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ST-6 ADDITION--

Late in August, 'TI' (Texas Instruments), made a radical reduction in cost of the 709C op amp. While most competitors are still charging approximately $2.60 each, 'TI' now charges only $1.00 brand new from any of their distributors for the dual inline 14-pin "dip" package. They charge $1.25 for the round 8-lead TO-5 can, that fits the boards we designed for the ST-6. Order the following:

SN72709N - 14 pin dual inline $1
SN72709L - 8 pin TO-5 $1.25

These are the commercial-grade and prices are for 1-99 items.

The p.c. boards use 12-pin connectors with .156" spacing. Amphenol type 143-012-01 are suggested, at $1.21 each. Others will work as well, but may be more expensive.

Irv. W6FFC

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OCTOBER 1970

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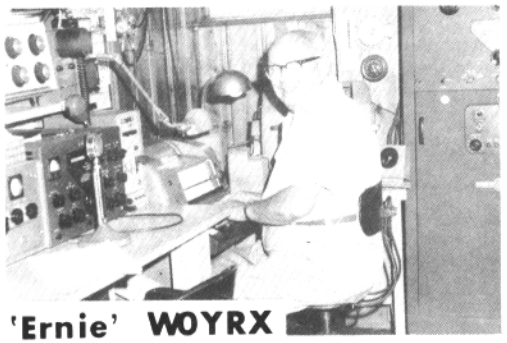

'Ernie' W0YRX

'Freeman' KH6A X

CONTENTS

FSK for the DRAKE *T4X*

LARRY FILBY', K1LPS
P.O. Box 47
PEACHAM, VERMONT, 05862

Having just completed putting shifter circuitry in the T4X I'd like to pass along a few ideas that might be of interest to others. The original idea started with the design of a PC board with dual shifters for wide and narrow shift. Circuit used was the well known Mainline shifter. The PC board layout is not shown because it is very simple to design around the particular components that the builder may already have on hand. The board measures 1-1/2" X 3" and components used here were Elmenco-Arco #423 7-100 pf trimmers, 1N177 diodes and necessary RFC's and bypasses. The 7-100 pf trimmer used for the wide shift side may have to be paralleled with additional capacity in the form of a 100 pf silver mica but this is easily accomplished on the underside of the board if necessary. Circuit values are given in the Drake instruction sheet for both tube and solid state VFO's. Mounting of the PC shifter and selection of shift can be accomplished in several ways. W1GKJ mounted his dual shifter board upright near the auxillary crystal sockets using a small "L" bracket. Switching was accomplished by installing a small slide switch in the spot provided for the crystal socket that is used for the T4 but not the T4X. The same chassis and cabinet is used for both models and when the unit is built as a T4X, the unused socket hole is simply covered with black plastic electrical tape. If a slide switch is used, the crystal sockets holes must be filed out to take the new switch. When trade-in time rolls around, the switch can be removed and the hole again covered with tape. If filing a square hole at that position bothers you, here's another suggestion: Get a Model 3501FP phono jack by Switchcraft or similar that mounts by a nut in a 1/4" hole. Mount this jack in the rear socket hole. Obtain a miniature SPDT toggle switch with 1/4" bushing mount and put this in the forward socket hole. These two holes are 1/4" so no modification is necessary here. Shielded cables with right angle phono plug at one end are available and make for a neat connection to the FSK driver. It may be necessary to file very slightly on the cutout made on the bottom cover to clear the switch mounting nut and outer shell of the phono jack but this would never be noticed if the filed edge is touched up with some flat black paint.

Still another suggestion is relay control of the shift from a remote point. This is the method that will most likely be used at this station. It is intended that both transmitter and TU shift be remotely selected from a central console. 28VDC crystal can relays are used at the shifter in the transmitter and at the TU. Power for the relays is derived from a supply in the central control console and lighted indicators show which shift is selected. The dual PC shifter is mounted horizontally above the auxillary crystal sockets and the mounting brackets for the board serve as the mount for the relay. Other means of mounting the relay may suggest themselves when you look the layout over. The PC board could be made large enough to mount the relay directly on top and these relays are available for PC mounting. Whatever type of bracket is used, the PC board is elevated to clear the auxillary crystals. In the case here, if I should ever need to change any of the auxillary crystals, it is a simple matter of taking out three screws, lifting the PC board slightly and making the crystal change. If using either of the manual switch methods mentioned above and lighted indication of shift selection is desired it is a simple matter to use a DPDT switch and use one section for remote indicator lamps.

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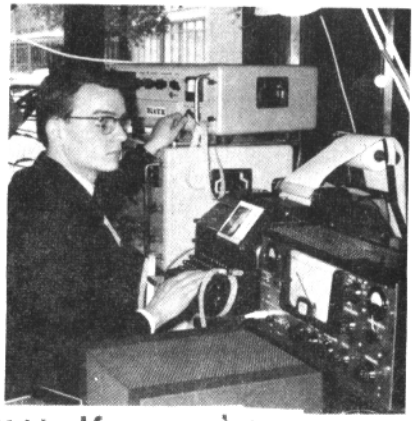


'Wolfgang' DL 8UX

Mainline ⊛ Solid State
ST-6 DEMODULATOR

PART 2

(Continued from September issue)

IRVIN M. HOFF, W6FFC
12130 Foothill Lane
Los Altos Hills, Calif. 94022

Last month we described the basic ST-6 circuit and most of its features. This month we shall go into the nitty-gritty of actually constructing and using the ST-6, plus some other comments of general interest.

CONSTRUCTION

The size of the power transformer and loop transformer rather dictated the size of the overall unit. Those are both approximately 2.5 inches high, so the cabinet almost had to then be a minimum of 3" in height. Various schemes were considered, and originally small cards less than 3" wide were planned. The cost seemed to be prohibitive, when the total number of cards reached 8. Thus other alternatives were considered, such as a couple of 6" by 9" boards. Unfortunately this project was never completed, but the total area in square inches of p.c. board had gotten to the point it appeared no great savings in cost would be accomplished. We then returned to the smaller cards and found that solder-plating the edge connector fingers would be adequate for amateur purposes, rather than the more expensive methods used for the aero-space industry which at first had seemed necessary. The cost of the boards then fell to what most people think is a modest price. However, there are 8 of them if you add both 170 and 850 shift, so the cost is still almost $23 for the 8 boards, pre-drilled. The connectors are $1.25 each, which adds another $10. The boards can be obtained undrilled, for $13.50 for the 8, however the tiny no. 77 drill needed for the op amps is difficult to obtain at most hardware stores, and falls right out of the typical chuck.

By using the 8-board system, a great deal of flexibility is offered, and various boards can be replaced if any changes are contemplated, like a 100-speed board could be built and then exchanged with the 60 speed on the rare occasions the operator might need a 100 speed configuration. Or a 850 shift discriminator could be exchanged with a 400 shift unit, etc. So some flexibility is offered that a vector - board arrangement or one using larger cards might not offer.

With the parts mounted, only the loop supply board exceeds one inch in total height. It also has the current-setting resistor so this board should be the last in the series, and placed so that it faces "open air" for best cooling of that resistor. From the photographs you will see what we have in mind. All other cards can be separated by only one inch.

We used some aluminum brackets that already were drilled at 1" intervals. It made a very neat installation, and left room to also mount the power transformer on the same brackets.

The size of the cabinet was 10" by 12" by 3", although other cabinets will certainly work as well. As an example, with a little care, two ST-6 units could go in one cabinet 17" wide, and the transformers mounted along the rear inside edge of the cabinet, etc.

The cards may be supported in their proper position by a small piece of wood, notched, that runs the width of the cabinet and is fastened to its sides, nothing fancy that would require a machine shop to construct is needed.

While speaking of construction, all the author used to make his unit was an electric drill, some chassis punches (for the meter hole and rear 120V socket for the printer motor), a screwdriver, fine-nose pliers, diagonal cutters, a knife to strip the insulation from the wires, and a tiny soldering iron. These tools are to be found in almost any ham shack.

The cabinet was covered with "shelf paper" obtained at the local dime store for a neat appearance. All the holes were first drilled, then the chassis covered and a sharp knife was used to cut the shelf paper away from those holes. No holes or bolts are in the top or bottom of the unit, only on the sides.

The shelf paper was a light-colored imitation wood grain. Rub-on decals were then added for a nice commercial appear-

ance.

TUNE-UP

The ST-6 was designed so that tune-up and alignment procedures are extremely simple, and once adjusted should not require any further adjustment. All that is needed is a normal d.c. voltmeter reading to at least 12-15 volts.

FIRST - disconnect the audio input or short the input to ground. Put the voltmeter on test point 1 (output of the limiter op amp) and adjust the 25K pot on the input to pin 3 of OA-1 for zero volts d.c. on the meter. It will be difficult to do and the reading will not necessarily "hold", but do the best you can and forget about it.

SECOND -- either move the meter to test point 2, or just observe the tuning meter on the ST-6 itself, now add audio input and tune back-and-forth between mark and space signals, adjusting the 5K pot on the output of OA-1 so both mark and space give the same voltage. This balances the discriminator for equal output.

THIRD -- Tune to steady mark signal and adjust the 10K pot on the tuning meter circuit so the meter reads 70% full scale. Hopefully the meter will read 0-10 and have marks each 0.1 of full scale. Then detune the input signal to where the meter reads only 60% of full scale. Now adjust the autostart sensitivity pot at pin 3 of OA-5 to where the voltmeter (now at test point 4) cannot make up its mind to go positive or negative. If you added the lamp drivers for "standby-receive" you can adjust the 5K pot to where they cannot decide which of the two lamps to display. This is a one-only adjustment.

You are now finished with all the adjustments and can put the bottom on the unit.

The autostart sensitivity primarily sets the bandwidth to which the unit responds. The ratio of turn-on to turn-off time is set primarily by time constants in the autostart stage itself. Thus the autostart sensitivity control is inside the unit on the p.c. board and not on the front panel as on the TT/L and TT/L-2 units.

OTHER "ADJUSTMENTS"

There are no other pots, but there are a few other things which one may wish to change. The feedback resistor on pin 2 of OA-1 (the 47K) was selected for "No bandpass input filter" configuration. If using the bandpass input filter(s) change this resistor to 470K. If you wish, you can hand-pick a value that may work better in your installation. This is simple to do: Tune the receiver to a normal signal, advance the audio gain to the point you normally prefer to run it, put the ST-6 in limiterless and note the tuning meter -- pick a resistor that gives about normal meter reading in limiterless for that receiver -- that is, if you then reduced the volume on the receiver, the meter would go to a lesser value. If this is confusing at all, just use the 470 K and forget about it.

For proper operation of the various circuits, it is quite important to have close to 12 volts from the power supply. With modest-cost Zener diodes, this may or may not be the case. If your voltage is more than a half volt too high, remove the silicon diodes in series with the Zener diodes in the power supply, and short across where they were. If the voltage is less than 12 volts, add another silicon diode in series with the Zeners. On the p.c. boards, provisions have been made for two silicons diodes in series with each Zener. If one or both are not needed, just short across the terminals to complete the circuit.

The voltage at pin 2 of OA-6 should be at least 2.2 volts. If less than 2.2 volts, change the 2.2K resistor to ground to say a 2.4K size. If the voltage is as high as 2.5 it won't hurt anything.

On the anti-space, the 10 Mfd. capacitor (near Q7 collector) can be reduced in size. If you really want to adjust it "just right", keep reducing the value until while sending blanks the printer starts printing the letter "T" instead, then go the next larger size of capacitor. However, the 10 Mfd, should give excellent results.

If you wish, you can measure the current in the loop by placing a milliameter in series with the teleprinter. With the components shown and the Triad N-51X transformer, the meter will probably read just about 60 mills. This is in no way critical, and if you are reading from any 55-65 mills, fine, forget it. You could change the value of the 2750 ohm 20W resistor in the loop supply to something else to get closer to 60 ma. if it bothers you. Anything within 10% of 60 mills is plenty close enough however. For this reason no loop-adjusting pots, or meters are provided on any of the Mainline demodulators, such things are entirely superfluous, but could appeal to individual owners for reasons best known only to them.

The resistor in the collector of Q6 in the autostart relay circuit should be about

the same value as the d.c. resistance of the relay itself. A 500 ohm 5W resistor is shown. Some 24V relays are around 470 ohms, some around 500 ohms, it really doesn't matter all that much -- this resistor merely keeps the current level in the power supply about the same whether the motor is on or off, helping keep the voltage regulation at an optimum stability.

The 3.6V Zeners on the input (OA-1) may be 3.9V, but the 3.6V value allows for inexpensive 20% types to be used, if getting 3.9 V types, make sure they are 10% types. Also 4.3 V 10% units could be used, but are not recommended.

DRILLING THE BOARDS

We mentioned previously that the no. 77 drill used for the op amps (if you drill your own boards) falls out of most drill chucks. For 75¢ you can buy a suitable drill chuck that holds anything from no. 60 to no. 80 drills. It is made by "X-ACTO" (same company that makes the knives for hobbiests) and is their model 22-A-ST drill chuck. It can be found at stores handling the X-ACTO line -- hobby stores, primarily, but some drafting supply stores, some hardware stores, etc. Here is a little chart that Cole Ellsworth W2FLJ worked out:

709C op amps	no. 77 (0.018")
1/4W resistors	no. 72 (0.025")
1/2W resistors	no. 65 (0.035")
1W resistors	no. 58 (0.041")
2W resistors	no. 56 (0.045")

Most standard drill sets only go down to 1/16" in the smallest size. Although this seems "very small" to most people, this is actually 0.0625", substantially larger (by nearly 50% in fact!) than is needed even for a 2W resistor!

You may/may not wish to consider drilling your own boards, then. If your smallest drill is 1/16", forget it!

100 SPEED

Some readers will want to use 100 speed since some MARS nets operate at the faster speeds. It is very simple to change the St-6 for this requirement. On pin 3 of OA-3 are two 16K resistors. Change both to 10K instead. Also between pins 2 and 6 of OA-2 is a capacitor whose size depends on the discriminator being used. Make this capacitor 60% of the size used for 60 speed. Example, for the 850 shift discriminator using 2125 and 2975 tones, the normal capacitor is a 0.03 -- the new size for 100 speed would be 0.018 Mfd.

If you will need 100 speed frequently, we recommend you make these changes when constructing the ST-6, as 60, 75 and 100 speed may then be received suitably.

Since only a handful of people will have need for 100 speed, the schematic was drawn to show the optimum values for 60 speed.

THE LOW-PASS FILTER

While speaking of the low-pass filter, you may wish to read (or re-read) Vic Poor's outstanding article on "FILTERS FOR RTTY" in the May 1964 RTTY issue. He mentions the requirements for minimum bandwidth filter systems, and shows the type of "eye" pattern one would get with a perfectly designed filter for a given reversal speed. At any rate, the low-pass filter in the ST-6 was designed with this information in mind. As it happens, Vic Poor was a house guest at the time we were developing the ST-6, and set up the test equipment needed to observe this eye pattern. We used a Tektronix scope, and he was delighted with the results obtained. Thus it is safe to say the low-pass in the ST-6 is indeed minimum bandwidth. This one item does more for improved performance in mediocre conditions than any other single thing you can do to the typical demodulator.

Although mentioned previously, with 10% capacitors and 5% resistors, the low-pass filter would then give similar performance from one unit to another, while the use of passive components (such as the 350 Hy. choke we used in the Mainline TT/L and TT/L-2) with their 50% tolerance limits cannot achieve such uniformity.

AUTOSTART RATIOS

Ratio	Duty	R61	R59	R60	ON	OFF
2:1	67%	5.1K	390	4.7K	1.80	.88
3:1	75%	3.6K	2.4K	4.7K	2.48	.84
4:1	80%	3.3K	3.9K	6.8K	3.53	.87
5:1	83%	3.0K	5.1K	6.8K	4.16	.84
6:1	86%	3.0K	6.8K	8.2K	5.25	.88
7:1	87%	3.0K	9.1K	9.1K	6.38	.90
8:1	89%	3.0K	10 K	11 K	7.35	.93

TABLE 1.

The last two columns are in seconds. These figures give additional autostart ratios you may wish to try to keep marginal signals from tripping the unit.

Table 1 shows various resistor values that you may try giving more protection against weak signals, c.w., etc. The 8:1

value will take a long time to turn on, and will respond only to excellent signals, ignoring signals too weak to print decently on the machine for the most part. For normal purposes, the 3.3:1 ratio gives adequate protection against c.w., does not take excessively long to turn on, and does not drop out if a decent signal takes a momentary dip. Have fun. The autostart sensitivity pot is set as previously mentioned, and not changed at all, regardless what ratio you have chosen to use.

AUTOSTART BANDWIDTH

When the autostart pot on pin 3 of OA-5 has been set as previously discussed under "TUNE-UP", the unit will respond to signals approximately plus-minus 45 Hz. for the 170 shift filters and approximately plus-minus 100 Hz. for the 850 shift filters.

THE BANDPASS INPUT FILTERS

Some people have wondered what value the bandpass input filters would be where they already have excellent i.f. filters in their receiver, such as 400 Hz. and 1200 Hz. as in the Drake series of receivers. In this case the value of the bandpass input filters is indeed negligible with one exception, they do prevent the hum level in the receiver audio output stage from reaching the limiter. However, the input of the ST-6 (when no bandpass input filter is used) will accomplish this same thing rather nicely. So in the case of the Drake receivers, the bandpass input filters really aren't needed. This assumes you do not, however diddle with the pass band tuning once it is correctly set.

Another astute individual mentioned that he had used a computer to discover that with 60-90 db. of limiting available in OA-1 that the bandpass input filter was useless, since the limiter itself would amplify to at least the 60-80 db. point on the filter skirts anyway. This only indicates that the individual was not familiar with the properties of a limiter, and the "capture effect" limiters exhibit. Any strong signal will capture the limiter in virtual exclusion of other weaker signals, This is a familiar phenomena on 2M FM voice channels, repeaters, etc. If two people are talking at one time, they do not interfere as in "AM" signals where you may hear both of them simultaneously. On "FM", the stronger station captures the limiter and you do not even realize there is a second, weaker station on the frequency at all unless you stop transmitting.

Thus with the bandpass input filter, it still does a lot to minimize the effect a strong nearby station will have on the limiter . If the i.f. in the receiver is rather broad (many receivers have only a 2100 Hz. i.f. position, and no 400 or 1200 filters at all), then the use of a bandpass input filter is most worthwhile, particularly when the operator keeps the r.f. gain back to where even strong signals do not completely capture the AGC in the receiver.

No, even though the limiter has all sorts of gain, it does not mean a bandpass input filter is of no value, as the limiter follows that filter. Again Poor went into some detail on this type of thing in his May 1964 article, one of the really outstanding articles ever written for RTTY enthusiasts, and still the most authoritative discussion of this type available to amateurs. Perhaps the editor will reprint that article at some future date.

BUTTERWORTH FILTERS

3-pole Butterworth filters would be beneficial in place of the simple single-toroid linear discriminators offered. However they are somewhat difficult to make at home, so we started out with the more simple filters. I have 80-Hz. filters for 2125. 2295, 2425, 2905 and 2975 in my personal TT/L, plus linear discriminators for 170 shift and 850 shift. I find myself quite satisfied about 98% of the time with the 850 shift linear discriminator, or perhaps I should say that 98% of the time I prefer the linear discriminator, as it is much more tolerant of signals that are not exactly 850, that drift, etc. Even when I am sitting right there watching the unit perform, I almost never used the 3-pole Butterworth filters unless there is a considerable amount of interference of the frequency.

WHY NO DTC?

This is a complex discussion that I would prefer to avoid entirely. The DTC as used in the TT/L and TT/L-2 is an extremely high impedance circuit. This was done so that relatively small capacitors could be used in 10% values for accuracy. To get the DTC to work properly, the disconnect capacitors have to be completely discharged in one bit time (22 ms. for 60 speed, 13 ms. for 100 speed). Even so, the disconnect capacitors in the TT/L circuit are 0.5 Mfd. To short out a capacitor this size in only a few milliseconds takes a pretty hefty system. It was taxing the cathode-follower to do this properly. This is why the DTC in the TT/L-2 doesn't really work properly at 100 speed where

the total bit time was less than the discharge time.

In the ST-6 we could easily discharge a much larger capacitor in only 2-3 milliseconds, but other problems then become important. In the TT/L and TT/L-2, we had some 60 volts of mark and space signal to play with. In the ST-6, we only have about 9-10 volts instead. We thus went to Germanium diodes rather than Silicon to get comparable dynamic range. These diodes do not have high reverse resistance, so cannot be used in high impedance circuits.

To circumvent the forward voltage drop of the diodes so that 50-60 dB. dynamic range or more could be realized, op amps could be used. Indeed a DTC circuit has been developed which offers 70-80 dB. dynamic range, but it uses 8 op. amps. In order to use this to advantage, you could not use diode detection either, but would need an active detector. We also have developed this circuit, but again it takes another op amp plus a discrete stage.

Since the only time the DTC circuit really comes into its own is during limiterless AM copy on slow hand-sent signals, we decided to just leave it off entirely -- our experience has shown that few people use limiterless copy except in rare occasions anyway -- due probably to the fact the automatic printer control (autostart system) must be disabled.

This entire subject is worth an article all its own. We felt the improvement offered by the DTC during conditions that few people normally use anyway was hardly worth the rather complex circuitry needed in solid-state units.

This is why we wince whenever somebody tries to come up with a solid-state replacement for the TT/L-2, and includes the DTC together with lots of silicon diodes. Although they don't really have a good grasp of the problems involved they plunge ahead anyway, and the typical reader thinks boy this is great, and it has DTC also. The truth is those units would do well to get even 20-25 dB. of dynamic range -- this would be the theoretical limit, in fact.

NEARBY R.F.

These 709C op amps have such fantastic gain we were afraid they would amplify every broadcast station in town unless great care was used, short leads, etc. We added by-pass capacitors to each op amp power supply lead, to the input, and to the power supplies. We are able to run a full kilowatt on any band and yet not affect the ST-6 adversely, in fact our ST-6 is used on 20M autostart, yet copies just fine while transmitting on the 80M band.

170-850 SHIFT BOTH

You will need a two-position multipole switch for this. You would want to switch the audio input, the mark scope display, the space scope display, the output of the limiter, the 47K (or 470K) limiter-out resistor, the autostart (and meter) line, and the discriminator output to the input of the low pass filter. This is perhaps 7 items to be switched. I used a two-section (6 poles per section) two position ceramic switch. Since this gave me 12 poles, I also switched the unused bandpass input filter to ground, and also switched the unused board to limiterless configuration, to eliminate any possible cross-talk.

CHECKING FOR OSCILLATIONS

The OA-1 limiter is run "wide open" with minimum frequency compensation for maximum loop gain. The unit was tested with seven different op amps and no oscillation occurred. You can quickly determine if there is any such oscillation by looking at the tuning meter with no audio input connected. If the meter does not say "zero" reading, you probably have an oscillation. Try the unit both in limiter on and limiter off to see that the meter does indeed read or remain at zero. It should. If it doesn't, you may wish to put a 5-10 pf. capacitor across the feedback resistor if this occurs in limiter off position as well as increase the value of the 47 pf. on pin 8 of OA-1 to perhaps 68 or 82 pf. If you do get an oscillation and these steps do not immediately cure it, replace the 709C op amp and go back to the original values and start over. One individual got this oscillation and found he had a bad op amp for OA-1.

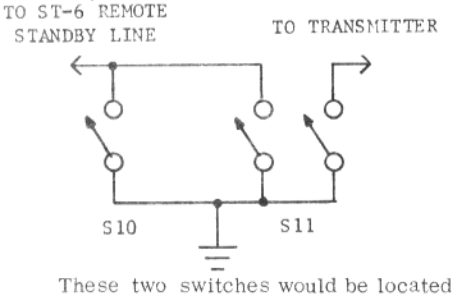
SHIELDED LINES

The boards were all laid out so that shielded lines are not needed with one exception, we found it would be advisable to shield the lines to the scope jack on the rear, as they are rather high impedance on most scopes, and you can pick up "cross-talk" very easily from the other channel.

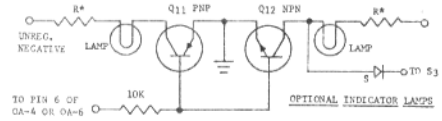
INDICATOR LAMPS

Fig. 1 shows an indicator lamp system -- if attached to pin 6 of OA4, they will show mark and space. While nice it is somewhat superfluous, and most operators

prefer to have an indication of standby and receive instead, so attach it to pin 6 of OA-6. In this case the diode is added to the collector of Q-12 (it would be left off for the mark-space indication by the way) and connected to the standby switch S3. There is no provision for this diode on the p.c. boards. All other components except the lamps themselves are on the boards, however.



These two switches would be located at or on the printer. S10 provides a standby line that also turns the motor on if it has been off. S11 is the master station control and turns the transmitter on while putting the ST-6 in standby. With these two switches at the printer, the ST-6 need not be within arm's reach.



Say you have a green lamp for receive and a yellow lamp for standby, in this case whenever the standby switch S3 is used, both the yellow and the green lamp come on. The green lamp merely indicates that the autostart system is off, the yellow lamp merely indicates that the autostart system does not think there is a signal or that the unit has been placed in standby by the anti-space or the standby switch itself.

The fact that both lights come on whenever the standby or remote standby switches are used makes an excellent fail-safe indication that you indeed do have the system in manual standby. Thus you would not wish to leave the room with both lights on, as this would indicate the automatic system was disabled -- also the motor will stay on which is a second indication.

The lamps should be low-current types. Most 12V lamps are 80-170 mills, and this is really too much for the transistors to handle with only a 10K resistor to their base. We suggest you use Sylvania cartridge indicator lamps - they have one that takes only 15-20 mills at 16 volts, others that take only 35-40 mills at 18V. Both Allied and Newark handle the Sylvania brand. If you must use lamps that require 80 ma. current, change the 10 K resistor to a 4.7K value.

PARTS

You will no doubt wish to scrounge many of the parts from the junk box. All resistors can be half-watt or even quarter-watt except where shown otherwise. On some diagrams the 33K on pin 6 of OA-4 is shown as a 1W, the draftsman marked the wrong resistor, the 2.2K on the base of Q1 should be 1W, the 33K can be 1/4W or more.

The 5W resistors can be Ohmite type 99, Sprague type 243E, Mallory type 5MOL, etc.

The op amps must be the TO-5 type round can with 8-pin leads for the p.c. boards, if making your own boards or using vector board, you may prefer the dual-inline 14-pin types. Motorola, Signetics, Fairchild, National Semi-Conductor, and Texas Instruments all make the 709C units, but call them by somewhat differing names. Prices are constantly dropping on these, it is possible to get them from some manufacturers for as low as $1 each in small quantities (1-99) now.

Nice 0-1 ma. meters are available for under $5 -- the one I used was gotten at "Ham Shack" for $2.98 -- this one was on the ST-5 pictured in the July-August RTTY JOURNAL. The one on the ST-6 is a "Micronta" for under $5.

The relay is any 24V (approx. 500 ohms d.c. resistance) DPDT type, such as the Potter and Brumfield KA11DG for $3.90.

The pots are 39¢ Mallory MTC-L1 for vertical mounting on p.c. boards. (The MTC-L4 are for horizontal mounting.) IRC makes a similar type of pot also for 39¢.

The smaller value capacitors that fit the p.c. board best are Sprague "Orange Drop" Mylar-types, 75 volts or more rated. The 0.1 Mfd. 400 volt in the collector of Q1 was a Sprague "Black Beauty" type 160P. The 10 Mfd, 20 Mfd, 150 Mfd, and 350 Mfd. are Sprague type 30D. The 100 Mfd, 250 Mfd, and 1000 Mfd. in the power supply and loop supply are Sprague TVA electrolytics. The 0.1 Mfd. capacitors used on pins 4 and 7 of each op amp are Sprague Hypercon disc ceramic type HY-550 at 25V, for 21¢.

Diodes marked "G" are 1N270 germanium Those marked "S" are silicon, 50 PIV except those in the loop supply which must be at least 400 PIV. The 3.6V Zener diodes can be Motorola type 1N5227 at $.67 and the 12V can be 1W such as the Motorola 1N4742, etc. Other types may be substituted.

Q1 is a Motorola MJE-340 for $1.06. Other 300-500 volt transistors rated 5W or more will work as well. Q2, Q3 and Q4 are normal PNP such as MPS-3703 for 39¢. Q5 and Q6 are medium-voltage NPN such as MPS-6565 for 52¢. Q7 and Q10 may be MPS-3394 for 27¢. Q8 is a NPN such as the MJE-340 or RCA 40635 or 40314. The PNP used for Q9 may be a MJE-370 or RCA 40537 or 40362. Others will work as well, make sure they are at least 5W.

Other types of transformers may be used. The Stancor PA-8421 makes a good loop transformer. Literally any 24VCT transformer of at least 400 ma. will be suitable for the power supply.

The toroids are 88 mh. types obtained from several advertisers at the rear of this publication.

ST-6 KIT OF PARTS

Arrangements have been made with George Perrine W9KOI of Hal Devices to supply a complete kit of parts for the ST-6. This includes p.c. boards (available separately) for the dual-inline 14-pin op amps. A brochure listing prices and options is available from:

HAL DEVICES
P.O. Box 365
URBANA, ILLINOIS 61801

Approximately $25 can be saved over prices normally paid when the items are purchased separately.

George also mentions they can build a limited number of complete ST-6 units ready to use.

An unique transformer is also available from Hal Devices that has both the loop supply winding and the 24VCT winding as well. This will save money for the ST-6 as well as other solid-state projects, and take up substantially less room.

Newark in Grand Rapids is no longer able to offer this service, as Truman Boerkoel K8JUG has been transferred to the home office in Chicago.

Charlie Halle W1KJL in New Hampshire is also offering a kit with most of the parts (less p.c. boards).

John Roache W1SOG of 'J-J Electronics' is also planning to offer the complete ST-6 unit ready to use, on a custom-built basis.

·Check the ads in this issue for more information.

ST-6 BOARDS IN CANADA

Len Morris VE3FJB has made arrangements for ST-6 p.c. boards to be made in Canada. They will be available from:

SPACE CIRCUITS LTD.
156 ROGER STREET
WATERLOC, ONTARIO
ATTN: MR. HUGH WATT
VE3HY, PRES.

The boards are on fiberglass, are tinned, drilled and back marked.

FUSES

The fuses shown are correct if no indicator lamps are used. On the p.c. boards, these lamps connect downstream of the 10 ohm resistors, so the fuses may need to be the next larger size. It will depend upon the current in the lamps you choose.

SWITCHES

S7 is shown in 120 VAC 'off' position. All other switches are shown normal autostart receive with the exception of S-4A which is shown in 'FAST' autostart. We recommend you orient the switches so they would all be in the 'up' position for normal unattended automatic reception.

HEAT SINKS

On the main power supply, if using any of the RCA transistors for Q8 and/or Q9, finned heat sinks would be advantageous, as there will be around 0.4 watt dissipated, these transistors are normally rated at 1W in free air. The Motorola types are rated at over 20W, however they will only take a maximum of 500 mills. The ST-6 pulls approximately 75 mills on each of the two supplies. While speaking of the power supply, the p.c. boards are laid out for the Motorola MJE -- transistors. The RCA and others will fit, but follow the instruction sheets very carefully, as the base terminal is in a different position than on the other transistors on the other boards.

OPTIONAL AUDIO TONES

Many people say they "cannot receive 2975 audio" and must have other tones like 1275-2125. In almost every case, receivers CAN in fact receive 2975, but it requires changing the BFO crystal or the carrier oscillator crystal about one kHz. from that normally used. This is usually fairly simple to do, and the results are superior to those obtained when using 1275-2125 audio

for reasons beyond the scope of this discussion. However for those who insist on using 1275-2125, here are the values:

DISCRIMINATOR VALUES FOR "LOW TONES"

	170 1275/1445	850 1275/2125
R'A' (R1)	2.7K	1.5K
R'B' (R2)	27K	8.2K
R'C' (R3)	2.7K	2.2K
R'D' (R4)	240K	160K
C'A' (C1)	.18	.18
C'B' (C2)	.12 +.018	.068
C'C' (C3)	.022	.033

The numbers in parenthesis are designations originally put on the schematic prior to numbered components; many people who sent for the original schematic would not recognize the newer designation on the current schematic.

No bandpass input filters are contemplated for the "low tones", as most serious enthusiasts do not use 1275-2125.

TUNING THE FILTERS

The capacitor values for tuning the filters are only approximate. You will need some means of determining accurate mark and space frequencies. If not familiar with the procedure used to tune the Butterworth bandpass input filter, you may wish to review the article on this subject in the Sept. 1966 QST magazine by the author. A quick review is to leave the input and output resistors off temporarily, short across the middle toroid and tune the first and third sections independently. Then remove the shorting wire on the middle toroid and short across the first and third toroids. Now tune the middle section. Remove the shorting wires, add the resistors and you are finished.

If you have a digital counter a good way to tune the mark and space filters accurately is to tune for maximum voltage on the meter, then tune to either side for the same meter reading, read the counter for each and average to find the center frequency, and make whatever adjustments are indicated.

FRONT PANEL LAYOUT

The layout I used may or may not appeal to you. The rotary switch at the left selects 170 or 850 shift. The two switches on the top row are S1 (limiter on-off) and S4 (fast-slow autostart). Then comes the green receive lamp and the yellow standby lamp. Underneath these from left to right is the neon "power on" lamp and the S7 on-off switch below that.

REAR PANEL LAYOUT

In my case, from left-to-right on the rear: First the remote standby jack, then the scope jack (two-way jack), the audio input (600 ohm), then the printer motor jack, the FSK output (or to the AFSK system either one, such as the Mainline AK-1 AFSK), then the teleprinter jack and finally the master fuse and 120 VAC input line.

The fuse does not carry the motor current, the motors themselves have protection inside the printer proper.

FINAL COMMENTS

The ST-6 project has created more interest than any project the author has undertaken. Over 250 people sent for the schematic prior to its publication. Those who have built the unit already seem as enthusiastic over it as those who want to build it.

***

Armed Service Day Success-

WAR, NSS, NPG, and AIR had a combined total of 8,208 QSO's during the twelve hours and forty-five minutes devoted to the military-to-amateur cross-band portion of the communication tests. Included in this total were 197 air/ground QSO's made by Navy aircraft on the East and West coast. Commemorative QSL cards have been mailed to all contacts that could be identified in the Spring 1970 issue of the "Radio Amateur Callbook Magazine". Any amateur who has not received a QSL card confirming his contact should address a request for confirmation to the appropriate station, or Armed Forces Day Contest, Attention: Headquarters, U.S. Air Force, PRCOM, Room 5B531, The Pentagon, Washington, D.C. 20310. This request must include the amateur's call sign, the station worked, time of contact, and the frequency utilized by the military station.

There were 597 perfect entries for the 60 WPM RTTY broadcast message originated by the Secretary of Defense. A certificate of Merit has been mailed to all those individuals who submitted a perfect contest entry. It should be noted that there were more perfect radioteletypewriter contest entries than CW, demonstrating the increasing competence of the amateur radio operator in this mode of operation.

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RTTY theory & applications-

RON 'RG' GUENTZLER, W8BBB
Route 1 Box 30
ADA OHIO, 45810

USING A MILLIAMMETER IN A LOOP

Frequently, questions are asked about why a dc milliammeter acts the way it does when placed into a telegraph loop. The following will (hopefully) explain its behavior.

A dc meter (voltmeter or millammeter) is an average-reading device. This means that the indication given by the meter is the average (with time) of the current flowing thru it.

If a very slowly alternating current is applied to a milliammeter, the meter will respond to the varying current and will, at any instant of time, give a reading corresponding to the current flowing at that instant of time. If a true alternating current were applied, half the time the meter would be going down scale because the current is reversed half the time and the deflection is directly proportional to the current flowing, including polarity.

The meter movement, although fairly lightweight, still has some mass and cannot, therefore, respond instantaneously. If the alternating current applied to the meter is increased in frequency, the meter may not be able to respond rapidly enough and the reading given by the meter will be less than it was previously even if the actual current being applied has the same magnitude. Remember, the higher the frequency, the faster the current (or voltage) varies with time.

If an even higher frequency alternating current is applied (60 Hz is sufficient with most dc meters), the meter time to respond becomes so slow relative to the rate of variation of the ac that the meter will read zero. In other words, by the time the meter starts to respond upscale, the applied ac has already reversed, and it is trying to make the meter read downscale, etc.

It is under this condition where the applied current is varying more rapidly than the meter can respond that the dc meter is truly average-reading. The average of a sine wave is zero, and that is what the dc meter reads so long as the meter "sluggishness' is sufficient to keep it from responding instantaneously.

A simple, but typical, telegraph loop is shown in Figure 1. The loop consists of a loop supply, some resistance, the selector magnets in the printer, the keyboard contacts, and a dc milliammeter. Assume for purposes of discussion that the dc milliammeter is 60 mA full scale. Also assume that the selector in the teleprinter is a 60 mA selector. Regardless of the loop supply voltage (which should be at least 130 V dc), the resistor is to be adjusted to give 60 mA loop current when the keyboard contacts are closed. (If the loop is keyed by a polar relay, a vacuum tube, or a transistor, the discussion is still exactly the same.)

When the contacts are closed, the meter reads 60 mA. When the contacts are open, the meter reads zero. (Closed contacts correspond to a Mark, and open contacts correspond to a Space.) Figure 2A shows current (I) versus time for a steady Mark, and Figure 2B for a steady Space. These pictures are as would be seen on a dc oscilloscope.

What happens when a telegraph character is sent; i.e., when someone is "typing" something?

For initial explanation purposes, assume that the keyboard can send "dots." Dots are simply constantly repeated opens and closures of the loop in perfectly even intervals. Figure 2C shows how the loop current would vary when dots are sent (and there is no loop inductance). This is simply a square wave. During the first interval when the current is 60 mA, the meter will attempt to travel from zero toward 60 mA. However, if it is a typical meter, 22 milliseconds is not sufficient time for the meter to respond from zero to 60 mA. Therefore, it will only get part way up toward 60 mA when the loop current goes to zero. The meter will then try to return to zero. However, it was moving upward and will require a while to stop

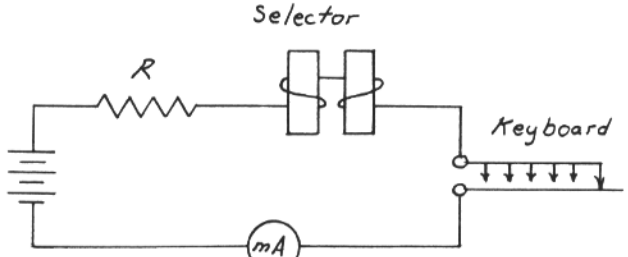

Fig.. 1

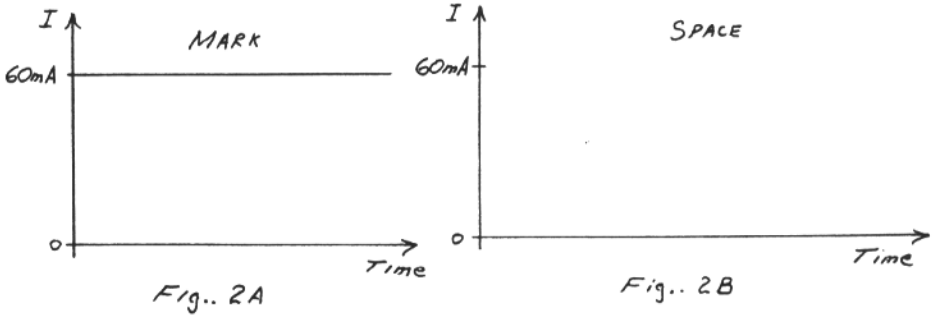

Fig.. 2A Fig.. 2B

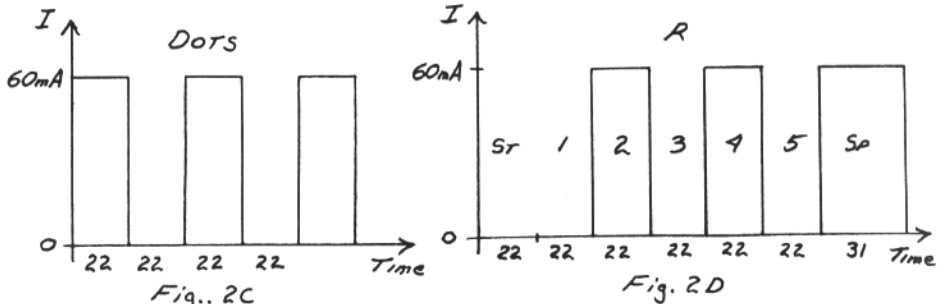

Fig.. 2C Fig. 2D

moving upward before it can start to move downward. It will probably be able to start moving downward but will not get to zero before the current goes to 60 mA again, and it again has to reverse and start going upward, etc.

Consequently, the meter will not read zero and will not read 60 mA, but will hover between the two values. If the meter is sufficiently sluggish (most meters are), it will appear to stand still somewhere between 60 mA and 0 mA. The question is: Where will it appear to remain stationary? Well, the meter is spending half its time trying to go to 60 mA and half its time trying to go to 0 mA. (Note, that when the dots are being sent, exactly half the time the current is 60 mA and exactly half the time the current is zero.) Therefore, the meter must indicate exactly half of 60 and 0, or 30 mA.

If the meter is less sluggish, it will not sit steadily at 30 mA but it will appear to hover or vibrate about 30 mA.

What happens when a single repeated RTTY character such as R is being sent thru the loop? Figure 2D shows the current as a function of time in the loop. As in the previous example, the meter will spend part of its time trying to get up to 60 mA and part of the time trying to go to zero. However, in this case the two portions of time are not equal. Because the meter indicates a simple average, the expected meter reading can be calculated as: (22x0 plus 22x0 plus 22x60 plus 22x0 plus 22x60 plus 22x0 plus 31x60)/163 equals 27.6 mA. Or: 75x60/163 equals 27.6 mA. Therefore, the meter should read 27.6 mA because this is the average.

In order for the meter to indicate the value just calculated, several conditions must be met: The steady Mark current must be exactly 60 mA, there is no inductance in the loop (inductance distorts the wave shape), the contacts on the keyboard are properly adjusted, the keyboard is being keyed at keyboard speed, and a Bell System machine with a 7.42-unit code is being used. These may seem to be unduly restricting, but that's life! If any one of the above conditions is not met, the meter will not read exactly 27.6 mA. This can be used as a good indicator all components in the loop. However, if two (or more) of the above conditions are not met, the meter could read 27.6 mA. Therefore, the above is not an infallible check, but it is a simple, useful indicator.

When the repeated character, such as R is sent, the meter may appear to fluctuate more than with dots. The reason is that the start pulse and the first unit are both spaces; therefore, the meter has a longer time to move during this interval.

When just "typing" on the keyboard, the meter may appear to move somewhat erratically. This is to be expected, because the meter is constantly trying to find an average, and each character has a different average (or nearly so). Also, the time spent between characters is a variable depending upon the "typing" speed of the operator.

In summary, when a dc milliameter is used in a loop, it will indicate something other than 60 mA (Mark) and 0 mA (Space) when something is being sent in the loop. The meter cannot follow the rapid variations in loop current during the bit intervals within a character. When a steady repeated character such as dots or a letter are sent, most meters will indicate a steady current that is the average of the loop current. In the case of dots it will be 30 mA; for a repeated R, 27.6 mA; and for a repeated Y, 35.7 mA.

An incidental note: several months ago we were discussing Fourier Series. The meter readings given here are the a0 or dc term in the Fourier Series.

73 ES CUL, RG.

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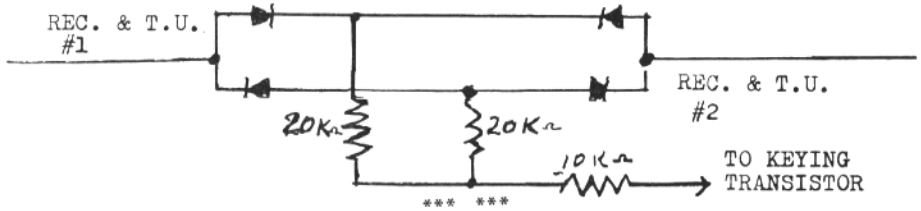
Diversity Comparator

Selective fading got you down? Then you need Diversity, and for Diversity, you need a comparator. This is not original, but it has all the features of the big CM&s and it will fit on a postage stamp.

Takes two receivers and two T.U.s of course, and the 2 antennas should be at least one wavelength apart, but the best in accurate RTTY for the amateur. Which ever receiver has the best mark or space signal, will bias the opposing diode "off".

Lem Stevenson, WA 6PBO.



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DARC -WAE RTTY Contest- RESULTS -

Top Ten

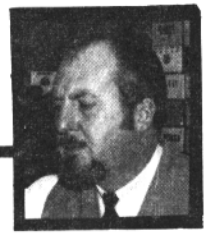
Europe		Non-Europe	
I1KG	30.940	VK2FZ	34.624
DL1VR	26.102	VE7UBC	24.901
I1CGE	14.706	VK3OM	19.032
DK1RV	10.800	EL2BD	14.688
DM2BRN	8.428	WA2YVK	12.480
I1CWX	6.545	WB6RXM	11.368
F9RC	5.130	KZ5LF	7.101
G6JF	4.800	WA2BYJ	6.890
SMØKV	3.354	W1KQY	6.752
DK1MP	2.970	K8ILL	5.983

North America

Canada				
VE3RTT	189	10	5	7
VE7UBC	24.901	106	165	59
Canal Zone				
KZ5LF	7.101	73	40	27
USA				
W1KQY	6.752	58	55	32
WA2YVK	12.480	64	107	39
WA2BYJ	6.890	50	75	26
W2VAQ	57	3	6	3
WB6RXM	11.368	72	122	49
W6AEE	2.314	34	19	26
WA6WGL	2.222	25	44	22
WA6TLA	1.978	26	40	23
WB6QFE	1.380	33	13	20
K8ILL	5.983	55	21	31
WØHAH	2.280	43	42	20

MOST QTC's SENT	
VE2LO/W6	130
I1KG	114
VK2FZ	110

RTTY-DX



JOHN POSSEHL - W3KV
Box 73 Blue Bell, Pa., 19422

Hello there . . .

For most of us in these latitudes vacations are over, the days are getting shorter, and before we know it winter will be upon us. This combination of events usually makes for more activity on the ham bands. This year however, the usual summer doldrums did not really occur at all. Quite the contrary, and anyone that was even reasonably active surely added several more countries to their totals. Hardly a week went by without something new, or at least quite rare, showing up on the RTTY frequencies. With calls like CR 6CA, FY7YQ, HI8XRM, GI3VDB, EA7 PZ, CT2AA, CT3LBT, ZS6BBK, KR6MD, OA4BR, VU2KV, JA1ACB, K2RSR/VP9, KZ5LF, LX2BQ. and FO8BS, to name a few, it begins to look like a page from a DXCC log.

Last month we mentioned that EL2BD finally accomplished W A C by a last minute contact with CR 6CA. Well, Leo sent in the confirmations and we are happy to post the following item.

Nr. 131 - Leo J. Small - EL2BD

Leo expects to be QRV from his stateside location very soon and can be reached as follows ----

Leo J. Small, K4AGC
8220 Cottage St.
Vienna, Virginia 22180

As the P.S. on the tail end of last months column indicated, the DXpedition to Andorra did became QRV as C3LBT at about August 7th for about a week. The signals were very good here in the States and we would like to say "THANKS" from all RTTY operators to F5JB and his group for making this rare prefix possible. An undertaking of this type is quite a job for all concerned. It takes many hours of planning and being sure all items are on hand before the pleasure of operating can begin. QSL's can go as follows--

Jean-Claude Boulanger, F5JB
59 Rue des Bruyeres
93 Les Lilas, France

Just at about the time Andorra became active we were quite startled to print CT2AA calling CQ with a tremendous signal. This was one of the few times Bill gets the RTTY gear fired up. He is located at a military installation there in the Azores and I guess he has to keep the gears and levers from sticking together from time to time. Frank, WA2YVK, was next in line and no doubt many more of you made a contact with Bill that Saturday evening. Cards can reach Bill thru his QSL manager as follows--

Mary A. Crider, WA3HUP
105 June Drive
Camp Hill, Penna.

This is beginning to look like a Call Book issue but we would like to mention that Pierre, FY7YQ, also asks that you send cards to his QSL manager. His QTH is as follows--

Paul Gallagher, WA4GOM
392 Byron Drive
Memphis, Tenn. 38109

Pierre by the way, is now building the ST-5 and should be doing better on the receiving end very shortly. His transmitted signal certainly is terrific.

A letter from Frank, WA2YVK, informed us of the initial operation of EA7PZ, Sevilla, Spain. Rene has excellent signals from a SB-301, SB-401, combination and is using a Model 28 printer. His TU is a "one tube" affair however, so you will have to have patience particularly if QRM is present. Frank says that Rene has two additional Model 28's and hopes to activate additional EA stations but he is lacking information to get them properly adjusted. If anyone can help Rene he will be very grateful. Since the 28 has quite a perfusion of manuals I would suppose that something that covers the operation and adjustment of the page printer would be appropriate. Rene can be reached as follows--

P.O. Box 479
Sevilla, Spain

Although there had been previous RTTY activity by EA4AH (DL1VR), this had been of only short duration while Herbert was in Spain on business. We are delighted

to see the prospects of sustained activity by Rene and perhaps a few others in the near future.

Here is some more great news from Carl, WB6RXM. FO8BS, Tahiti, is now QRV on RTTY. Carl was his first contact on or about August 21. Although his shift is inverted Henri is S9 plus on the West coast. We understand that Henri is an old timer and works all bands SSB so let's hope he will do the same on RTTY. He can be reached at--

Henri Costa, FO8BS
P.O. Box 910
Papeete, Tahiti

From "down Under" Barney, ZM2ALW/ZL2, reports possibly more activity from New Zealand on the HF bands as more printers have recently been released to the amateurs. Apparently there is quite a bit of activity on 80 Meters and we hope that the boys get the urge to try 20 and 15 in the near future. Hooking up with ZL on 80 Meters is quite an accomplishment on any mode let alone RTTY.

Barney recently received the BARTG QCA Award Nr. 38 and his new home brew TX of mainly solid state design is doing a good job on RTTY. You can look forward to contacting Barney in the Contest next month as he does manage to get in there and give out numbers in just about all of them.

Arthur, ON4BX, reports more activity from Africa with signals from Jan, ZS6BBK in Johannesburg. We have printed Jan here in the morning hours via long path and he does have an excellent RTTY signal.

KR6MD fired up again recently on 20 with rock solid signals from his stateside oriented rhombic. This is a MARS station and not very often on the amateur portion of the band. The operator at the time was Bill, whose home call is WB6ZAK. These military stations put out tremendous signals but seem to have trouble hearing things unless they are S9.

Also, for a moment or two, we heard Charlie, W1KJL, operating portable KP4. Couldn't raise him however, so no further details. Understand he was closing down so perhaps he was in Puerto Rico for a short vacation.

The results of the WAE Contest are out and are perhaps listed on other pages of this issue. Our congratulations to TOP man, VK2FZ. Adrain did a tremendous job with 34,624 points and right on his heels was that old Contester, Giovanni, I1KG, for second place. In the multi-op division, Marcel, VE2LO/W6 swept the field and Marcel tells us that he has an "antenna farm" in the works and will be a real contendor in the Contests coming up.

The German Group publishes a very nice RTTY BULLETIN and we receive a recent copy. It is no doubt meant for internal distribution since it is all printed in German which is one of a great many languages we cannot read. I am sure that if you have an interest a note to U1i Stolz, DJ9XB, RTTY Manager of the DARC, will bring additional information.

From ON4BX, we hear that the newly formed SARTG transmits weekly bulletins as follows. Wednesday, 2000 GMT, 3580 khz for European hams and on Saturday, 2000 GMT, 14090 khz for DX stations.

I guess that about covers it for this month, at least that's all the news we have. Don't forget, you still have a week or so to get things prepared for the CONTEST. REMEMBER - OCTOBER 16-18. See you then.

73 de John

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BARTG RTTY Sweepstakes

- Oct. 16-18. Plaques -- Trophys -- Certificates

See Last Month for Details.....

The contest season starts in October, As usual QRM will probably be maddening, everyone will be extending their calls hoping the other guy will stop first and they will be printed. Although RTTY operates in a fairly narrow band of frequencies some of the scarcer foreign stations might request calls up or down a few KH, but please, if you call such a station listen first to make sure you are not interferring with a QSO already in progress.

3 hints that can help your score, work 10 and 15 meters and if the band is quiet at night look for Canadian stations on the lower frequencies. Remember there is a bonus for every Canadian station worked. With a hugh pile-up on one station, look for someone else and come back, it is surprising how soon even the scarce stations can thin out a pile up if they can work them without QRM.

AND - if everyone worked narrow shift QRM would be cut in half!!!

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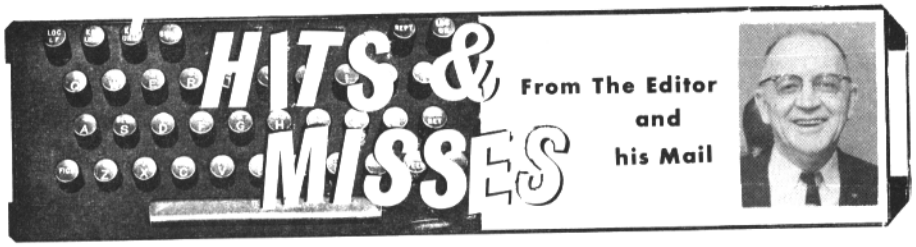

The convention committee as far as we can tell has made no provision for any RTTY fans, HOWEVER --

We hope to see some of you in Boston, ARRL Convention, September 25-27th.

As in Dayton, we have reserved a suite as a gathering place for all RTTY fans. We are not sure if the room number will be on the bulletin board but if there is any confusion ask for the number at the desk. It will be under RTTY JOURNAL. John, W3KV our DX editor will also be in attendance and glad to meet old and new friends. The hours that the suite will be open are indefinite at this time but probably every evening until early morning. If you don't go to the Play Boy Club, come play with us. Everyone welcome. Kentucky Kool Ade should be available so you can drink your Wheaties and enjoy some sociability.

We have also been promised a ST-6 demodulator for display and inspection.

This is the second consecutive issue of 20 pages and it looks like another maybe next month. We have an article by K5ANS on a solid state RTTY character counter all ready to go. Irv W6FFC has promised a follow up article on the ST-6 giving voltage checks and trouble shooting procedures and other construction hints. We have other articles ready to go and the classified ads have grown to 2 pages, all of which makes it hard to get everything in 16 pages. One thing we can use however are short articles and hints and kinks that come in handy not only for our readers but to us in filling in those partial pages. We do have a good supply of pictures but it wasn't long ago that we were using the crying towel for material so keep it coming.

Several months ago we mentioned our Signal One exciter and promised a report on it for RTTY use. Without a polar relay it is necessary to use a simple transistor keyer to use the built-in FSK. Keith Peterson W8SDZ figured this out for us and we had the rig on RTTY for a while. However we just do NOT like using a transceiver on RTTY, we are the old fashioned kind that like to listen and watch our signal on transmitting. Although the dual VFO in the signal one does away with the leap frogging of many transceivers we have gone back to our old rig for RTTY. Our strong recommendation for using the signal one on RTTY would be to use AFSK. The suppression is excellent and good AFSK generators are easy to build. It is necessary to receive up-side down but this can be corrected easily in the demodulator. If anyone wants the hook up for the transistor keyer we will be glad to furnish it. The pass band tuning should be set at about five o'clock for proper tones. The FSK input is to pin 9 of the power cord (a miserable job to get at as there are 16 connections to this small plug). We found out later that there is also a 500 ohm audio output at one of these plug connections but we had already run the speaker outlet through a transformer so never used it. The new instruction book promised soon should clarify many of the problems. The designer was very good with a slide rule but a number of changes could be made for easier operation by average hams. We must ad that everyone at the factory has been most anxious to take care of any problems and help owners in any way possible. A new, well written manual should help a lot.

On Saturday October 17 the ARRL hudson Division Convention at Tarrytown, NY will feature a 90 minute program on RTTY.

Cole Ellsworth , W2AGI (ex K5OLU) will describe and demonstrate Bill Malloch's new integrated circuit automatic CW identifier. Also on display will be one of the new ST-6 demodulators. RTTY operating hints and kinks will be covered by John Sheets, K2AGI. This session is scheduled from 3.30 to 5.00 P.M.

Canadian Amateur Radio Teletype Group. C.A.R.T.G. Sponsors

The 10 th World-Wide RTTY DX "Manitoba SWEEPSTAKES"

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SENT				RECEIVED					
NR	GMT	✓	STATION	NR	GMT	Cont	ZONE	COUNTRY	PTS

Sample log to be used in CARTG DX contest. Actual log is 5 1/2 x 7 1/2 inches and ruled for 25 entries on each sheet. Send IRCs and addressed envelope for supply or rule your own in similar form.

LOG SHEETS

"CARTG" Standard Log Sheets or facsimile of same must be used. with a separate page for each band.

Logs must contain; Bands. Number exchanges and times sent and received GMT, call signs. scores. countries. exchange points and rest periods. Logs must be received not later than November 30. 1970. Send to:

Canadian Amateur Radio Teletype Group
85 Fifeshire Road
Willowdale. Ontario. Canada
VE3RTT. (C.A.R.T.G.)

DATE _____ SHEET No _____

EXCHANGE POINTS..... times MULTIPLIERS..... equals..... (TOTAL SCORE)

✓ BONUS *My First RTTY Contest..*

I certify, on my honour, that I have observed all competition rules as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief.

DECLARED.....

(USE SEPARATE SHEETS FOR EACH BAND)

C.A.R.T.G.

.....
(Operator signature and call)

*** *** ***

VISIT US AT THE RTTY JOURNAL SUITE ARRL CONVENTION–BOSTON– SEPT 25-27

*** *** ***

BACK ISSUES---

THE ONLY back issues available are: August through December 1966. No issues of 1967. All issues of 1968 except for January and November. (July-August is one issue). All issues of 1969 and 1970 to date. All copies are 30¢ each.

RTTY Journal Binders are $2.50 each in USA. $3.00 in Canada or Mexico. Custom regulations make it impractical to ship binders overseas.

All copies of the TT/L-2 reprint are exhausted and as this article was reprinted in QST, May and June 1969, we plan no future supply.

RTTY JOURNAL
P.O. Box 837 Royal Oak, Mich. 48068
"Dusty" Dunn — W8CQ
Editor & Publisher

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CLASSIFIED ADS Rates- $1. - 30 words - Additional words 2¢ea. Closing date 1st of month.

COLLINS 32V-2 TRANSMITTER in exceptionally good condition $150.00 and Gonset GSB 201 (late model) 2 KW amplifier $275.00. Want typing unit for 28 KSR. Ronald Ott WA6FAD 2908 Benvenue Avenue, Berkeley, California 94705

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SPECIAL PROJECTS, TU's, kits, expertly built to order. Estimates without obligation. Of, by, and for hams. Applied Electronics Laboratories (W6BD, ex-W6CQK), 1068 Eden Bower Lane, Redwood City, Calif. 94061.

RTTY PICTURES FOR SALE. Volume 1, 8 pages $1.00. Volume 2 16 pages $2.00. Over 100 different pictures. Audio and perforated tapes available. W9DGV, 2210-30th. St. Rock Island, Illinois 61201.

PARTS KITS FOR ST-6: Build this sophisticated terminal unit, all solid state using P.C. boards. I.C. OP AMPS, with auto start and many other features. Send SASE for information on parts kits now available. Write W1KJL, PO box 689, Portsmouth, N.H. 03801

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SAROC, JANUARY 7-10,1971, Flamingo Hotel Convention Center, Las Vegas, Nevada. Sponsored by Southern Nevada ARC, Inc., Box 73, Boulder City, Nevada. Advance registration $14.50 per person accepted until January 4, regular registration at door, includes Flamingto Hotel Late Show and drinks, Sunday Breakfast, Cocktail Parties, technical seminars and meetings, ARRL, DX, FM. MARS, QCWA, WCARS - 7255, WPSS-3952 and WSSBA Ladies Program. Flamingo Hotel SAROC room rate $12.00 plus room tax,, per night, single or double occupancy January 3 thru 12, 1971. Mail accomodations request to Flamingo Hotel Mail advance registration to SAROC, W7PRM Club President, W7PBV, SAROC Convention Chairman.

FL-1 FILTER-LIMITER Kit. HAL offers the filter limiter of the Mainline ST-6 for use with any TU. 3 pole Butterworth filter and 709N OP AMP on 3x6 G10 glass PC board. Complete kit including toroids and 12 pin edge connector $11.00. Requires ±6 Or ±12 VDC. Write for more information on HAL RTTY Products. HAL Devices, Box 365RJ, Urbana, Ill. 61801.

TELETYPE PICTURES FOR SALE: Volume 2, 16 pages containing 50 pictures $2.00. Volume 3 coming $1.50. Also audio and perforated tapes. W9DGV-a 2210 30th St. Rock Island, Ill. 61201.

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MAINLINE ST-6 PC BOARDS and parts available. Please allow us to quote you on boards or on the complete unit. Write for details. HAL Devices, Box 365RJ, Urbana, Illinois 61801

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"2 METER FM RECEIVER: 11 transistors, 3 I.C.'s; easily built with our set of P.C. Boards - drilled, tinned and with terminals installed -- $9.50/set P.P. 2 Meter MOSFET Pre-amp - P.C. Board drilled, tinned, and with terminals -- $1 85 ea P.P. RMV Electronics, P.O. Box 283, Wood Dale, Ill. 60191

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TI SN72709L (round TU-5), SN72709 (DIP) OP AMP, $1.50, 7/$10.00. Molex DIP IC terminals, 25¢ each. Cinch 14 DIP, 8ICS DIP and round TO-5IC sockets, 60¢ each. Cinch 50-12A-20 12 pin edge connector, $1.70 each. Motorola MC890P/MC790P $2.00. MC724P, MC789P $1.05. Other MRTL including decade counters and decoder/driver in stock. HP-2800 Hot Carrier diodes 90¢ each, 12/$10.00. matched 4/$4.25. Fairchild 900, 914, 60¢, 923 90¢. All items new and fully guaranteed. Get our catalog. HAL Devices, Box 365RJ, Urbana, Ill. 61801.

Additional Classified on Page 19

FOR SALE: HAL RT-1 TU. Just completed, checked for operation on FSK reception. Complete with manual, modification kit, cabinet, and input filter board. $48.50 value, first money order for $35.00 gets it, and I'll prepay PP in USA. Urgently need money for college. Many other items for sale, send SASE. Frank Gilmore KØJPJ 560 S. Warren Springfield Missouri 65804

NORTHERN RADIO equipment. Demodulator type 104 model 3. Contains power for printer. $30.00. Frequency and shift monitor type 106 model 4 contains crystal oven, oscillator, etc. $25.00. Frequency shift keyer type 105 model 4 also has oven, W/PS, spare parts kit includes FSK/VFO adapter unit. New - unused in original packing. Real bargain - $100.00. CV89/URA8 comparator $35.00. URA8/Modules, tuning oscilloscope $12.50. Converter, discriminter complete $17.50. Keying units with multi-frequency oscillator for converter or comparator $15.00 each. Blower fan assembly $8.50. Filter and terminal board assembly $2.50. Rack mounting aluminum cabinet for two converters and one comparater $10.00. CAC shielded flat pack plug-in filter 2465 and 1615 cycles $2.50 each. Model 14TD $25.00. Model 15 printer and table $85.00, excellent working. Electro-mechanical perforator with table $25.00. All items new or mint. SASE for list or info. Books or schematics included. Reasonable offers considered. You ship. LADD-W3KA, 10406 Insley St., Silver Spring, Md. 20902. No Phone.

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