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THE WORLD SCANNER REPORT

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SCANNER MODIFICATION HANDBOOK CORNER

MOD-16 UPDATE: 6,400 Channels For The PRO-2004/5/6

Despite my offer to help with problems, there have been relatively few requests associated with any of the Mods in Vol-1 of my book. Perhaps the single greatest trouble spot, and it isn't great in the strictest sense of the word, is MOD-16, the 6,400 Channel Extended Memory for the PRO-2004/5/6. I worked on a couple of scanners that had MOD-16 problems and offered helpful suggestions to a handful more. In all cases, the trouble with MOD-16 was easily remedied: one or more errors in the wiring and connection of the 28 necessary wires.

Face it, when 28 wires must solder into a space of only a couple of square inches, there is an excellent opportunity to literally get your wires crossed. And, one crossed pair of wires means TWO mistakes! This type of mistake results in unpredictable, erratic operation, depending on which wires get crossed. In no event, however, has any serious harm been caused, though I have known the SRAM chip to blow out in a couple of cases because of errors in the wiring. Correct any wiring errors and start with a known good SRAM chip and 6,400-channel operation will be letter perfect! If you have put off adding 6,000 more channels to your PRO-2004/5/6 for fear of making a serious mistake, relax! The instructions for MOD-16 in Vol-1 of my SCANNER MODIFICATION HANDBOOK are accurate and detailed. If you will patiently follow the instructions, step by step, you'll be successful.

If you are following the directions in Vol-1 of my SCANNER MODIFICATION HANDBOOK, be sure to change the resistors, R1-R4, from 1-k (or 4.7-k) to 47-k. Better still, wait for Vol-2 of the SCANNER MODIFICATION HANDBOOK to come out next month where there will be featured a Keyboard Memory Block Controller (KMBC) for MOD-16, very similar to this month's Keyboard Extended Function Switch. In fact, the KMBC (MOD-28), eliminates the need for any external switches to control the 16 Blocks of 400 channels ea. You simply press two Keyboard keys and the rest is automatic. No external switches required!!!

>>>>> Vol-2, SCANNER MODIFICATION HANDBOOK IS COMING! <<<<<

CRB Research Books has informally announced that Volume 2 of my SCANNER MODIFICATION HANDBOOK will be available in early April, 1991. It will be sold at mail order dealers around the country, directly from the publisher, or best still, and from nowhere else, you can get a personally autographed copy directly from me. Orders now being accepted for either Vol-1 or Vol-2 at $17.95 ea, plus $3.00 (USA) first class shipping; $4.00 Canada or $5.00, other foreign. Allow extra for foreign Air Mail. All my books purchased from me will be autographed and will contain a notice (if necessary) of any pertinent errors or problems to be pen & ink corrected. NOTE: Vol-2 is not expected to be shipped before early-mid April, but your advance order with payment will receive priority attention; first come, first served, when available. It is probable, since I am the author, that I'll have Vol-2 ready for shipment before other dealers around the country. You can use the Sub Order Blank on Page 7 to order my books.

Please don't confuse Vol-2 with Vol-1. Rumors are circulating how Vol-2 is only an amended version of Vol-1. Ha ha! No way! Vol-2 takes up where Vol-1 leaves off. Short of a brief review of Vol-1 with error corrections and new ways of doing old things, Vol-2 takes off into uncharted territory with new mods, new hints and new tricks. If you're a Hacker, you'll need both.

This corner of ***"THE WORLD SCANNER REPORT"*** will keep both volumes of my books updated, so stay tuned here! Next month, or after Vol-2 has been released, I'll present a review of it for your consideration.

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Public Message (RECEIVED)
Message # 5598 * SHORT-WAVE/SCANNER *
To : All
From : Ken Hoehn
Subject : AOR scanners from ACE
Date : 91/02/17, 01:44:00

Beware of purchasing AOR scanners from ACE Comm. of Indianapolis, IN. I have gone through literal hell getting a problem resolved there. They take the $, and get to the problem when and IF they feel like it. In research, I find that the AOR-ACE relationship is not so rosy either, but ACE has the US market locked up.

If you buy it, good luck. If you need it fixed (and several have come to us with initial failures....better luck. Try sending it to your local high school electronics class....the repair will likely be better! ---= Ken =---

--- TAGMAIL v2.30
* Origin: The <<< Air Studio >>> BBS 313-546-7045 (1:120/216)

EDITOR'S NOTE: *The above message was taken from the Shortwave & Scanner Echo of the International FidoNet, a worldwide public computer network in which I participate. It is reproduced for you here as a follow up to last month's article on the AR-3000 by "Professor Peabody". This message should not be construed as the final say-so about AOR scanners or ACE Communications, but it does represent one person's opinion. I will reproduce more material, pro and con, on various subjects from the FidoNet occasionally.*

A BRIEF ON COMPUTER BULLETIN BOARDS

Computer BBS's, the FidoNet and radio are discussed at greater length in my coming Vol-2 of the SCANNER MODIFICATION HANDBOOK, but if you have a computer with a modem, you're all set for some

direct communications with me now if you like. I am available to you on three computer bulletin boards in the San Diego area. You can leave me either a private E-Mail or a public message as you see fit, and I will usually answer within 24 hours on the first two BBS's. I check into the third one listed about once a week. All three have great Scanner Conferences in which I participate. If you call, follow the simple log-on directions and we'll chat! The 1st & last are 24-hr/day BBS's; the 2nd is off from 8pm-12pm, Pacific Time. (619) 560-7659; (619) 273-6339; (619) 275-6129

FEATURE ARTICLE

HI-TECH EXTRA FUNCTION SWITCHES FOR YOUR PRO-2004/5/6 AND MAYBE OTHER SCANNERS, TOO!

Have you ever flipped a wall light switch in your home only to wish that it would control not only the lights, but also a TV, maybe flush the toilet, start the dishwasher, open the garage door and shut off the kids' stereo system? You know, one switch to do many different things? Mental telepathy might do it if you're capable, but for the unadept, a few cheap chips and a handful of junkbox parts can be wired together to make the Keyboard of your scanner do lots more than just what the manufacturer intended!

Ok, let me explain..... See, your scanner's keyboard has anywhere from 15 to 29 push-button switches on it, each one controlling a different function. Fine 'n dandy until you do some modifications and extra functions which require external control. A conventional method for any necessary extra switching is to drill some holes and install toggle switches of one sort or another. I prefer the newfangled DIP switches, but they're hard to install and a mess of things can be made if you're not careful. Toggle switches are easy to install, but may the Cosmos help you if the drill bit suddenly breaks through the chassis and runs amok inside the scanner before you have the presence of mind to shut it off.

Retrofitted toggle switches seem to never match up with the design scheme of the scanner's face plate, or you have to install them in the rear panel out of sight (and mind) and are most difficult to reach for casual control of things. Eureka! I have developed a super slick method of controlling various modifications and extra functions, and absolutely no external switches of any kind are required! We'll just use the scanner's Keyboard in such a manner that won't disrupt normal scanner functions and which will still allow you to turn things on and off at will. The secret is the use of TWO KEYS simultaneously!

There is at least one or two keys on most scanners that, when pressed, do absolutely nothing under normal conditions. One of these keys is the CLEAR key and another is the ENTER key. For example, turn your scanner ON and immediately press either CLEAR or ENTER. Nothing out of the ordinary happens, right? If so, the rest of this article is for YOU, because we can use the CLEAR and/or ENTER keys in conjunction with certain other keys to generate a switching sequence for controlling add-ons such as an Automatic Tape Recorder Switch; Extended Delay Function, Data Squelch, 6,400 Channels of Extended Memory, or most anything else that requires an external switch of some sort or another!

The interesting thing about the CLEAR and ENTER keys is that not only do they do nothing when pressed under normal circumstances, but they also tell the CPU to ignore any other key if pressed at the same time! So try this to see what I mean: first press and hold the CLEAR key followed by the PROGRAM key (or any other key). Nothing happens! Wonderful, because we will make use of a dual keypress in a simple logic circuit to operate an electronic switch which is good enough for many switching requirements! You won't have to drill any holes or deface the scanner at all unless you'd like some neat looking LEDs to indicate what switch functions are on or off. In that case, you'll have to drill some $^1/_8$" holes for T-1 sized LEDs, but this is not necessary if you're not turned on by drilling holes. You'll just have to remember what has been switched on or off which shouldn't be all that difficult. Otherwise, install LEDs as shown herein for a super sporty and great looking effect!

The Keyboard Extended Function Switch features four unique and separate electronic switches that can control most low current functions typical of my scanner modifications. You will operate these switch functions by merely pressing the scanner's CLEAR key and one other key at the same time. Press both for ON; press both again for OFF. How much simpler or more aesthetic can it be?

THE KEYBOARD EXTENDED FUNCTION SWITCH (KEFS)

The heart and soul of the KEFS is the 4066 "bilateral" (two-way) electronic switch chip which comes in a standard 14-pin DIP package. Nothing unusual about the wiring and layout of this neat chip except that it contains the equivalent of four SPST toggle switches. Four of the 4066's pins are for control of the switches; eight pins for the actual switches; and then there's a ground pin and a power supply pin for a total of 14 pins.

The logic of my KEFS consists of a Quad Dual Input AND chip, (74HC08) which feeds two Dual Type D Flip-Flops, (4013). Each segment of the AND chip required two inputs to generate one output. This creates the dual keypress logic. My KEFS ignores normal scanner keypresses and the scanner ignores the KEFS dual keypresses!. Each output of the AND chip triggers a corresponding Flip-Flop to trigger the pertinent switch segment of the 4066 chip. The design is such that when you first turn on your scanner, all switch segments are OFF. This ensures that your scanner fires up normally as the manufacturer intended. You can then select whichever of the four switch combinations you desire to perform intended functions. The circuit is simple enough, and even if you don't know a thing about digital electronics, you can still achieve success if you follow my steps and diagrams here.

If, for any reason, you do not wish to perform this project yourself, anyone with amateur technical ability can do it for you. I will offer the Keyboard Extended Function Switch as MOD-47 of my standard modification services. The KEFS will also be available as a preassembled and tested circuit board, ready for you, me or someone else to install. Since this modification is so new, prices and availability are not yet certain, but you can contact me for details which should be available soon. Now let's build the Keyboard Extended Function Switch to control whatever in your scanner needs to be controlled. Refer to the Parts List, the diagrams and pictorials, and the steps of procedure on the following pages. Nothing is terribly critical, but work carefully and don't deviate from the Parts List.

PARTS LIST FOR THE KEYBOARD EXTENDED FUNCTION SWITCH

Ckt Sym	Quan	Description	Radio Shack Cat Number
U-1	1	IC; 74HC08 or 74C08; Dual Input Quad AND	none
U-2,3	2	IC; 4013; Dual Type D Flip-Flop	none
U-4	1	IC; 4066; Quad Bilateral Switch	none
Ux1-4	4	IC DIP sockets; 14-pin	276-1999
C-1-4	4	0.47-uF/35vdc capacitor; tantalum	272-1433
C-5-8	4	2.2-uF/35vdc capacitor; tantalum	272-1435
R-1-4	4	10-k resistor	271-1335
R-5-8	4	100-k resistor	271-1347
R-9-12	4	1.5-k resistor	271-025
LED A-D	4	T-1 sized LEDs; your choice of color	276-026 typ
misc	3ft	Hookup wire; assorted color codes	278-776
misc	1	"Perf Board"	276-1395
misc	?	Solid copper wire; 18-ga; small quantity	278-1291
misc	?	Solid copper wire; 24-ga; board wiring	278-1341
misc	?	Heat Shrink Tubing; for neat wire bundling	278-1627
temp	1	1-k resistor	271-1321
temp	4	10-k resistor	271-1335

STARTING CONSIDERATIONS

1. Build the KEFS on a piece of "perf board" measuring about 1 1/2" x 2 1/4". Use the general layout as shown.

2. Solder to 14-pin DIP IC sockets and plug the chips in only after the KEFS board is completed and inspected for errors.

3. Begin by wiring together the Pin 7's of all four chips. This will be KEFS ground. Also ground pins 4 and 10 of U-2 and U-3, the 4013's.

4. Wire together the Pin 14's of all four chips. This will be the +5v power supply buss.

5. Next install and solder in place all capacitors, followed by the resistors. You can eliminate resistors R9-R12 if you don't want external LED indicators. Otherwise, install R9-R12 on end with a free end of each pointing up from the KEFS circuit board. We'll put wires to these 4 resistors later for the LED assembly that will be installed in the front panel.

6. You will probably have to use "jumper" wires to cross other wires on your KEFS circuit board. Try to use both sides of the board for jumpering as shown in the photos to minimize the use of messy insulated wiring on the board. Fully complete the KEFS board at this time before proceeding further.

7. Set up a color coded wiring scheme for the Keyboard Switch Control; LEDs; Switch Input/Output; +5v power and ground wires so that you can tell the difference among them later. Each of the wires should be about 6"-10" in length for starters. You can trim them to length later. A great source of color coded hookup wires is Radio Shack's #278-776. Strip the outer insulation & shield & salvage the wires for hookups!

A. Solder a color coded pair of wires to U-1, Pins 1 & 2. Solder a similar, but different color coded pair of wires to U-4, Pins 1 & 2. Solder a similar color coded wire to the free end of R-9. These wires are associated with "Switch A".

B. Solder a color coded pair of wires to U-1, Pins 4 & 5. Solder a similar, but different color coded pair of wires to U-4, Pins 3 & 4. Solder a similar color coded wire to the free end of R-10. These wires are associated with "Switch B".

C. Solder a color coded pair of wires to U-1, Pins 9 & 10. Solder a similar, but different color coded pair of wires to U-4, Pins 8 & 9. Solder a similar color coded wire to the free end of R-11. These wires are associated with "Switch C".

D. Solder a color coded pair of wires to U-1, Pins 12 & 13. Solder a similar, but different color coded pair of wires to U-4, Pins 10 & 11. Solder a similar color coded wire to the free end of R-12. These wires are associated with "Switch D".

E. Solder a color coded wire to the +5v power buss that connects the Pins #14 of all four chips on the KEFS board..

F. Solder two color coded wires to the ground buss that connects the Pins #7 of all four chips.

G. Route one of the ground wires connected in Step 7.F along with the four wires that were connected to R9-R12 in Steps 7.A - 7.D above. Make a bundle of these five wires for routing to the LED assembly later. Skip this step and one of the two ground wires if you do not want the LED Indicator.

H. Depending on HOW you want to install the KEFS in your scanner, solder a stiff, bare copper wire (18-ga) about 3" long to the ground buss that connects the Pins #7 of all four chips. This stiff copper wire can later be soldered to the scanner's inner metal chassis or to a PCB ground trace for a nice, shock-free installation that will permit easy removal at any time needed. Otherwise, you can mount the KEFS board using machine nuts, bolts and standoffs as desired.

DO NOT INSTALL THE KEFS IN THE SCANNER AT THIS TIME!

I. Bundle together the Keyboard Control wires that were soldered to U-1 in Steps 7.A - 7.D above. Strip 1/4" of insulation from the ends of each of the eight wires and twist together the bare ends of each wire pair. (Keep each pair separate!) Solder a 10,000-ohm (10-k) resistor to each of the wire pair junctions. Solder together the free ends of the four resistors into a common junction. Then solder this common resistor junction to a ground on the KEFS board. NOTE: This Step is temporary for testing and later the resistors will be removed and the wire pairs will be separated.

J. Bundle together the 4066 Switch In-Out wire pairs that were soldered to U-4 in Steps 7.A - 7.D above. Strip 1/4" of insulation from the ends of each wire pair and leave the bare ends close together but not touching.

K. If an LED Indicator is desired, then select four T-1 sized LEDs of your color choice (orange, green, yellow & red?) and temporarily solder all the cathodes together, and solder that common cathode junction to one of the ground wires connected in Step 7.F above. Then solder the wire from R-9 to the anode of LED "A". Solder the wire from R-10 to the anode of LED "B". Solder the wire from R-11 to the anode of LED "C". Solder the wire from R-12 to the anode of LED "D".

TESTING YOUR KEFS BOARD

The KEFS board should NOT be installed in your scanner at this time. We will test it for proper operation prior to installation.

8. You should have a 5-volt DC power supply for testing the KEFS board, but if none is available, you can use the one in your scanner. See below. You could also rig three flashlight batteries in series for 4.5 volts which ought to work fine.

   First connect the ground buss of the KEFS (Steps 7.F or 7.H) to the (-) terminal of the 5-v power supply. Then connect the KEFS +5v power lead (Step 7.E) to the (+) terminal of the 5-volt power supply.

   NOTE: If you're using the scanner's power supply, BE SURE THE SCANNER IS TURNED OFF. Position the KEFS board near, but not in the scanner, and then connect the KEFS ground buss to the scanner's metal chassis somewhere. An alligator clip lead will do nicely. Then connect the KEFS +5v power lead to the OUTPUT lug of IC-8 in your PRO-2004/5/6. A temporary solder connection will be better than an alligator clip lead here to prevent accidental shorts & embarrassing smoke.

9. Connect a handy length of hookup wire to the (+) terminal of the power supply. If you're using the scanner's power supply, then connect this wire to the same point as the KEFS +5v power lead in Step 8. Then solder a 1,000-ohm resistor (1-k) to the free end of this wire. NOTE: This is a temporary step for test purposes only. This 1-k resistor and wire will not be needed later.

10. If you have a milliammeter available, connect it in series with the (+) power supply lead to determine current flow. If you don't have a milliammeter, don't worry. Turn the +5v Test Power Supply On (or the scanner, as appropriate). Be real nervous at this point while you check for smoke or other weird effects in case something went wrong. The LEDs should be OFF. If you have a milliammeter connected for current measurement, check to see that current drain is less than one milliamp. Anything more than 1 to 5-ma indicates a problem. Actually, if all is well, the milliammeter should indicate virtually zero after a few seconds have lapsed. If something appears to be wrong at this point, shut off the power and troubleshoot your KEFS Board. If all appears ok, then proceed below.

11. Assuming that all appears ok at this point; i.e., minimal current drain and no LEDs lit up, momentarily touch the 1-k resistor connected in Step 9 to Pin 1 or 2 of U-1 on the KEFS Board. LED "A" will light up! It might momentarily light or flicker and then go off. This is due to the "noise" caused by touching the 1-k resistor to U-1's pins. Not to worry. Practice this a little, and you'll see where a quick, firm, momentary touch of the 1-k resistor to Pin 1 or 2 of U-1 will turn on LED "A". Now touch the 1-k resistor again to Pin 1 or 2 and LED "A" will extinguish. This simulates a push-on, push off action which will be done by the Keyboard buttons later! If all is well, at this point, touch the 1-k resistor to Pin 4 or 5 of U-1 and note that LED "B" can be controlled similar to the first. Repeat this test procedure for Pin 9 or 10 and again for Pin 12 or 13 to test the action of LEDs "C" & "D".

    Now, turn the power supply or scanner OFF; wait a minute or so, and then turn it back on again. All LEDs should be extinguished. Proceed below.

12. If you did not opt for the LED Indicator, or if you successfully performed Step 11, then do this Step now. Connect an ohmmeter or other continuity tester to the wire pair at U-4, Pins 1 & 2. Repeat the procedures in Step 11, except watch the ohmmeter which should indicate an open circuit (infinity ohms). Now touch the 1-k resistor to Pin 1 or 2 of U-1, and note that the continuity tester will show a path, just like a switch was closed! If using an ohmmeter, the resistance will be between 100-300 ohms. This is normal. Now again touch the 1-k resistor to Pin 1 or 2 of U-1 and see that the continuity tester or ohmmeter again reads an open circuit. If all is well, at this point, connect the ohmmeter to the wire pair at U-4, Pins 3 & 4. Touch the 1-k resistor to Pin 4 or 5 of U-1 and note that the ohmmeter can be controlled similar to the first. Repeat this test procedure for U-1, Pin 9 or 10 and again for Pin 12 or 13 to test the action of the 3rd and 4th Switch Segments, U-4, Pins 8 & 9 and Pins 10 & 11. Just like in Step 11, this simulates a push-on, push off action which will be done by the Keyboard buttons later! This step tests the action of the 4066 switch, so if all is well at this point, you're done and ready to install the KEFS board in your scanner.

13. Remove the temporary 10-k resistors from the ends of the wire pairs that go to U-1 (Step 7.I). Separate the twisted ends of the wire pairs and clip off all but about $^1/_8$" of exposed wire. Tin with solder the exposed end of each of the eight wires. Remove and discard the 1-k resistor and temporary hookup wire (Step 9).

INSTALLATION OF THE KEFS IN YOUR SCANNER

It is impossible to cover precise installation procedures for all scanners but the following steps will cover the Realistic PRO-2004, 2005 and 2006. With some variance here and there, many other Realistic scanners can be readily adapted to accept the Keyboard Extended Function Switch. Chances are that any scanner with adequate space to hold the KEFS and which has a matrix type of keyboard with at least a CLEAR and/or ENTER key can also accept the KEFS. The following procedures are specifically for the PRO-2004/5/6 and will be followed up with general suggestions for other scanners.

14. Find a suitable mounting location for the KEFS board in your scanner. Wire length is not critical, so anywhere there is

room will be ok. Just keep in mind that you may be making numerous modifications to your scanner in the coming months, so don't squander what little "real estate" is available. Make your installation neat and conservative. Connect the KEFS ground buss (or stiff copper wire) to a scanner ground, either the metal chassis or a printed circuit board ground trace. Mount the KEFS in the scanner now.

15. Connect the +5v power lead of the KEFS (Step 7.E) to the scanner's +5v power supply. This is the OUTPUT lug of IC-8.

16. If necessary, remake the LED Indicator Assembly (Step 7.K) so that it conforms to a nice appearing arrangement for the front panel of your scanner. If you don't know how to go about this aspect of the installation, please wait for my forthcoming SCANNER MODIFICATION HANDBOOK, Vol-2 which shows in great detail how to install T-1 LEDs in the faceplate of the PRO-2004/5/6 and other scanners. Otherwise, install the LED assembly in the face plate of your scanner at this time. It may be convenient to temporarily remove the wiring from the LED Assembly to facilitate installation. Reconnect the wires per Step 7.K. after the LED Assembly has been installed.

17. Group and bundle together the four wire pairs (Switched wires) from U-4. These wires will serve as the switch connections for any modifications or controls that you wish to incorporate into the KEFS. Position this wire bundle out of the way for now. Tape off the ends of any pair you won't be using. They will always be available for future needs!

18. Group and bundle together the four wire pairs (Keyboard Control) from U-1. Identify the individual wires that go to U-1, Pins 1, 4, and 9. Twist together and solder the stripped ends of these three wires. Strip the ends and prepare the remaining five wires as follows: twist together and tin with solder the ends of the two wires that go to U-1, Pins 2 and 13. Also twist together and solder the ends of the two wires that go to U-1, Pins 5 and 12. Leave free the remaining wire that goes to U-1, Pin 10.

19. PRO-2004 - Only: Turn the scanner upside down so that you can see the inside area just behind the Keyboard. Locate the 13 solder pads in a vertical line along the right edge of the Keyboard circuit board. The closest spot is Pad 13. The deepest, most difficult to get to is Pad 1.

A. Solder the wire from U-1, Pin 10 (Step 18) to Keyboard Pad 9. This is the numeral "3" key pad.

B. Solder the two wires from U-1, Pins 2 & 13 (Step 18) to Keyboard Pad 10. This is the PROGRAM key pad.

C. Solder the two wires from U-1, Pins 5 & 12 (Step 18) to Keyboard Pad 11. This is the ENTER key pad.

D. Solder the three KEFS wires from U-1, Pins 1, 4 & 9 (Step 18) to Pad 12 of the Keyboard. This is the CLEAR key control pad.

20. PRO-2005/6 - Only: Facing the front of the scanner with the top cover removed, look immediately behind the number 1, 2 & 3 keys inside the front panel where you'll see a white connector strip, CN-501. Looking down from the top, the closest pin of CN-501 to the metal side chassis is Keyboard Pin 1. The opposite end pin of CN-501 is Pin 13. Cut four pieces of stiff, bare copper wire, 18-22 ga, about $^1/_2$" to $^5/_8$" long. Insert one of these short copper stubs into Keyboard Pin 12. Grip this wire stub with a forceps or needlenose pliers and work it gently but firmly into Keyboard Pin 12 until it seats. It might help to first practice with a sewing needle or a pin until you can see how an insertion can be made. Then, insert the remaining three stiff copper wires into Keyboard Pins 11, 10 and 9 respectively. When properly inserted, these four short copper stubs will be firmly seated and cannot "fall out" without a definite pulling force.

A. Solder the three KEFS wires from U-1, Pins 1, 4 & 9 (Step 18) to the stub in Keyboard Pin 12. This is the CLEAR key control pin.

B. Solder the two wires from U-1, Pins 5 & 12 (Step 18) to the stub in Keyboard Pin 11. This is the ENTER key pin.

C. Solder the two wires from U-1, Pins 2 & 13 (Step 18) to the stub in Keyboard Pin 10. This is the PROGRAM key pin.

D. Solder the wire from U-1, Pin 10 (Step 18) to the stub in Keyboard Pin 9. This is the numeral "3" key pad.

That's it; your KEFS is fully installed and operational.

HINTS FOR INSTALLATION OF THE KEFS IN OTHER SCANNERS

You'll have to study the Keyboard Switch Matrix in the Service Manual for your scanner. If your scanner has, say fifteen keys, they might be electrically arranged in a matrix of 3 x 5, that is three rows by five columns. The probable connection points for the KEFS will likely be to the narrowest dimension of the matrix. Therefore, if yours is a 3 x 5 matrix, you'll only be able to get two switch functions from dual keypresses. There are only two combinations of two switches in a 3-row matrix. So you'll not be able to use all four switch segments of the KEFS if this is so. The PRO-2004/5/6 have a 4 x 8 matrix so there are a total of six possible pairs of switching in a four row matrix. In general, do not attempt to connect your KEFS to the widest dimension, thinking that there will be more combinations; there will not! The columns or widest dimension of a Keyboard Switch Matrix usually have a full-time 5-volts; the rows or narrowest dimension is almost always 0-volts until contacted by the columns. This is the logic basis of the KEFS, you see. The inputs of U-1 must always be "Low" or 0-volts except when a keyboard pair is pressed. So, in the final analysis, you may have to test your Keyboard Matrix with a voltmeter to determine which rows/columns are "Low" and which are "High". The KEFS must be connected to "Low" keys. One other thing: your scanner must have a 5-volt power supply or else my KEFS will not work. Most scanners nowadays do, so this should not be a problem. If in doubt, I will be glad to offer suggestions and a professional opinion on the suitability of my KEFS with your scanner. You MUST, however, enclose a SASE and one loose extra stamp with your request. Also, send me a copy of the Service Manual for your scanner or the schematic diagram, if I don't already have one. I do have manuals for most current Realistic

scanners and the BC-760/950, BC-200/205 and a few others. I can't help you here without benefit of a diagram or a Service Manual. Besides all that, you can't help yourself without the diagram and Manual, so you better have 'em regardless of whether or not you need my help!

LIMITATIONS OF THE KEYBOARD EXTENDED FUNCTION SWITCH

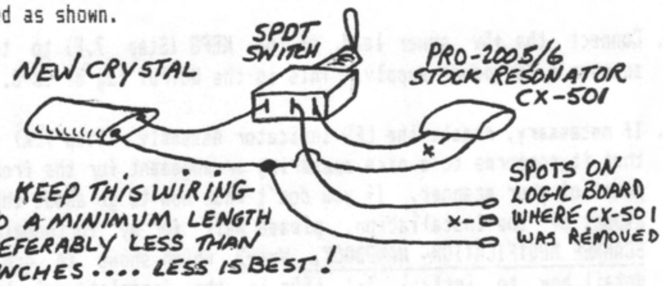
The KEFS is capable of turning on or off most low current circuits, and switching in or out virtually all low-level signal paths. There is an inherent resistance of around 250-ohms in each segment of the 4066 Bilateral Switch chip, so this limits the amount of current that can flow through the 4066 without burning it up. This limit appears to be about 20-ma; possibly 25-ma. The 4066 is cheap, though, so if you burn one out, just replace it. You can parallel switch segments for increased current handling if necessary, but there is a better method that I will show you next month. It involves a simple circuit of one transistor and one resistor to allow current drains of 100-ma or more.

Another limitation of the KEFS as presented this month is that the 4066 Bilateral Switch cannot switch voltages higher than the power supply voltage or else it will burn out. While the 4066 can be powered by up to 12 volts, my KEFS is powered by 5 volts, so you can't use it to directly switch 12-volt circuits. Relax, because the add-on circuit I'll show you next month will not only handle higher currents but also voltages to as high as 25 volts or so which is well beyond anything you'll encounter in your scanner. Most of our switching needs are for 5-volts, which makes the KEFS eminently suitable for most applications and next month, I'll show you how to adapt one or more switch segments for higher voltage or current needs.

As depicted and designed here, the KEFS is not well suited for switching RF signals. RF is susceptible to degradation by lengthy wire runs, so don't attempt to use it as a "Crystal Switch", a better approach for which is discussed in "Professor Peabody's" article this month. The 4066 Bilateral Switch chip can handle RF, but it must be laid out differently than in the KEFS, which was designed to switch DC power, digital and audio signals only.

HOW TO SWITCH CPU CLOCK CRYSTALS by "Professor Peabody"

By now many of you hackers have changed the CPU Clock resonators to increase the SCAN & SEARCH speed of your scanners. Typical is 30-cps for the PRO-2004/5 and 45-cps for the PRO-2006. The PRO-34 can be cranked up to maybe 20-25-cps, and the BC-200XLT speed can be doubled at least. This is a great mod but it has one liability: shortened DELAY time. But it is possible to gang your Clock crystals on a switch so you can select original speed and delay; faster speed but shorter delay, and/or you can always put in a lower freq crystal than stock if you wish. One example of why you'd want a slower mode sometimes is the military aircraft band, 225-400 MHz. NFM is the default mode for this band in the PRO-2004/5/6. But AM is the most commonly used mode here. So if you program 100 military aircraft freqs, you have to change modes 100 times, with lots of chances for error. Don't forget, DELAY has to be programmed too. Instead of "boinking" the manual button 100 times to check programming, just put the slowest speed into operaton and watch the display. Any errors can be quickly found and corrected. Plus, wear on the keyboard and your finger are reduced. A 5 MHz crystal will create a longer DELAY than the stock 7.37 MHz crystal. But speed will be lowered to 13 CPS in the PRO-2004/5. But no matter how you want to tailor the speed, the big word here is versatility! Choose the speed for the mode you select. Crystal switching can be easy; all you need is a SPDT switch such as Radio Shack's micromini toggle, catalog #275-625; wired as shown.



One caution if you use the stock resonator: DO NOT SOLDER the center pin back to ground. Leave it open and just use the two outside pins. Otherwise the resonator will override the other crystal. The switch should be mounted any place convenient on the front panel. The best place for a toggle switch in the PRO-2005/6 is along the vertical groove that separates the Keyboard from the LCD Display area. There is a problem with the PRO-2004 since the Clock resonator is not physically near the front panel like in the PRO-2005/6. We have to keep the wires as short as possible because of the RF generated by crstals. A coming article will present a "diode" switch that will be suitable for any scanner, regardless of where the Clock crystal is located. For now, and for the PRO-2005/6, be sure to insulate the crystal body with tape to protect it from shorting out something on the CPU board.

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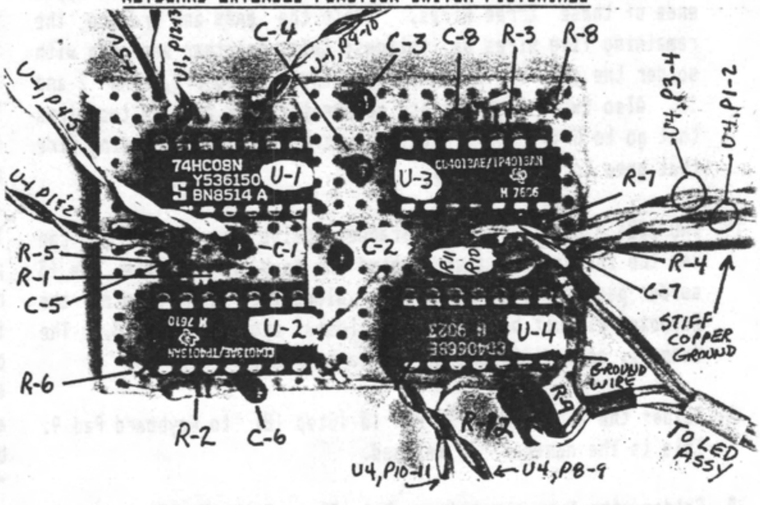

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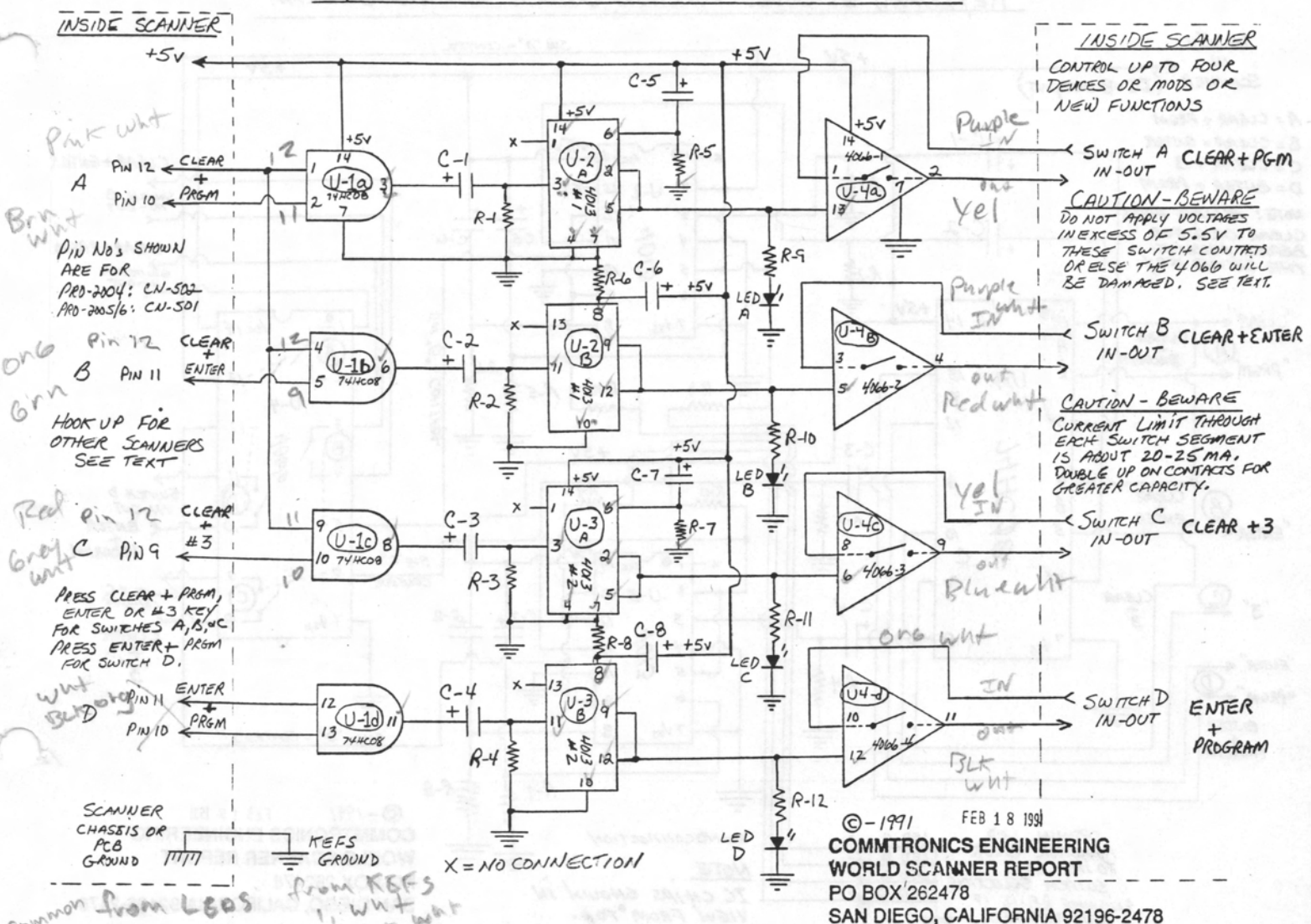
KEYBOARD EXTENDED FUNCTION SWITCH - FUNCTIONAL DIAGRAM



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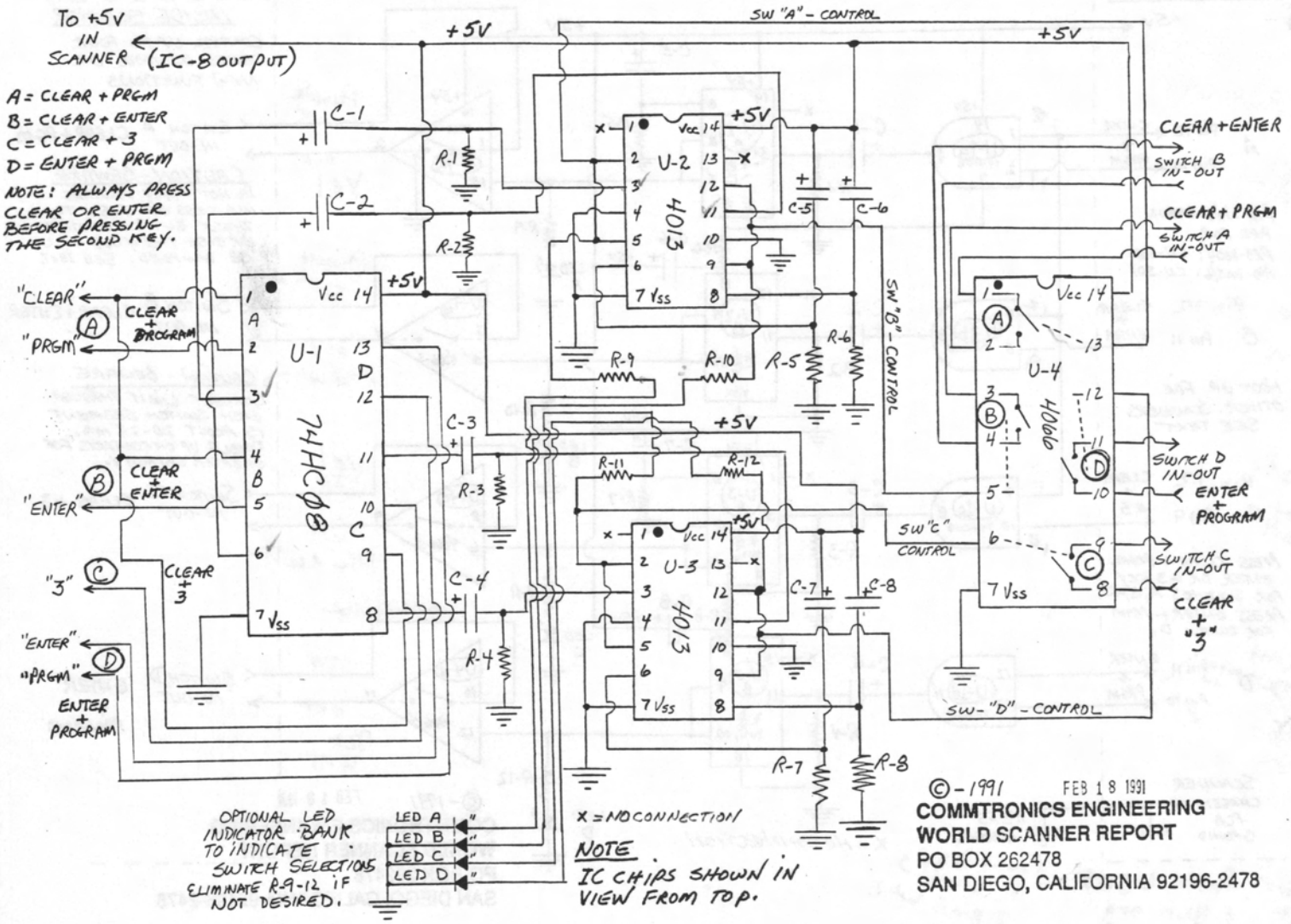

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