



WHAT DO YOU NEED TO RECEIVE RTTY?

(1) A reasonably selective, stable communications receiver fitted with a beat frequency oscillator (BFO).

(2) A frequency shift (FS) converter or terminal unit (TU) to convert the receiver's audio output into negative and positive DC pulses to operate:-

(3) A teleprinter (T/P) which prints out the message, and which requires:-

(4) A motor power supply unit (PSU) and a loop PSU for the T/P's operating magnets

...AND TO TRANSMIT BY RTTY?

Licensed radio amateurs, in addition to needing the above gear for receiving RTTY, also need to add a simple frequency shift keying (FSK) stage in the VFO of their transmitter, which will be controlled by the keyboard of their teleprinter.

WHAT DOES RTTY COST?

A Govt. surplus TU costs about £4-£8, depending upon type and condition. Home-built TUs can be made for less than this, and need merely a receiver-type PSU.

Teleprinters (printing on narrow tape) cost about £5. More modern pageprinters (printing on paper rolls/packs) cost £12-£15. Motor and loop PSUs can be bought or built for about £3. Starting RTTY does NOT mean selling the wife's mink coat.

THE TU.

Although you can buy a surplus commercial TU, it is very easy to build your own. The DL6EQ type of Limiterless Two-Tone TU - an excellent modern design - was described by G3CQE in the Aug.'65 S.W.MAGAZINE. You can also see all the circuit details later in this booklet.

Buying surplus, go for such types as the ATM FSY.1.1 (AP100386 or 10P/16142), ATM FSR.1.1X (AP66862 or 10P/-16132) or GCRE FS/10 - all are audio types, fed by the receiver AF output, usually costing £4-£8. The first two of these TUs need only a 300V/6.3V PSU to get going (ensure that there is a Carpenter Type 3 polar relay plugged into the hole in the front panel when you buy!). The GCRE FS/10 has a built-in PSU, but needs some minor

modifications before use as a TU. Apart from these AF types, IF types of TU are also freely available (eg. the Redifon CFS ZA39384, RCA FS No C1) and these have to be aligned to the receiver IF, from which stages they are fed. Newcomers to RTTY will do better to start with AF type TUs. (How do you find these TUs? Simple! BARTG NEWSLETTER and BARTG RTTY NEWSFLASH keep members in the know. If there is any gear going, BARTG soon finds it!)

### THE TELEPRINTER.

Most popular type: Creed 7B pageprinter, usually has a 24VDC, 110/160/250VDC, or 240VAC governed motor, and either a friction-feed paper carriage unit (uses paper rolls 8½" wide, 3" diam.) or a sprocket-feed carriage unit (uses paper perforated down both edges, also 8½" wide, usually in fanfold flat packs). Instead of a page carriage, a tape printing unit may be fitted, printing the message on ¾" wide paper tape. The 7B is a sending/receiving machine, the almost-similar 8B has no keyboard and receives only. Adding a keyboard unit to an 8B to change it into a 7B could involve changing the keyboard driving gear as well.

It is important to remember that the keyboard (sending) unit in the T/P is electrically separated from the printer (receiving) unit. Thus, either unit can be used independently, even at the same time - or the two units can be interconnected by simple switching so that the printer writes out what you type on the keyboard. Even if you never want to transmit RTTY, it is better to go for a T/P with keyboard as this tests the whole machine regularly and easily. Assuming motor speed is correct, a T/P working OK from its keyboard should print OK from receiver and TU. Simple switching is shown later.

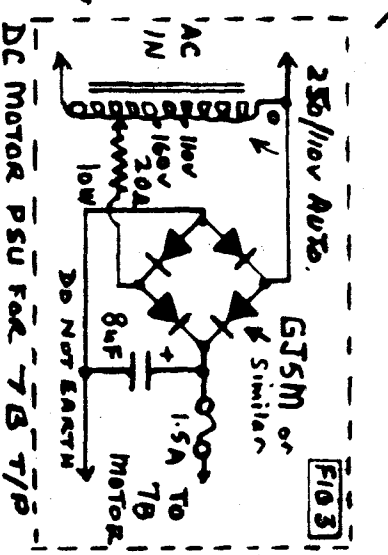
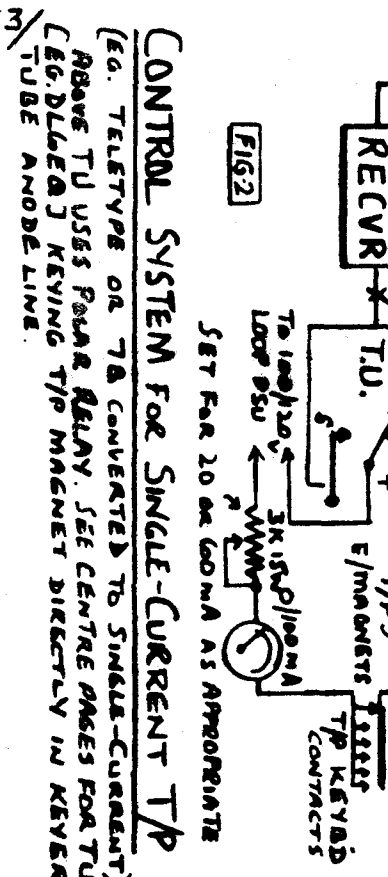
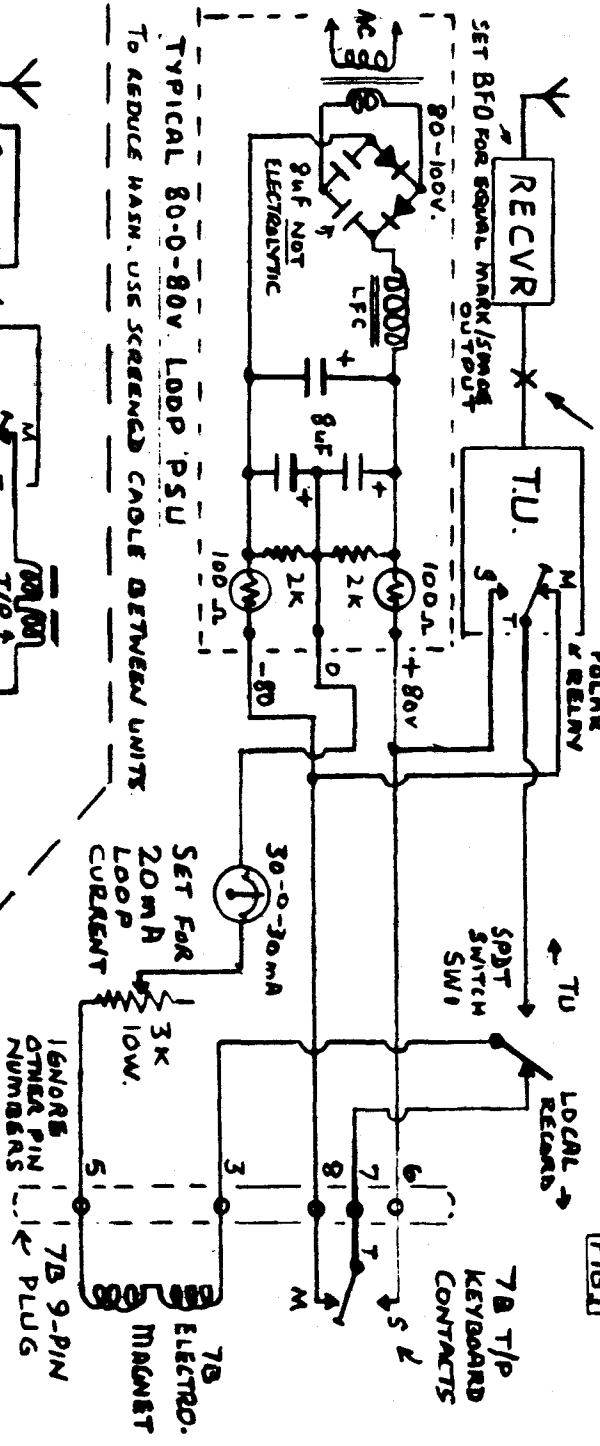
American T/Ps (Teletype 15/TG7A/TG7B etc), German T/Ps (Lorenz, Siemens) are also found in the UK. BEWARE of buying an U.S. T/P with a 60 cycles mains synchronous motor. Go for T/Ps with governed 50cs motors.

### MOTOR AND LOOP PSUs.

Although easily built, the surplus market often has 24, 110 and 160VDC motor PSUs (eg: 43A, 66A), 80-0-80VDC loop PSUs (eg: 26B, 66A - 66A combines motor/loop PSUs). Easily-built PSU circuits are shown in this booklet.

# SIMPLE CONTROL SYSTEM FOR 7B T/P WITH 80-0-80V. LOOP SUPPLY

USE MATCHING TRANSFORMER HERE  
IF RX OUTPUT 2 IS NOT 600 Ω



## CONTROL SYSTEM FOR SINGLE-CURRENT T/P

(EG. TELETYPE OR 7B CONVERTED TO SINGLE-CURRENT)

ABOVE TU USES POLAR RELAY. SEE CENTRE PAGES FOR TU, (EG. DLE00) KEYING TYP MAGNET DIRECTLY IN KEYS

TUBE ANODE LINE.

SET FOR 20 OR 600mA AS APPROPRIATE

There is no magic about 80-0-80v: it can just as easily be 100-0-100v. Any value around that region, in fact, if equal either side of zero, and will allow the loop current through the T/P magnets to be limited to 20mA with a variable series resistor. DON'T run your magnets off a pair of small batteries, as sometimes advised: you need the 80-0-80v & resistor to snap the T/P magnets over smartly.

In simple control circuits, the only pins you need bother about on the 7B T/P's 9-pin plug are: 3 & 5 (magnets) and 6, 7, 8 (keyboard contacts). Some of the circuitry in the 7B is rarely used in amateur RTTY.

### T/P MOTOR SPEED IS VITAL TO GOOD PRINTING!

7B motors must run at 3000rpm for 50 Bauds transmissions, or at 2730rpm for 45.45 Bauds. Motor speed can be altered by adjusting the governor spring tension screw with a screwdriver (slacken the two outside clamp screws first). Unless a pocket tachometer is handy, use a 125 cps stroboscope fork to view (in bright light) black and white segments painted on the governor cover (50 Bauds: 5 black/5 white. 45.45 Bds: 11 black/11 white). U.S. Teletype Corpn. T/Ps use other motor speeds and need different forks (eg. 87.6 & 96.19cps) for the two speeds.

### BFO SETTING IS CRITICAL TOO! (on audio-type TUs).

You do NOT tune in RTTY signals using the BFO knob - RTTY is tuned in with the tuning knob as with other signals. The BFO pitch needs to be correctly set at the very start, and a large 'DO NOT DISTURB' notice hung on it after that. Set the BFO correctly this way:

BFO off, tune in a steady Mark (ie, any steady signal such as from your VFO) for max S-meter reading. If the S-meter falls when VFO is on Space, tune RX slowly half-way back to the max reading you got on Mark. If on switching back to Mark S-meter stays steady, this is the spot. If not, find the RX tuning point where S-meter stays steady when VFO flicks back & forth between Mark & Space (which ensures equal Mark & Space input to the TU).

BFO on again, set BFO pitch for correct M & S tones in TU (found by watching TU tuning indicator, the discriminator output meter, or a VTVM or CRO at both tuned filters in TU). Having thus set the BFO - leave it there!

The foregoing method pre-supposes that you have a VFO already fitted with an FSKeyer. If you have no gear to inject an FSK signal into your RX, you will get near the correct BFO setting by tuning the RX for strongest signals (BFO off) then (BFO on) watching the input and discriminator output meters on the TU while slowly moving the BFO pitch from zero to max on one side. When correct the input meter stays quite steady on continuous RTTY, while the discriminator meter will swing equally either side of zero. Other TU types may have flashing Mark and Space neons to watch, or some other method of display.

#### MATCHING THE RECEIVER OUTPUT TO THE TU INPUT.

TUs have a standard input impedance of 500/600 ohms. It is, therefore, no use connecting it to the low-impedance (3-7 ohms) output of many receivers. Many people run into difficulties due to a bad mismatch here. Some surplus RXs do have a 600 ohm output (eg. AR88) however. If you need a matching transformer, but do not have the correct type, try all the transformers you have in the junk box, and compare the input into the TU with each one. Heater transformers have been known to afford a reasonably close match in an emergency!

If your TU uses a polar relay to key the printer loop be sure the relay is correctly adjusted and contacts are clean. Loop current, too, is important: 20mA for a 7B, or 60mA with most single-current U.S. T/Ps. Use a meter!

#### WHAT CAN YOU PRINT - AND WHERE?

With correct tuning, BFO setting, and motor speed, your T/P should print off any strong RTTY signal using 850 cycles frequency shift and the same speed as your own. Try your TU's 'Normal/Reverse' polarity switch on both positions in case the station is keying "upside-down". You will soon come to recognize the rhythmic sound of the frequently-used RYRYRYRY signal, and if it prints out as SYSYSYSY, throw the polarity switch to get the correct signals. One of the CRT tuning indicators used with a TU are a great help in quick, accurate acquisition of a RTTY signal, especially in your early days.

Don't get discouraged if some of the strong RTTY signals you tune in produce only garble: amateur RTTY gear takes the simplest form of single-shift transmission and

many commercial stations use other values of frequency shift, different speeds (eg: 75, 100 Bauds), multiple-shifts, special error-correcting techniques, etc. Also, some high-speed Morse commercials use FSK transmission (but using the Morse code, and not the 5-unit Murray code used for RTTY... You would be surprised how many amateurs think that RTTY is merely high-speed Morse!)

Amateur RTTY can be found on the 80, 40, 20, 15, 10, 4 & 2 M. bands (NOT permitted on 160M), but most of the activity is on 80M (G's on 50 Bds around 3540kcs, Europeans on 45.45 Bds 3580/90kcs, W's around 3620kcs also on 45.45 Bds), on 20M (around 14090kcs, 45.45 Bds), and there are many local nets in G, PA, DL, etc. on 2 & 4M.

Due to the use of two operating speeds (50 & 45.45 Bauds) many RTTYers build dual-speed governors to allow quick switching between the two speeds. The best-known published designs are by G8LT, Rudge and Wadsworth.

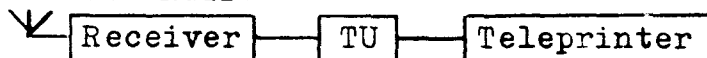
Standard amateur frequency shift is 850 cs (ie: the separation between the Mark & Space frequencies) using the two audio tones 2125 & 2975cs (but RTTYers sending RTTY with SSB TXs by the AFSK method often use tones more suited to their passband, eg: 2125/1275, 1900/1050). 170cs narrow-shift is also becoming popular on the DX bands, often using 2125/2295cs: it may be more efficient in QRM, and also allows the use of narrow RX filters.

It is standard amateur practice to put the Mark signal on the higher radio frequency, but reversal switches are fitted in most TUs & FSKeyers to correct "upside-down" shifts that may be met (eg: from some SSB TXs).

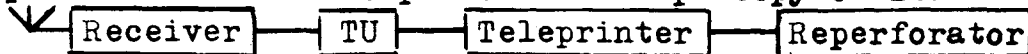
Peak activity in G is around 3540kcs on Sunday mornings (50 Bds) but DX RTTY rolls in any evening on 14090 kcs (45.45 Bds) if you want to print some exotic calls. Every Friday evening, 2030-2100 GMT, the headquarters station of the Dutch amateur radio society VERON, PAØAA, transmits a RTTY bulletin in English to amateurs on 3600 kcs, 50 Bauds, and is strongly received in the U.K.

#### WHAT RTTY MACHINE DOES WHAT?

To receive RTTY:

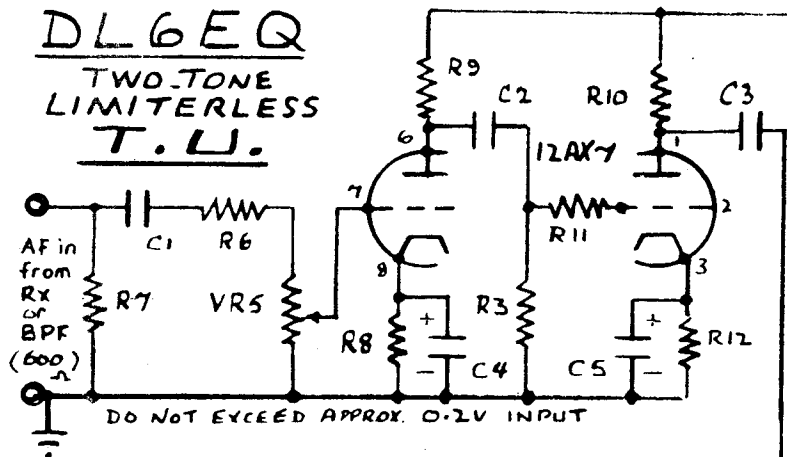


To print RTTY and also perforate a tape copy of it:

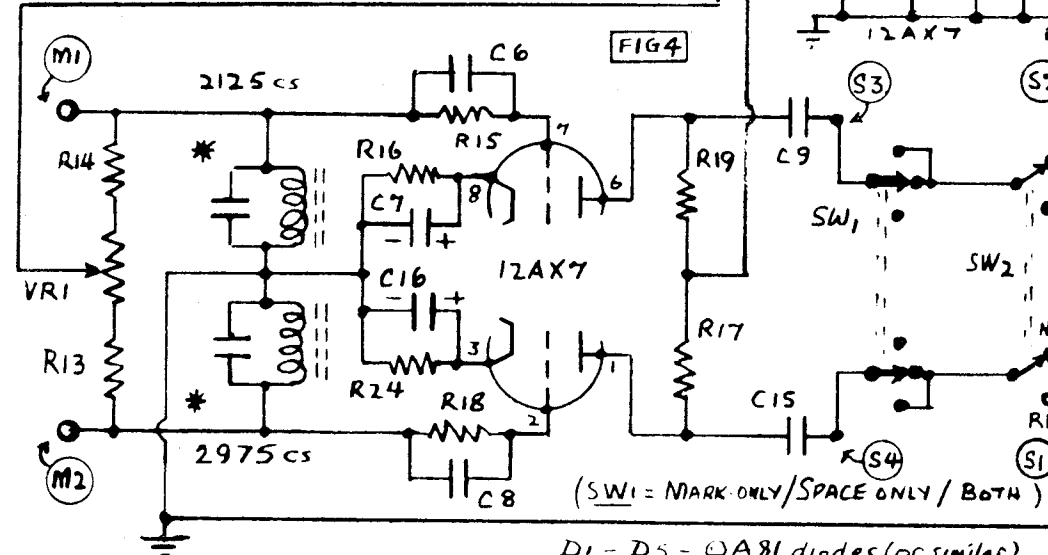


# DL6EQ

## TWO-TONE LIMITERLESS T.U.

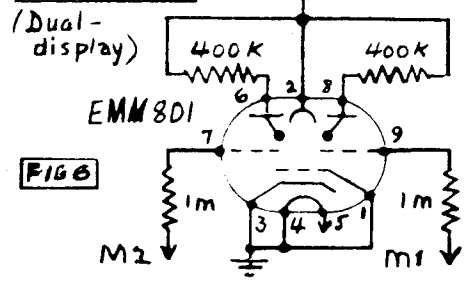


THIS TU DESCRIBED BY G3CAG IN "SHORT WAVE MAG" FOR AUG. 1965



(SW1 = MARK ONLY / SPACE ONLY / BOTH)

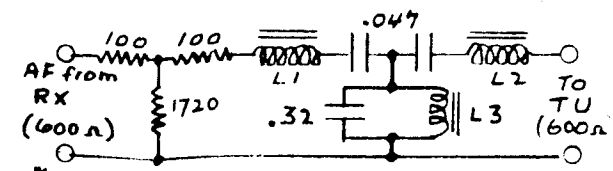
### MAGIC EYE TUNING INDICATOR



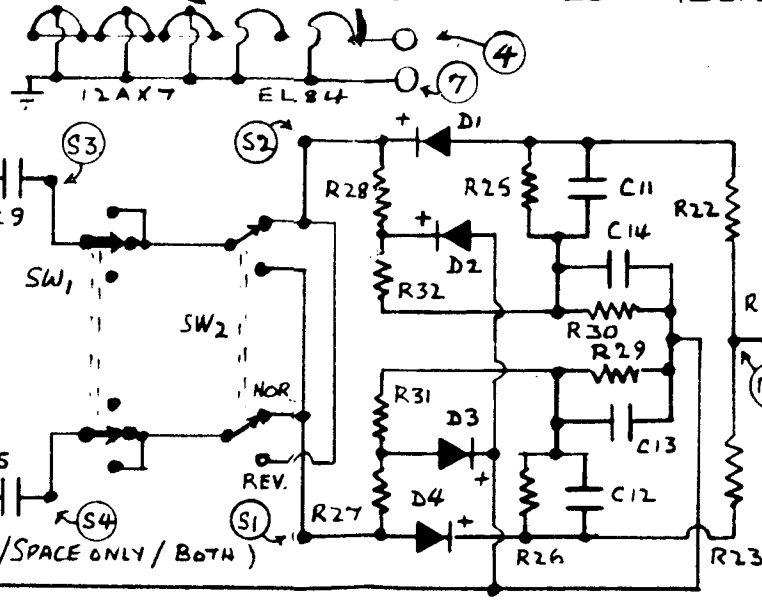
- C1, C2 - .0032uF 125V
- C3, C6, C8 - 100pF 50V
- C9, C15 - .01uF 400V
- C4, C5, C7 - 100pF 50V
- C16 - 20uF 15V
- C10 - .005uF 125V
- C11, C12 - .033uF 125V
- C13, C14 - 0.22uF 125V
- R1, R9, R10 - 100K 1/2W
- R17, R19 - 200K 1/2W
- R2, R3 - 50K
- R4, R11 - 50K
- R12, R23 - 300K
- R6 - 160K 1/2W
- R7 - 600Ω
- R8, R12, R13, R14 - 200Ω
- R16, R24 - 2.200Ω
- R20 - 4.7MΩ
- R21 - 220K
- R25, R26, R27, R28 - 100K
- R31, R32 - 20K
- R29, R30 - 1MΩ
- R33 - 2.2MΩ
- VR1, VR2 - 100K LIN.
- VR3 - 5K LIN.
- VR4 - 5K 10W LIN.
- VR5 - 200K LOG.

POINTS MARKED ARE ON DL6EQ'S PRINTED CIRCUIT BOARD.

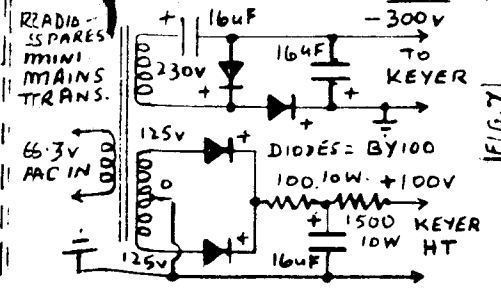
**BANDPASS INPUT FILTER** Typical values  
 L1/L2 - 88mH toroids (2 windings in series)  
 L3 - Use 1 winding of 88mH only, with 14 feet of the wire removed



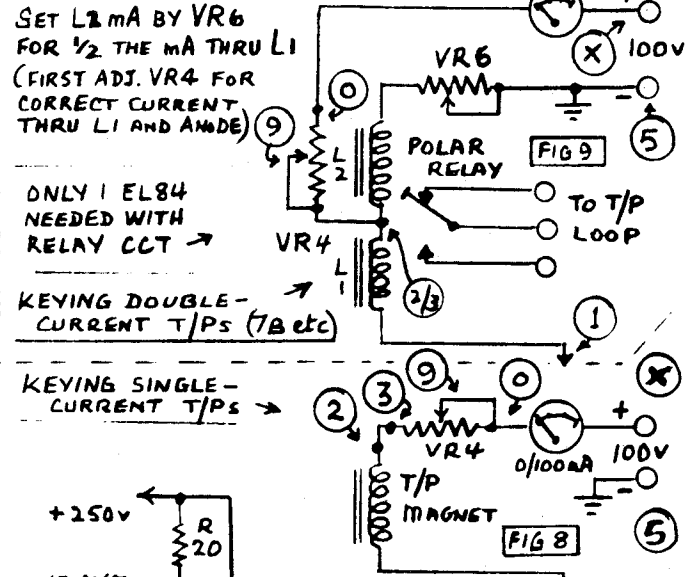
**DL6EQ T.U. PRINTED CIRCUIT BOARD, BP/2125/2975 FILTERS, MAGIC EYE KIT, ETC. OBTAINABLE VIA THE EDITOR, G2FUD**



### G3LN PSU FOR THE T.U.'S +100V AND -300V VOLTAGES



### G8LT POLAR KEYING MOD.

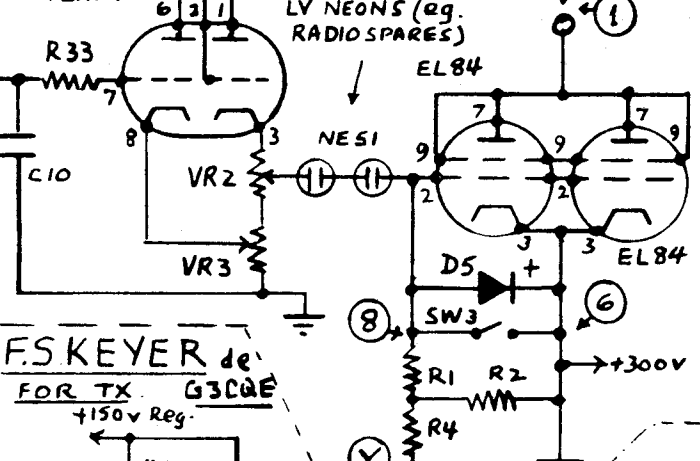


SET L2 mA BY VR6 FOR 1/2 THE mA THRU L1 (FIRST ADJ. VR4 FOR CORRECT CURRENT THRU L1 AND ANODE)

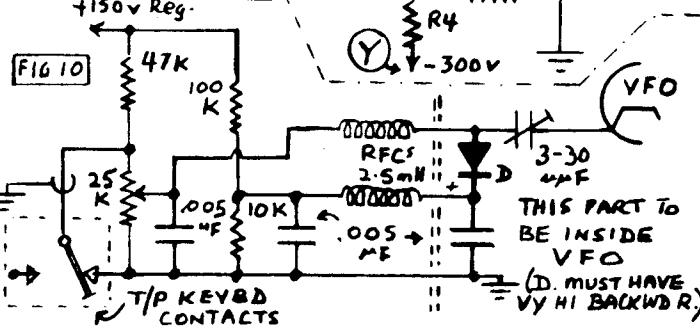
ONLY 1 EL84 NEEDED WITH RELAY CCT →

KEYING DOUBLE-CURRENT T/PS (7B etc)

KEYING SINGLE-CURRENT T/PS →



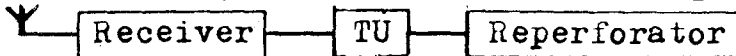
### F.S. KEYS de G3CAG FOR TX



THIS PART TO BE INSIDE VFO (D. MUST HAVE VY HI BACKWB.R)



To punch a tape from received RTTY sigs (no printed copy)

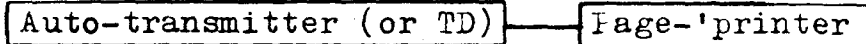


To perforate tape for later transmission (or print-out):

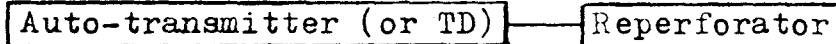
Either: Keyboard perforator only

or: Teleprinter — Reperforator

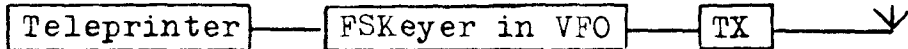
To print out from a perf'd tape onto a page-roll:



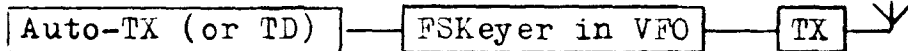
To make a perf'd tape copy of an existing perf'd tape:



To transmit RTTY from Teleprinter keyboard:



To transmit RTTY from a pre-perf'd tape (eg: CQ calls):



Whenever a Reperforator appears in the above blocks, it can be either the Printing (or Typing) Reperforator, or the Non-Printing type. Both types perforate the message on 11/16" wide parchment tape, and the Printing Reperf (you've guessed?) types the message on the tape as well. Some Reperfs (eg: Teletype) use the "chadless" method of perforating: the holes are not completely punched out, leaving a little "hinge" of paper. These tiny chads lift easily under the sensing pressure of the five peckers of the Auto-transmitter or Transmitter-Distributor (TD) but are smoothed down once outside the gate to give an apparently unperforated tape to print on.

Obviously, the more RTTY machines in your shack, the more complex your control switching and inter-connections. However, modern multi-function machines (eg: page printers fitted with built-in reperf and auto-TX) help to simplify wiring and use less space in the shack.

### YOUR FIRST RTTY TRANSMISSION.

Any early difficulty in making contact with another amateur RTTY station (assuming your shift, and motor speed, are correct) usually results from not zero-beating your Mark freq with that of the other man (if he is

already in QSO, his RX crystal filter may cut out any sigs either side of the channel), or the polarity of your shift is opposite to that in use by the other fellow(s) called. REMEMBER: zero-beat, shift same way up!

If calling two RTTYers already in QSO, observe the above, then peck out RYRYRY DE G3ZZZ smartly while one of them is sending his brief DE G2QQQ identification on CW at the end of his over. Nothing catches a RTTYer's ear more than another RTTY signal in a welter of CW sigs - so DON'T waste precious seconds lumbering through an initial CW call. The other man has his hand poised on the 'transmit' switch, but he may hear your RTTY during his partner's CW IDENT. He may then either give you K right away, or bring you into the contact when he signs.

Don't worry about your slow typing speed - RTTY is not a rat-race yet, and most RTTYers are tolerant chaps, but DO MAKE YOUR OVERS SHORT AND SNAPPY! Five minutes is long enough in the early days, and never over 10 mins

How do you start your transmission?

(On CW): DE G3ZZZ (Then switch to RTTY):

LTRS LTRS LTRS CAR-RET CAR-RET LINE-FEED

LTRS LTRS LTRS RYRYRYRYRYRYRYRYRYRY CAR-RET CAR-RET LINEFEED

LTRS LTRS LTRS G2QQQ DE G3ZZZ .... and you're off!

At the end of every line send CAR-RET CAR-RET LINEF'D LTRS LTRS LTRS - it will soon become an unconscious and efficient habit, and will keep errors due to QRM/QSB down to a minimum. RYRYRY at the start helps tuning-in.

End your over with G2QQQ DE G3ZZZ KKK (but don't go over leaving the other man's carriage stuck halfway down a line - finish off with a neat CAR-RET CAR-RET LINEFEED LTRS LTRS LTRS, send your DE G3ZZZ on CW, and go over).

If your RX (or the other TX) drifts, you may have to retune him slightly - a tuning 'scope speeds tuning in.

If conditions are poor, with QRM/QSB, send LTRS or FIGS several times whenever you change case. It helps.

CW ID is often sent with very narrow-shift (FSK), and within the bandwidth of the TU Mark filter, so that T/Ps do not run wild on the Spaces. Switching from the shift-width pot in the FSKeyer to another pot easily achieves this narrow-shift CW ID. Be prepared to find that some of the overseas RTTYers do not send CW ID, but start up immediately on RTTY.

HOW DO I MONITOR MY OWN TRANSMISSION?

New RTTYers often wonder how to get the printer to provide a record of what you are sending to the other station. The simplest way to monitor your print is to use those spare contacts on the TX SEND/RECEIVE relay to switch either the T/P keyboard contacts, or the TU relay contacts, to operate the printer (like SW1 in Fig. 1). Then if you insert the windings of another polar relay in series with the local-record (self-print) loop, its contacts will key the TX FSKeyer with simultaneous print-out. Result: automatic printing from the keyboard at any time when not receiving from RX/TU. (With this simple system it may be advisable to monitor the TX RF output... it is so easy to forget to close the Morse key after the first CW ID, with the result that you have no carrier and you're sending only to yourself!) Some tune in their own sigs on the RX/TU at reduced sensitivity (disabling any RX muting), but they always have a trained octopus standing by to handle all the retuning and RF Gain knob-twisting that this method entails. Sure, it proves you're pumping out the RF - but it COULD be from just the VFO alone, and no HT on the final!

Another thought: instead of using TX relay contacts as suggested above, you can use the S/R contacts in the 7B keyboard unit to switch automatically between TU and local record. These S/R contacts are much neglected.

WHERE ELSE CAN I READ UP ON RTTY?

TELEGRAPHY by J.W.Freebody (Pitmans, £4). Your local library will get it for you. This 738pp. tome covers Creed machines, polar relays, FSUs, etc. in detail up to about 1958. It does not cover adjustment & maintenance.

THE NEW RTTY HANDBOOK by B.H.Kretzman W2JTP (CQ mag.) In the UK from RSGB (30/- pp) or S.W.Mag.Ltd. Covers the entire US RTTY scene, T/Ps, circuits, theory, etc.

HAM RTTY by W2NSD/1 & W4RWM. (73 Inc, Peterborough, N.H, USA, \$2. or via RSGB?). More US T/Ps, circuits, etc

BARTG RTTY MANUAL. The Radio Teleprinter handbook. Published by R.S.G.B. Issue date 1973.

Monthly journals: RSGB BULLETIN, SHORT WAVE MAGAZINE, RADIO CONSTRUCTOR, DL-QTC (Germany), SSB & RTTY PRESS (Italy), QST, CQ, 73, RTTY, RTTY BULLETIN (USA), feature regular RTTY articles. Also BARTG NEWSLETTER quarterly.

TO JOIN BARTG, complete and send the form below to the Hon. Treasurer,  
..... Cut off along this line .....

BRITISH AMATEUR RADIO TELEPRINTER GROUP

TO THE HON TREASURER: Miss G W Southby, 51 Norman Road,  
Swindon, Wilts. SN2 1AX (Tel. 0793-21740)

I wish to renew/apply for BARTG Membership, and require:

- Membership: 75p (or £3.00 overseas).....
- $\frac{1}{2}$ yr Membership - when payment is made after the 30th June of  
any year: 40p. (or £1.50).....
- Lapel Badge: 13p (or £0.50) Buttonhole or brooch fitting? ...
- Lapel Badge with callsign: 30p (or £1.00) Delay 13 weeks ....
- OR 35p (UK MEMBERS ONLY) Delivery 5 weeks .....
- PLEASE STATE CALLSIGN & WHETHER BUTTONHOLE OR BROOCH FITTING.
- BARTG Diamond Windscreen Sticker, 15p (or £0.50).....
- "RTTY - The Easy Way" booklet, 15p postpaid UK/Europe .....
- 35p (£1.00) Airmail .....

I Enclose crossed cheque/PO made out to "BARTG" for .....

Name ..... Callsign .....

Address ..... Town .....

County ..... Code .....

Telephone No ..... Date .....

PLEASE  
PRINT!

FOR BARTG USE ONLY: Renewal ..... New Member ..... Badge .....

RTTY W/Strkr Cheque PO Date RECD .....

Remarks \_\_\_\_\_



WHY STRUGGLE ALONG ON YOUR OWN?

J O I N     B A R T G !

- founded in 1959, and for many years the only 100%-RTTY society in Europe.

With a head start like this, the chances are that we know the answer to your RTTY problem!

DON'T PUT IT OFF - JOIN NOW!

Tear off the Application form overleaf, and post it to the  
HON. TREASURER.

DO IT TODAY!!!

WHERE DO YOU GO FROM HERE?

Work as many stations as possible, improve your typing speed, and your station control system for snappy changeovers and automatic monitoring. Soon you will be looking for more gear to enable you to perforate your reply on 11/16" perf tape while the other man is sending to you so that, as soon as he signs, you merely clip the start of your reply tape into the auto-TX gate and off goes your answer automatically at the full RTTY speed. No "what-shall-I-say-next?" pauses - just a slick and professional torrent of RTTY. Using tape like this, you can get a surprising number of words across in five minutes! Later on, you'll be working the DX on 20 and 15 M (and 10?), entering the three annual international RTTY DX contests, and applying for BARTG's QCA AWARD after you have worked/confirmed 25 countries. If you haven't done so already, you will certainly join the BRITISH AMATEUR RADIO TELEPRINTER GROUP (BARTG), and so be able to make full use of the many services it offers.

BRITISH AMATEUR RADIO TELEPRINTER GROUP

Formed in 1959, BARTG encourages and co-ordinates the use of RTTY as an efficient mode of amateur communication, and the Group offers its Members many services.

BARTG NEWSLETTER is published quarterly. Enjoying a world-wide circulation, it includes technical articles, RTTY news, and sources of supply of RTTY equipment.

Additionally, the Group provides a service to its Members whereby funds are provided for bulk purchase of scarce equipment which can then be re-sold to those in need of it.

BARTG sponsors the annual international SPRING RTTY CONTEST, and also the QUARTER CENTURY AWARD (QCA) for two-way RTTY contacts with 25 or more countries.

Membership lists are issued annually to enable other RTTYers in the vicinity to be spotted. Attractive lapel badges (also with callsign) and a self-adhesive car window sticker will aid recognition. Membership costs only 75p (or \$3.00) per annum, renewable in January.

# RTTY - THE EASY WAY

## ----- CONTENTS -----

What do you need to receive RTTY? .....	1
... And to transmit by RTTY? .....	1
What does RTTY cost? .....	1
The Terminal Unit .....	1
The Teleprinter .....	2
Motor and Loop power supplies .....	2
Simple control system for 80-0-80V loop ....	3
Control system for single-current loop ....	3
Power supply for 7B T/P DC motors .....	3
80-0-80V loop power supply .....	3
T/P motor speed is vital to good printing! .	4
Receiver BFO setting is critical too .....	4
Matching receiver output to the TU input ...	5
What can you print - and where? .....	5
What RTTY machine does what? .....	6
DL6EQ two-tone limiterless TU circuit .....	7
DL6EQ BF filter & Magic-eye indicator .....	7
Power supply for DL6EQ TU (G3LZN) .....	7
Polar keying circuit for DL6EQ TU (G8LT) ...	8
FS Keyer for transmitter (G3CQE) .....	8
Your first RTTY transmission .....	9
How do I monitor my own transmission? .....	11
Where else can I read up on RTTY? .....	11
Where do you go from here? .....	14
British Amateur Radio Teleprinter Group ...	14

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