Introduction

The MP-C Control Interface is a 5 1/4" x 3 1/2" double sided, plated thru hole board which is meant to interface a serial terminal to the Computer System for both system control and when selected, user program input/output. It may be jumper configured to operate serially at either 110 baud (10 characters/second) or 300 baud (30 characters/second) with an upper case ASCII terminal RS-232C or 20 Ma TTY compatable. Baudot coded TTY's are not compatable with this interface, they must be ASCII coded. Our CT-1024 terminal system kit, however, is compatable. All terminal input/output data is made thru a ten pin connector installed along the top edge of the board. Power for the board is supplied by a +5V voltage regulator and has a current consumption of approximately 0.2A.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confussion during assembly. The MOS integrated circuits supplied with this kit are susceptible to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

( ) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks". It is unlikely that you will find any but should there be on especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

( ) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder.

( ) Install all of the capacitors on the board. Solder.

( ) Install the transistors and diodes on the board. The diodes must be turned so the banded end corresponds with that shown on the component layout drawing, and the transistors must be turned to match the outlines on the component layout drawing as well. Sandwich the nylon spacer between the body of transistor Q2 and the circuit board. Solder.

( ) Starting from one end of the circuit board install each of the three, 10 pin Molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugged onto the mother board. It is suggested that you solder only the two end pins of each of the three connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins.

( ) Following the procedure outlined above, attach the remaining 10 pin Molex female edge connector along the upper edge of the board.

( ) Insert the small nylon indexing plugs into both the upper and lower edge connector pins indicated by the small triangular arrow on the "BOTTOM" side of the circuit board. This prevents the board and I/O connector from being accidently plugged on incorrectly.

( ) Install integrated circuits IC5 thru IC9. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hold the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semicircle notch, dot or bar on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

( ) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board as is secured to the circuit board with a #4 -40 x 1/4" screw, lockwasher and nut. A heatsink is not used. The three leads of the integrated circuit must be bent down into each of their respective holes. Solder.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when

installing them, even if you are grounded. On those MOS IC's being soldered in place, the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

( )   Install MOS integrated circuits IC1, IC3 and IC4 following the precautions given in the preceding section. As each is installed, make sure it is down firmly against the board before soldering all of its leads. Be very careful to install each in it's correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The "dot" or "notch" on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for each of the IC's.

( )   The board should now be jumper programmed for either 110 baud (10 characters per second) or 300 baud (30 characters per second) operation. It is desirable to program the board for 300 baud operation if possible (RS-232 only). For 110 baud operation jumper point "C" on the board to the "110" point just to the left of point "C". Also jumper point "D" on the board to the "110" point just to the left of point "D". For 300 baud operation jumper point "C" on the board to the "300" point just to the left of point "C". Also jumper point "D" on the board to the "300" point just to the left of point "D". Make these connections using two 1" pieces of light gauge insulated wire and attach them so they may easily be removed should you wish to reconfigure the board at a later time. No connections should be made to the "A", "B", "NMI" and "IRQ" points.

( )   Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability. Be sure not to fill in the holes marked "110", "300", "NMI", "A", "B" and "IRQ".

( )   Now that all of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( )   Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

Since the MP-C circuit board now contains MOS devices it is susceptable to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

Input/Output (I/O) Connector Wiring

Actual I/O connections are made thru the 10 pin connector along the top edge of the board. The 10 pin male connector should be attached to the control terminal's cable as outlined in the instructions below and my be jumper configured for either RS-232 (TV typewriter format) or 20 Ma TTY (ASR-33 TTY format) operation. There are nine connection points on the I/O connector with the tenth used for indexing which prevents the male connector from being plugged on incorrectly. The function of each of the nine is abreviated on the "BOTTOM" side of the board beneath the connector with a detailed description of each as follows:

⏚   This is the system's ground point and is the "common" return line for the RS-232 input (RI) and output (RO)

CO   The Clock Output (CO) line is used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Input (CI) point on the male connector for the system to work. The actual output of this line is a CMOS compatable (not TTL) square wave whose frequency is 1758.8 Hz when the board is programmed for 110 baud operation and 4800.0 Hz when the board is programmed for 300 baud operation.

CI   The Clock Input (CI) is also used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Output (CO) point on the male connector for the system to work.

RI   The RS-232 Input (RI) is the interface's voltage activated input which conforms to RS-232 specifications. It is the input to use when tying the computer system to the SWTPC CT-1024 Terminal System via its CT-S serial interface option. If you are not using the RS-232 Input (RI), it must be jumpered to the ground pin of the male connector.

RO   The RS-232 Output (RO) is the interface's voltage activated output which conforms to RS-232 sepcifications. It is the output to use when tying the computer system to the SWTPC CT-1024 Terminal System via it's CT-S serial interface option. When not in use leave open; do not jumper to ground.

TC   The TTY Common (TC) line is the "common" return line for the 20 Ma TTY compatable input and output and the Reader Control (RC) output. Electrically it is the same as the -12 VDC power supply buss.

TO   The 20 Ma TTY Output (TO) is the interface's current activated output. It is the output to use when tying the Computer System to an ASR-33 or similar TTY configured for 20 Ma full duplex operation.

RC   The Reader Control output (RO) is a line which may be used to implement automatic reader/punch operation on a TTY not having the "automatic" function already built in. It does so by activating a reed relay incorporated into the TTY system. Complete details are given later in the instructions.

TI   The TTY Input (TI) is the interface's current activated input. It is the
      input to use when connecting the Computer System to an ASR-33 or similar
      teletype configured for 20 Ma full duplex operation. If you are not
      using the TTY Input (TI), it must be jumpered to the TTY Common (TC) pin
      on the male connector.

Attaching the I/O Connector to the Interface

        The male I/O connector which is attached to the interface is simply a row
of ten pins supported by a nylon base. The longer side of the male connector
plugs onto the interface board edge connector while the cable wires going to
the control terminal are soldered onto the shorter side of the connector.
The cable which goes back to the interface should, if at all possible, be a
multi-conductor cable (not supplied with the kit) with a minimum of five
separate conductors.

        When preparing to attach the cable to the connector, first strip back 2"
of the cable's outer insulation. While positioning the cable in line with the
male connector's nylon support strip allowing the wires to extend just beyond
the last pin on the strip, attach and solder each of the appropiate wires
following the wiring diagram (given later in the instructions) oriented so the
ground pin ($\frac{1}{\top}$) is connected to the shortest wire. It is very easy to melt
the body of the nylon connector which will loosen the pins, so be very careful
and use a heatsink on each pin between the solder point and connector body
where possible. After attaching all of the cable wires bend the connector
around the cable a full 180 degrees and secure with two wire ties (supplied
with the kit). Now cut off the indexing pin on the male connector.

Configuring the Interface(s)

        When operating the interface in the TTY mode you must have the serial
control interface (MP-C) configured for 110 baud operation as was detailed
earlier in the instructions. In this mode the interface operates at 110 baud
with one start bit, 8 data bits (no parity) and two stop bits. TTY's operate
with this same fixed data format.

        When operating the interface in the RS-232 mode you may operate it at
either 110 or 300 baud (jumper programmable as detailed earlier in the in-
structions). You must of course have the terminal's interface (CT-S board on
the CT-1024 configured for the same baud rate. The 300 baud rate is prefer-
able if your terminal will handle it. This will make future cassette tape
stored data transfer three times faster than it would be at 110 baud operation.
No matter which baud rate you select, the terminal must be configured for
handling 8 data bits, with bit 8 either a zero or one but preferably a 0,
with no parity selection. There should be two stop bits for 110 baud opera-
tion and one stop bit for 300 baud operation. Details for configuring the
parity and bit arrangements of the CT-S interface on the CT-1024 terminal
system are in the CT-S instruction set. The CT-S interface automatically
selects two stop bits for 110 baud operation and one stop bit for 300 baud
operation.

        This completes the assembly phase for the MP-C board. Actual checkout pro-

cedures are given in the System Checkout Instructions provided with the MP-B Mother Board, however the System Assembly Instructions are used only after having assembled the MP-A Microprocessor/System Board, MP-B mother board, MP-C serial control interface and the MP-P power supply.

RS-232 Operation (CT-1024 Users)

If you will be operating the interface with an ASCII coded, RS-232 terminal such as the CT-1024 terminal system with the CT-S serial interface, you will have to configure both the terminal and computer interfaces for compatable operation.

To interconnect the two, make the connections illustrated in Figure 1.

( ) Run a jumper between the TI and TC pins on the interface connector plug.

( ) On the terminal end of the I/O cable solder two of the wires in the cable together. On the computer's interface connector plug end attach one of these wires to the CI pin and the other to the CO pin.

( ) Attach another of the terminal I/O cable wires from the RS-232 output of the terminal's serial interface (CT-S jack JS-1 pin 6) to the RI pin on the computer's interface connector plug.

( ) Attach another of the terminal I/O cable wires from the RS-232 input of the terminal's serial interface (CT-S jack JS-1 pin 7) to the RO pin on the computer's interface connector plug.

( ) Attach another of the terminal I/O cable wires from the ground of the terminal's serial interface (CT-S JS-1 pin 1) to the ⊥ pin on the computer's interface connector plug.

( ) Be sure you have configured the baud rate and parity of both the computer and terminal interfaces as called for earlier in the instructions.
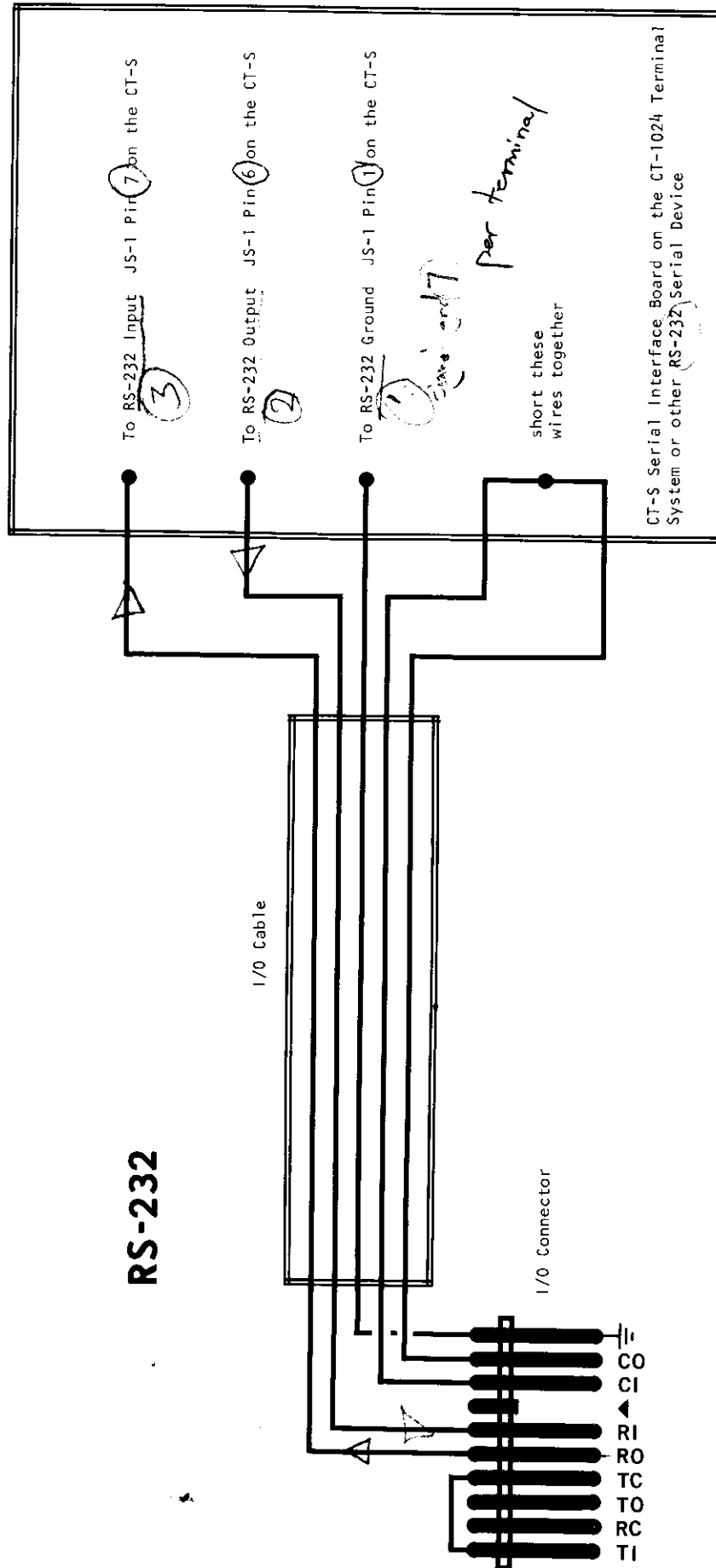
RS-232

To RS-232 Input   JS-1 Pin (7) on the CT-S

To RS-232 Output   JS-1 Pin (6) on the CT-S

To RS-232 Ground   JS-1 Pin (1) on the CT-S

short these
wires together

Per terminal

CT-S Serial Interface Board on the CT-1024 Terminal
System or other RS-232 Serial Device

I/O Cable

I/O Connector

CO
CI
RI
RO
TC
TO
RC
TI

Figure I   Wiring Diagram – Attaching a Serial RS-232 Device to the MP-C or MP-S Interfaces
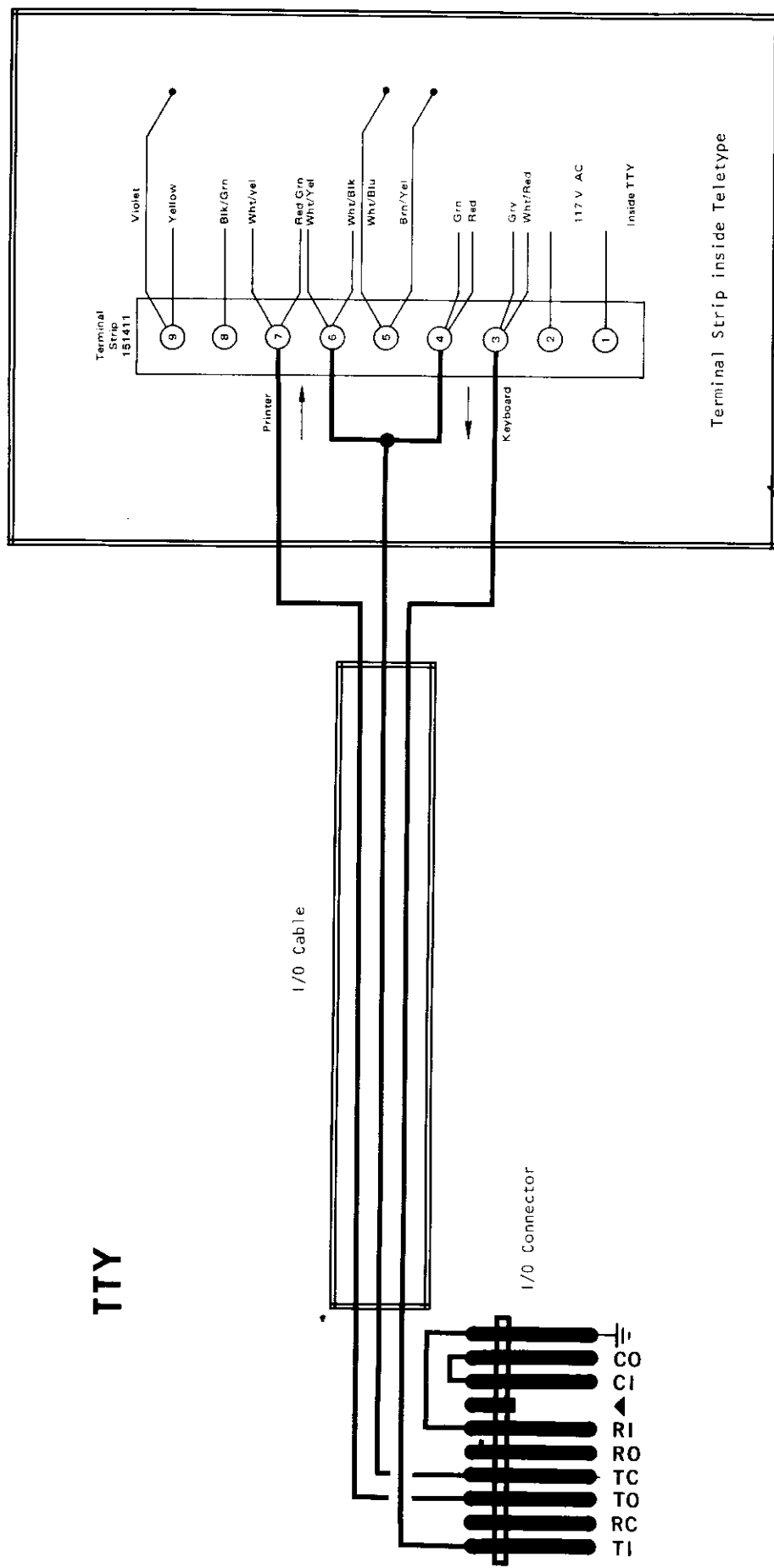
TTY

Figure 2   Wiring Diagram – Teletype Configuring and Connections to the MP-C or MP-S Interfaces

The board is now configured for full duplex, 20 Ma TTY operation.

The SWTPC 6800 Computer System is designed to work with a TTY having an automatic reader/punch feature (under software control). If your teletype does not have this feature, you can add it by incorporating the following modifications:

( ) Using the parts list below, the parts layout in figure 3 and the schematic shown in figure 5, construct the circuit on a piece of vector board. <u>Note</u>: We do not supply these parts.

PARTS LIST:

1 EA.	Reed Relay	12V, 600 ohm coil Potter Brumfield # JR-1005 or equiv.
1 EA.	Resistor	470 ohm 1/2 watt
1 EA.	Capacitor	0.1 mfd @600 VDC
1 EA.	Diode	1N5060 or equiv.
1 EA.	Board	Vector Board (2.5" x 3.8")

( ) Mount the component board on the teletype using the holes in the terminal's mounting plate as shown in figure 4.

( ) Refering to the schematic in figure 5, connect the relay, capacitor and resistor into the TTY's circuitry. The LINE and LOCAL lines must be connected to the line/off/local switch as shown in figure 5. Make sure no voltages from the TTY are accidentally connected to the relay's primary windings. Such a voltage can damage the SWTPC 6800 Computer System.

( ) The relay coil is controlled by the reader control line (RC) with respect to the TC line on the interface board, so be sure to connect the relay's coil windings back to the RC and TC points on the interface connector plug thru the I/O cable.

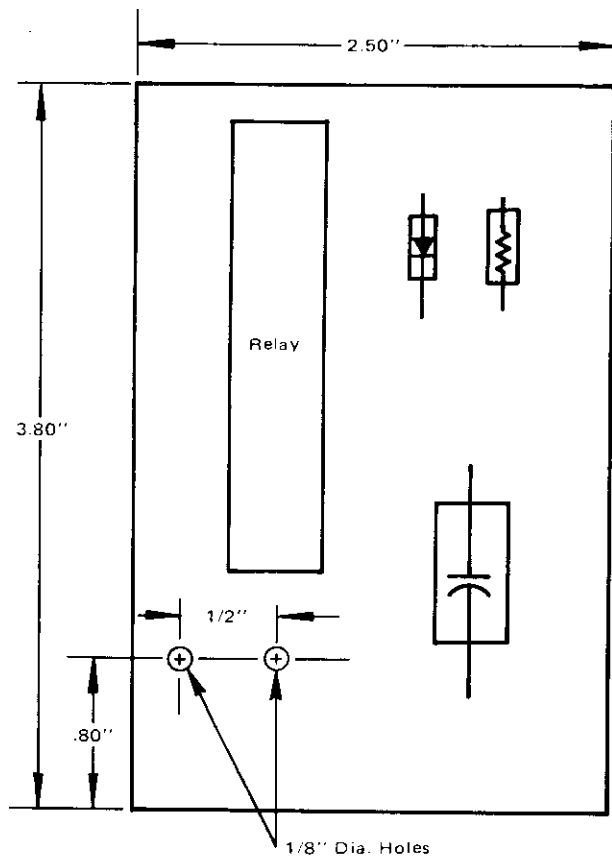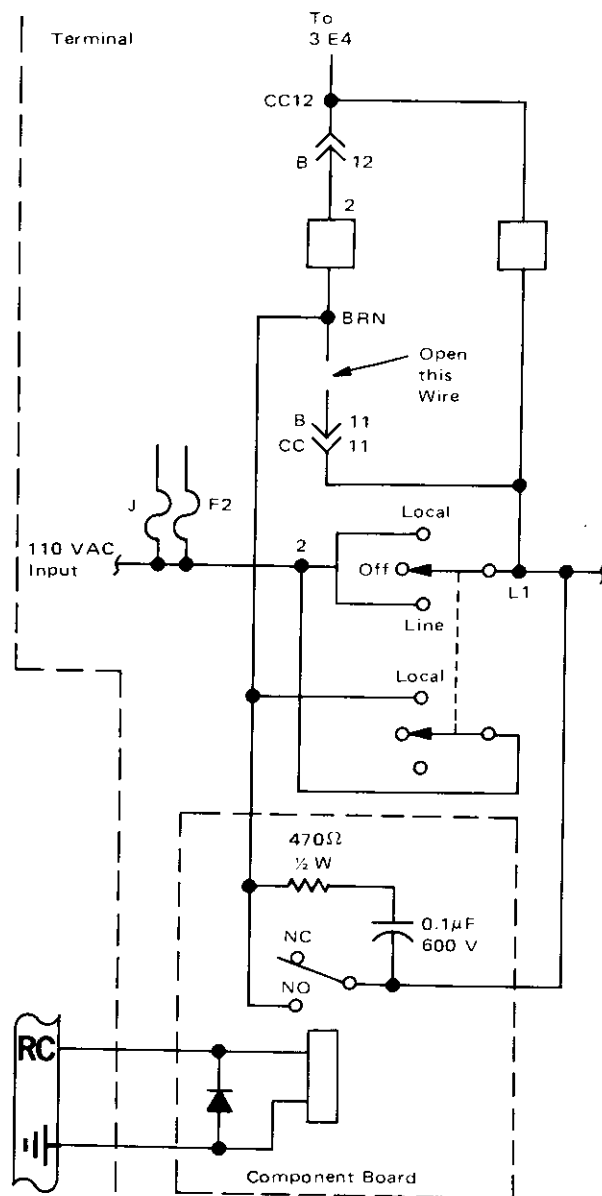Teletype Ⓡ is a registered trademark of the Teletype Corporation.

Figure 3

Figure 4

TTY Terminal Schematic Incorporating
Automatic Reader Control

Figure 5

Upgrading a Teletype for
Automatic Reader/Punch Operation

Resistors

R1, R2, R3	680 ohm 1/4 watt resistor
R4, R5	10K " " " "
R6	47K " " " "
R7	2.7K " " " "
R8	1.1K ohm 1 watt resistor
R9	330 ohm 1/2 watt resistor
R10	820 ohm 1 watt resistor
R11	100 ohm 1/4 watt resistor

Capacitors

C1	0.1 mfd mylar capacitor
C2	0.1 mfd disc capacitor

Semiconductors

D1, D2	1N4003 silicon diode
D3, D4	1N914/1N4148 silicon diode (sm.glass case)
Q1	2N5210 silicon transistor
Q2	SS1122 silicon transistor
IC1	MC6820 peripheral interface adaptor (MOS)
IC2	7805 5 VDC voltage regulator
IC3	CD4024AE CMOS binary counter (MOS)
IC4	CD4011A CMOS quad NAND gate (MOS)
IC5	1489AJ quad RS-232 receiver
IC6	7400 quad NAND gate
IC7 - IC9	4N33 optical coupled isolator

IC 2

+5

C2

GND

+8 UNR

GND

¼ IC6

13 IC5 11 R3 2

¼ IC6

+5 R1

+12 1

IC5 4

5 IC7 4 2

+12

PA0 2

PA7 9 8 IC5 10

+12 +12

+5

-12 -12

¼ IC6 10 8 4 ¼ IC6 6

+5

+5 9 5

RS0 36 RS0

RS1 35 RS1

CB2 19 1 IC5 3

R2 2

D0 33 D0

D1 32 D1

D2 31 D2

D3 30 D3

D4 29 D4

D5 28 D5

D6 27 D6

D7 26 D7

IC1
6820

PB6 16 C +5 110 baud (2 STOP BITS)

300 baud (1 STOP BIT)

R/W̄ 21 R/W̄

∅₂ 25 ENABLE

PB7 17

22 CS0
+5 CS1
24

PB2 12

23 C̄S̄2

I/O#

PB0 10

RESET 34 RESET

IRQ 38 ĪRQA
37 ĪRQB

2

Vss 1

110b D

1 IN IC3 ÷32 5

RESET

÷16 6

300b

D4 D3 +5

Schematic - MP-C Serial C...

+5
11
+12
15

-12

320 ʌ 1 watt

R3
2
IC9
4
D1
D2
R10
TO
20 ma
TTY SERIAL
OUTPUT

IC5
11

R8
1.1 KΩ 1watt
TI
20ma
TTY SERIAL
INPUT

C1

+5
TC
-12
20ma
TTY SERIAL & READER
CONTROL COMMON

+12 1
IC7
4
5
2

R5
R6
R4
Q1
Q2
R11
RO
RS-232C
OUTPUT

R7
-12

RI
RS-232C
INPUT

¼ IC6
6

+5 11 5 +12
IC8
R2
2
4

RS-232
GROUND

R9
RC
READER
CONTROL

2 STOP BITS)

STOP BIT)

CO
CASSETTE
CLOCK OUT

CI
CASSETTE
CLOCK IN

12
13
¼ IC4
11
8
¼ IC4
10

÷32
5

÷16
6

1
2
¼ IC4
3

5
6
¼ IC4
4

9

atic - MP-C Serial Control Interface

Introduction

The MP-S Serial Interface is a 5 1/4" x 3 1/2" double sided, plated thru hole board which interfaces a serial device to the Microprocessor system. It may be jumper configured to operate serially at 110, 150, 300, 600, or 1200 baud and is RS 232C and 20 Ma TTY compatable. Baudot coded TTY's are not compatable with this interface. Complete interrupt control of the interface is under software control thru the user's program. All data input/output is made thru a ten pin connector installed along the top edge of the board. Power for the board is supplied by a +5V voltage regulator and has a current con-sumption of approximately 0.2 A.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confusion during assembly. The MOS integrated circuits supplied with this kit are susceptable to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

The MP-S serial interface is an option board and need not be assembled nor should be installed onto the mother board until the entire computer system has been checked out and is known to be working properly.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical con-nection to the top foil.

( ) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks". It is unlikely that you will find any but should there be one especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

( ) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8"

of wire remains. Solder.

( ) Install all of the capacitors on the board. Solder.

( ) Install the transistors and diodes on the board. The diodes must be turned so the banded end corresponds with that shown on the component layout drawing, and the transistors must be turned to match the outlines on the component layout drawing as well. Sandwich the nylon spacer between the body of transistor Q2 and the circuit board. Solder.

( ) Starting from one end of the circuit board install each of the three, 10 pin molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugged onto the mother board. It is suggested that you solder only the two end pins of each of the three connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins.

( ) Following the procedure outlined above, attach the remaining 10 pin Molex female edge connector along the upper edge of the board.

( ) Insert the small nylon indexing plugs into both the upper and lower edge connector pins indicated by the small triangular arrow on the "BOTTOM" side of the circuit board. This prevents the board and I/O connector from being accidently plugged on incorrectly.

( ) Install integrated circuits IC3 thru IC6. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hold the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semicircle notch, dot or bar on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

( ) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board as is secured to the circuit board with a #4 -40 x 1/4" screw, lockwasher and nut. A heatsink is not used. The three leads of the integrated circuit must be bent down into each of their respective holes. Solder.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid

touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place, the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

( ) Install MOS integrated circuit IC1, following the precautions given in the preceeding section. As it is installed, make sure it is down firmly against the board before soldering all of its leads. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integraed circuit should replacement ever be necessary. The "dot" or "notch" on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for the IC.

( ) The board should now be programmed for the selected baud rate. Using a 1" piece of light gauge insulated wire, attach and solder one end of the wire to the selected baud rate pad and attach the other end of the wire to the pad adjacent this connection.

( ) Using a 1/2" piece of light gauge wire, attach and solder one end of the wire to the "I" pad (between the "IRQ" and "NMI" pads). Attach and solder the other end to the "IRQ" pad. This will allow you to use maskable interrupts when program selected.

( ) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability. Be sure not to fill in the holes marked "110", "150", "300", "600", "1200", the five pads adjacent these, or the "NMI" pad.

( ) Now that all of the componnets have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( ) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

Since the MP-S circuit board now contains MOS devices it is susceptable to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

Input/Output (I/O) Connector Wiring

Actual I/O connections are made thru the 10 pin connector along the top edge of the board. The 10 pin male connector should be attached to the con-

trol terminal's cable as outlined in the instructions below and may be jumper configured for either RS-232 (TV Typewriter format) or 20 Ma TTY (ASR-33 TTY format) operation. There are nine connection points on the I/O connector with the tenth used for indexing which prevents the male connector from being plugged on incorrectly. The function of each of the nine is abbreviated on the "BOTTOM" side of the board beneath the connector with a detailed description of each as follows:

⏚ This is the system's ground point and is the "common" return line for the RS-232 input (RI) and output (RO).

CO The Clock Output (CO) line is used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Input (CI) point on the male connector for the system to work. The actual output of this line is a CMOS compatable (not TTL) square wave whose frequency is approximately sixteen times the baud rate.

CI The Clock Input (CI) is also used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Output (CO) point on the male connector for the system to work.

RI The RS-232 Input (RI) is the interface's voltage activated input which conforms to RS-232 specifications. It is the input to use when tying the computer system to the SWTPC CT-1024 Terminal System via its CT-S serial interface option. If you are not using the RS-232 Input (RI), it must be jumpered to the ground pin of the male connector.

RO The RS-232 Output (RO) is the interface's voltage activated output which conforms to RS-232 sepcifications. It is the output to use when tying the computer system to the SWTPC CT-1024 Terminal System via it's CT-S serial interface option. When not in use leave open; do not jumper to ground.

TC The TTY Common (TC) line is the "common" return line for the 20 Ma TTY compatable input and output and the Reader Control (RC) output. Electrically it is the same as the -12 VDC power supply buss.

TO The 20 Ma TTY Output (TO) is the interface's current activated output. It is the output to use when tying the Computer System to an ASR-33 or similar TTY configured for 20 Ma full duplex operation.

RC The Reader Control output (RO) is a line which may be used to implement automatic reader/punch operation on a TTY not having the "automatic" function already built in. It does so by activating a reed relay incorporated into the TTY system. Complete details are given later in the instructions.

TI The TTY Input (TI) is the interface's current activated input. It is the input to use when connecting the Computer System to an ASR-33 or similar teletype configured for 20 Ma full duplex operation. If you are not using the TTY Input (TI), it must be jumpered to the TTY Common (TC) pin on the male connector.

Attaching the I/O Connector to the Interface

The male I/O connector which is attached to the interface is simply a row of ten pins supported by a nylon base. The longer side of the male connector plugs onto the interface board edge connector while the cable wires going to the control terminal are soldered onto the shorter side of the connector. The cable which goes back to the interface should, if at all possible, be a multi-connector cable (not supplied with the kit) with a minimum of five separate conductors.

When preparing to attach the cable to the connector, first strip back 2" of the cable's outer insulation. While positioning the cable in line with the male connector's nylon support strip allowing the wires to extend just beyond the last pin on the strip, attach and solder each of the appropiate wires following the wiring diagram (given later in the instructions) oriented so the ground pin ($\perp$) is connected to the shortest wire. It is very easy to melt the body of the nylon connector which will loosen the pins, so be very careful and use a heatsink on each pin between the solder point and connector body where possible. After attaching all of the cable wires bend the connector around the cable a full 180 degrees and secure with two wire ties (supplied with the kit). Now cut off the indexing pin on the male connector.

Configuring the Interface(s)

When operating the interface in the TTY mode you must have the serial interface (MP-S) configured for 110 baud operation as was detailed earlier in the instructions. In this mode the interface operates at 110 baud with one start bit, 8 data bits (no parity) and two stop bits. TTY's operate with this same fixed data format.

When operating the interface in the RS-232 mode you may operate it at either 110, 150, 300, 600 or 1200 baud (jumper programmable as detailed earlier in the instructions). You must of course have the terminal's inter-face (CT-S board on the CT-1024) configured for the same baud rate. The 300 baud rate is preferable if your terminal will handle it. This will make future cassette tape stored data systems compatable. No matter which baud rate you select, the terminal must be configured for handling the same parity and bit format as the MP-S interface. This is all done thru software pro-gramming. There should be two stop bits for 110 baud operation and one stop bit for 150, 300, 600 and 1200 baud operation. Details for configuring the parity and bit arrangements of the CT-S interface on the CT-1024 terminal system are in the CT-S instruction set. The CT-S interface automatically selects two stop bits for 110 baud operation and one stop bit for 300 baud operation.

RS-232 Operation (CT-1024 Users)

If you will be operating the interface with an ASCII coded, RS-232 ter-minal such as the CT-1024 terminal system with the CT-S serial interface, you will have to configure both the terminal and computer interfaces for compat-able operation.

To interconnect the two, make the connections illustrated in Figure 1.

( )   Run a jumper between the TI and TC pins on the interface connector plug.

( )   On the terminal end of the I/O cable solder two of the wires in the cable together. On the computer's interface connector plug end attach on of these wires to the Cl pin and the other to the CO pin.

( )   Attach another of the terminal I/O cable wires from the RS-232 output of the terminal's serial interface (CT-S jack JS-1 pin 6) to the RI pin on the computer's interface connector plug.

( )   Attach another of the terminal I/O cable wires from the RS-232 input of the terminal's serial interface (CT-S jack JS-1 pin 7) to the RO pin on the computer's interface connector plug.

( )   Attach another of the terminal I/O cable wires from the ground of the terminal's serial interface (CT-S JS-1 pin 1) to the $\perp$ pin on the computer's interface connector plug.

( )   Be sure you have configured the baud rate of both the computer and terminal interfaces as called for earlier in the instructions.
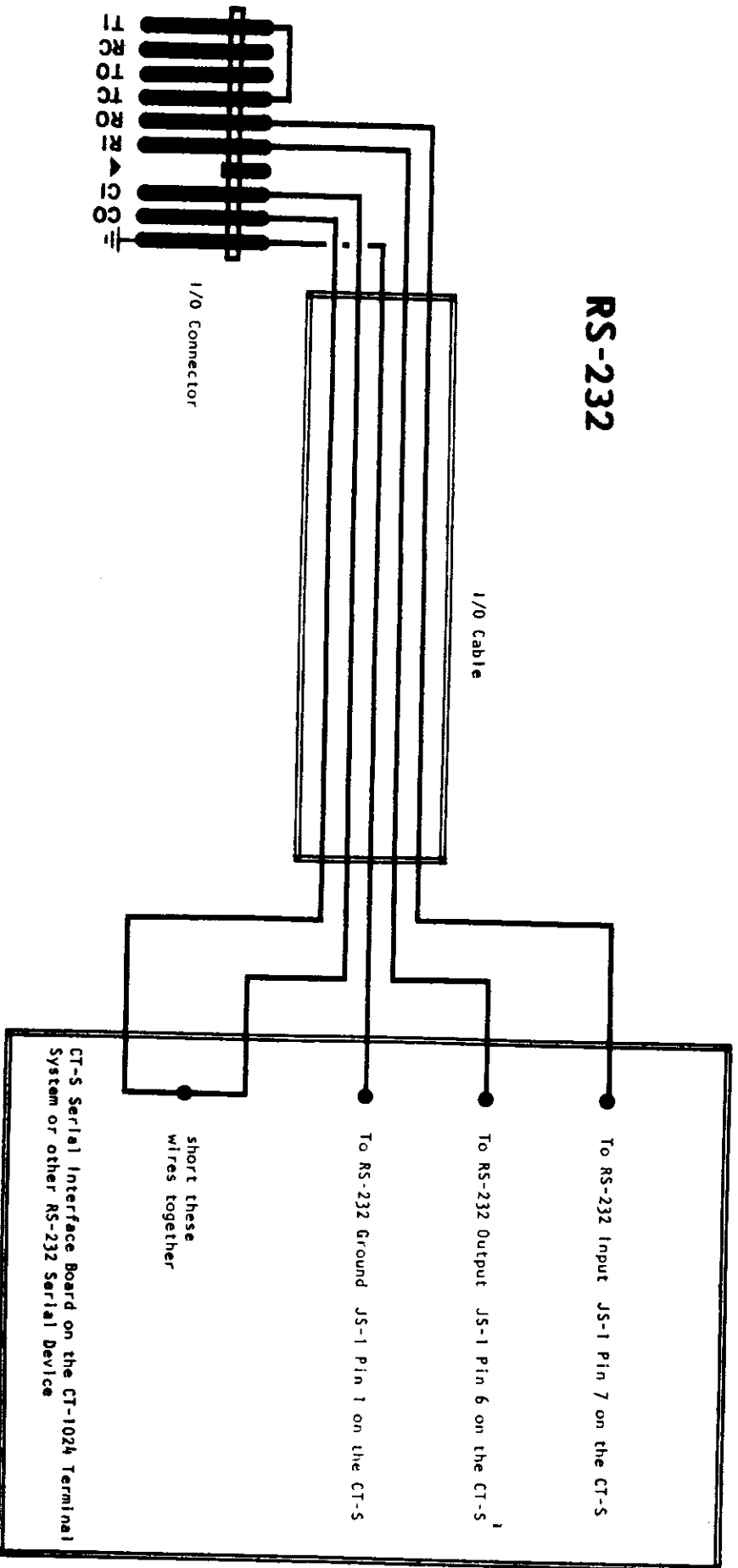
RS-232

I/O Connector

I/O Cable

TRS232R▲DCT
OUTREGSR▲DCGND

To RS-232 Input JS-1 Pin 7 on the CT-S

To RS-232 Output JS-1 Pin 6 on the CT-S

To RS-232 Ground JS-1 Pin 1 on the CT-S

short these
wires together

CT-S Serial Interface Board on the CT-1024 Terminal
System or other RS-232 Serial Device

Figure I   Wiring Diagram - Attaching a Serial RS-232 Device to the MP-C or MP-S Interfaces

<center>Teletype ® Operation (TTY)</center>

If you will be operating the interface with an ASCII coded Teletype ® (TTY), you will have to configure TTY for full duplex, 20 Ma current loop operation and the interface for 110 baud, TTY operation. The interface will work with ASCII coded terminals only. It will not work with the older 5-level Baudot coded terminals.

Although you should refer to the TTY manufacturer's documentation for specific details you can generally configure the TTY for full duplex, 20 Ma operation as follows:

(In reference to the I/O terminal strip inside the TTY-see figure 2)

( ) Connect the white/blue wire to terminal 5.

( ) Connect the brown/yellow wire to terminal 5.

( ) Connect the violet wire to terminal 9.

(In reference to the power resistor behind the power supply <u>inside</u> the TTY)

( ) Move the blue wire from the 750 ohm tap to the 1450 ohm tap.

To configure the interface for 110 baud, TTY operation for attachment to the TTY, make the connections illustrated in figure 2.

( ) Run a jumper between the CI and the CO pins on the interface connector plug.

( ) Run a jumper between the $\perp$ and the RI pins on the interface connector plug.

( ) Attach one of the TTY I/O cable wires from terminal 7 of the TTY's terminal strip to the TO pin on the interface connector plug.

( ) Run a jumper between terminals 4 and 6 on the TTY-s terminal strip.

( ) Attach another of the TTY I/O cable wires from terminal 6 of the TTY's terminal strip to the TC pin on the interface connector plug.

( ) Attach another of the TTY I/O cable wires from terminal 3 of the TTY's terminal strip to the TI pin on the interface connector plug.

Configure the board for 110 baud operation if you have not already done so by installing a jumper across the "110" pads. Be sure there are no jumpers in any of the other baud rate positions on the board.

The selected board is now configured for full duplex, 20 Ma TTY operation.

The SWTPC 6800 Computer System is designed to work with a TTY having an automatic reader/punch feature (under software control). If your teletype does not have this feature, you can add it by incorporating the following modifications.

<center>- 8 -</center>

( ) Using the parts list below, the parts layout in figure 3 and the schematic shown in figure 5, construct the circuit on a piece of vector board. **Note:** We do not supply these parts.

PARTS LIST:

1 EA.	Reed Relay	12V, 600 ohm coil Potter Brumfield # JR-1005 or equiv.
1 EA.	Resistor	470 ohm 1/2 watt.
1 EA.	Capacitor	0.1 mfd @600 VDC
1 EA.	Diode	1N5060 or equiv.
1 EA.	Board	Vector Board (2.5" x 3.8")

( ) Mount the component board on the teletype using the holes in the terminal's mounting plate as shown in figure 4.

( ) Refering to the schematic in figure 5, connect the relay, capacitor and resistor into the TTY's circuitry. The LINE and LOCAL lines must be connected to the line/off/local switch as shown in figure 5. Make sure no voltages from the TTY are accidentally connected to the relay's primary windings. Such a voltage can damage the SWTPC 6800 Computer System.

( ) The relay coil is controlled by the reader control line (RC) with respect to the TC line on the interface board, so be sure to connect the relay's coil windings back to the TC and TC points on the interface connector plug thru the I/O cable.

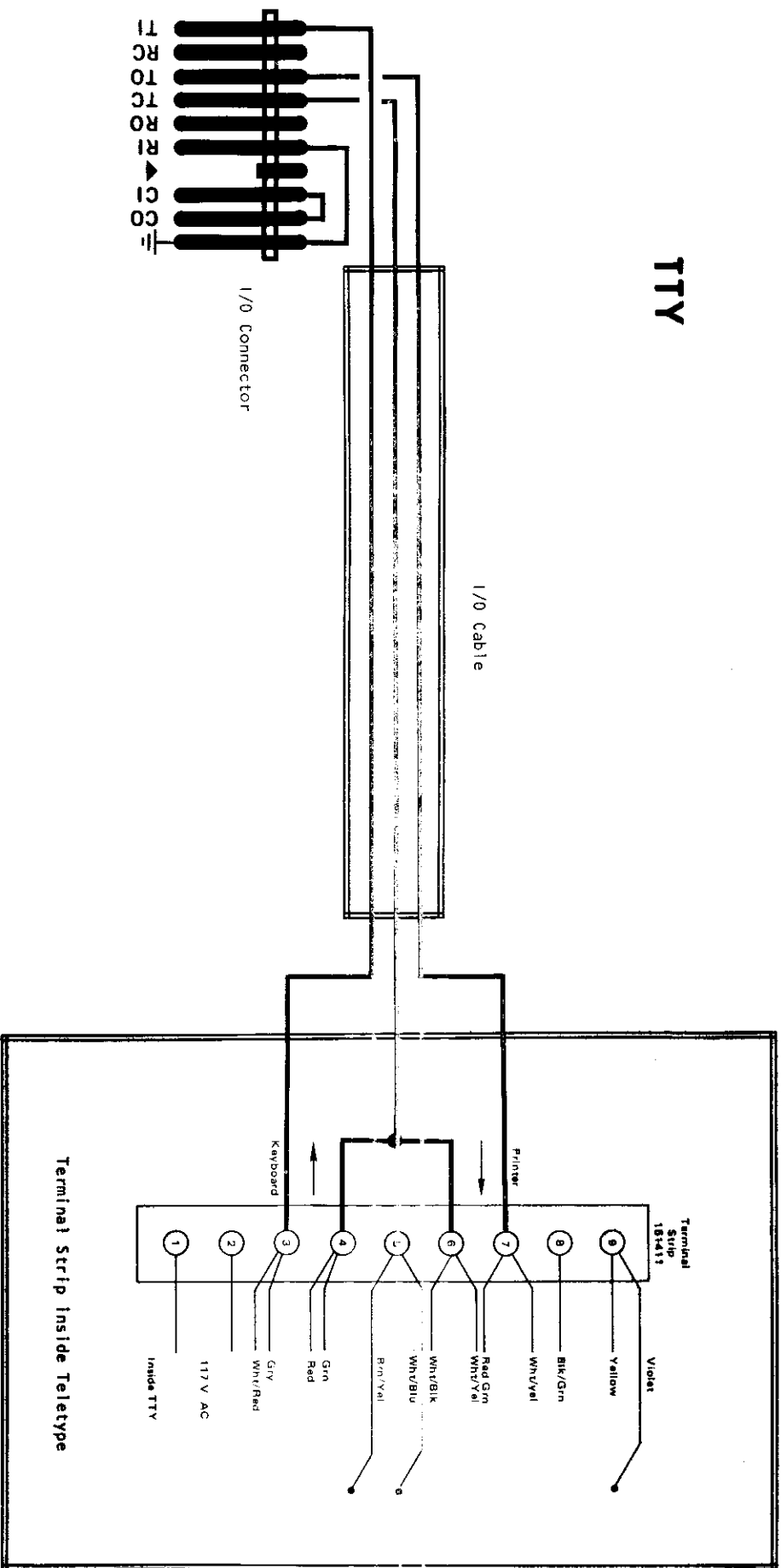Teletype ® is a registered trademark of the Teletype Corporation.

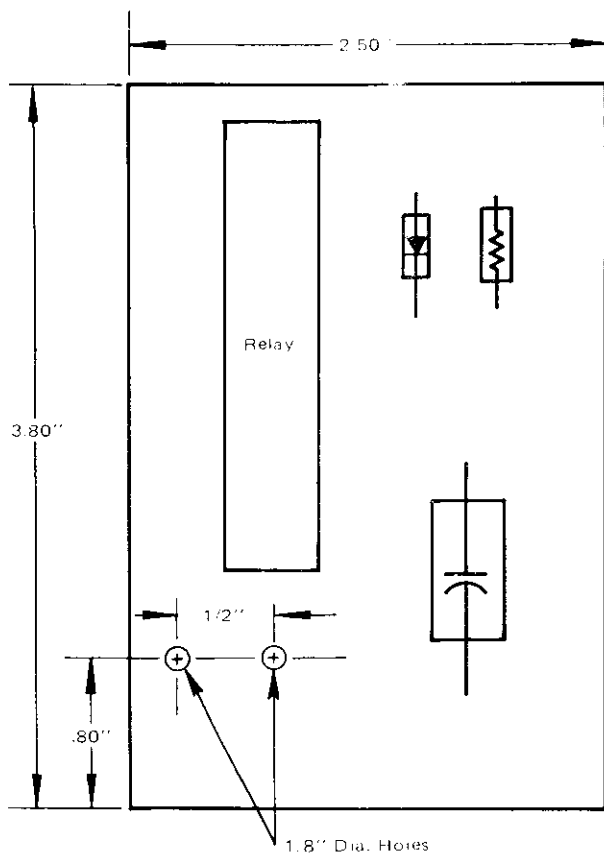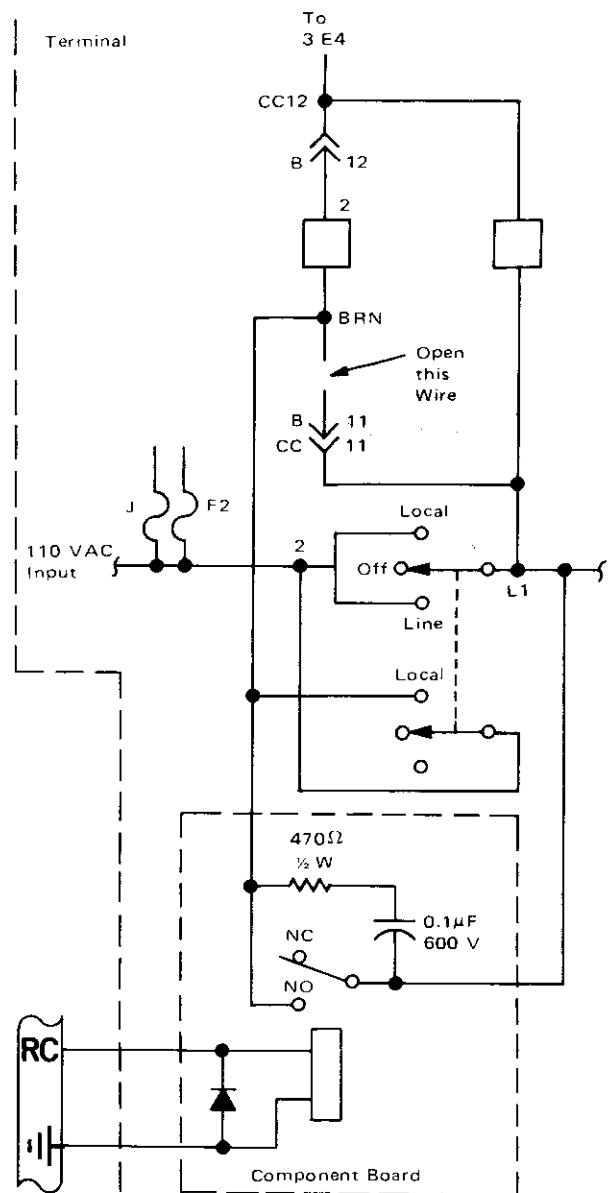Figure 2   Wiring Diagram - Teletype Configuring and Connections to the MP-C or MP-S Interfaces

2.50 ←→

3.80"

Relay

1/2"

.80"

1.8" Dia. Holes

Figure 3

Figure 4

Terminal

To
3 E4

CC12

B 12

2

BRN

Open
this
Wire

B 11
CC 11

Local

J   F2

110 VAC
Input

2

Off

Line

L1

Local

470Ω
½ W

0.1μF
600 V

NC

NO

RC

Component Board

TTY Terminal Schematic Incorporating
Automatic Reader Control

Figure 5

Upgrading a Teletype for

Automatic Reader/Punch Operation

Address Assignments

Four address assignments have been allocated for each interface port; they are as follows:

```
PORT 0    8000 to 8003
PORT 1    8004 to 8007 (serial control interface only)
PORT 2    8008 to 800B
PORT 3    800C to 800F
PORT 4    8010 to 8013
PORT 5    8014 to 8017
PORT 6    8018 to 801B
PORT 7    801C to 801F
```

The actual addresses to be used in your programs for the interface(s) is determined by the interface position (port #) onto which the board is plugged.

Within each block of four addresses, the lowest is used for the control and status registers. You write to the control register and read from the status register. The second sequential address are the transmit and receive data registers. You write to the transmit register and read from the receive register. The last two sequential addresses are not to be used for serial interfaces. They are reserved for the parallel interfaces.

Before the serial interfaces may be used within your programs, you must configure and use them as outlined in the Hardware section of the System Documentation Notebook.

MP-S Serial Interface Checkout Procedure

The board may be checked out using the SERINT diagnostic contained in the software section of the System Documentation Notebook. However, the MP-S Serial Interface board should not even be plugged onto the computer system until you have confirmed that the computer system itself is working properly.

How It Works

The MP-S Serial Interface uses IC1 as a software programmable serial type interface chip to communicate with a serial peripheral device. Unlike the MP-C Serial Control Interface, the actual encoding and decoding including start and stop bits is done by the interface integrated circuit itself thru hardware. This saves a considerable amount of processor time.

The $\overline{RTS}$ output on IC1 may be used to generate a "Reader Control" output which may control a TTY not having the automatic reader/punch function or some other user defined function.

Any "echo" functions for full duplex appliactions must be done thru software in your program.

Optical Couplers IC3 thru IC5 are used for isolation on the various inputs/outputs. Both -12 and +12 voltages are required by the interface for RS-232/TTY communication. These lines are not regulated and are derived from the computer's power supply board. +5 VDC power for the board is supplied by voltage regulator IC2.

Parts List MP-S Serial Interface

Resistors

R1, R2, R3	680 ohm 1/4 watt resistor
R4, R5	10K " " " "
R6	47K " " " "
R7	2.7K " " " "
R8	1.1K ohm 1 watt resistor
R9	330 ohm 1/2 watt resistor
R10	820 ohm 1 watt resistor
R11	100 ohm 1/4 watt resistor

Capacitors

C1	0.1 mfd mylar capacitor
C2	0.1 mfd disc capacitor

Semiconductors

D1, D2	1N4003 silicon diode
D3, D4	1N4148 small glass silicon diode
Q1	2N5210 transistor
Q2	SS1122 transistor
IC1	MC6850 asynchronous communications adaptor (MOS)
IC2	7805 5 VDC voltage regulator
IC3	1489AJ quad RS-232 receiver
IC4 - IC6	4N33 optical coupled isolator

Modification

so that

CO - is same as clock signal feeding pin4-TXC that is outgoing serial is clocked to CO

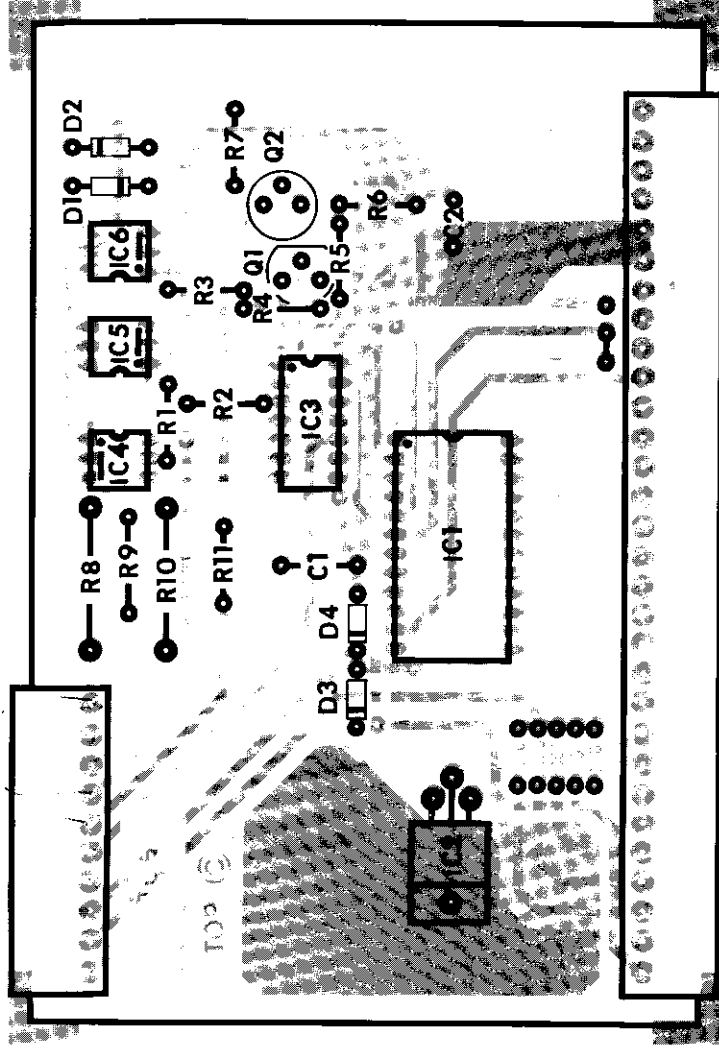was before incoming serial is clocked to CI-pin3-RXC

modification

① break line from CI to pin3 & pin4 IC1

② separate pins3 & pin4 foil

③ connect CI line to pin3 IC1

④ connect line for CO to pin4 IC1

Board labels: D2, D1, R7, Q2, IC6, R6, C2, R3, Q1, R5, R4, IC5, R1, R2, IC3, R8, R9, R10, R11, C1, IC1, D4, D3, IC4, TOP

Connector Reference Sheet

In order to avoid confusion in distinguishing between the various connectors supplied with our many kits, we are including this connector reference sheet with the kit instruction set. We have had a great many customers interchange the male and female connector shells when assembling their kits so we have clearly illustrated each connector along with its proper name and gender on this reference sheet. All are shown actual size.

Male Pin
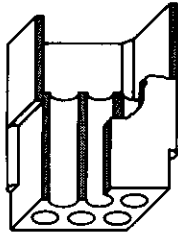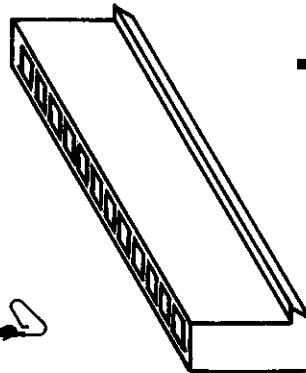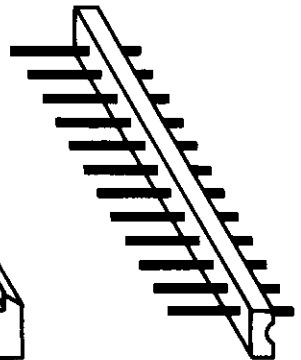
Female Pin

Molex Female Shell Connector

Molex Male Shell Connector
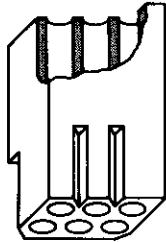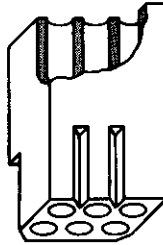
Molex Male Shell Connector

Molex Wafercon ®

Pin for Harness Connector

Harness Connector

Straight Pin Edge Connector

Male Solder Tail Pin PC Type

Female Solder Tail Pin PC Type
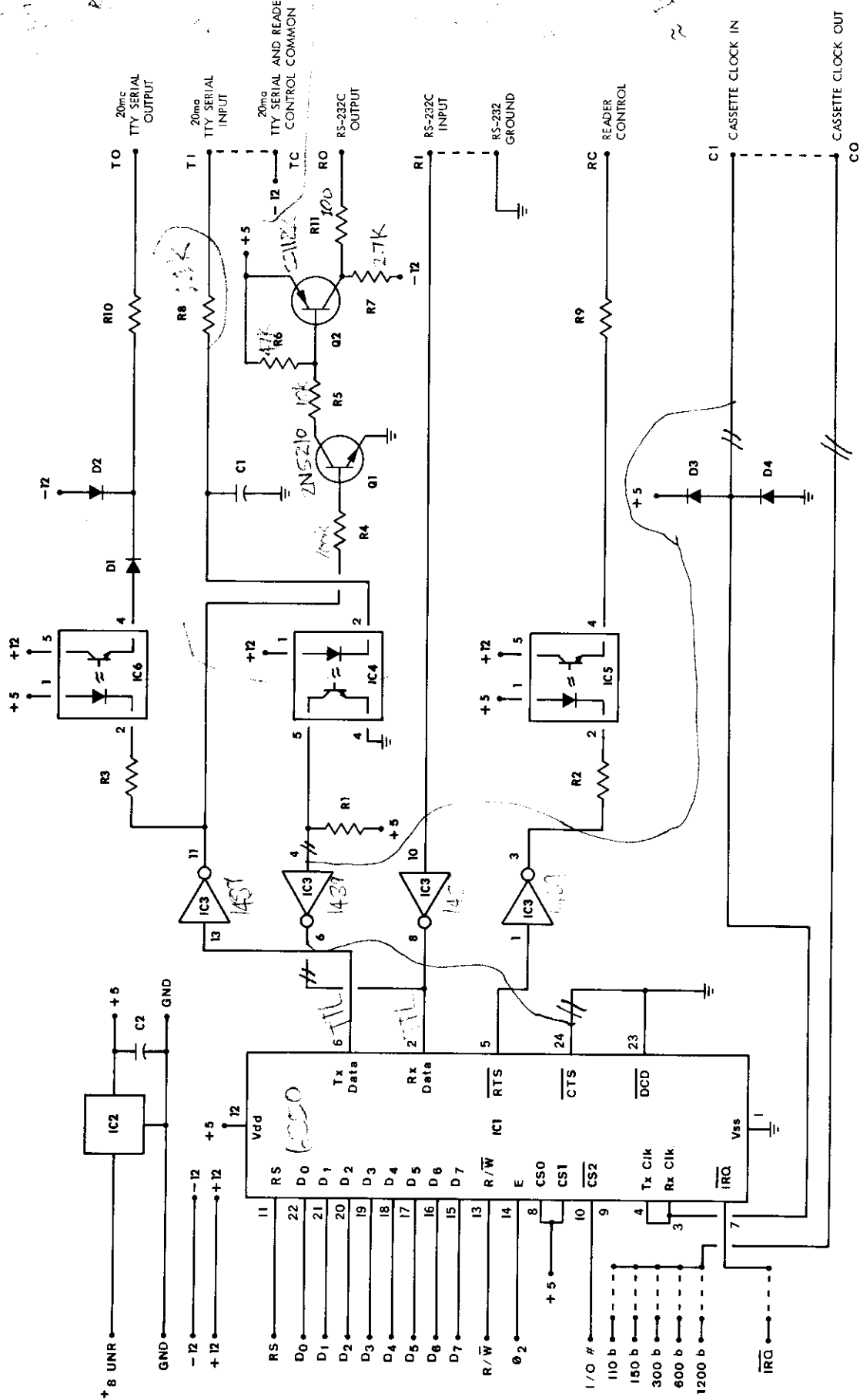
SCHEMATIC MP-S SERIAL INTERFACE

TTY

Terminal Strip 151411

9 — Violet
8 — Yellow
    Blk/Grn
7 — Wht/yel
    Red Grn / Wht/Yel
6 — Wht/Blk
5 — Wht/Blu
    Brn/Yel
4 — Grn / Red
3 — Gry / Wht/Red
2 — 117 V AC
1 — Inside TTY

Printer

Keyboard

-12vdc

Terminal Strip inside Teletype

I/O Cable

I/O Connector

CO
CT
RI
RO
TC
TO
RC
TI
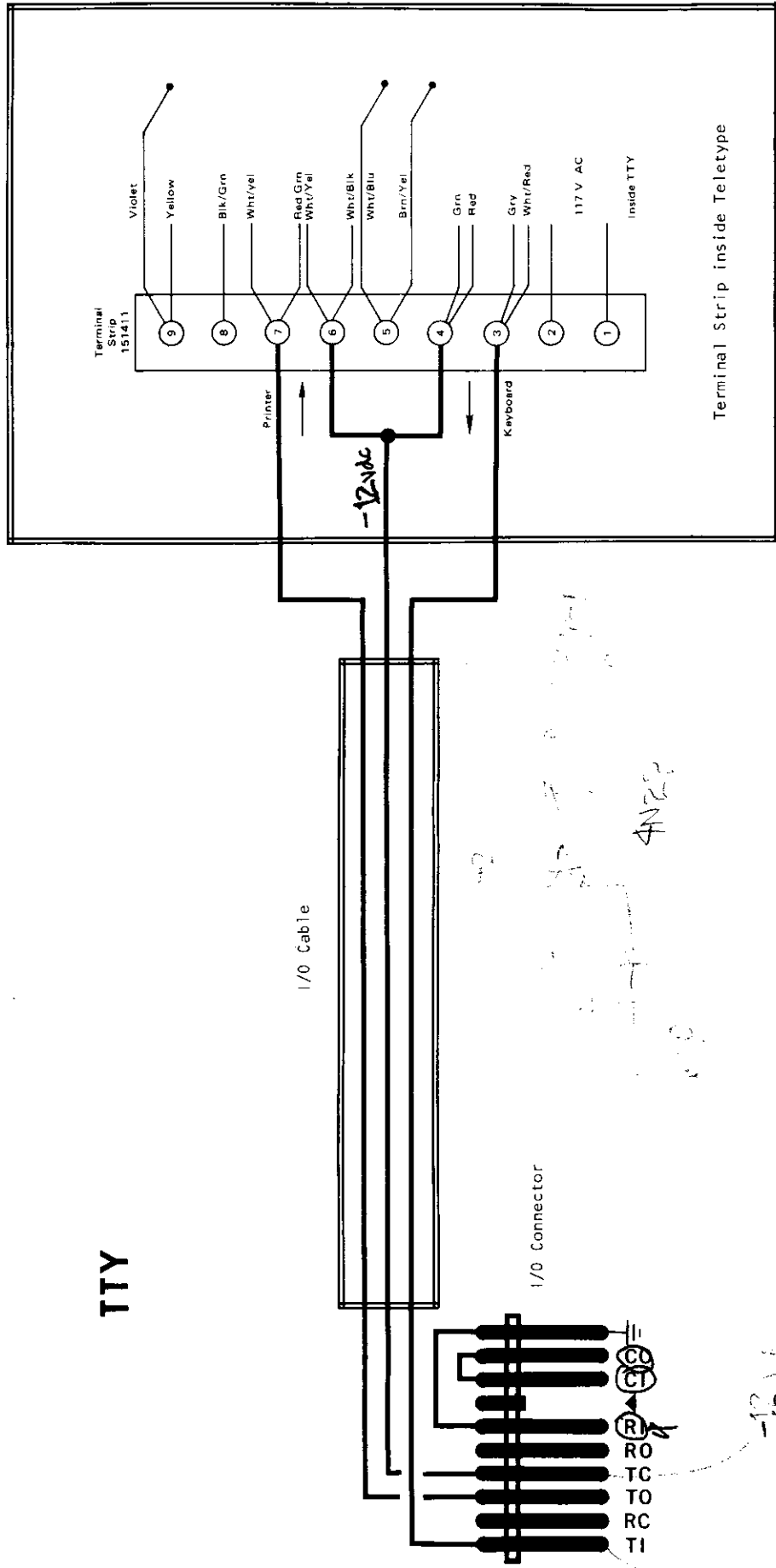
Figure 2   Wiring Diagram – Teletype Configuring and Connections to the MP-C or MP-S Interfaces
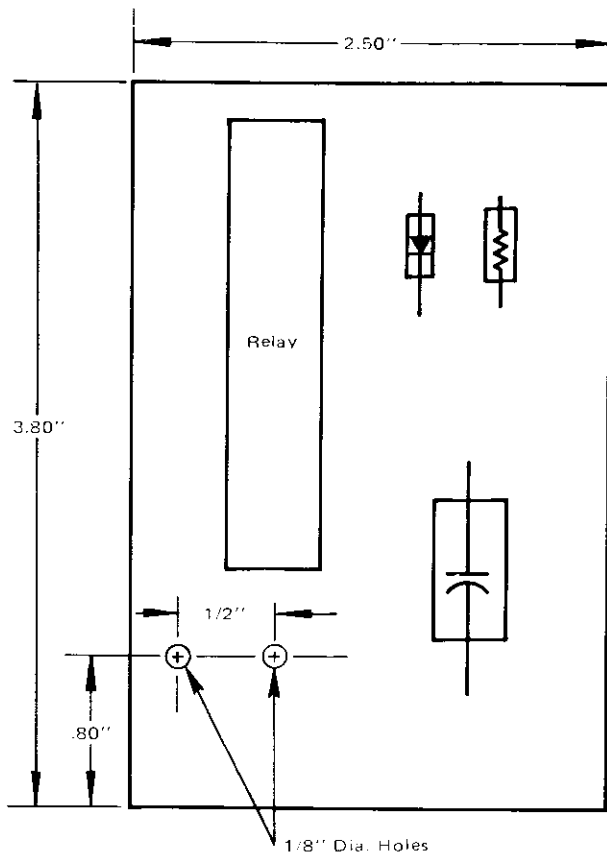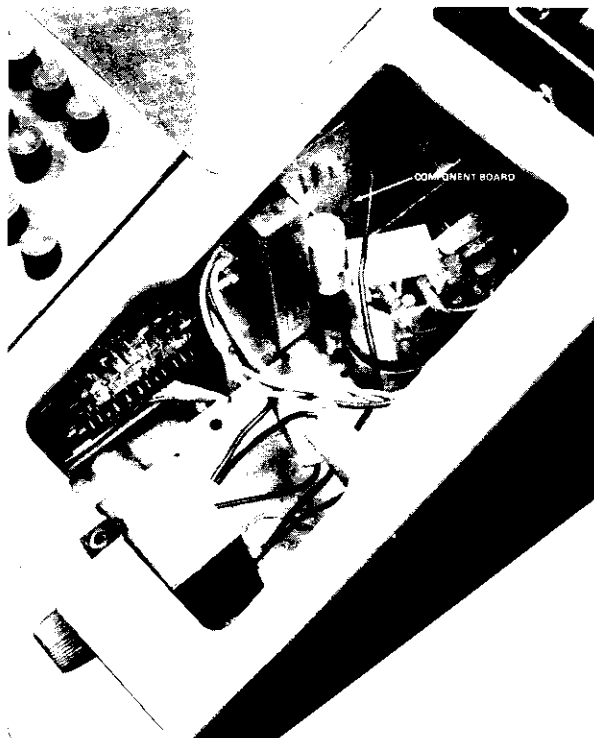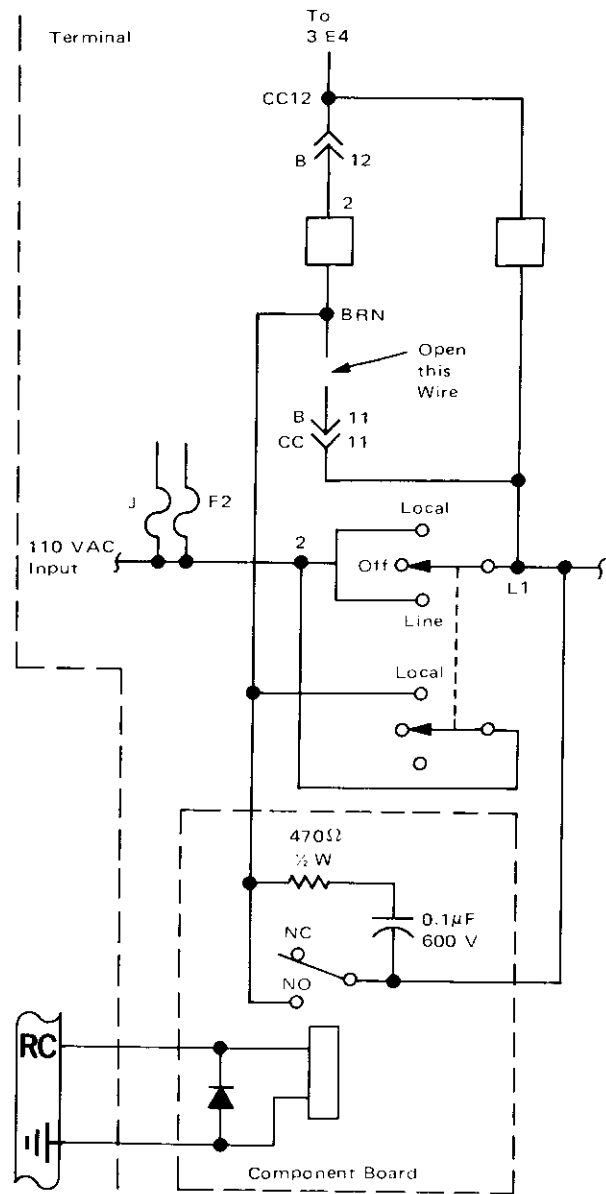
Figure 3

Figure 4

TTY Terminal Schematic Incorporating
Automatic Reader Control

Figure 5

Upgrading a Teletype for
Automatic Reader/Punch Operation

Address Assignments

Four address assignments have been allocated for each interface port; They are as follows:

PORT 0   8000 to 8003
PORT 1   8004 to 8007 (serial control interface only)
PORT 2   8008 to 800B
PORT 3   800C to 800F
PORT 4   8010 to 8013
PORT 5   8014 to 8017
PORT 6   8018 to 801B
PORT 7   801C to 801F

The actual addresses to be used in your programs for the interface(s) are determined by the interface position (port #) onto which the board is plugged.

Within each block of four addresses, the lowest is used for the control and status registers. You write to the control register and read from the status register. The second sequential address are the transmit and receive data registers. You write to the transmit register and read from the receive register. The last two sequential address are **not** to be used for serial interfaces. They are reserved for the parallel interfaces.

Before the serial interfaces may be used within your programs, you must configure and use them as outlined in the Hardware section of the System Documentation Notebook.

MP-S Serial Interface Checkout Procedure

The board may be checked out using the SERINT diagnostic contained in the software section of the System Documentation Notebook

How It Works

The MP-S Serial Interface uses IC1 as a software programmable serial type interface chip to communicate with a serial peripheral device. Unlike the MP-C Serial Control Interface, the actual encoding and decoding including start and stop bits are done by the interface integrated circuit itself thru hardware. This saves a considerable amount of processor time.

The RTS output on IC1 may be used to generate a "Reader Control" output which may control a TTY not having the automatic reader/punch function or some other user defined function.

Any "echo" functions for full duplex applications must be done thru software in your program.

Optical Couplers IC3 thru IC5 are used for isolation on the various inputs/ouputs. Both -12 and +12 voltages are required by the interface for RS-232/TTY communication. These lines are not regulated and are derived from the computer's power supply board. +5 VDC power for the board is supplied by voltage regulator IC2.

Parts List MP-S Serial Interface

Resistors

——	R1	680 ohm ¼ watt resistor
——	R2	680 ohm " " "
——	R3	680 ohm " " "
——	R4	10K ohm " " "
——	R5	10K ohm " " "
——	R6	47K ohm " " "

——	R7	2.7K ohm ¼ watt resistor
——	R8	1.1K ohm 1 watt resistor
——	R9	330 ohm ½ watt resistor
——	R10	820 ohm 1 watt resistor
——	R11	100 ohm ¼ watt resistor

Capacitors

——	C1	0.1 mfd mylar capacitor
——	C2	0.1 mfd disc capacitor

Semiconductors

——	D1	1N4003 silicon diode
——	D2	1N4003 silicon diode
——	D3	1N4148 small glass silicon diode

——	D4	1N4148 small glass silicon diode
——	Q1	2N5210 transistor
——	Q2	SS1122 transistor

——	IC1	MC6850 asynchronous communications adaptor (MOS)
——	IC2	7805 5 VDC voltage regulator
——	IC3	1489AJ quad RS-232 receiver

——	IC4	4N33 optical coupled isolator
——	IC5	4N33 optical coupled isolator
——	IC6	4N33 optical coupled isolator

$$21.92 \text{ ma} = \frac{24 \text{ volts}}{1.1K \Omega}$$

$$51.08 \text{ ma} = \frac{\text{4 volts}}{47 \Omega}$$

blue - bottom
red - top

TOP

D2
D1
D1 D2
IC6
IC5
IC4
R8
R9
R10
R11
R1
R2
R3
R4 Q1
R5
R6
R7
Q2
C2
IC3
C1
D4
D3
IC1

IC2

+B UNR

GND   GND

+5

−12   −12
+12   +12

+5 12
VDD

RS   11   RS
D0   22   D0
D1   21   D1
D2   20   D2
D3   19   D3
D4   18   D4
D5   17   D5
D6   16   D6
D7   15   D7

R/W̄ 13   R/W̄   IC1
     14   E
Ø2

     8   CS0
+5   CS1
     10
I/O* 9   C̄S̄2̄

1106
1506
3006
6006
12006

     4   Tx Clk
          Rx Clk
     3
     7   ĪR̄Q̄

ĪR̄Q̄

Vss
     1

Tx Data 6
Rx Data 2   TTL
R̄T̄S̄ 5   TTL
C̄T̄S̄ 24
D̄C̄D̄ 23

IC3 13   11   R3   2
IC3 6   4   +5 R1   5   +12
IC3   4   IC4
IC3 8   10
IC3 1   3   R2   2

Schematic − MP-S Serial

+5 1
+12 5
-12

2
D2
D1
R10
IC 6
4
TO **20 ma** **TTY SERIAL OUTPUT**

R8
TI **20 ma** **TTY SERIAL INPUT**

C1
20 ma **TTY SERIAL AND READER CONTROL COMMON**
-12

+12 1
R6
+5

2
R5
Q2
R4
R11
RO **RS-232C OUTPUT**
Q1
R7
-12

RI **RS-232C INPUT**

+5 1
+12 5
RS-232 GROUND

2
R9
IC 5
4
RC **READER CONTROL**

+5
D3
CI **CASSETTE CLOCK IN**
CASSETTE CLOCK OUT
CO
D4

MP-S Serial Interface