with the addition of R1 and C3. This certainly smoothed out the DC but I have since found that in practice, it makes little difference. R1 can be shorted out with no detrimental effect on the trace. Different values for C1 and C2 were tried and even as low as 2uF still produced 520V.

However, the DC was very "rough" resulting in a very unclear spot on the tube face. The values of 32uF give a much sharper spot and hence a sharper trace and there is no lack of brilliance. The rectifiers, which came out of the junk box. are type BY 206 (P.I.V. 400v). Any silicon rectifiers with a big enough P.I.V. would do in this position. Suggested types are IN4004/5/6/7 or BY126/127/133/134/207/208 but the widely used IN4001 will not do because it's P.I.V. is only 50v. The current rating of the transformer is not known but it is phsically small with a core measuring 2 1/4 in x 1 7/8. Since the current requirement is so tiny, almost any small mains transformer will do providing the right AC voltage can be found. Care must be taken to insulate the case of C1 because this is 260V positive to chassis. I next turned my attention to the brilliance control. I found this to be not very effective as originally shown. However, this brings me very conveniently to the excellent circuit by G3ISD published in the Spring (1986) issue of DATACOM, (p39). Like him, I also found that in the transmit or no signal or no signal state, the trace collapsed into a small, brilliant spot on the CRT face and I realised the risk of burning the face. Accordingly, I have incorporated G3ISD's blanker circuit exactly as shown and including the brilliance control in the HT1 bleeder chain. I did not have a MJE 340 but I did find in the junk box a BF 337 which is actually a TV video amplifier. This works perfectly and indeed I suggest that any NPN transistor would do with a working voltage higher than that developed across the 330k resistor at the bottom of the bleeder chain - 32v in my case.

Supply voltages for the 741 were taken from the 6.3v heater winding with the circuit as shown in Fig 2. The wiper of the 470 ohm potentiometer was set at 4v AC and this produces 4-5v DC on pins 4 and 7 of the 741 under working conditions.

This is an interesting circuit to use . Any signals which fall into the 1275/1445 Hz pass-band of the Terminal Unit will trigger the circuit and the trace will appear. In my case the trace comes on at 1120 Hz and cuts off at 1795 Hz. Anything below or above those frequencies is not passed by the T.U circuits and so there is no trace. If the T.U/ recognises any 1275/1445 element in the general band noise, the trace will appear as a random pattern. During transmissions, the trace is fully blanked off and the risk of burning the screen is avoided.

I found it necessary for consistent operation to parallel the 1 Meg resistors on pins 3 and 4 in the ST5C with

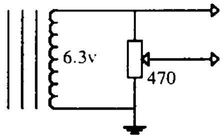


Fig. 2.

further 1 Meg resistors thus halving their effective value and raising the signal input to the blanker circuit. I also decided to wire the input of this circuit to the MARK signal (pin 4 in the ST5C) so that when a RTTY station pauses and is sending no data, the ever - present MARK signal will hold the trace on the screen. One final tip. If you find you are short of scan, try decoupling the 1K5 cathode resistors on the ECC 83 with 0.1uF condensers. You will be surprised how much gain the valve will give. I really have made this from the junk box. The ICP1 was a gift from a benevolent fellow amateur and so all it has cost me is £2.10 for the aluminium case to house it.

TUNING SCOPE RE-VISITED - GD3YEO

Having found lots of space in the case of my ST5 terminal after removing a G3PLX vdu unit, and with Amtor signals not registering very well on the ST5 tuning meter, alternative methods of tuning were sought. Looking back through Datacom* I found G4KDZ's tuning scope, and G3ISD's beam blanker. Being in possession of a 3BP1 tube this was the obvious choice. Various circuits were examined using similar tubes but some had negative EHT supplies, with the plates at ground potential for RF monitoring, and eventually the circuit shown evolved. The values given give adequate range on the focus and brilliance controls, the values of the fixed resistors in the shift supply had to be increased to 1 Meg to give sufficient range on the beam shift controls to cover the screen (200 V/inch). On the blanking circuit, I find that including a variable blanking level control is worthwhile to set the level to optimum. My transformer happened to have a centre-tapped heater winding, which when rectified provided +/- 4 volt supplies for the 741, which proved adequate for correct operation. My unit was constructed on 4x4 Vero with the valve-base stood off on 1 inch pillars, and the blanking circuit on a separate plug-on panel, using the RS 'inter-pcb' plugs and sockets, which make the construction much tidier than direct wiring, enabling boards to be removed for modification or adjustment. Component types will vary depending on the owners junk box, but my types are mostly from scrap TV panels. The BF337 is hv RGB video driver and the SHG1.5 is A1 supply rectifier (1.5Kv piv). The blanker signal could be taken from a valve cathode to reduce loading on the tone detector.

* Ref Datacom Winter 85, Spring 86.

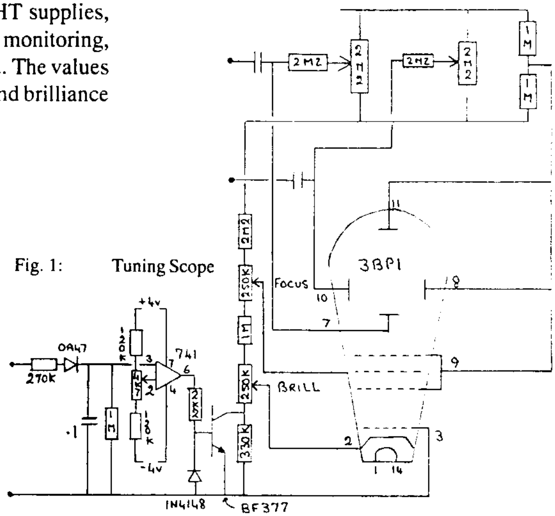


Fig. 1: Tuning Scope

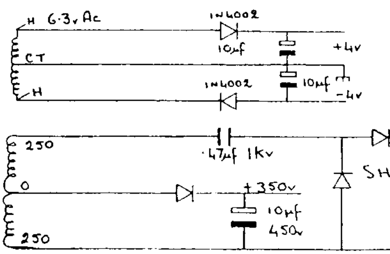


FIG 2 Power Supplies

LED RTTY TUNING INDICATOR

With the advent of the UA180 I.C. which is specifically designed to drive LED indicators it has now become possible to dispense with the use of an oscilloscope for accurately tuning an RTTY signal.

The Siemens LED strip Type LD469 (10 way), designed as a voltage and level indicator for use on stereo and other equipment, together with the UA180 and a few simple components provides an easy to read level and balance indicator and, providing that the time constants of the circuit are selected to give fast attack and decay, the use of the LED strip wlll prove to be more sensitive as an indicator for the pulse type voltages generated in RTTY modulators and demodulators.

It has long been felt that there is a need for something more economical than the oscilloscope which, in itself, is an excellent indicator but, for RTTY modulators and demodulators, the LED "bar of light" is far superior as regards initial cost, power requirements, and size and is solid state compatible with all families of integrated circuits.

The indicator display provided by Fig. 1 should be arranged in 2 vertical columns of light, one for Mark and one for Space. Each column comprises a 10 way LED strip plus 2 individual LEDs mounted vertically above. Experience has shown that green is the best colour for the 10 way strip, amber for the 11th LED and red for the 12th. The red LED serves to indicate peak voltage with the signal in tune and everthing properly adjusted.

The circuit shown in Fig. 1 is straight forward and it will be seen that, as an optional addition, the circuit of a two stage, linear amplifier is shown. One of these amplifiers may be required in each channel to boost the output from the "scope" outlets of demodulators such as the ST5, ST6 and DT600 which do not have active discriminators. In the case of the ST5 and ST6 it is suggested that the 1 megohm isolating resistors in the scope output of the tuning units be reduced to 100 K ohm.

It will be noticed when using the LED indicator that, with some of the more simple tuning units, there is some indication in the Space channel when the Mark tone only is present and the signal is properly tuned. The LEDs are very sensitive and it will be possible to correctly tune signals which are well down into the noise which, in fact, are so distorted that the machine has no chance of producing 100% copy. However if the noise and QRM are low it is possible to print a signal well below zero meter reading when correctly tuned by the LEDs. me LEDs appear to be superior to the oscilloscope as tuning indicators but do not replace the oscilloscope in the investigation of pulse forms and distortion etc. within modulators and demodulators.

Alignment

Alignment and adjustment is quite simple as the two 100 k ohm potentiometers in each section are virtually volume or voltage gain controls. To adjust them for the best performance, put both inputs individually on a strong signal, or use other methods of audio injection to the Tuning Unit and adjust the 100 k ohm potentiometers until the top (red) LED lights steadily (not flickering).

Components

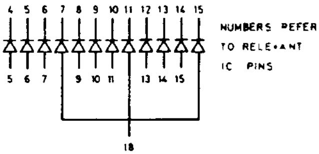
Led Tuning Indicator

C1	470 uF
C2,3	.047 uF
C4,5	.220 uF
D1	EM401
D2,3	IN750
D4,5,6,7	IN914
R1,2	lk8
R3,4	lM
R5,6,9,10	lk
RV1,2,3,4	100k trimpots
IC1,2	UA180 with sockets
Ledstrip 1,2	Siemens LD469 (green) + 2 amber and red Leds

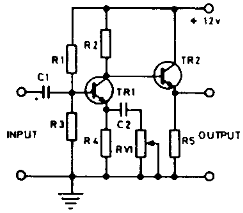
Optional Channel Amplifiers

C1	1 uF per amplifier
C2	10 uF per amplifier

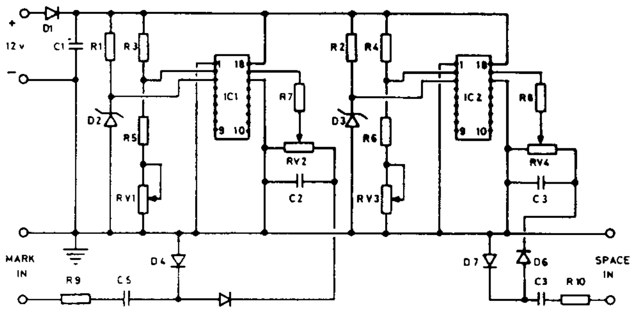
R1	220k per amplifier	R5	lk per amplifier
R2	10k per amplifier	RV1	10k per amplifier
R3	56k per amplifier	TR1,2	BC548 per amplifier
R4	3k3 per amplifier		



LEDSTRIP (2required)



CHANNEL AMP.



LEDSTRIP DRIVERS

CONSTRUCT A TUNING INDICATOR
G6WSN

Here is a circuit of a simple and inexpensive tuning indicator for FAX or RTTY.

The circuit uses an LM2917N8, which is a basic FREQUENCY to voltage or current converter, normally used as a techometer, but ideal as a tuning indicator.

The input sentivity is around 100mV, and the output contains little ripple and it will stand quite heavy overloads.

The LM2917N8 feeds another IC a UAA170, which is a basic bargraph display chip using 16 led's. It has an on board reference supply and the upper and lower reference levels (frequency range) can be adjusted, and a constant current led supply.

The circuit is pretty straightforward, with the LM2917N8 connected as FREQUENCY to VOLTAGE converter with a range of about 50Hz. to 8500Hz.

The frequency to be indicated is fed into pin 1 of the LM2917N8, whose output (pin 4) connects to the low pass filter R1,C1.

Some IC's produce a greater ripple on the output than others. Should this be the case you can try varying C1. Feed in the lowest freq to be displayed, and try to have only ONE led on by shifting frequency slightly. If this cannot be achieved, then increase the value of C1, and try again. Or just fit a 0.1uF as that has proved to be OK in most cases.

The IN4148 diode clamps the 'input voltage' to the UAA170 (pin 11) to the reference supply on pin 14, whilst R2 sets the led current.

Use 10 or 15 turn 'multiturn resistors' for both the 'span' and the 'zero' pre-sets. The Zero pre-set determines the 'lower' reference level, and the 'span' the upper reference level.

SETTING UP

After assembly set the 'zero pre-set' to maximum resistance. The 'span pre-set' to maximum resistance to earth. This will be the same as adjusting for the highest voltage on pin 13 of the UAA170.

Now take the signal from a signal generator at about 250mV and connect to the input of the tuning indicator. Vary the frequency of the signal generator to confirm that all the led's glow one at a time in sequence. This will correspond to an input change from about 100Hz to 8kHz.

Set the input frequency to the lowest freq to be displayed and adjust the ZERO control until No. 1 led is fully ON and No. 2 led is only just ON.

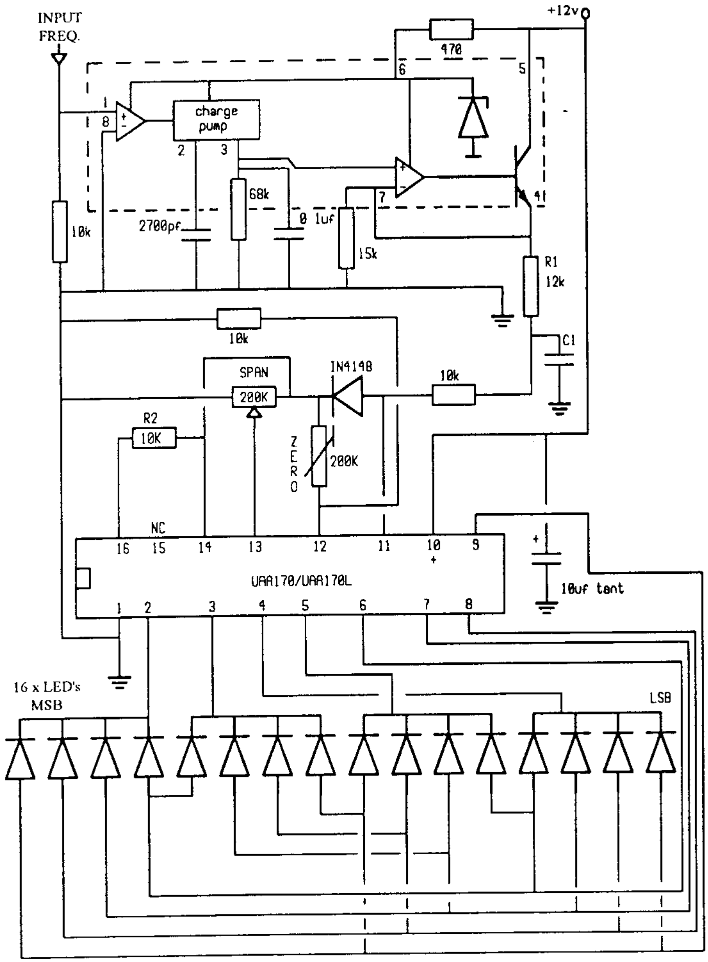
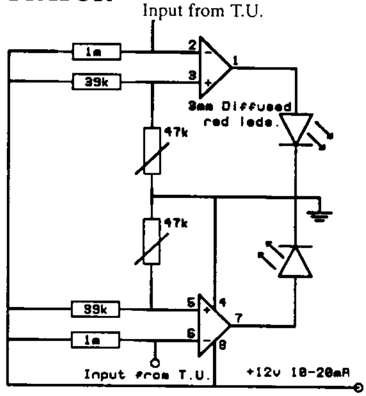


Fig. 1: Tuning Indicator

A SIMPLE TUNING INDICATOR



Adjust trimmer resistors for suitable brightness levels.

In use, adjust tuning for maximum brightness.

If there is insufficient signal level to light the LED's and there should be, lower the values of the resistors (1M) from the ST5/6 toroids (input from other units most probably would not require adjustment).

Integrated Circuit type MC1458 or MC4558.

THE TONI-TUNA
Tony Oakley G4HYD/5Z4DJ

The Toni-Tuna is a versatile audio frequency meter designed by Tony Oakley, G4HYD/5Z4DJ, for use as a simple tuning indicator for RTTY tones. Its main feature is the LED bargraph display, which indicates the frequency to a resolution of 10Hz, and, being totally electronic, it gives an instantaneous readout. This makes the Toni-Tuna ideal not only for RTTY but also for AMTOR and other systems which transmit data in bursts. In addition, the Toni-Tuna can be modified for wide shift operation, making it suitable for slow scan and FAX signals as well as wide shift RTTY. This article incorporates all of the features described in Tony Oakley's original articles on the Toni-Tuna in RadCom [1,2].

INTRODUCTION

The Toni-Tuna was designed to be a simple and effective tuning indicator for RTTY signals, but apart from this prime function it has turned out to be a very useful instrument for a variety of other purposes. It is basically an audio frequency meter, whose display is a row of 40 LED's. In the instrument's standard form, each LED represents a frequency 10Hz different to its adjacent LED's, the whole scale thus covering a portion of the audio spectrum 400Hz wide. Because each LED overlaps, it is possible to read to a resolution of 5Hz.

The really important feature, however, is that an LED meter has no moving parts and is inertia-less. Full advantage has been taken of this, and the Toni-Tuna will accurately indicate the frequency of a short burst of audio less than 20mS long (e.g. a single Mark or Space element in RTTY). This makes it particularly useful in receiving AMTOR signals, where characters are transmitted in bursts, and where the conventional tuning meter is all but useless. As a bonus, the Toni-Tuna will easily measure the frequency of a toneburst as used for repeater operation - the only instrument the author knows of that is capable of this feat.

In its standard form, the Toni-Tuna covers three different switch selectable audio frequency ranges, each 400Hz wide. This is suitable for narrow shift (170Hz) signals. Thus, for example, the instrument can be calibrated to have a "LOW" range from 1165Hz to 1555Hz to span the 1275/1445Hz tones, and to have a "HIGH" range from 2015Hz to 2405Hz to span the 2125/2295Hz tones, leaving the "MEDIUM" range spare for another tone pair. With each of these ranges the resolution of the instrument is 10Hz.

To extend the coverage to wide shift (850Hz) signals, a few minor additions to the circuit are required. These are described in detail towards the end of this article. When operating in wide shift mode, the resolution of the instrument is 50Hz.

CIRCUIT DESCRIPTION

Fig 1 shows the input amplifier and frequency-to-voltage converter section of the Toni-Tuna. IC1 is a limiting amplifier whose function is to provide a constant amplitude signal to the next device. As it fully limits with only 50mV on the input, only a small amount of audio is needed, which may be taken from the headphone socket on the receiver, or from the speaker terminals. Because this stage operates at a very high gain, RV1 is provided to adjust for any DC offset that may occur.

IC2 is a frequency-to-voltage converter. With the values of components used, it will have a linear relationship between the average output voltage and the input frequency up to about 3000Hz. However, because a zero Hz input generates zero volts output, and because only a small portion of the audio spectrum is of interest, the actual output voltage used is considerably offset, and only varies by about 400mV. In addition it has a considerable ripple content at the input audio frequency.

Turning to Fig 2, which contains the DC amplifier and low-pass filter, IC3 is used to convert the offset output voltage from IC2 into a voltage varying over a range of +/- 3V on either side of zero. Switch S1 selects the lower end of the frequency range of the instrument, by selecting RV2, RV3 or RV4 to set the bias to counteract the offset in the input voltage. RV5 controls the stage gain of the amplifier, and is used to set the frequency span (e.g. to 400Hz in the standard version). Finally, the feedback components are chosen so that the device operates as a single-stage active low-pass filter.

This is followed by two further stages of unity gain low-pass filters in IC4 and IC5, which effectively remove the ripple content, yet allow the output voltage to follow rapid changes of signal frequency.

Fig 3 shows the display end of the Toni-Tuna. IC6, IC7, IC8 and IC9 are LED bargraph drivers cascaded to drive 40 LED's in the "dot" mode. Component values are chosen so that -3v input to the display IC's just lights the leftmost LED, and +3V just lights the rightmost LED, and LED current is held at 20mA.

Fig 4 shows the power supply. IC10 and IC11, together with the transformer, diodes and associated capacitors, provide the dual rail supply voltages required by the unit.

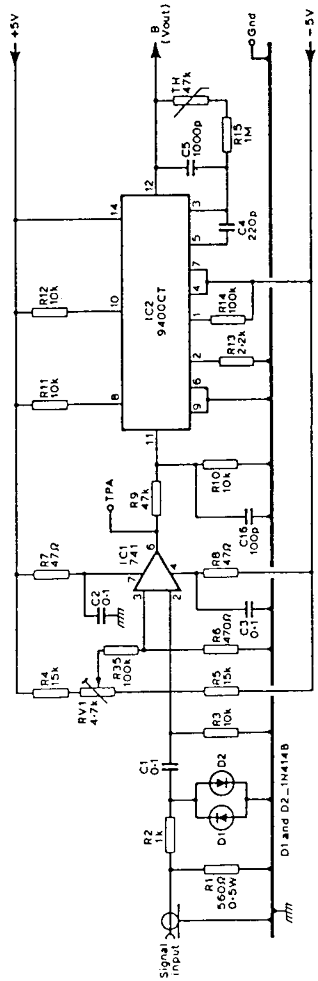


Fig 1: Input Amplifier and Voltage-to-Frequency Converter.

CONSTRUCTION

Construction involves the assembly of two single-sided printed circuit boards: the main board contains the majority of the components, and a small display board contains the LED's.

Once assembled, the boards can then be mounted with the power transformer and other ancillary components in a suitable box.

First decide upon the display it is intended to use. The display board will accept either discrete LED's (the ones designed for 0.1" spacing) or four of the 10-bar DIL arrays. If the latter are used, they may be mounted in IC sockets, but use the low-profile type to save space. If using discrete LED's, an effective way of indicating Mark and Space is by using different colours. The author uses red LED's for the Mark and Space frequencies (i.e. LED's 12 and 29), yellow LED's either side of the red ones (LED's 11,13,28 and 30), and green LED's for the rest of the scale.

Before mounting any components, fit the display board to the main board. This is done by soldering 41 short (0.5") lengths of 22swg tinned copper wire to the track side of the display PCB to make a 41-pin "edge plug", looking rather like a comb. Insert this into the 41 holes on the main board from the component side, and solder the other ends of the wires to the main board. Trim off the excess. Next mount the display LED's as previously decided.

The remainder of the construction is straightforward Use 22swg wire for the links, and use IC sockets if desired, but none of the IC's are delicate and they may be soldered directly into position. Be careful, however, to mount them the right way round - note that IC1/IC2 face the opposite way from IC3/IC4/IC5. If only a single-range instrument is required, components S1, RV3 and RV4 may be omitted. In this event, wire a link from where the switch pole would have been to the "LOW" pin (i.e. make a direct connection between R19 and the slider of RV2).

Note that there are two capacitors designated C16: one of them is a 100pF polystyrene type in parallel with R10 (Fig 1), and the other is a 2200uF electrolytic used in the power supply circuit (Fig 4). This duplication was accidental, but because of the totally different sizes of these two capacitors there should be no difficulty in deciding where each one is to be mounted.

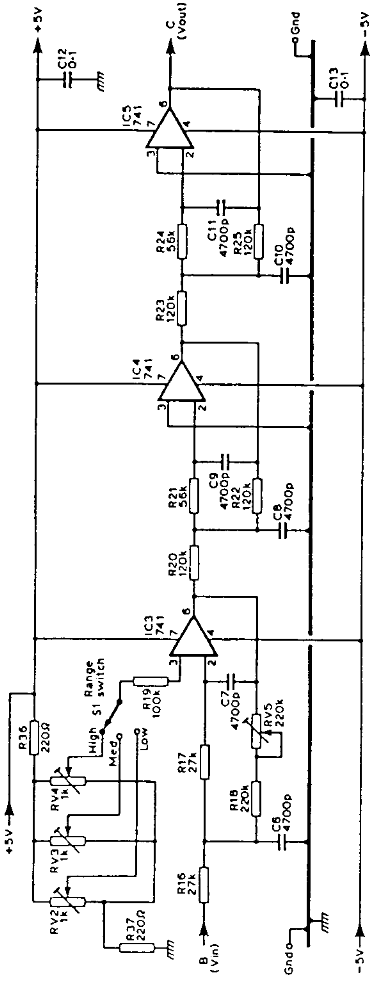


Fig 2: DC Amplifier and Low Pass Filter.

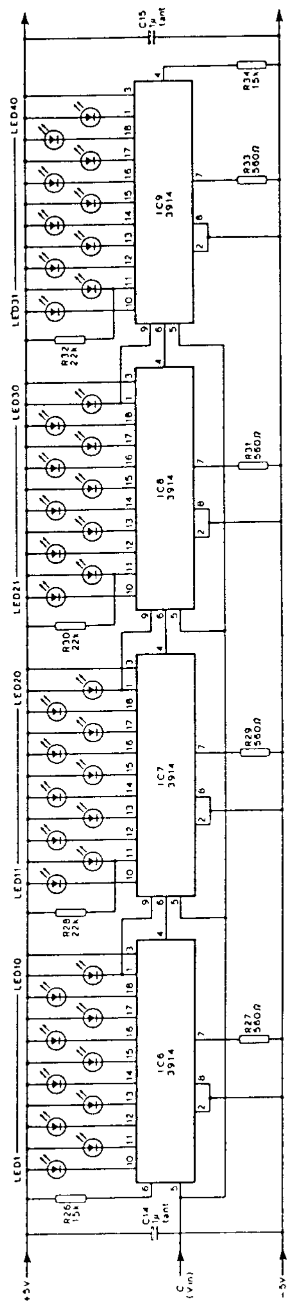


Fig 3: The Toni-Tuna Display.

The transformer, cassette type mains input plug and the 3.5mm audio input jack socket are mounted onto the rear panel of the box, and a slot is cut in the front panel to view the display. The box should be drilled with a few small ventilation holes in the region of the transformer to avoid undue temperature rise.

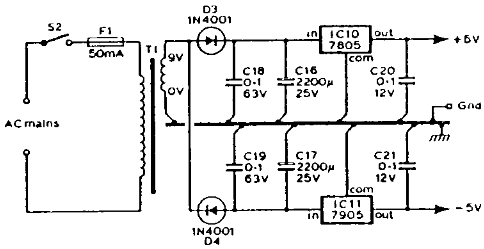


Fig 4: Power Supply.

Some constructors have had difficulty with drifting of the indicated frequency with temperature. Although all the prototypes used the components specified, it appears that the sensitivity of IC2 to heat varies between manufacturers, and maybe even between batches from the same supplier. If this is a problem, change the 47K thermistor to another value - if the display indication moves to the right with time, increase the value of the thermistor, and vice versa. In the event, it may prove that the thermistor is not required at all, and indeed the circuit could be tested initially with a shorting link in place of the thermistor.

A further problem encountered by some constructors is drift due to temperature changes affecting the values of capacitors C4 and C5. These must be polystyrene or similar low temperature coefficient parts ceramic types are completely unsuitable.

SETTING UP

To set up the Toni-Tuna, a voltmeter, a stable audio oscillator and frequency counter are required.

WARNING! THE MAIN PCB HAS TRACKS CARRYING MAINS POWER. EXTREME CARE MUST BE TAKEN TO AVOID ACCIDENTAL CONTACT WITH THESE TRACKS.

(It is advisable to mask them with insulating tape during the setting up process).

First, short the input terminals and connect the voltmeter between TPA and ground. Adjust RV1 so that the voltmeter reads zero - this adjustment may be critical, in which case adjust RV1 as close to the cross-over point as possible. Remove the short.

Select the limits of the particular segment of the audio frequency required to be displayed. For the standard IARU RTTY tones of 1275/1445Hz, the lower and upper limits will be 1165Hz and 1555Hz, and the setting up procedure for these frequencies is now described.

Connect the frequency counter to read the audio oscillator input frequency while the signal is applied to the input of the Toni-Tuna. Set the range switch S1 to "LOW". At an input frequency of 1165Hz, adjust RV2 so that the leftmost LED is lit. Swing the input frequency up to 1555Hz and adjust RV5 so that the rightmost LED is lit. Repeat these two adjustments a few times until no further improvement can be made.

The other ranges, if fitted, are then set up by applying an input frequency corresponding to the lower end of the range, and adjusting RV3 or RV4 so that the leftmost LED is lit when the appropriate range is selected by S1. Do not re-adjust RV5.

USES

As a RTTY tuning device, note the position of the two LED's representing the Mark and Space tones. When tuning in a RTTY signal a "bar" of 18 LED's should be seen moving across the display as the receiver is tuned across the signal. The two end ones will be brightly lit, and the intermediate ones will be a lot fainter. Adjust the receiver tuning to bring the ends of this bar coincident with the Mark and Space indications.

The length of the bar is proportional to the frequency shift, which can be measured off the air to an accuracy of 5Hz, and with AFSK signals the actual frequencies can be measured to the same accuracy. Straddle tuning of FSK signals with incorrect shifts is easily accomplished, giving improved reception, and signal distortion is indicated by a "widening" of the ends of the bar so that two, three or more LED's are brightly lit.

A little practice on the air will quickly show how to use the Toni-Tuna to best advantage, and, although it does not give as much information as a phase-shift monitor [3], as a pure tuning device it is unexcelled. Do not be surprised if the signal appears to drift during a QSO. It really may drift, due to both transmitter and receiver deficiencies, and the Toni-Tuna will show up drifts as small as 5Hz - an accuracy far better than the stability of the best communication equipment in amateur use today.

To use the Toni-Tuna as an accurate audio frequency meter, mark a scale alongside the LED's. For measuring tonebursts the scale should be adjusted so that both the two centre LED's light up when an input signal of 1750Hz is applied, as this will give the greatest indication accuracy.

WIDE SHIFT OPERATION

As originally designed, the Toni-Tuna has a frequency resolution of 10Hz, giving a window 400Hz wide. If it is desired to use the unit as a tuning aid for wide shift (850Hz) signals this window is clearly not wide enough, and if it is also desired to use the same LED display, the resolution must be decreased in the same ratio as the increase in shift; i.e (850/170) = 5.

In the circuit description, it will be recalled that RV5 sets the stage gain of IC3, and hence the resolution. This stage gain can be reduced by the required factor of 5 by altering the values of R18 and RV5. By connecting an additional resistor/potentiometer combination in parallel with the original R18/RV5, and using a spare pole on the range switch, the Toni-Tuna can provide a dual-standard instrument (Fig 5). To set up the wide shift range(s) the unit should first be correctly set for 170Hz shift, and then the new RV6 and appropriate range offset control (RV2/RV3/RV4) should be adjusted to suit the wide shift tones in use.

If the unit is set up for the 850Hz shift standard tones of 2125/2975Hz, the lower and upper limits of the display will be 1575Hz and 3525Hz respectively. It may be found that there is some non-linearity at the upper frequency end of the display. This will not affect the operation or usefulness of this instrument, and may be corrected by altering the value of C4. However, this will also affect all other adjustments.

REFERENCES

[1] "The Toni-Tuna" A J Oakley, G4HYD. RadCom August 1982

[2] "The Toni-Tuna Revisited" A J Oakley, G4HYD and A G Hobbs, G8GOJ. RadCom January 1983

[3] "Phase Shift Monitor - an aid to tuning RTTY" A J Oakley, G4HYD. RadCom April 1981.

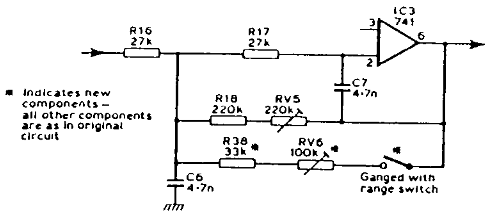


Fig 5: Wide Shift Modifications.

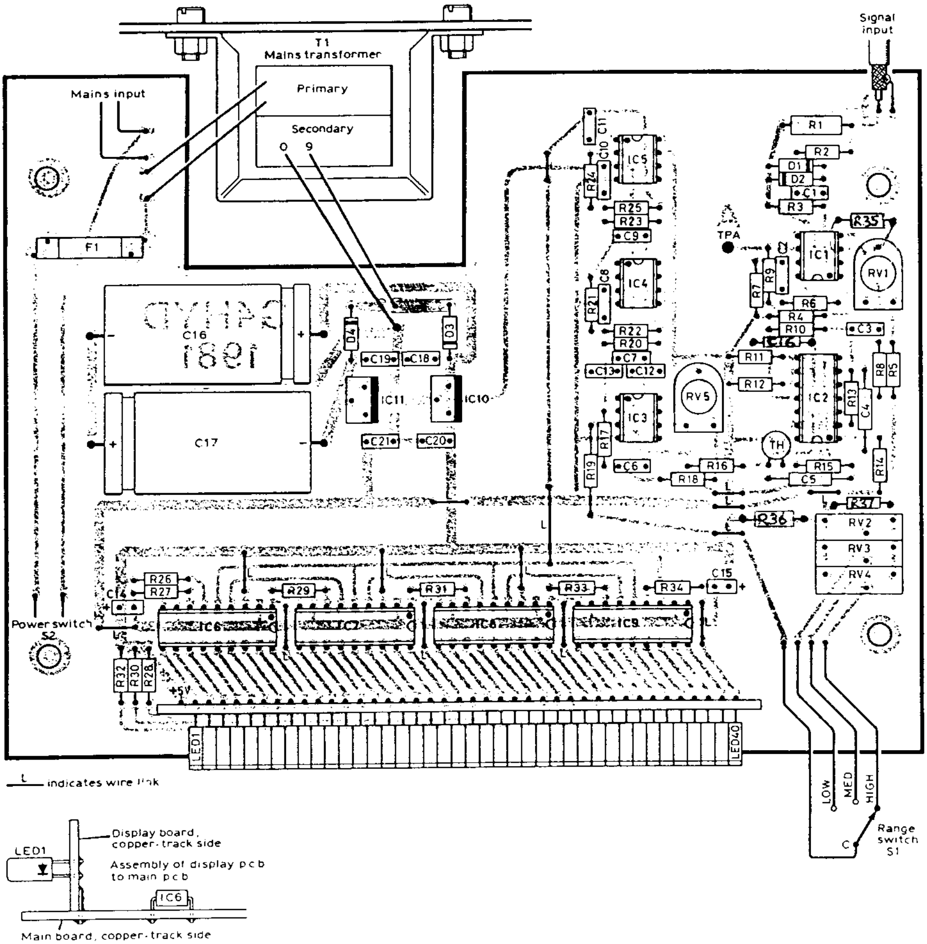


Fig 6: Printed Circuit Board Assembly.

TONI-TUNA COMPONENTS LIST

In the list that follows, the RS Components Ltd stock number and possible sources of supply are given for a few of the more unusual components.

Resistors (all 1/8 watt except where otherwise stated)

R1	560 (1/2 w)
R2	1K (1/4 w)
R3,10,11,12	10K
R4,5,26,34	15K
R6	470
R7,8	47
R9	47K
R13	2K2
R14,19,35	100K
R15	1M
R16,17	27K
R18	220K
R20,22,23,25	120K
R21,24	56K
R27,29,31,33	560
R28,30,32	22K
R36,37	220
RV1	4K7 hor trimpot
RV2,3,4	1K multi-turn trimpot (0.75")
RV5	220K hor trimpot
TH	47K thermistor (miniature bead ntc; e.g. GM473/VA3410/RS151-158)

Capacitors

C1,2,3,12,13, 20,21	100nF 12V disc ceramic
C4	220pF polystyrene
C5	1000pF polystyrene
C6,7,8,9,10,11	4700pF mylar
C14,15	1uF 15V tantalum
C16 (Fig 1)	100pF polystyrene
C16 (Fig 4),17	2200uF 25V electrolytic
C18,19	100nF 63V polyester

Semiconductors

D1,2	1N4148
D3,4	1N4001
IC1,3,4,5	741
IC2	9400CT(RS307- 070)
IC6,7,8,9	3914 (RS308-174)
IC10	7805
IC11	7905
LED1-40	see text

Miscellaneous

T1	9V 100mA transformer (RS 208-096)
S1	single pole 3-way
S2	single pole 1-way
F1	50mA 20mm fuse
Case	Verobox 201, (part No. 202-21034J)

Toni - Tuna Range Switch
Alan Hobbs G8GOJ

The Range switch on the Toni-Tuna is shown as a single-pole- 3-way toggle switch. Toggle switches of this type may be hard to come by, but it is possible to use a readily available single-pole 2-way centre-off toggle switch, by the addition of ony one resistor. The circuit is shown below.

With the range switch in the centre (off) position, the bias set by RV3 (middle range) is fed to R19 and IC3 via the new resistor. If the range switch is moved to either the high or low range position, the bias set by RV4 or RV2 respectively is fed directly to R19 and IC3. However, due to the parallel connection with RV3 via the new 3k3 resistor, there will be some interaction between the ranges, but providing the middle range is set first, this interaction will not be a disadvantage.

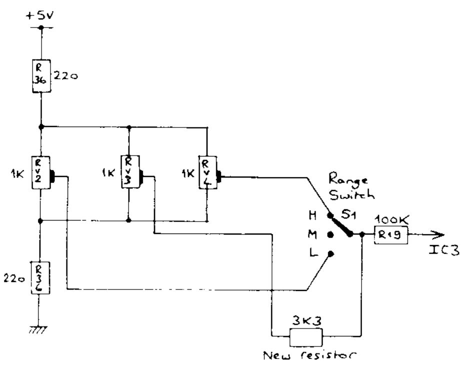


Fig 1: Connections to the new Toni-Tuna Range Switch.

BARTG TONI - TUNA MKII
(G6LZB/G6EJD)

The Toni-Tuna is a versatile audio frequency meter originally designed by Tony Oakley, G4HYD/5Z4DJ, for use as a simple tuning indicator for RTTY and AMTOR tones, Its main feature is the LED or BARGRAPH display, which indicates the frequency to a resolution of 10Hz, and, being totally electronic, it gives an instantaneous readout. This makes the Toni-Tuna ideal for RTTY and AMTOR and other systems which transmit data in bursts. In addition, the unit has now been improved as follows:

1. Six shifts are provided covering, LOW, MED, and HIGH tones (or whatever pairs of tones are required, with the exception of anything above 450 Baud).

2. Full wave rectified power supply.

3. Automatic front end adjustment.

4. R1 has been increased to 10k, so that the Toni-Tuna does not load the 600 ohm T.U. input.

INTRODUCTION

The Toni-Tuna was designed to be a simple tuning indicator for RTTY and AMTOR signals, but apart from this prime function it has turned out to be a very useful instrument for a variety of other purposes. It is basically an audio frequency meter, whose display is a row of 40 LED's or BARGRAPH display. In the instrument's standard form, each LED represents a frequency 10Hz different to it's adjacent LED's, the whole scale thus covering a portion of the audio spectrum 400Hz wide. Because each LED overlaps, it is possible to read to a resolution of 5Hz. The really important feature, however, is that an LED meter has no moving parts and is therefore inertia-less. Full advantage has been taken of this, and the Toni-Tuna will accurately indicate the frequency of a short burst of audio less than 20ms long (e.g. a single Mark or Space element in RTTY). This makes it particularly useful in receiving AMTOR signals, where characters are transmitted in bursts, and where the conventional tuning meter is all but useless. As a bonus, the Toni-Tuna will easily measure the frequency of a toneburst as used for repeater operation- the only instrument the author knows of that is capable of this feat. In the MKII version the Toni-Tuna covers six different switch selectable audio frequency ranges,

1.	Low Tones	170Hz	1275	1445
2.	Low Tones	425Hz	1275	1700
3.	Low Tones	850Hz	1275	2125
4.	High Tones	170Hz	2125	2295
5	High Tones	425Hz	2125	2550
6.	High Tones	850Hz	2125	2975

Or as mentioned previously any suitable pairs of tones.

NOTE;- When using different shifts the resolution of the instrument is different.

CIRCUIT DESCRIPTION

Fig 1 shows the input amplifier and frequency-to-voltage converter section of the Toni-Tuna. IC1 is a limiting amplifier whose function is to provide a constant amplitude signal to the next device. As it fully limits with only 50mv on the input, only a small amount of audio is needed, which may be taken from the headphone socket or from the extension speaker socket. As this stage operates at a very high gain, an automatic front end adjustment has been fitted so it is always at the correct level.

IC2 is a frequency-to-voltage converter. With the values of components used, it will have a linear relationship between the average output voltage and the input frequency up to about 3000Hz. however, because a zero Hz input generates zero volts output, and because only a small portion of the audio spectrum is of interest, the actual output voltage used is considerably offset, and only varies by about 400mv. In addition it has a considerable ripple content at the input audio frequency.

Turning to fig 2, which contains the DC amplifier and low-pass filter.IC3 is used to convert the offset output voltage from IC2 into a voltage varying over a range of +/- 3v on either side of zero.

S1 a 2 pole 6 way rotary switch, selects the frequency range of the instrument. VR5 controls the stage gain of the amplifier, and is used to set the frequency span. Finally, the feedback components are chosen so that the device operates as a single-stage active low-pass filter.

This is followed by two further stages of unity gain low-pass filters in IC4 and IC5, which effectively remove the ripple content, yet allow the output voltage to follow rapid changes of signal frequency.

Fig 3 shows the display end of the Toni-Tuna. IC6, IC7, IC8, IC9 are LED Baragraph drivers cascaded to drive 40 LED'S or Bargraphs in the "dot" mode. Component values are chosen so that -3v input to the display IC'S just lights the left most LED, and +3v just lights the rightmost LED. the LED current is held at 20mA.

Fig 4 shows the power supply. IC10 and ICll, together with the transformer, diodes and associated capacitors, provide the supply voltages required by the unit.

Fig 5 shows the switching arrangement for the rotary switch.

Fig 6 shows the complete unit and the wiring details.

CONSTRUCTION

Construction involves the assembly of two single-sided printed circuit boards, the main board contains the majority of the components, and a small display board contains the LED'S or Bargraphs.

First decide upon the display it is intended to use. The display board will accept either discrete LED'S (the ones designed for 0.1" spacing) or four of the 10 bar DIL arrays. If the latter are used, they may be mounted in IC sockets, but use the low-profile type to save space. If using discrete LED's, an effective way of indicating Mark and Space is by using different colours. the original design used red LED's for the Mark and Space frequencies, LED's 12 and 29 yellow LED's either side of the red one's, LED'S 11,13,28 and 30 and green LED's for the rest of the scale.

Before mounting any components, fit the display board to the main board. This is done by soldering 41 short lengths of 22swg tinned copper wire to the track side of the display PCB to make a 41-pin "edge plug", looking rather like a comb. Before proceeding any further check that you have not bridged any of the tracks as they are rather close together. Next insert the small PCB into the 41 holes on the main board from the component side, and solder the other ends of the wires to main board. Trim off the excess. Next mount the display LED's or Bargraphs as previously decided.

The remainder of the construction is straightforward. Use 22swg wire for the links, and use IC sockets if required, however none of the IC's are delicate and may be soldered directly into position. Be careful, however, to mount them the right way round - note that ICl/IC2 face the opposite way from IC3/IC4/IC5.

The transformer, fuse and phono input socket are mounted on the rear panel of the box, and a slot is cut in the front panel to view the display. Switch S2 is mounted to the left of the display and switch S1 is mounted to the right of the display. If the case you use does not have any ventilation slots a few holes should be drilled in the case in the region of the transformer to avoid any undue rise in temperature.

Some constructors have had difficulty with drifting of the indicated frequency with temperature fluctuation. Although all the prototypes used the components specified, it appears that the sensitivity of IC2 to heat varies between manufacturers, and maybe even between batches from the same supplier. If this is a problem, change the 47K thermistor to another value - if the display indication moves to the right with time, increase the value of the thermistor, and vice versa. In the event, it may prove that the thermistor is not required at all, and indeed the circuit could be tested initally with a shorting link in place of the thermistor.

A further problem encountered by some constructors is drift due to temperature changes affecting the values of capacitors C4 and C5. These **MUST** be polystyrene or similar low temperature coefficient parts- ceramic types are completely unsuitable.

SETTING UP

To set up the Toni-Tuna, a voltmeter, a stable audio oscillator and frequency counter are required.

PLEASE NOTE;- The following instructions apply for setting the frequency ranges already mentioned, however other pairs of tones can be substituted as stated previously, by following the standard setting up procedure.

Connect the frequency counter to read the audio oscillator input frequency while the signal is applied to the input of the Toni-Tuna

Set the range switch to position 1 (fully anti-clockwise),input a frequency of 1275Hz and adjust RV2A until LED 12 is lit.

Turn the Range switch to position 2, input a frequency 1275Hz and adjust RV3A until LED 12 is lit.

Turn the Range switch to position 3, input a frequency of 1275Hz and adjust RV4A until LED 12 is lit.

Turn the Range switch to position 4, input a frequency of 2125Hz and adjust RV2B until LED 12 is lit.

Turn the Range switch to position 5, input a frequency of 2125Hz and adjust RV3B until LED 12 is lit.

Turn the Range switch to position 6, input a frequency 2125Hz and adjust RV4B until LED 12 is lit.
Turn the Range switch to position 1 (fully anti-clockwise), input a frequency of 1445Hz and adjust VR5 until LED 29 is lit.

Turn the Range switch to position 2, input a frequency of 1700Hz and adjust VRA until LED 29 is lit.

Turn the Range switch to position 3, input a frequency of 2125Hz and adjust VRB until LED 29 is lit.

This completes the setting up procedure for the Toni-Tuna. If any settings are changed the whole setting up routine will have to be carried out.

USES

As a RTTY tuning device, note the position of the two LED's representing the Mark and Space tones. When tuning in a RTTY signal a "bar" of 18 LED's should be seen moving across the display as the receiver is tuned across the signal. The two end ones will be brightly lit, and the intermediate ones will be a lot fainter. Adjust the receiver tuning to bring the ends of this bar coincident with the Mark and Space indications.

The length of the bar is proportional to the frequency shift, which can be measured off the air to an accuracy of 5Hz, and with AFSK signals the actual frequencies can be measured to the same accuracy. Straddle tuning of FSK signals with incorrect shifts is easily accomplished, giving improved reception and signal distortion is indicated by a "widening" of the ends of the bar so that two, three or more LED's are brightly lit.

A little practice on the air will quickly show how to use the Toni-Tuna to best advantage, and, although it does not give as much information as a phase shift monitor, as a pure tuning device it is unexcelled. Do not be surprised if the signal appears to drift during a QSO, It really may drift, due to both transmitter and receiver deficiencies, and the Toni-Tuna will show up drifts as small as 5Hz - an accuracy far better than the stability of the best communication equipment in amateur use today.

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WIDE SHIFT OPERATION

As originally designed, the Toni-Tuna has a frequency resolution of 10Hz, giving a window 400Hz wide. If it is desired to use the unit as a tuning aid for wide shift (850Hz) signals this window is clearly not wide enough, and if it is also desired to use the same LED display, the resolution must be decreased in the same ratio as the increase in shift; i.e (850/170) = 5.

In the circuit description, it will be recalled that RV5 sets the stage gain of IC3, and hence the resolution. This stage gain can be reduced by the required factor of 5 by altering the values of R18 and RV5. By connecting an additional resistor/potentiometer combination in parallel with the original R18/RV5, and using a spare pole on the range switch, the Toni-Tuna can provide a dual-standard instrument (Fig 5).

To set up the wide shift range(s) the unit should first be correctly set for 170Hz shift, and then the new RV6 and appropriate range offset control (RV2/RV3/RV4) should be adjusted to suit the wide shift tones in use.

If the unit is set up for the 850Hz shift standard tones of 2125/2975Hz, the lower and upper limits of the display will be 1575Hz and 3525Hz respectively. It may be found that there is some non-linearity at the upper frequency end of the display. This will not affect the operation or usefulness of this instrument, and may be corrected by altering the value of C4. However, this will also affect all other adjustments.

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BARTG wishes to thank the Editor of RadCom for permission to reproduce extracts from References [1] and [2].

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In the list that follows, the RS Components stock number and possible sources of supply are given for a few of the more unusual components.

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R3,10,11,12	10K
R4,5,26,34	15K
R6	470
R7,8	47
R9	47K
R13	2K2
R14,19,35	100K
R15	1M
R16,17	27K
R18	220K
R20,22,23,25	120K
R21,24	56K
R27,29,31,33	560
R28,30,32	22K
R36,37	220
RV1	4K7 hor trimpot
RV2,3,4	1K multi-turn trimpot (0.75")
RV5	220K hor trimpot
TH	47K thermistor (miniature bead ntc;

Capacitors

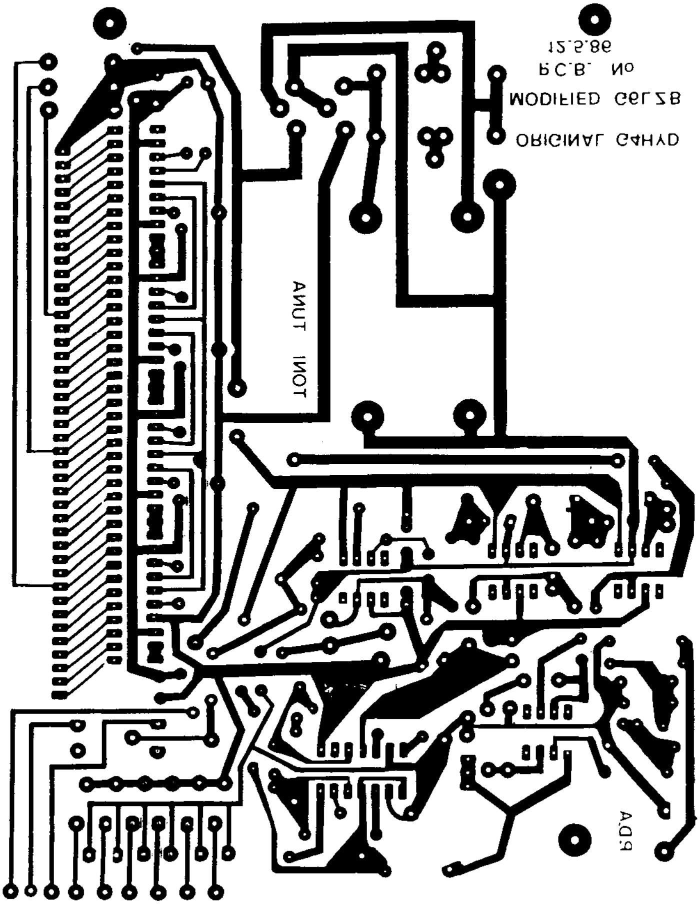
C1,2,3,12,13, 20,21	100nF 12V disc ceramic
C4	220pF polystyrene
C5	1000pF polystyrene
C6,7,8,9,10,11	4700pF mylar
C14,15	1uF 15V tantalum
C16 (Fig 1)	100pF polystyrene
C16 (Fig 4),17	2200uF 25V electrolytic
C18,19	100nF 63V polyester

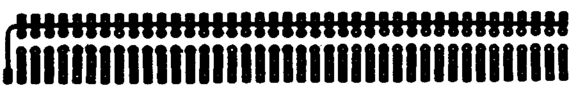
Semiconductors

D1,2	1N4148
D3,4	1N4001
IC1,3,4,5	741
IC2	9400CT(RS307-070)
IC6,7,8,9	3914 (RS308-174)
IC10	7805
IC11	7905
LED1-40	** see text

Miscellaneous

T1	9V 100mA transformer (RS 208-096)
S1	single pole 3-way
S2	single pole 1-way
F1	50mA 20mm fuse
Case	Verobox 201, part no 202-21034J





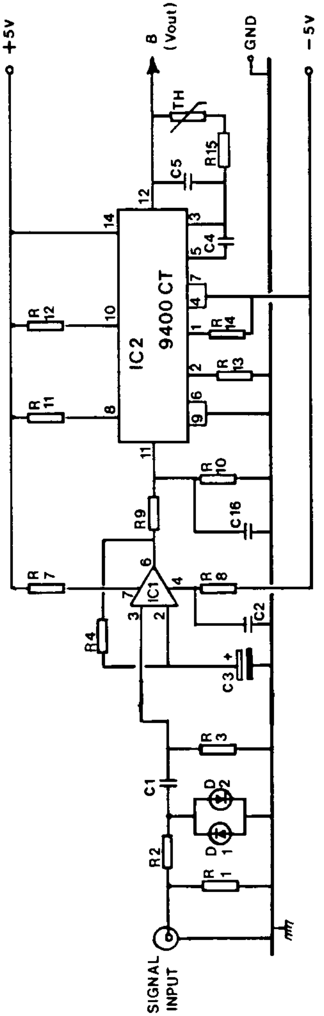


FIG 1: INPUT AMPLIFIER AND VOLTAGE-TO-FREQUENCY CONVERTER

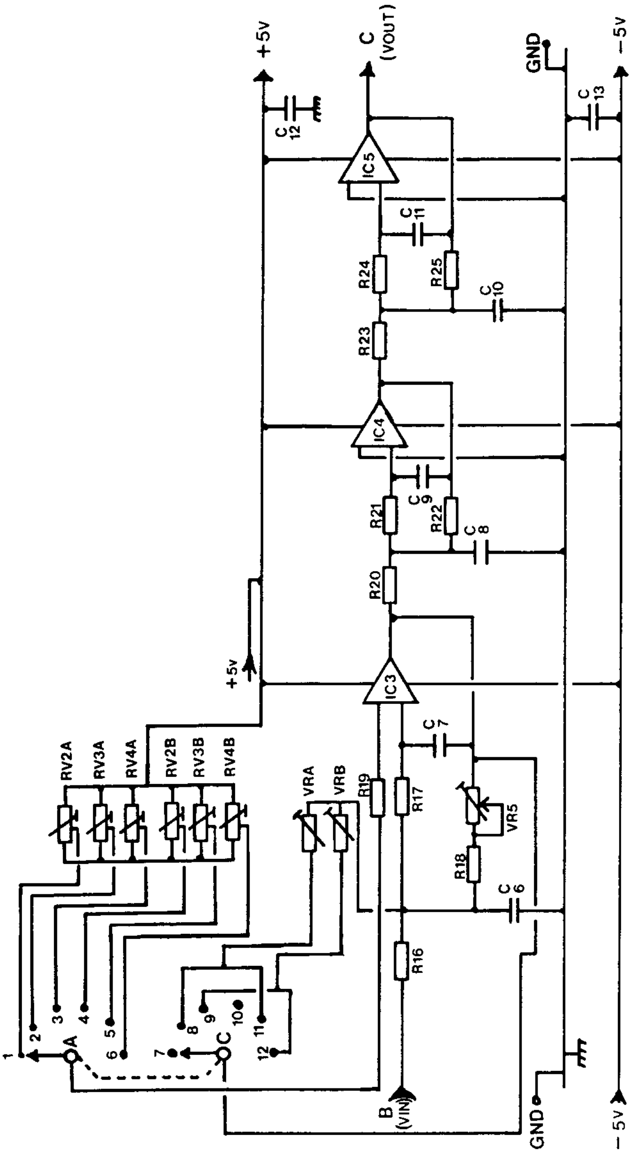


FIG 2: DC AMPLIFIER AND LOW PASS FILTER.

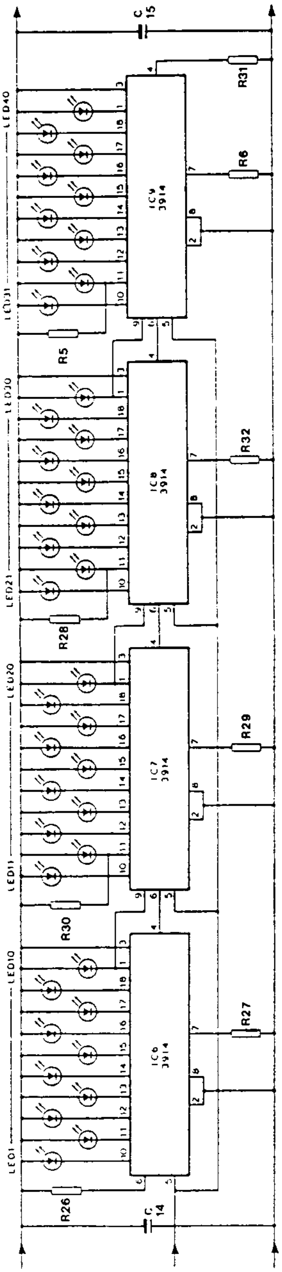


Fig 3: The Toni-Tuna Display.

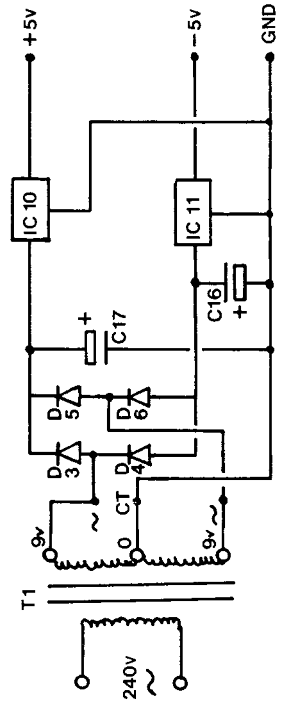


FIG4: POWER SUPPLY

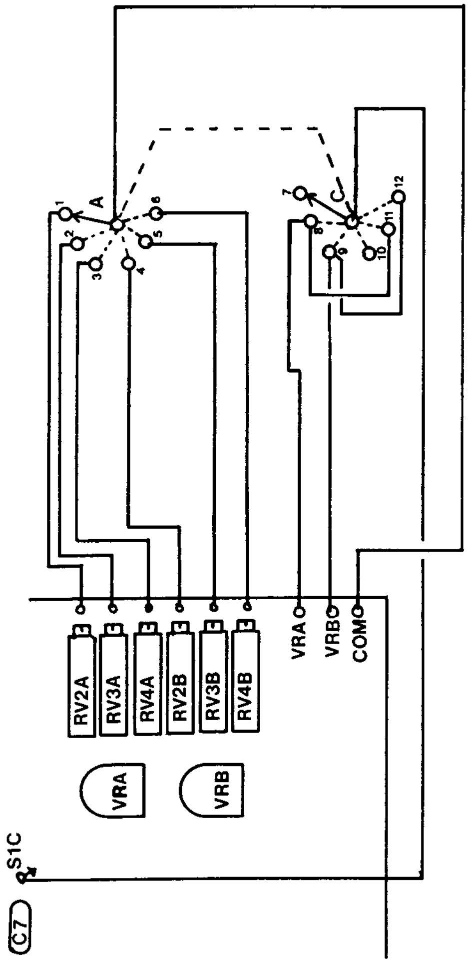
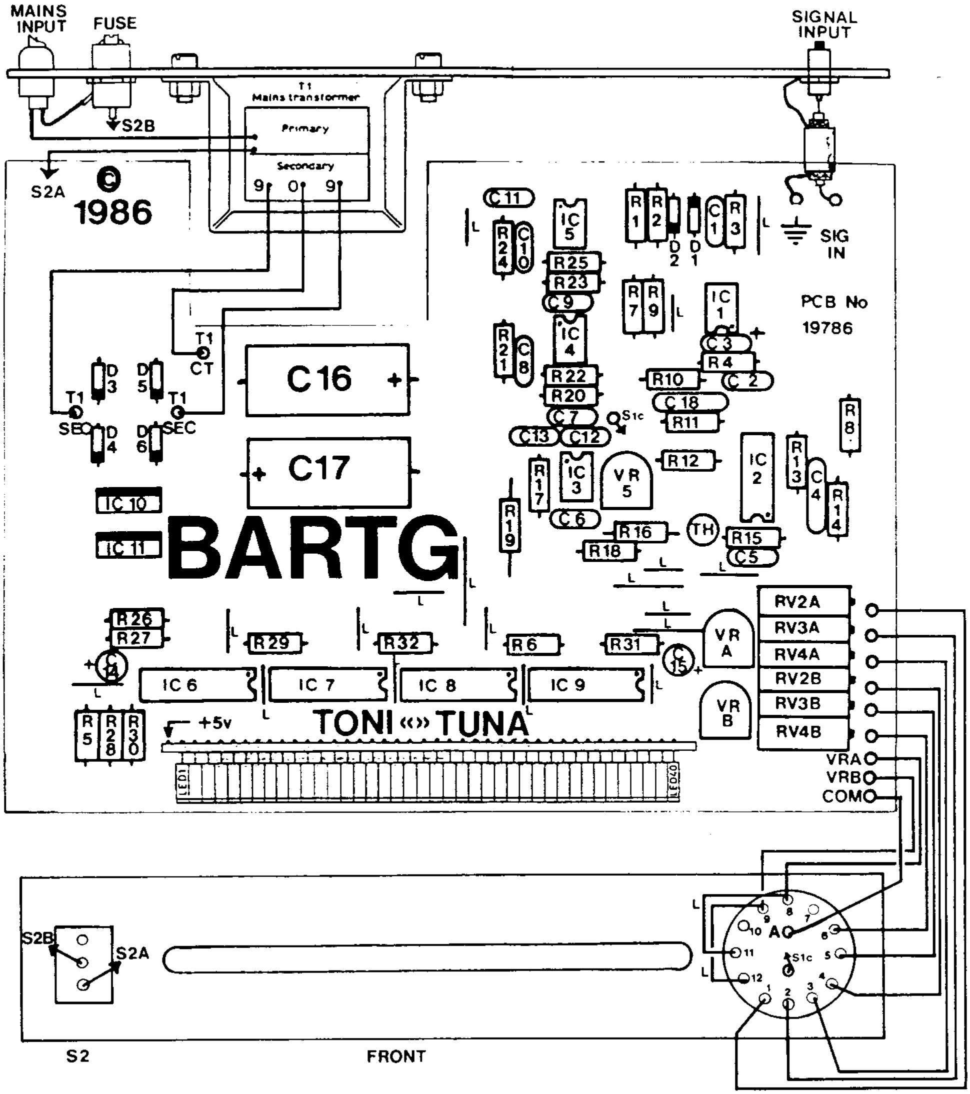


FIG 5: SWITCHING ARRANGEMENT



L indicates wire link

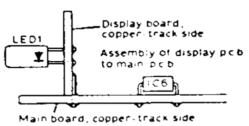


FIG 6 : LAYOUT

Switch connections also shown on separate sheet

TONI - TUNA MKIII - G3ISD

The Toni-Tuna is an audio frequency meter designed by Tony Oakley G4HYD for use as a tuning indicator for RTTY/Amtor tones, and which was first described in RadCom in August 1982, although since then several minor modifications have been made. It features a 40 LED bargraph display which indicates the frequency to a resolution of 10Hz. This electronic inertialess display makes the device suitable for Amtor which transmits data in bursts.

Circuit

Figure 1 shows the limiting input amplifier IC1 and the frequency to voltage converter IC2. The circuitry of IC1 provides for automatic DC offset adjustment of IC1, and the component values of IC2 are chosen to give a linear relationship between the average output voltage and the input frequency up to about 3000Hz. The actual output voltage is considerably offset, and only varies by about 400mV when covering the portion of the audio spectrum which is of interest. It also contains a large amount of ripple at the input frequency which must be removed before application to the display. The V/F converter is followed by a DC amplifier and low pass filter as shown in Figure 2, where IC3 converts the offset output voltage from IC2 into a voltage varying over a range of approx. +-3v on either side of zero. The component values are chosen so that the device operates as a single stage active low pass filter, which is followed by two further stages of unity gain low pass filtering in IC4 and IC5, effectively removing the ripple content yet allowing the output voltage to follow rapid changes in signal frequency. Figure 3 shows the display section of the Toni-Tuna. IC6, IC7, IC8, and IC9 are LED bargraph drivers, cascaded to drive a total of 40 LEDs (in four 10 way bargraphs) in “dot” mode, so that each LED corresponds to a particular frequency. The component values used are such that approx. -3 volts input to the display ICs just lights the leftmost LED, and approx. +3 volts the rightmost LED, with LED current held at 20mA. The circuit has provision for three alternative tone pairs by switching, and the original article suggested that position 1 of Switch 1 should be set up for standard Region 1 low tones of 1275Hz and 1445Hz, and Position 3 fr "high" tones of 2125Hz and 2295Hz as used elsewhere, with Position 2 as a "spare".

Power Supply

This is shown in Figure 4 and employs full-wave rectification using a 9-0-9v transformer, an encapsulated bridge rectifier, and positive and negative 5 volt three terminal regulators.

Construction

Construction involves the assembly of two single-sided printed circuit boards, a small one for the display LEDS, and the larger one for all other components. The display consists of four 10 way DIL displays using low Profile DIL sockets.

First solder the display IC sockets to the display board, and before mounting any other components, fit the display board to the main board. This is done by soldering 41 short lengths of 22swg tinned copper wire to the track side of the display pcb to make a 41 pin "edge plug", looking rather like a comb. Insert this into the 41 holes in the main board from the component side, solder beneath the main board and trim off the surplus. Note that the bargraphs are plugged in with anodes uppermost. Insert vero pins at the audio input position, the mains transformer secondary connection points, and for Switch 1 connections. The remainder of the assembly is straightforward, with DIL sockets recommended for all ICs, and the usual care taken to avoid shorting pcb tracks.

The enclosure used is a matter of personal preference, but the most convenient position for the transformer will be on the rear panel of the case, by removing part of the unused area of the pcb behind C16 and C17. The display is viewed through a slot cut through the front panel. Cutting this slot is the most tedious part of the construction, but the care taken in careful marking out, drilling and filing will be amply repaid in the appearance of the completed unit.

The need or otherwise for the thermistor TH seems to vary from unit to unit depending on the particular 9400, and it is suggested that at first it be omitted and replaced by a link and only installed if there appears to be excessive drift. Even then, a value other than 47k may be required.

Setting-Up

A stable audio oscillator and a frequency counter are required for setting up as follows: Set Switch 1 to position 1, and at an input frequency of 1275Hz adjust RV2 so that led number 12 is lit. Reset the input frequency to 1445Hz. and adjust RV5 so that led number 29 is lit. These settings are somewhat interdependent, and the adjustments should be repeated until no further improvement can be made. Now set Switch 1 to position 3, proceed as above but adjust led number 12 for 2125Hz, and led number 29 for 2295Hz). Do not readjust RV5. Leds 12 and 29 should be marked in some way. A useful economy can be effected by omitting VR3. VR4, and S1, linking "COM" to "LOW". and setting up for "low" tones alone as there seems little point in providing for more than one tone pair.

Operation

With no audio input to the Toni-Tuna, only the leftmost led is illuminated. When audio is fed to the Toni-Tuna input from a transceiver, and in the absence of a signal, there would normally be random flickering of much of the entire row of leds caused by normal so - called "white noise". If an amateur signal of 170Hz shift is located, it will cause a band of 18 leds to be lit, which should then be positioned by tuning the transceiver so that it falls between leds 12 and 29. Many RTTY/Amtor signals emanating from multi-mode units (PK232 etc) may be seen to be using an AFSK shift of 200Hz, presumably as a compromise as the same units are used for HF packet which uses this slightly higher shift. However, RTTY/Amtor terminal units seem to have no problem in resolving it, and it is likely that many operators are not even aware of it. To copy commercial stations using 425Hz shift it is usually necessary to switch the terminal unit to "inverted", in which case correct tuning is indicated when the left-hand edge of the "line of light" is lined up with the left-hand "space" marker (led no. 12). The fact that in this case the right hand end of the lighted display will be "off-screen" does not affect tuning accuracy.

To avoid confusion, it is confirmed that the current Toni-Tuna differs from some earlier versions in one or more.of the following ways:

1. Original single shift,
2. Self-adjusting IC1.
3. Modified Power supply.
4. Elimination of 240v mains tracks from pcb.

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TONI-TUNA COMPONENTS LIST

R1	4k7 0.5w	(There is no R4,R5,R6,R35)	
R2	1k		
R3,R10.Rll,Rl2	10k	RV2,RV3,RV4	lk multiturn 3/4in.
R26,R34	15k,	RV5	220k horiz. 0.1w
R14,R19	100k		
R7,R8	47	C1,C2,C3,Cl2,C13,	0.1 ceramic
R9	47k	C18,Cl9,C20,C21	
R13	2k2	C4	220p polystyrene
R15	1m	C5	1000p " "
R16,RI7	27k	C6,C7,C8,C9,	4700p mylar
Rl8,R30	220k	C10,C11	
R20,R22.R23,R25	120k	C14,C15	1uf tantalum
R21,R24	56k	C16.C17	2200uf 25v electro.
R27,R29.R31,R33	560	C22	100p ceramic
R28,R30.R32	22k	C23	33uf tantalum.
R36,R37	220		
All res. 0.25w except Rl		Dl,D2	IN4148

D3	W005 bridge
IC1,IC3,IC4,IC5	741,
IC2	9400
IC6,IC7,IC8,IC9	3914
IC10	7805
IC11	7905

LED 1-40	4-10 segment bargraphs, common anode
TH	47k thermistor
T1	240/9-0-9 100mA
Case	Verobox 201, etc.
S1	DPST switch
S2	SP 3 way rotary switch
PCB	BARTG

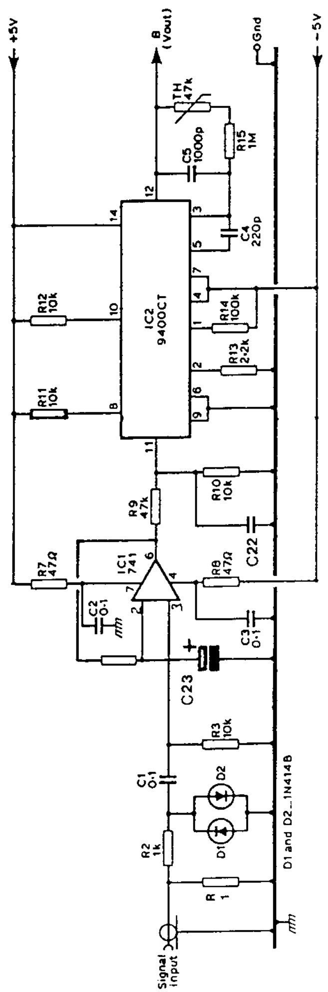

Fig. 1: Input Amplifier and Voltage to Frequency Converter

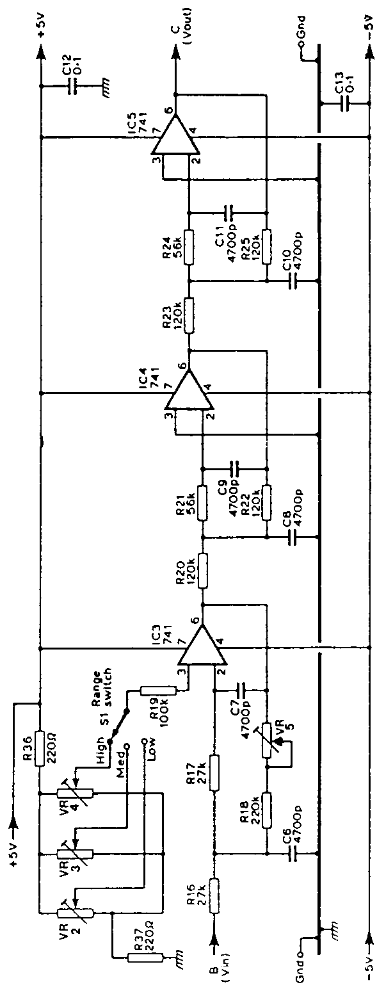

Fig. 2: DC Amplifier and Low Pass Filter

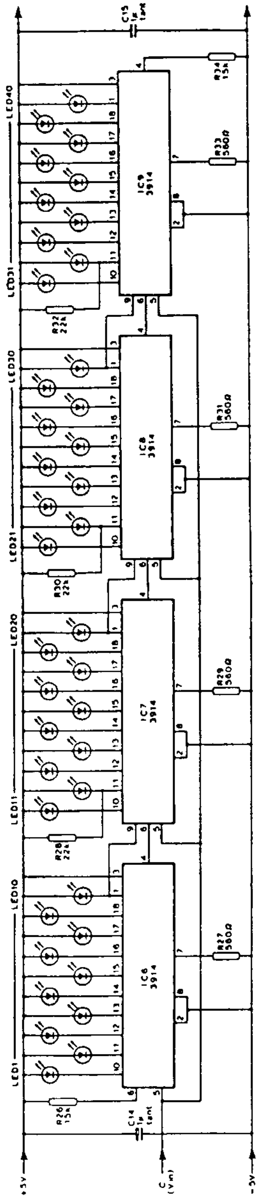

Fig 3: The Toni-Tuna Display.

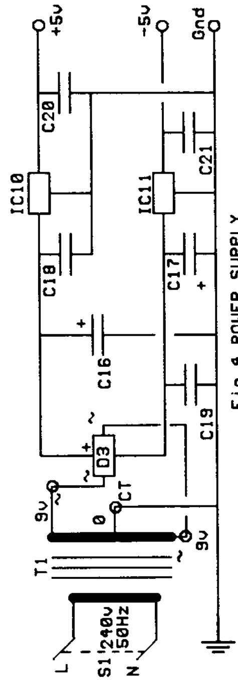

Fig.4 POWER SUPPLY