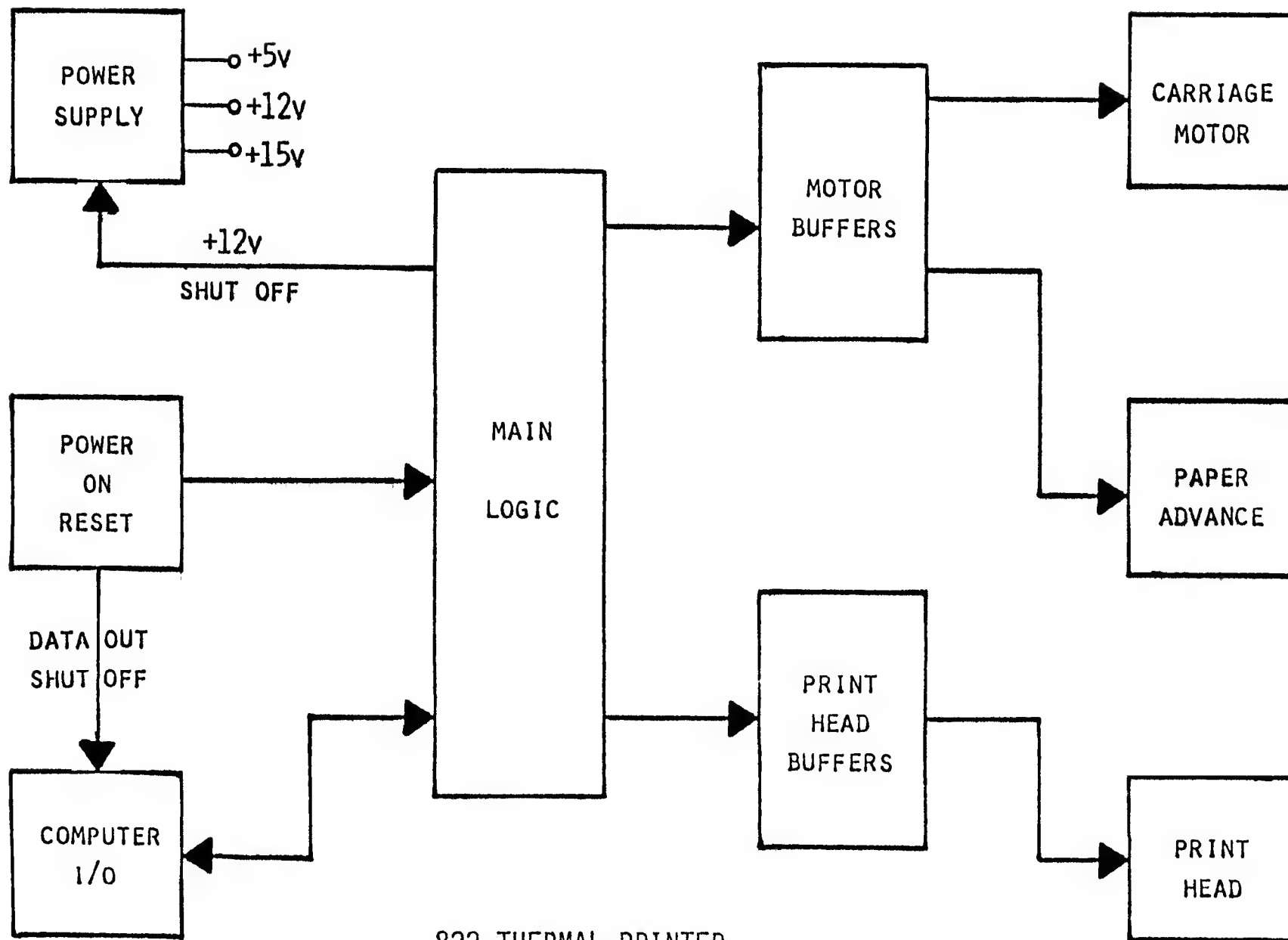


TITLE BLOCK DIAGRAM:
822 THERMAL PRINTER
NUMBER TS015897-01
REV 1 SHEET 1 OF 1



822 THERMAL PRINTER

POWER SUPPLY

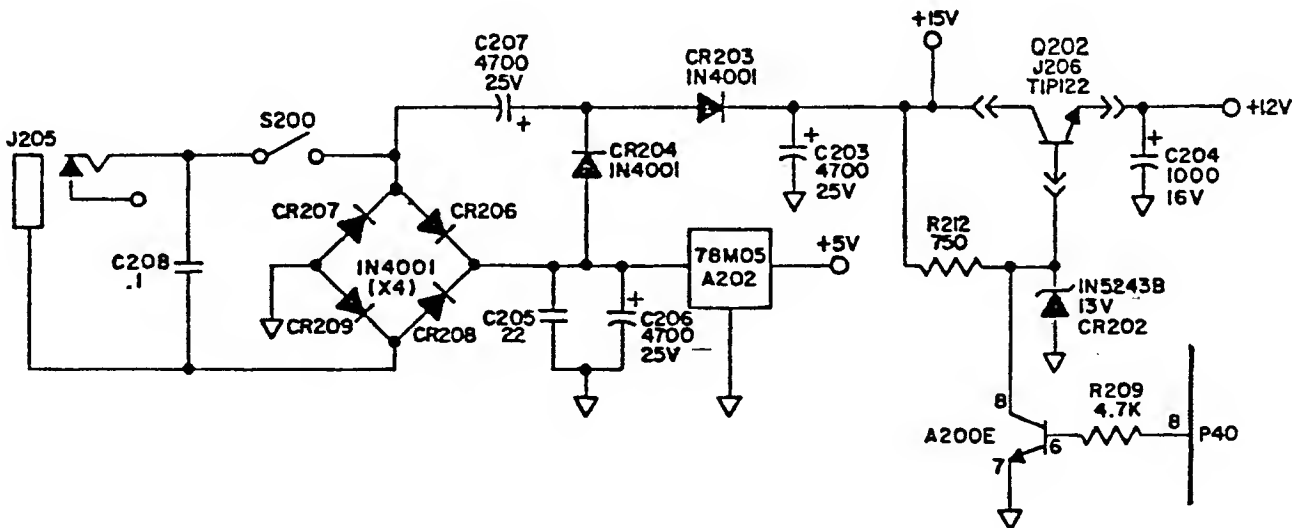
The Power Supply furnishes 3 voltages for use by the circuit board. +15volts is used by the Power On Reset circuitry and the microprocessor Z200. +12volts is used by the Carriage Motor and the Thermal Print Head, while the Paper Advance Motor is supplied with the +15volt unregulated supply.

Circuit Description

Operating voltage is supplied to the Power Supply from a 9v A.C. adapter plugged into J205. This voltage is fed through CR206,207,208 and CR209, a full wave bridge rectifier. This now pulsating D.C. is filtered by C206 and C205 and fed to the input of A202 (a 78M05), a 3 terminal voltage regulator. This regulator converts the 8-9v D.C. to a voltage between 4.75 volts and 5.25 volts.

The +15volt supply is generated by a voltage doubler circuit consisting of CR204 and C207. This boosted pulsating D.C. voltage is then fed through CR203 and filtered by capacitor C203. +12volts is created by feeding the +15 volt supply through Q202. The base of Q202 is sitting on the cathode of CR202 (a 13v Zener diode) which is fed through a limiting resistor, R212. The output voltage at the emitter of Q202 should be 12.4volts $\pm 10\%$.

The +12v supply can be shut OFF by Z200 (pin 8) turning on A200E and bringing the base of Q202 to ground. This turns OFF the Thermal Print Head and the Carriage Motor.



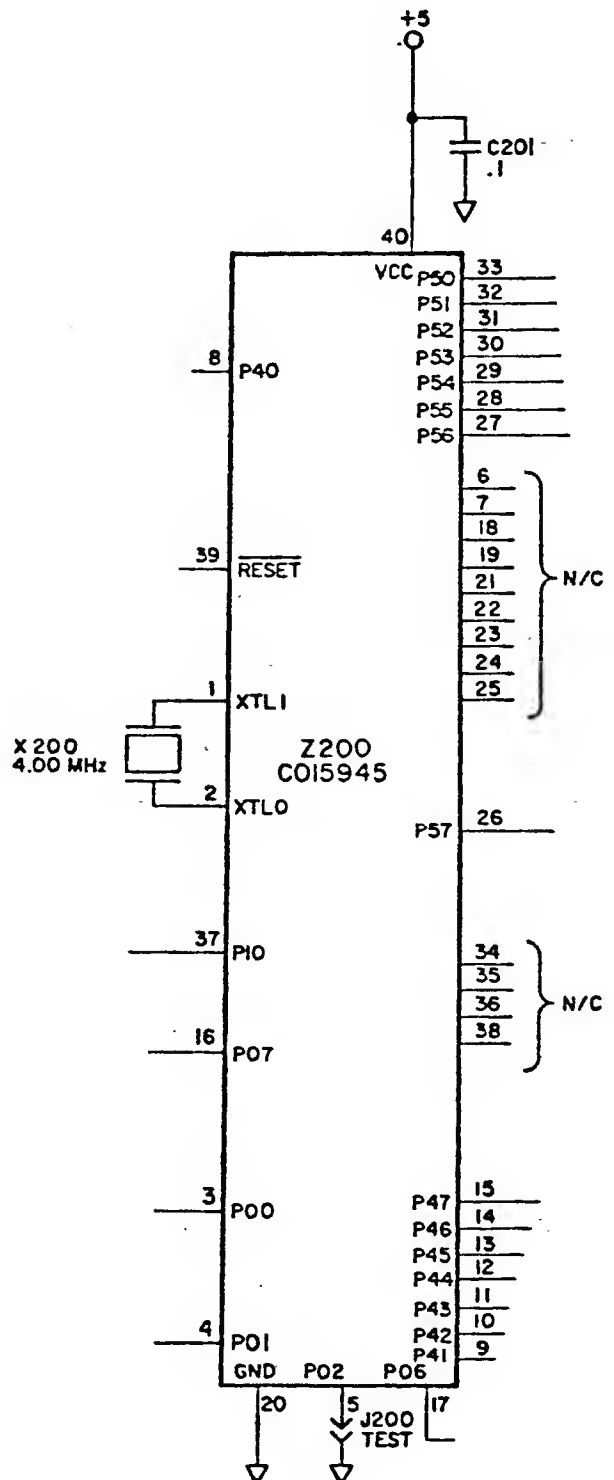
MAIN LOGIC

The Main Logic portion of the board controls all of the communication with the 400/800, as well as controlling the actual Print Head and the motors. This portion of the board also generates the 4.00MHz clock used by this section.

Circuit Description

All of the Main Logic used by the Printer is contained inside Z200. This I.C. is a complete micro-processor system containing 64 bytes of RAM (Random Access Memory), 2K bytes of ROM (Read Only Memory), and 32 I/O (Input/Output) Ports. Also contained inside this I.C. are all the parts (except the crystal) for the master oscillator.

Z200 can be told to go into a self test mode by bringing pin 5 to ground (with J200). This causes the output ports to the Thermal Print Head and the ports to the two Stepper motors to pulse in a known manner for testing.

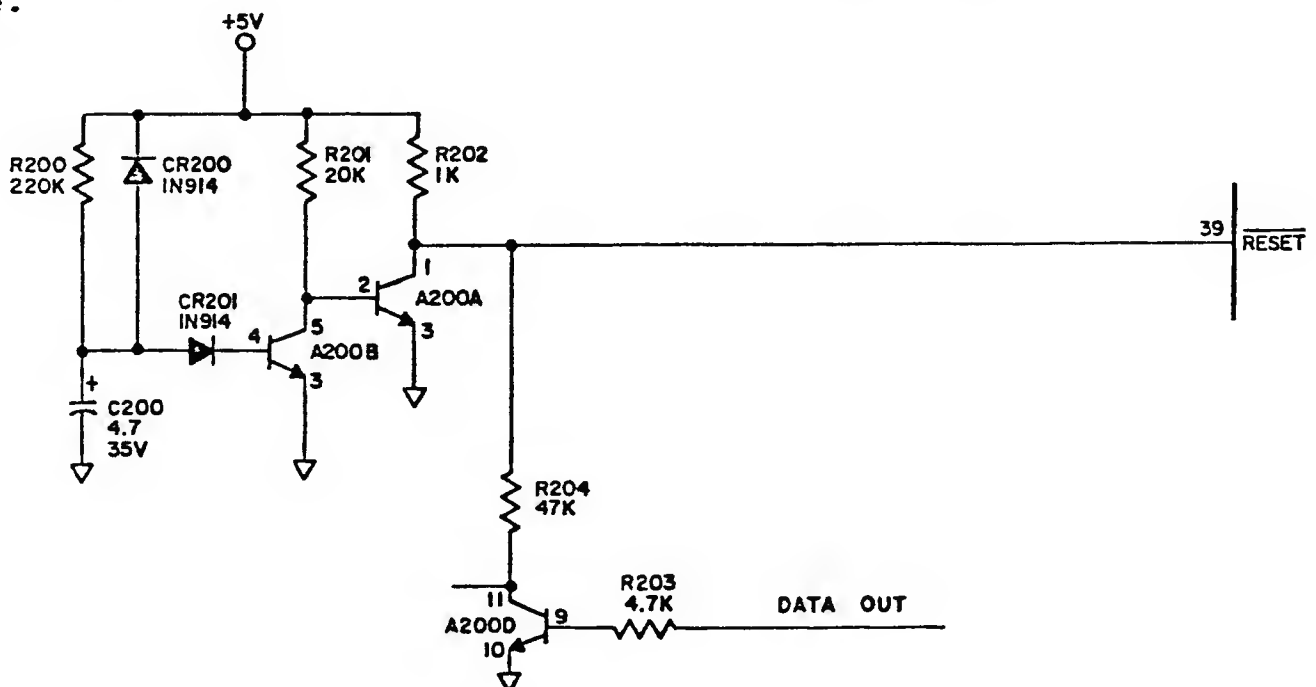


POWER ON RESET

The purpose of the Power On Reset circuitry is to make sure that the microprocessor (Z200) gets a chance to get set up properly when power is first turned ON. It does this by keeping the $\overline{\text{RESET}}$ (pin 39) on the processor at a logic "0" for about half a second after the power is first turned ON. A second function of the Reset circuit is to turn off the data out transistor going to the ATARI 800 while Z200 is doing its internal setup. This keeps false data from going out the Serial line and interfering with other devices already in use.

Circuit Description:

When the power switch is first turned ON, the voltage across C200 is 0 volts. This keeps A200B turned OFF, making the voltage at the collector (pin 5) 5 volts. This 5 volts is also at the base (pin 2) of A200A, turning ON this transistor and causing its collector (pin 1) to go to about .3volts.- C200 now begins to charge through R200 and when its voltage reaches about 1.2v, starts to turn ON A200B which causes A200A to turn OFF, bringing the voltage at the collector (pin 1) to 5 volts. CR200 is used as a low resistance path to drain off the charge from C200 when the power switch is turned OFF, or in the event of a power supply glitch, to ensure that the Power On Reset circuit will be ready to again begin its timing cycle.



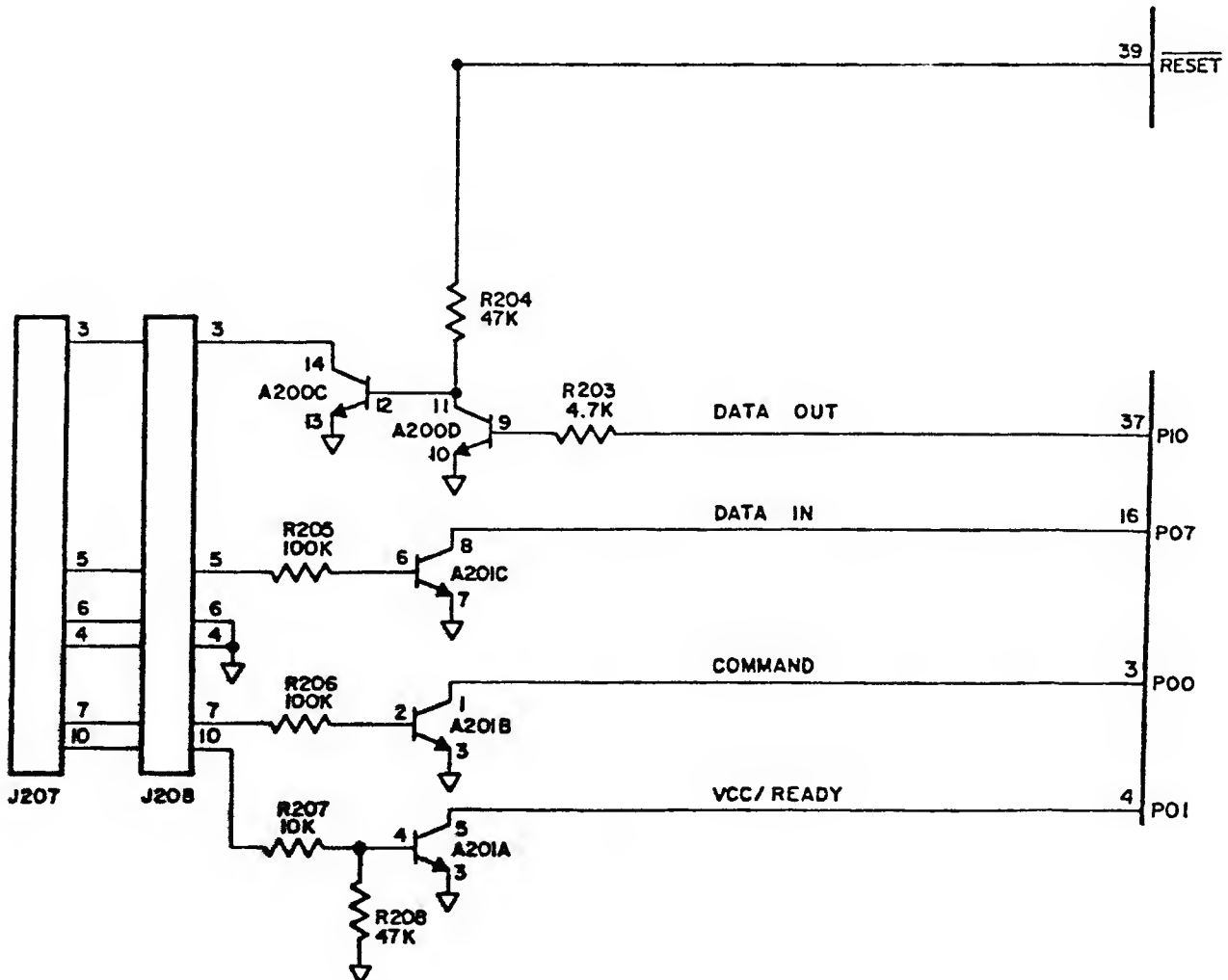
COMPUTER I/O

This block performs the signal conditioning for the serial communication lines between the Printer and the ATARI 400 or 800. The serial cable from the Computer can plug into either J207 or J208 on the Printer (both jacks are wired in parallel). The unused jack is used to "daisy chain" other accessories to the Computer.

Circuit Description

There are three input lines and one output line between the Computer and the Printer.

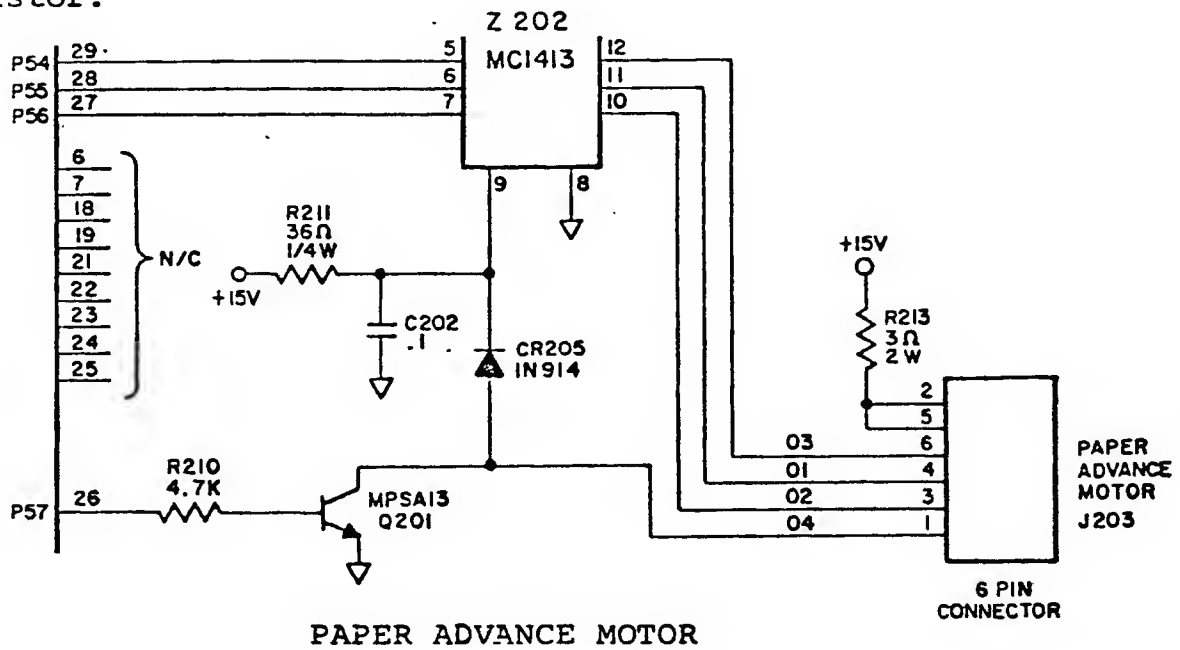
1. The Vcc/Ready line is connected to +5volts at the Computer. When the Printer is attached to the Computer, and the Computer is turned ON, the Vcc/Ready line becomes +5volts, causing A201A to turn ON by applying 1.3v to the base of the transistor (pin 4). This causes the collector (pin 5) to go low and presents a logic "0" at pin 4 of Z200.



2. The command line from the Computer enters on J207 or J208, and is fed through R206 (used as a current limiter). A logic high on this line causes A201B to turn ON, thus bringing the collector (pin 1) to a logic "0". This logic low is fed to pin 3 of Z200.
3. The data in line from the Computer comes in on pin 5 of either J207 or J208. It feeds through R205 (used as a current limiter) to the base (pin 6) of A201C. A logic high on the base of A201C causes the collector (pin 8) to go to a logic "0". This logic 0 is fed to pin 16 of Z200.
4. The data out line from the Printer to the Computer comes from pin 37 of Z200. Since there are two transistors between Z200 and J207,J208, the polarity of the signal seen at the output jack is the same as the polarity of the signal at Z200. The data out transistor (A200C) is held in an OFF condition when power is first turned ON to the Printer. The RESET line is at a logic "0" state and ties the base (pin 12) of A200C to ground through R204. This prevents false data from being sent down the data out line.

MOTOR BUFFERS

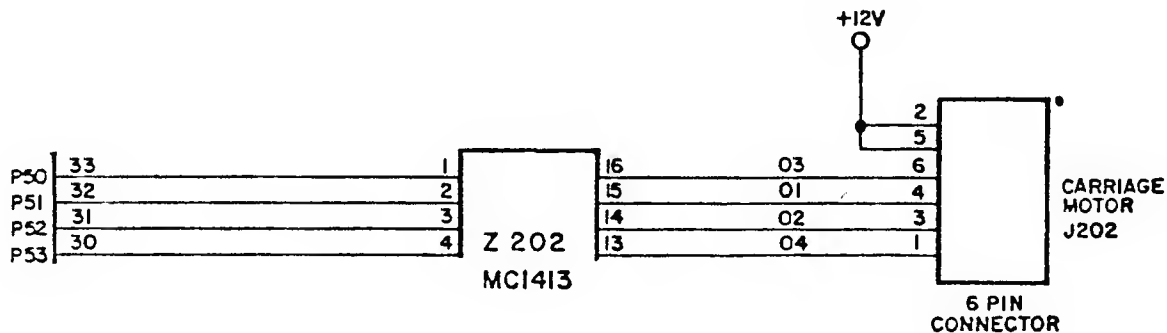
Since the outputs of Z200 are not of sufficient strength to "drive" the Paper Advance Motor directly, it is necessary to convert the current output from the pins to a higher level. Since the Paper Advance Motor needs about 400 milliamps to operate, a special driver I.C. (Z202) is used. Contained inside Z202 are seven Darlington driver transistors with Z200 driving the base of the transistors and the open collector outputs connected to J203. Since these transistors are NPNs, the output is inverted with respect to the inputs. Internal to Z202 (connected to pin 9) is a protection diode to suppress the inductive kick of the Stepper Motor windings. Since there are only seven driver transistors inside Z202, and four of them are used to drive the Carriage Advance Motor, this leaves only three transistors to drive the Paper Advance Motor. An additional transistor has been added to drive the fourth line needed by the Paper Advance Motor, this is Q201. Q201 also has a protection diode from its collector to the output of Z202 pin 9 to avoid destroying the transistor.



The Paper Advance Motor is a four phase Stepper Motor that operates by pulsing each of its motor windings one at a time. This permits very precise positioning of the Thermal Paper. This motor is responsible for advancing the Thermal Paper exactly one line at a time. Improper operation of this motor will result in uneven spacing between the lines of printing.

MOTOR BUFFERS

Since the outputs of Z200 are not of sufficient strength to "drive" the Carriage Motor directly, it is necessary to convert the current output from the pins to a higher level. Since the Carriage Motor needs about 370 milliamps to operate, a special driver I.C. (Z202) is used. Contained inside Z202 are seven Darlington driver transistors with Z200 driving the base of the transistors, and the open collector outputs connected to J202. Since these transistors are NPNs, the output is inverted with respect to the inputs. Internal to Z202 (connected to pin 9) is a protection diode to suppress the inductive kick of the Stepper Motor windings.



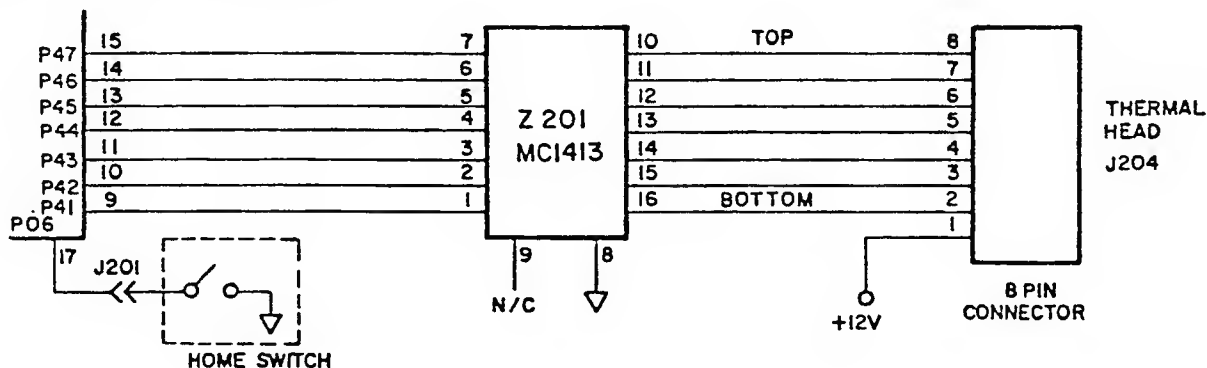
CARRIAGE ADVANCE MOTOR

The Carriage Advance Motor is a four phase Stepper Motor that operates by pulsing each of its motor windings one at a time. This permits very precise positioning of the Thermal Print Head. This motor is responsible for moving the Print Head across the paper and back, and must move exactly one dot position at a time for a proper printout.

PRINT HEAD BUFFERS

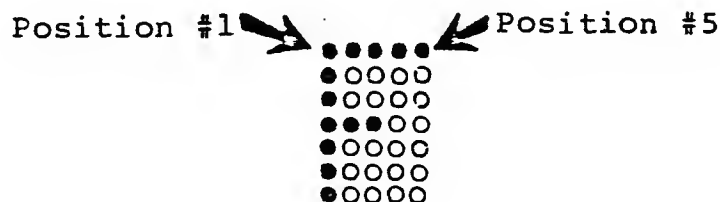
Since the outputs of Z200 are not of sufficient strength to "drive" the Thermal Print Head directly, it is necessary to convert the current output from the pins to a higher level. Since the Thermal Print Head needs about 240 milliamps to operate, a special driver I.C. (Z201) is used. Contained inside Z201 are seven Darlington driver transistors with Z200 driving the base of the transistors, and the open collector outputs connected to J204. Since these transistors are NPNs, the output is inverted with respect to the inputs.

A home switch is connected to Z200 (through J201) to tell the micro-processor chip when the Print Head is in the far left position. When the Print Head reaches the far left position, the switch closes and Z200 pin 17 is a ground.



THERMAL PRINT HEAD

The Thermal Print Head consists of seven inline heating elements which form a seven high dot pattern. In order to form the printed characters, the Print Head moves to the first (left side of character) position and burns the paper with some or all of the dot heating elements. It then advances one dot position to the right and burns again with some or all of the dot elements. This is done a total of five times (from left to right) for each character printed. A special paper must be used that can change color, when heated, as the Print Head moves across it.



Block #1 - +5volts

This is a measurement of the +5volt supply on the Printer board. The voltage limits on this supply are 4.75volts to 5.25volts. If the measured voltage is outside this range, the test system will END the test and PRINT OUT:

F*LO
(voltage less than
4.75volts)

or

F*HI
(voltage greater than
5.25volts)

Block #2 - +12volts

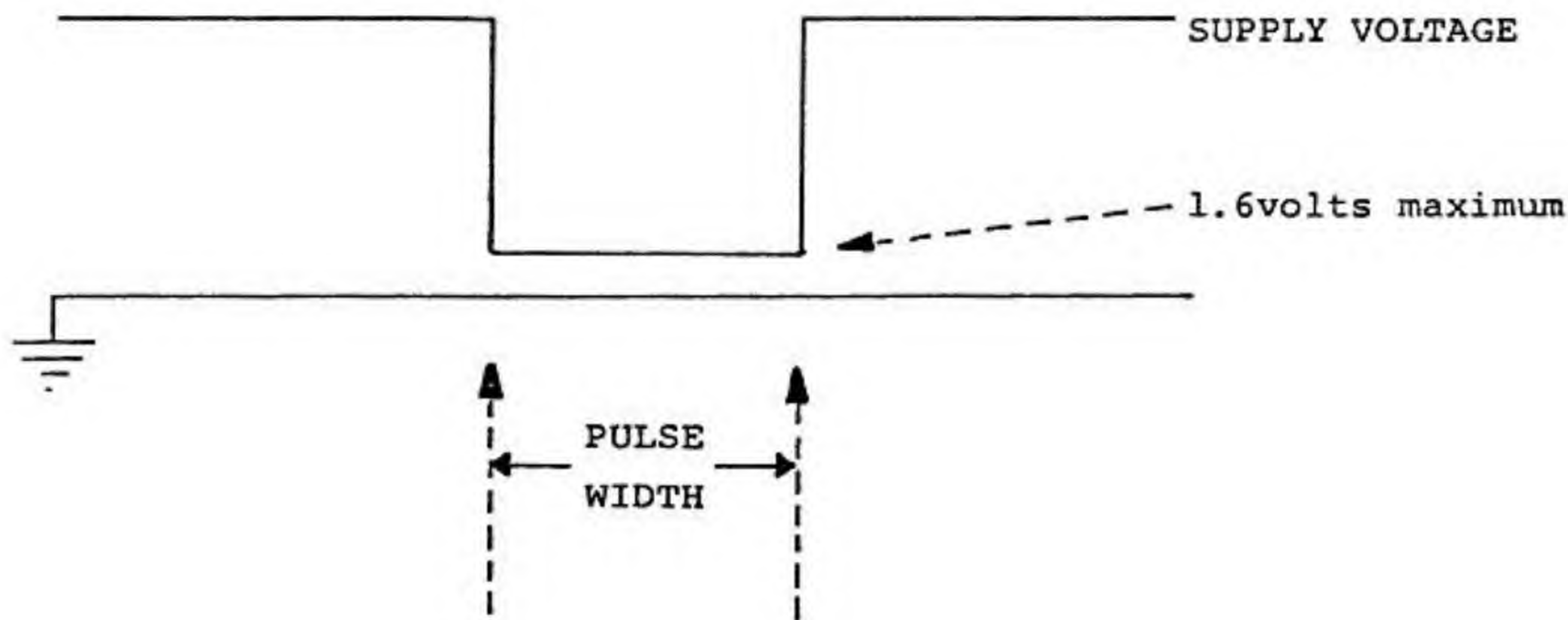
This is a measurement of the +12volt supply on the Printer board. The voltage limits on this supply are 11.16volts to 13.64 volts (12.4volts $\pm$ 10%). If the measured voltage is outside this range, the test system will END the test and PRINT OUT:

PASS*LO
(voltage less than
11.16 volts)

or

PASSF*HI
(voltage greater than
13.64 volts)

The next three blocks, Blocks 3,4, and 5, are measurements of the pulse widths of the Thermal Print Head, Carriage Advance Motor, and Paper Advance Motor outputs. All of these outputs are active low outputs. These outputs are generated by grounding pin 5 of Z200 (using J200) which puts Z200 into an auto test mode. On all of these outputs, the maximum voltage when the driver transistor is ON is 1.6volts, with the specified load resistance.



Block #3 - Thermal Print Head

This is a test of seven output lines going to J204. A failure in this block will be in one of three forms:

1. Pulse width too long (Failure Code L)
2. Pulse width too short (Failure Code S)
3. Pulse missing (Failure Code T)

A typical failure readout might look like this:

```
  PASSPASS12T4L6S12341234PASS
           └──┬──┘
               |
           Block #3
```

Each line to the Thermal Print Head is represented by one position at J204, starting from left to right in the failure readout:

- 1 = J204 pin 2
- 2 = J204 pin 3
- 3 = J204 pin 4
- 4 = J204 pin 5
- 5 = J204 pin 6
- 6 = J204 pin 7
- 7 = J204 pin 8

All readings are taken with a 47Ω 10watt resistor between each pin and +12 volts.

The allowable limits for the pulse width for the Thermal Print Head lines are from 2.7mseconds to 3.3mseconds.

lock #4 - Carriage Advance Motor

This is a test of the four output lines to J202. A failure in this block will be in one of three forms:

1. Pulse width too long (Failure Code L)
2. Pulse width too short (Failure Code S)
3. Pulse missing (Failure Code T)

A typical failure readout might look like this:

```
PASSPASS12345671LS41234PASS
                |
                |
            Block #4
```

Each line in the failure readout represents one position at J202. Reading from left to right, they are:

- 1 = J202 pin 4
- 2 = J202 pin 3
- 3 = J202 pin 6
- 4 = J202 pin 1

All readings are taken with a 33 Ω 10watt resistor between each pin and +12volts. The allowable pulse width for the Carriage Advance Motor is between 9.72msec. and 11.88msec.

NOTE: There will probably be a small positive going spike in the middle of the timing pulse; this is normal and can be ignored.

Block #5 - Paper Advance Motor

This is a test of the four output lines to J203. A failure in this block will be in one of three forms:

1. Pulse width too long (Failure Code L)
2. Pulse width too short (Failure Code S)
3. Pulse width missing (Failure Code T)

A typical failure readout might look like this:

```
PASSPASS12345671234LS34PASS
                [
                |
            Block #5
```

Each line in the failure readout represents one position at J203. Reading from left to right, they are:

- 1 = J203 pin 4
- 2 = J203 pin 3
- 3 = J203 pin 6
- 4 = J203 pin 1

All readings are taken with a 33Ω 10watt resistor between each pin and pins 2 and 5. These two pins go through a 3Ω 2watt resistor to +15volts. The allowable pulse width for the Paper Advance Motor is between 15msec. and 40msec.

Block #6 - Computer I/O

This block is generated when the person performing the test has examined an actual printout from the board being tested, and either PASSES or FAILS the board. A failure readout will look like this:

```
PASSPASS123456712341234FAIL
                [
                |
            Block #6
```

822 THERMAL PRINTER

Test Results

The 822 Thermal Printer test fixture will print out the test results when the test is finished. This information is also displayed on the T.V. screen.

A printout tag is interpreted as follows:

