

Sharp & Associates

Computer Systems
Box 26045, Lakewood, Colorado 80226

# SELECTRIC® CONVERSION MANUAL

(hardware)

This manual describes the installation of a typewriter conversion kit which includes items on which patents are pending. Its sole purpose is to assist the kit user or to provide an evaluation aid for the prospective kit purchaser.

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#### Introduction

The Sharp & Associates Selectric® conversion kit includes items necessary to modify and interface a standard typewriter mechanism, of either Model I or Model II type for use with digital electronic logic. The kit allows both computer veterans as well as newcomers to take the most popular and successful typewriter ever and apply its proven reliability and print quality to their unique needs. Because of the varied qualifications of the users of this type of kit, three levels of conversion are offered. The first is basically the parts that have been specially designed by Sharp & Associates for the interfacing of the mechanism. The second level takes this basic kit and supplies the necessary logic to make it TTL compatible and includes all necessary power supplies - requiring the external supply of power to be 110 volts at 60 Hz. The third level of kit takes the basic kit and includes a sophisticated micro-computer oriented kit for a controller - giving a finished product that will function as an ASCII printing terminal. It requires only a 110 volt 60 Hz. power supply and (if desired) a cover.

The third level (ASCII terminal) kit supplies, in addition, the capability to drive a paper tape reader punch at the maximum speed of the data transfer. This gives a very "interfacible" level for most paper tape mechanisms currently available, in many cases requiring only the basic buss interface integrated circuits and cable with driver transistors. All necessary software for the paper tape mechanism is included in the ROM supplied with the kit.

Following modification, the typewriter mechanism is able to function as a normal typewriter in every way that it did previously, and the only physical modifications apparent are the slightly increased height (less than 2 inches) and the modified bottom cover (if one looks under the unit). When properly installed, no tactile change (feel of operation) is noticed by the operator.

Since the basic level three kit is computer oriented, it lends itself well to modification for special uses. Basic modifications already available are things like EBCDIC character sets, special codes for print control, and certain "word processing" options to make its use in this application especially easy.

#### General Kit Description

A block diagram of each level of the kit is shown in figure 1-1. The following paragraphs supply a general description of each part of all the kits. Neither assembly nor operation of the finished product requires a detailed understanding of the electronics or their interrelationship. A basic understanding of electronic kit assembly, together with a bit of skill in using a soldering iron and small mechanical tools such as adjustable wrenches and pliars.

## Typewriter mechanism modification

This portion of the kit (supplied on all kit levels) contains all necessary parts for the complete conversion of the mechanism itself. After the successful installation of this portion of the kit, the user will be able to operate the mechanism manually and detect what character is depressed (or what function). He can also actuate the mechanism to cause it to print all characters and perform the shift, space, backspace, and return functions.

The portion here described contains the following parts:

- 1. A base modification plate designed to hold the sensor/actuators and intended for inclusion in the typewriter mechanism by bolting onto the cover mounting brackets
- 2. Eleven sensor/actuator kits consisting of (for each unit):
  - a. a heavy duty solenoid
  - b. a photo-transistor/LED matched pair of sensing elements
  - c. a Teflon coated sensor slide.
  - d. a solenoid-sensor-slide connector
  - e. a solenoid ejection spring
  - f. a sensor slide spring
  - g. two mounting screws for the solenoid
  - h. three mounting screws for the mechanism
  - i. sensor-actuator plastic base
- 3. sufficient connecting cable and clamps for connecting the sensor/actuators
- 4. Longer cover attachment screws for mounting the base plate, remounting hardware for reconnection of the base cover (required on certain models).
- 5. Base cover modification template
- 6. Sufficient wire to connect the units
- 7. Cable end plug and cover
- 8. Character selector attachment adapters (six)

#### TTL Compatibility Module

This portion of the kit is the extension required to make kit level two (SK-2) with the basic mechanism just described.

This portion contains the following items:

- 1. Printed circuit board
- 2. Eleven pullup resistors
- 3. Eleven SCR's (gate TTL compatible)
- 4. Ten amp 12 volt regulator
- 5. Five amp 12 V RMS transformer
- 6. bridge and filter circuit components
- 7. LED power circuit components

Successful completion of this module will give the user a total unit that requires 110 volts 60 Hz poer and directly interfaces with an eleven bit I/O TTL buss.

## Terminal Controller Module

This portion of the kit is used to control the basic mechanism adapter in such a fashion as to yield a complete ASCII printing terminal, using the RS232 interface specification. This specification is applicable to the read/write levels, the terminal ready level, and their associated voltage and current specifications only. The operation can be done over a 103a type of modem or acoustic coupler.

Included also is the ability to leave out the RS232 driver chips and instead use opto-isolators in their place as a current loop interface (these components are not included in the kit, but described elsewhere in this manual) which will duplicate the operation of an ASR33 teletype.

A port for an eight level paper tape reader-punch mechanism is included so that only the necessary buss interface/latch chips, strobe length one-shots, and driver transistors are required. In this manual is described the necessary interface for this and a schematic is included for interfacing one particular type of paper tape unit. There are points available on the controller(on an integrated circuit socket plug) where the manual ASR functions (x-on, x-off, tp-on, tp-off) are available for wiring to a SPST switch. The controller interprets these codes also internally to allow remote control of these functions. There are two additional functions included to enhance the paper tape operation: p-on and p-off, which turn the typewriter mechanism on or off, allowing the paper tape unit to function at full speed and/or the typewriter mechanism to be silenced.

Operating at 10 characters per second, the unit is able to duplicate the functions of an ASR33. However, the unit can be operated at a much greater speed, and most certainly should be, if a paper tape unit is put on it. Since the average throughput of the typewriter mechanism is approximately 15 characters per second, 2 options are included which will allow the remote unit to fill the controllers buffer at the full allowable rate, and then wait for the typewriter controller to send either a "LF" character or to manipulate an RS232 level during the time required to empty the buffer. Other options include the ability to transmit only upper case letters, and to send the special characters "break", "ESC", and "LF".

The controller module kit contains the following items:

- 1. Printed circuit board.
- 2. Items 2-7 of the TTL compatibility module.
- 3. All controller electronics components.
- 4. Yower supply components for supplying +5, -12, and -7 volts regulated voltages as required by the controller kit.

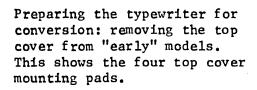
The controller kit does not include the following items:

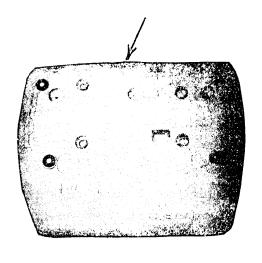
- 1. A cover for the unit (specifications for this are found elsewhere in this manual).
- 2. A power cord for the 110 volt supply.
- 3. A 25 pin miniature plug or socket for the RS232 interface, although either a socket or plug can be soldered directly to the edge of the board to supply this, if needed, as the leads go to the edge of the board in the specifically needed place for this to be done.
- 4. The switches for the options.
- 5. The cables and associated cable ends for the paper tape equipment.
- 6. Driver components for a specific paper tape unit. Specifications for this are included elsewhere in the manual.

## <u>Illustrations</u>

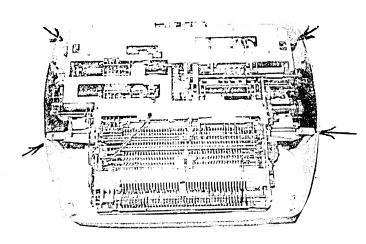
The following illustrations show the builder the areas or specific items referred to in the sections on converting the typewriter mechanism. The binding of this manual is such that it can be removed, allowing the illustration section to be removed temporarily for use in assembling the kit.

Preparing the typewriter for conversion: ascertaining typewriter type. This is the screw location on "early" models.



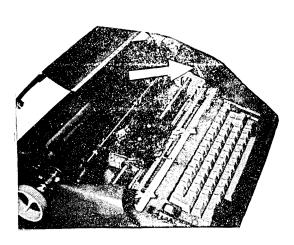


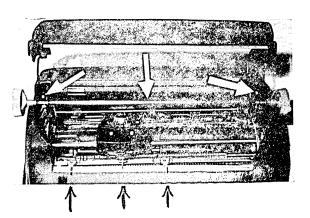
1



2

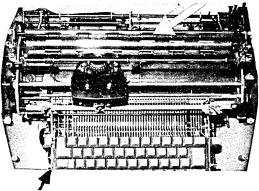
Preparing the typewriter for conversion: This points out the lever that allows the top to be removed on "late" models. Preparing the typewriter for conversion: Location of the two levers allowing platen removal. Note that the platen is pointed out here.





These are the margin stops and red character (the color of the plastic used) position indication pointer.

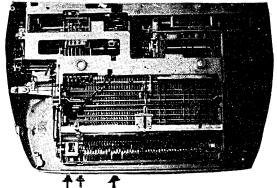
Preparing the typewriter for conversion: this shows the plate and rollers to be removed once the top is removed.



location of the bottom removal lever for the latch on "late" models.

5

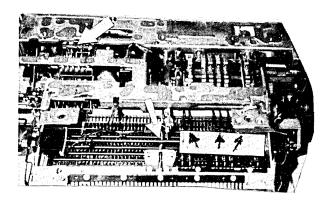
Installing the character actuator cable: the rod is third from top, fifth from bottom. don't count the large rod lower down.



Installing the shift, space, backspace, and return: this shows location. press each key to tell which is which.

7

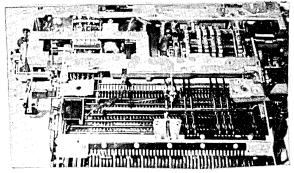
inserting the character selector
adapters: (right) the rods mentioned



Installing the function and character sensors: (left) function sensor connect point. (center) character sensor point.

6

This picture is the same as the one on the left, except that the "left" one is for "early" models, and the one below is for "late" models. Very little difference.



Installing the base plate: note the bottom cover mounting brackets are left on to show their location. These are to be removed. On the picture on the left, the top cover mounting brackets are visible, holding the top cover mounting pads (refer back to the picture showing top cover mounting pads, if necessary).

## Preparing the Typewriter For Conversion

Prior to the conversion effort, the user should verify the integrity of his typewriter mechanism. It should type properly when manually used, even if a finger is "raked" over the surface of the keys, forcing it to type at maximum speed. There should be no squealing or rasping noises in the mechanism as this will usually indicate a severe mechanical problem. It must perform the shift, space, backspace, and return functions properly and promptly. No requirements for the operation of the tabbing mechanism are made.

Verification of the model type is first required. Future reference will be made as to "early" or 'late" models as ascertained by the following means:

- 1. All Selectric II's are "late" models.
- 2. All Selectric I's with bolted on top covers are "early" models. All other Selectric I's are "late" models. Some variation in the space and shift mechanisms, where pertinent to this conversion exist, but each is explained individually at the proper step of the process. To find out whether your mechanism has a bolt-on top cover, invert the unit, and examine the middle back part of the bottom cover, looking for a screw. If the removal or loosening of this screw allows the bottom cover to be loosened and removed, then this is an "early" model.

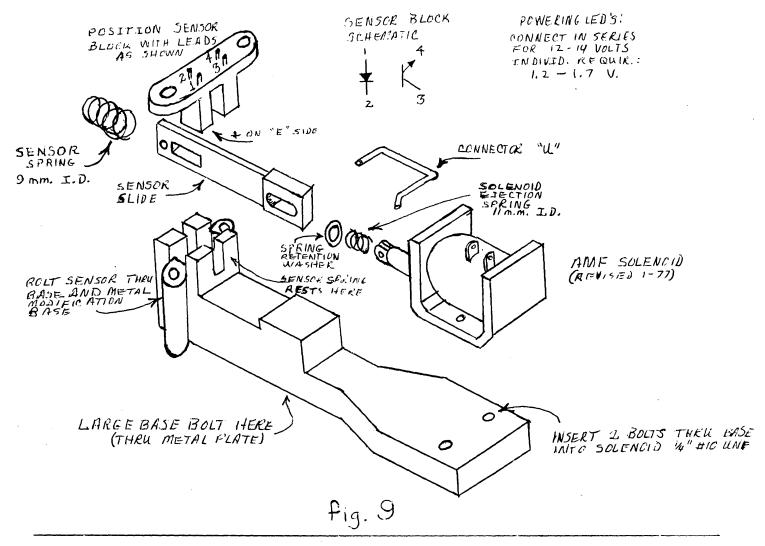
Preparation of an area for the modification should be made. The conversion at this phase is not a trivial tinkering operation, but consists of several steps, each of which may involve the installation of several small parts. An orderly work area will enhance the conversion effort immensely and avoid the frustrating loss of some of the small parts involved. Some oil may be dripped from the mechanism in the conversion process, so this item must be considered in the preparation process. Place a pillow or other protective pad sufficient to hold the typewriter mechanism in the work area and proceed.

The first step is to remove the cover from the typewriter. On "early models" follow the instructions in the next paragraph. On "late" models skip the next paragraph.

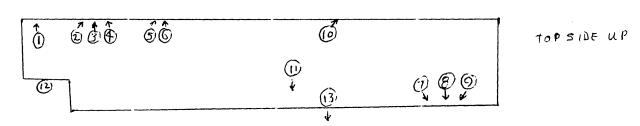
After removing the bottom cover (see verification step 2.), note the presence of the four places that the top cover attaches to the mechanism. These are characterized by four straps that are secured on one end by a bolt and what appears to be a "U" shaped washer. Loosening of the bolts will allow the "U" shaped washers to be removed and the top cover to be freed by lifting the straps from the rubber mounting pads and rotated to the side. Carefully turn the mechanism back over (the top cover is now loose, and should be handled cautionsly). Skip the next paragraph.

On the "late" models, lift the hinged top cover and feel the sides of the top cover about one inch from the top and 2 inches from the place where the rubber platen (the thing that the paper rolls around) extends out of the cover. There will be a lever touching the foam on each side that can be pulled back to release the top cover. A definite "snap" will be heard if the latch is engaged. After both latches are pulled as far forward (toward the front of the typewriter, at the space bar) as possible, the top cover should be loose.

# ASSENIBLY DIAGRAM : SENSOR ACTUATOR



POSITIONING DIAGRAM : SENSONPACTUATORS ONTO BASE PLATE
ARROWS INDICATE DIRECTION SENSOR SLIDE POINTS



- 1-6 CHARACTER SENSOR JACTUATORS
- 7 SHIFT SEMSOR JACTUATOR
- 8 RACKSPACE ACTUATOR
- 9 RETURN SENSOENACTUATOR

- 10 FUNCTION SENSOR
- 11. CHARACTER PRINT SENSOR
- 12. CHARACTER PRINT SOLENOW
- 13 SPACE SOLENCID ( UPRIGHT)

fig. 10

Now plug in the mechanism and turn it on. Adjust the margins to the far left and right sides of the mechanism. Then position the printing mechanism to the middle of the margin area. Now turn the mechanism off and unplug it. Lift up the hinged top part of the top cover.

Pull the roller mechanism that holds the paper to the platen forward, so that it does not touch the platen anymore. Flip up the hinged plate touching the rear part of the platen (if there is a plate like this - applicable only to certain models) so that it does not touch the platen. Note that there are two levers with bent tabs about 1/2 inch from each side of the back of the platen. When these two levers are pressed down, they release the platen from its bearing surfaces. While holding the two levers down, at the same time pull up gently on the platen and lift it out of the typewriter. Immediately below where it rested is a steel or aluminum plate with several rubber rollers sticking up through it about 1/8 or 1/4 of an inch. This plate lifts out easily (dont force it - it cannot be bent and function properly) and take out the rubber rollers. There is no need to mark each roller as to its location, as the proper place will be filled only by the proper roller on re-assembly. Tape the margin levers and red position lever straight up.

The typewriter top cover on "early" models should now be removed. On "late" models the top cover must be slipped up gently, while the latches are held, if they are loose enough to slip down and re-engage with the bottom cover. Place the top cover to the side. Turn the mechanism back over and proceed with the next paragraph if using an "early" model. Leave right side up and skip the next paragraph if using a "late" model.

Using a scribe or sharp metal tool such as an ice pick or a good felt tip pen, mark very carefully the position of the two cover mounting brackets (one on each side of the mechanism) and remove the two bolts in each one. This mark= ing , if done properly, will save much adjustment later. Set the brackets aside. Skip the next paragraph.

under the left side of "late" model mechanisms, once exposed to the builder by removal of the top cover, about 3 1/2 inches from the very front of the mechanism is a latch very similar to the ones found on the sides (they held the top cover on). Pull this latch as far forward as it will go. This will release the bottom cover from the mechanism, allowing the mechanism to slide forward and lifted from the bottom cover. The two slide—in holding mechanisms on the back of the typewriter should slip forward easily, but may need a bit of persuasion with a small screwdriver. Turn the mechanism over and note the two places where the mechanism rested on the lower cover. One has the latch lever on it that released the bottom cover. The other does not have a latch lever, but is on the other side of the mechanism in the same area as the first. Both of these brackets are held on by two screws and must be removed and set aside.

The mechanism is now ready to accept the modifications.

## Inserting the Character Selector Adapters

There are six rods on the left side of the front part of the mechanism that attach to a character selection mechanism in the rear of the machine. The small character selector attachment adapters must be attached to these rods as shown. They should snap right onto the rods, but may be crimped tighter or loosened with pliers if necessary.

## Assembling the Sensor/actuator units

There are eleven sensor/actuator units included in the kit. Nine of these are to be assembled completely as shown. The other two are to be assembled to the same point except that the solenoids are not attached, consequently the solenoid-sensor-slide connector is not attached.

## Assembling the base plate

The sensor/actuator units are then bolted onto the base plate as shown. Note that the two long bolts holding the sensor unit in place go through the base and are attached on the bottom of the base with a washer and a nut. The other bolt goes through the bottom of the base and bolts into the plastic of the sensor/actuator unit. DO NOT tighten this bolt too tight as it can be easily stripped in the plastic. Position the units in the center of the area (the larger holes allow adjustment later - see installation of actuator cables section) and tighten the three bolts just enough to keep the units in place. Wire each LED and photo transistor as shown, labeling the other end.

#### Installing the Character Actuator Cable

A four inch long piece of the 1/64 inch cable is looped around the character actuator rod as shown and the clamp is crimped onto the cable with heavy pressure applied with pliers. If there is any doubt that this connection is secure, a small amount of solder can be flowed into the bottom end of the clamp, soldering it to the cable. The other end should be left laying on the mechanism, toward the front of the typewriter.

#### Installing the Shift and Space cables

As shown, the shift mechanism is controlled by a bar in the very front of the typewriter. A four inch cable is secured to this bar as with the character actuator cable. A seven inch cable is looped around the end of the space bar and the clamp is applied after the cable is pushed up through the top of the mechanism and crimped with the pliers to make a very narrow loop and then pulled down through the bottom so that the clamp is past the frame of the typewriter as shown. Solder may be applied as with the other cable. Leave both ends laying out of the front of the typewriter.

## Installing the Backspace and Return Cables

Note that at the very front of the machine, on the left side of the mechanism, there are some levers, two of which will actuate when the backspace and/or the return keys are depressed. Note which lever is for which key and attach a six inch length of cable to each. Label the other end of the cable (using a small piece of masking tape folded over the cable) as to which one is the backspace key and which one is the return key. Due to the variation in the style of this lever over the models, it is suggested that the builder attach the cable as he best feels he can. Two acceptable ways are shown for the two types of levers usually used. The builder may find that he can crimp the cable end, apply the clamp, and then slide the whole end over the lever afterwards — saving some close work. Tape the cables to the mechanism as the cables would lie if going straight back to the back of the machine.

## Installing the Base Plate

The base plate is now installed. On the "late" models, washers are placed under the mounting ends and the plate bolted onto the mechanism. On "early" models, the plate is bolted over the mounting brackets after they are repositioned onto the mechanism as originally marked. The use of double -faced masking tape here will assist in keeping the "early" model brackets in place while the base is placed into position. Use the four longer bolts for this attachment, as supplied in the kit. Discard the original screws (two for each side). These four bolts must be securely tightened, but do not strip the threads in the typewriter mechanism.

## Installing the Cables onto the Base Plate

Referring back to the "assembling the base plate" picture, note the placement of the respective actuators for the eleven functions. There must be a cable attached for each. The procedure is to pull out the sensor slide as far as it will go (which is about 9/32 inch), measure the cable to the hole in the end of it (just hold the cable in place, but not firmly enough to pull whatever it is attached to out of place), mark it with a falt tip pen, crimp it with the pliers to form a narrow loop, place it through the sensor slide after putting a clamp on the cable, and pass the end back through the clamp. The builder may find it easier to secure the cable first to the sensor slides of the base plate and then to measure and install to the character selector adapters than the other way around — in each case dependent on his mechanism. The two solenoids are attached in the same manner, with the solenoid plunger extended approximately 9/32 of an inch.

#### Installing the Function and Character Sensors

The two remaining sensors must be installed with cables to the respective sensing points. Note the point of attachment in the picture. Variations will occur in the character sensing mechanism, but attachment is made in such a manner as to not interfere with the operation of the mechanism.

#### Adjusting the Base Plate

The mechanism is now turned over (right side up) and plugged in. Once turned on, any levers or rods that have been "tripped" will clear and the mechanism will return to a normal state. If any continuous printing or other continuous action occurs, immediately turn off the mechanism and find the cable that is too tight or binding the mechanism. This must then be corrected.

The builder should then be able to manually type on the mechanism without interference in the characters, the space, backspace, return, and the shift functions. Again, if this is not so, correction of the cable connections is in order.

Turn off the mechanism and unplug it. After tilting the unit back enough to see under the base plate in each area that an actuator of either type or a sensor alone exists, verify that the cable is taut, and that the unit is extended the 9/32 inch as specified. Less of an extension on the sensors will result in either a constant or premature sensing of that unit. Less of an extension on the two solenoids is not that critical, as less than 9/32 inch travel will actuate the respective mechanism.

## Modifying the Bottom Cover

The unit is now ready for re-assembly with the bottom cover. The bottom cover must now be cut out with a saber saw, using the appropriate aluminum blade, and drilling out the corners first to allow smoothly rounded corners. Re-attachment of the bottom cover by use of the base-plate-to-bottom-cover hardware is necessary only for the "late" model covers, as the "early" model covers are attached directly to the top cover and derive their support from the top cover. Proper adjustment of the mounting hardware is essential for the "late" model covers, as this affects the way that the keys protrude through the top cover. Routing of the cable is essentially left to the builder so that it is to his best interests as to its final exiting place. It can be taken directly out of the bottom cover hole, for example.

## Attaching the Cable End and Cover

Use the table to attach the proper wire to the proper pin on the 24 pin connector, as needed for the attachment to the controller. Glue the cover onto the end after attachment.

#### TESTING THE UNIT

When the conversion of the typewriter is complete, the mechanism is tested to insure that the sensors are all working and the solenoids are actuated as intended. This process does not require any elaborate test equipment, just a 12 volt supply capable of producing a two amp continuous current supply. A VOM is needed to complete the tests. An easy way to not only test the unit but also to get a good exercise in how the unit works in actual use is to construct the "exercisor" circuit to manipulate the unit at its maximum print speed (figure 11.)

The theory of operation is that the unit can space, backspace, shift, and return the carriage with the simple operation of each individual solenoid. These functions can therefore be tested by connecting 12 volts directly between the respective cable pins and ground. The solenoids are intended for an operation of a maximum duty cycle of 25%; therefore, DO NOT leave this continuous 12 volt connection in place for longer than a couple of minutes. If each function operates, the testing can continue onto the character printing mechanism.

The character printing mechanism operates on the principle that a character is first selected by the application of power to the proper combination of the six character selection solenoids and then the mechanism is actuated by the operation of the character print solenoid. The mechanism can be tested by actuating the mechanism for a brief moment (continuous operation will result in continuous printing) without any character selection solenoids selected. The character printed should be a dash ("-"). The remaining solenoids can be actuated one at a time solenoids 1 - 4 to print "b", "w", "q", "y" respectively. Solenoids 5 and 6 can be tested by using a combination of 3 and 5 to print a plus (or whatever character is next to the backspace key on the keyboard) ("+") and a combination of 3 and 6 to print a comma (","). This should be done with a very brief connection to the character print solenoid, if using a supply delivering less than 3 amps continuously as this requires a continous three amp draw during the duration of the three solenoids being selected.

To test the sensing mechanism, actuate the LED light sources (as powered by either the regulation network supplied with the level 1 kit or with 2.5 volts as used in the level 2 and 3 kits) to actuate the sensors. A VOM will show that output current through each phototransistor placed in series with a 300 ohm load will pass no current (check voltage over the resistor — it should be practically zero). Be careful of polarization during this test. When the mechanism is actuated, the corresponding sensors of the solenoids tested before (using the same sequence) will show a passage of current during the cycle that the corresponding schenoid actuation occured (test this by showing a voltage across the resistor (s) going from zero to something greater than 2.5).

Any deviation from this indicates either a faulty component or (more likely) an out-of-adjustment solenoid or sensor. Check for binding in the mechanism or some other item interfering with the smooth operation of each individual sensor or solenoid. Do not attempt to verify the LED operation visually, as it emits light not normally visible.

#### CIRCUIT BOARD ASSEMBLY

The circuit boards in level 2 and 3 kits can be assembled with soldering equipment and simple tools. Recommended tools and materials to be used are listed in the table below. Some general recommendations and precautions are:

- 1. Review component location sheet to verify integrated circuit placement and wire lead soldering location.
- 2. Exercise caution in placing the polarized capacitors in place.
  Failure to do so could result in unnecessary component replacement.
- 3. Do not use a high-powered soldering iron or gun. This could cause severe damage to the circuit board or ruin the integrated circuits. Use the table as a guide to the proper iron.
- 4. If it does become necessary to remove an integrated circuit from the board, use a suction device or wooden toothpick to remove the solder from the holes while heating it with the iron. Do not use a sharp metal device to do this.
- 5. Remove excess flux from the board after assembly.

## Recommended tools and solder equipment

<u>item</u>	usage			ification				_			•
solder iron	soldering, desoldering	not	to	exceed	40	watts	or	600 <sup>6</sup>	F	tip	temperature

Desolder tool remove solder Suction device

Solder	installing I.C.'s	Rosin core flux, high	tin content (60% tin,
	replacing I.C.'s	40 % lead) 18 guage	
	other wiring		

Resin	remove excess	Freon, acetone, isopropyl alcohol or
solvent	f lux	other solvent not affecting circuit
		board, bonding agent, or components

needle	nose	install	I.C.'s
pliars		wiring	<b>a</b> id

Diagonal install/replace pliars components, wiring aid

NOTE OF CAUTION: Upon opening the electronic component part sack, the user should be prepared to handle MOS devices. These are the SCP/MP chip, the ROM and RAM chips. They are susceptible to damage by static electricity. They should be placed in foil and any subsequent handling should occur on a grounded bench area, with grounded tools, after the builder grounds himself to remove any static charges. Do not wear nylon.

After verifying the parts received with the included parts list, these items should be installed on the board. The following procedure is recommended:

- 1. Install all discrete components (capacitors, resistors, transistors, SCR's, bridge) and bend leads just enough to keep component in place.
- 2. Install integrated circuit sockets (for the MOS components) and integrated circuits, bending two opposing leads to keep the unit in place during soldering.
- 3. Install the crystal.
- 4. Solder all components in place.
- 5. Remove excess leads from discrete components with diagonal pliars.
- 6. Install transformers and filter capacitors, using included mounting hardware (see figure 12 ). Solder leads into place after proper wire length is cut.
- 7. Verify the proper placement of all polarized capacitors (check the + mark or solder bead which could be used instead of a + sign).
- 8. Verify that no integrated circuit is placed on the board in the wrong direction.

Note that all soldering is done from the reverse side of the board and that never is there any soldering done on the "component" side of the board.

Installation is complete when the 110volt power connection is made. It is suggested that this be done by connecting the power leads into the CPU power switch or typewriter power switch, whichever is desired to control the circuit.

Mounting of the controller kit (level 3) can be done by following the case description and assembly diagram found in figure 13.

## INTERFACING THE UNIT (LEV. 1-2)

The unit is interfaced by generating a circuit that will drive the solenoids and test the sensors. If there is any question as to the principles involved in interfacing the unit, it is suggested that the user build the exercisor module shown in the section on testing the unit. This duplicates all functions of the controller, and will answer any questions on the code translations involved.

Two items of consideration are involved with designing a controller that will effectively drive the unit. There is a requirement for eleven input/output lines to be used in the unit. A maximum of eight of these lines are active at any given time. The second item is that the solenoids are activated by application of 12 volts and require one amp for each solenoid. However, the requirements of the unit for actual usage are such that once the solenoid is fully closed (especially pertinent to the operation of the shift key, since it may be closed for several seconds at a given time) the power requirements become only 1/4 that of the unit to exert the same force that was done at the beginning of the actuation cycle. Also the unit exerts about eight ounces of force under a one amp draw - much more than is necessary for the usage by a healthy typewriter mechanism (the over -rated units were used to make even a badly out-of-adjustment unit or a well worn unit function). fact can be used when actuating the solenoids under software control: to "pulse" the solenoids in whatever manner or to whatever level of sophistication necessary to match the unit to the given supply. This allows the unit to draw close to one amp when pulsed on a healthy typewriter mechanism. This need not be done if this sophistication is not needed. Only the shift mechanism will be subject to the 25% duty cycle (maximum "on" time is 25%) limitation if an eight amp power supply (eight amp intermittent draw) is used. An easy way to accomplish this pulsing on the one line is shown in figure 14, using a "hardware approach".

If the user is interfacing the unit to a 16 bit buss commonly found on minis, he can interface the unit directly through power transistors (NPN 40 watt or more without heat dissipation) or SCR's and with standard input gates with pullups (1000 ohm typical). He must then apply the proper sequence of program steps to print and sense the keyboard(see the programming manual).

If the user is interfacing the unit into an eight bit buss, he must go to somewhat more sophistication to allow a simplified sort of multiplexing of the signals to occur over the eight bit buss. A suggested technique is to perform a "write" to the unit that will be latched and act as a guide for the next operation, which would read the selected lines or write the selected solenoids.

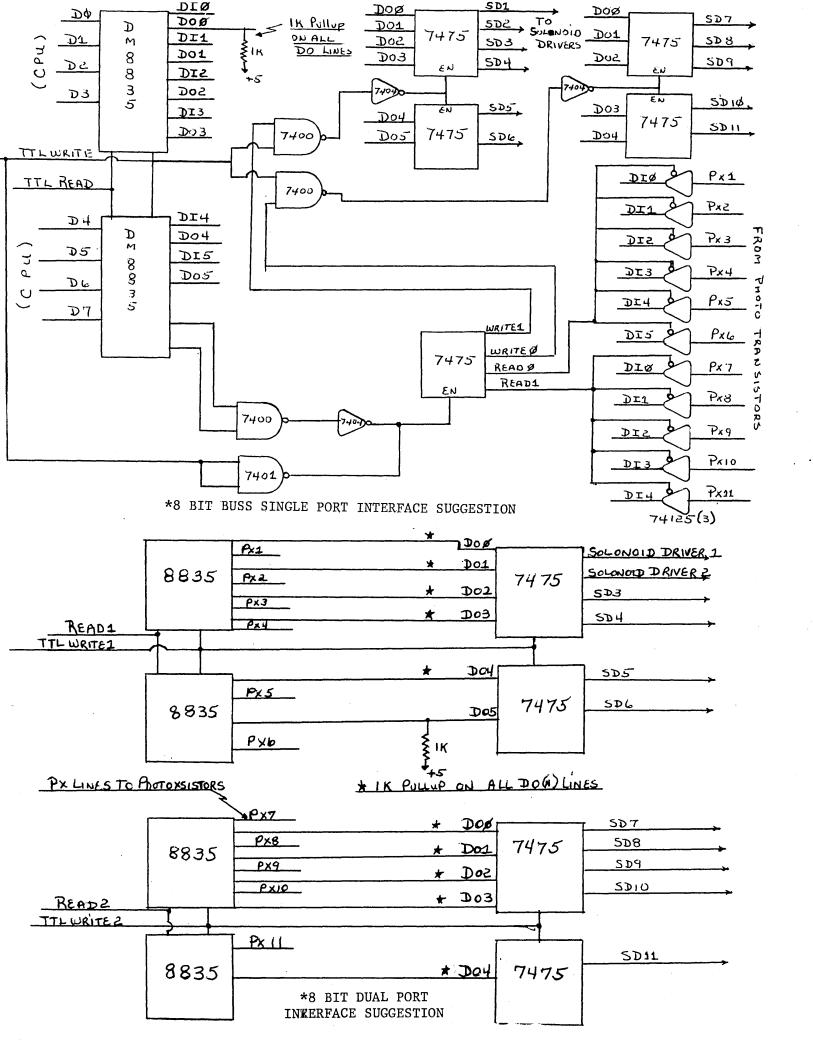
The simplest interface for an eight bit buss is to use two "ports", however. This is quite easy on systems that reference their peripherals through the technique of assigning certain memory locations to the affected devices and reading or writing that device as though it were a memory cell. This technique is employed in the level 3 kit, using the National SC/MP micro.

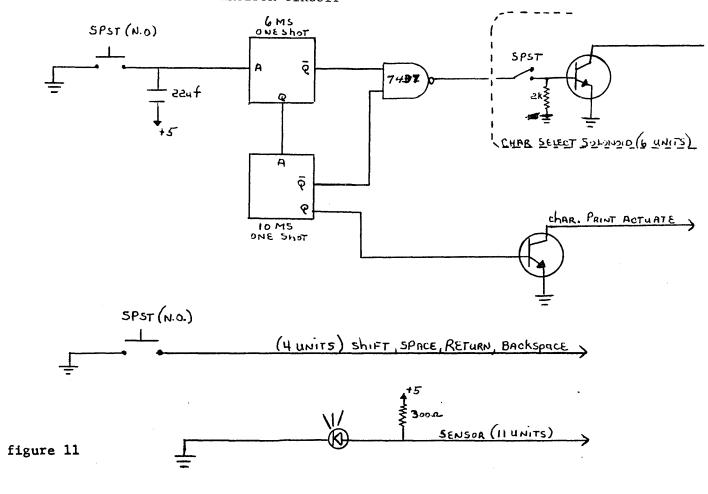
The accompanying schematics show how this interface is done in each case. The user need only supply those levels (read, write strobes, data levels) as peculiarly derived from his particular buss-\$100, 6800, etc.).

## OPTION DESCRIPTION AND INSTALLATION (lev.3)

In using the level three kit, the builder should install any desired options at the time of assembly. These options all have to do with the way that the typewriter mechanism will respond to either line control commands and/or disciplines or operator key-in instructions. A list of these options follow:

- 1. Baud rate adjustment. The small potentiometer will adjust the baud rate. (see schematic for location). The indicated test point will yield the baud rate multiplied by 16. The indicated values of resistance (set to one of these prior to soldering the potentiometer into the circuit) will give either 110 or 300 baud. Other rates are applicable, for instance, 1200 baud would yield a frequency of 52 micro-seconds at the test point.
- 2. There are three pins on the "option socket" available for wiring in the special codes Break", "LF", and "ESC" so that the operator might send these via a button depression. These can be wired through a SPST N.O. pushbutton switch wired in parallel with a 22 Uf capacitor (for de-bouncing), one switch unit per socket pin, and the controller will send the corresponding special code when that pushbutton is depressed. It is suggested that if these characters are used often, they should be wired to the switches after they are mounted in holes drilled for them in the typewriter case front.
- 3. There is a pin on the "option socket" that will force, when grounded, the controller to transmit upper case letters (only the 26 letters) to the output port. The option will not affect in any way the printing or punching of lower case letters received from the input port. This option is listed on the schematic as "U.C. only". This option can be wired as a switch if desired, and placed within the operating space on the typewriter cover.
- 4. Since the average effective throughput of the typewriter is 15 characters per second, there is a way to enable the typewriter to transmit an "LF" character at the end of processing a single print line (as terminated by a "CR" character. This option, shown as "LF trans." on the schematic, can be wired into a switch as for the previous option.
- 5. Another way to sense the completion of a print cycle is by wiring the option "DTR print" to the designated solder pad on the board. This will cause the RS232 level DTR to become false during the time required to print the line. If this option is not normally selected as available, the option should be wired to ground to force a true level on the DTR line. This option can be wired to any other of the unused RS232 signals by wiring the option in and then breaking the land (carefully please) and re-routing the wire to the pin desired (other than pin 20, which is DTR).





\* INTERFACE LOGIC - 8 BIT BUSS

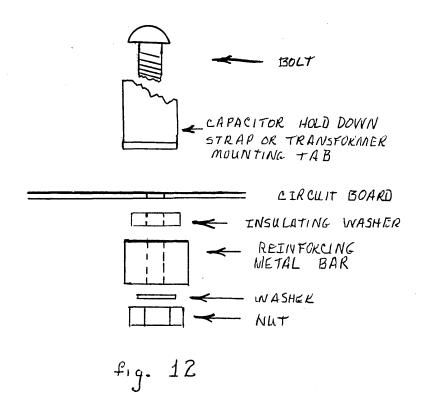
These two interface suggestions work in the following manner:

#### single port:

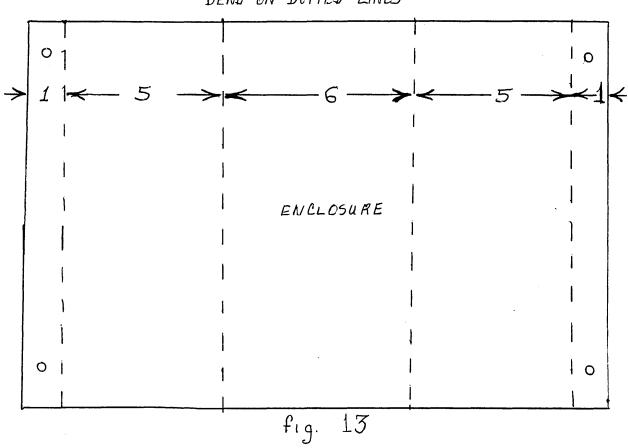
- 1. write to the unit, set upper two bits true, set bits 2-5 to indicate function to be done next
  - 1011 write to solenoid bank 1
  - 0111 write to solenoid bank 0
  - 0001 read array 0
  - 0010 read array 1
- 2. perform the read or write to sense functions, characters, or to write to proper solenoids

## dual port:

One port reads and writes 6 solenoids/sensors, the other port performs IO for the remaining five.



## BEND ON DOTTED LINES



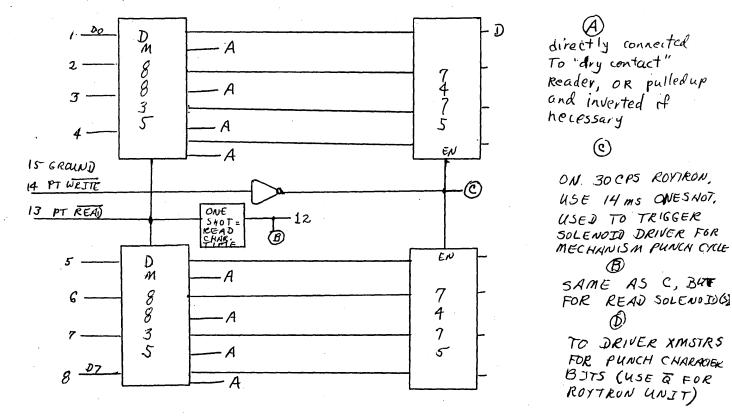
CIRCUIT BOARD ENCLOSURE, MAKE FROM ROLLED STOCK OF DESIRED THICKNESS, BOTTOM AND PRONT ARE L-SHAPED STOCK 12 & X 58 BENT ON 5" FROM END.

#### PAPER TAPE UNIT

The level 3 controller contains provisions for a paper tape unit to be slaved from the typewriter. The schematic shows how to interface this unit to the 16 pin plug included for this purpose, and the ROM software has provision for controlling this unit when interfaced as shown. This feature is designed to pass eight level code, via a 3-state port, with strobe pulses to control the punch and the vader.

The remote CPU software necessary to use this feature is identical to that used for the ASR 33. The X-ON, X-OFF, TAPE-ON and TAPE-OFF commands work identically. The switch positions on the controller board, as shown on the schematic, allow a push button normally open switch (SPST) to duplicate the manual controls. An additional switch position allows similar control over the typewriter printing mechanism. Software control of this is accomplished by using P-ON (X' $\emptyset$ E') and P-OFF (X' $\emptyset$ F'). This will allow the paper tape to function at full speed.

On paper tape units with a reader faster than the punch, the one shot controlling the vader must be set to the speed of the RS232 port to avoid overun of the data. The speed of the RS232 port must not exceed the speed of the paper tape punch.



PAPER TAPE ELECTRONICS LMOUNTED IN UNIT USED)

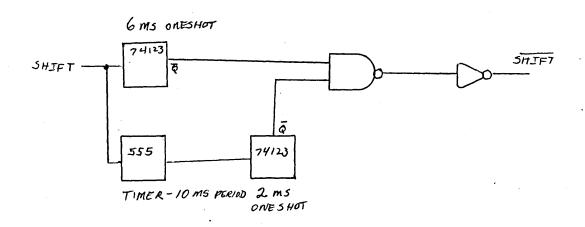


fig. 14

25% DUTY CYCLE ON SHIFT - BY HARDWARE CONTROL