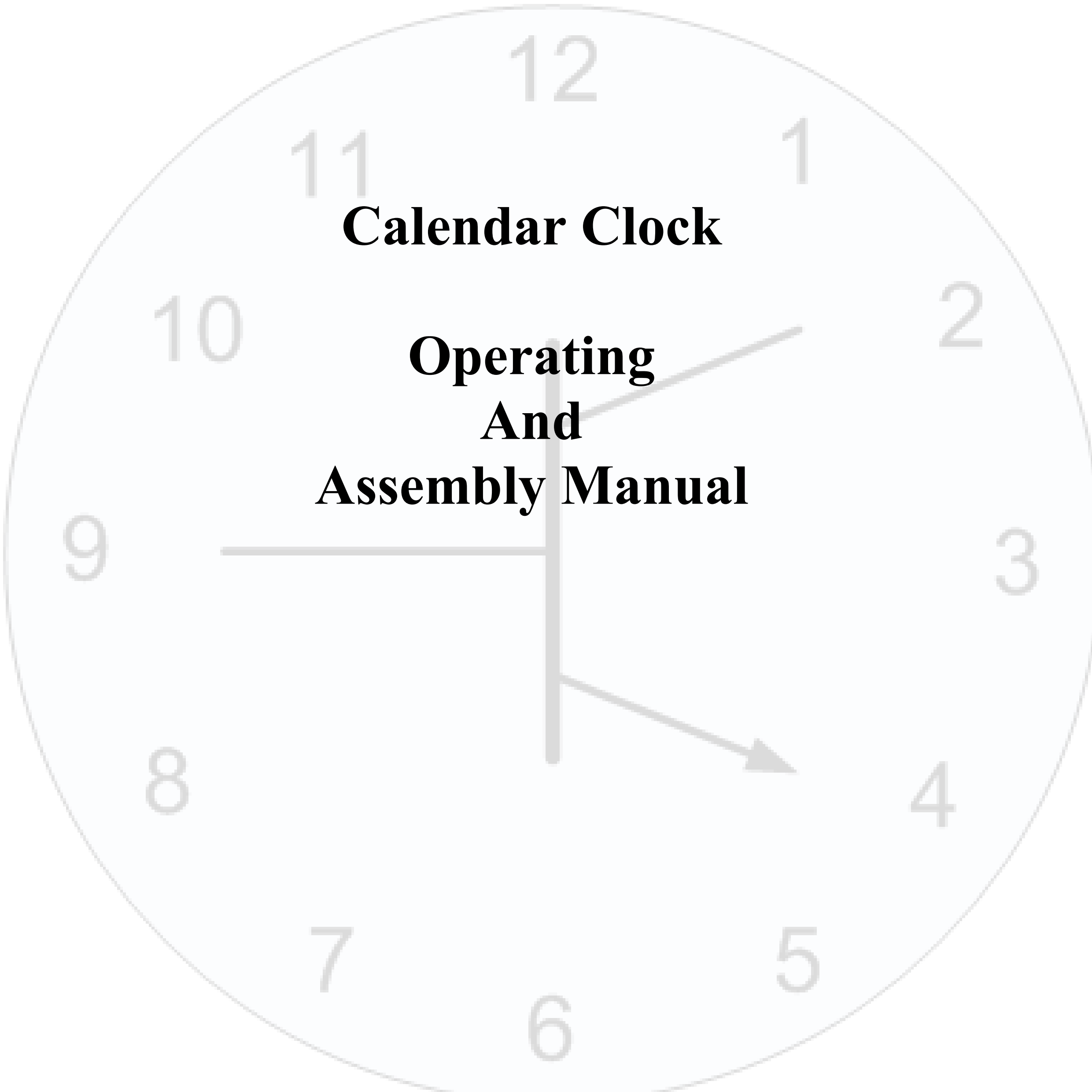

Calendar Clock

Operating
And
Assembly Manual

KABtronics

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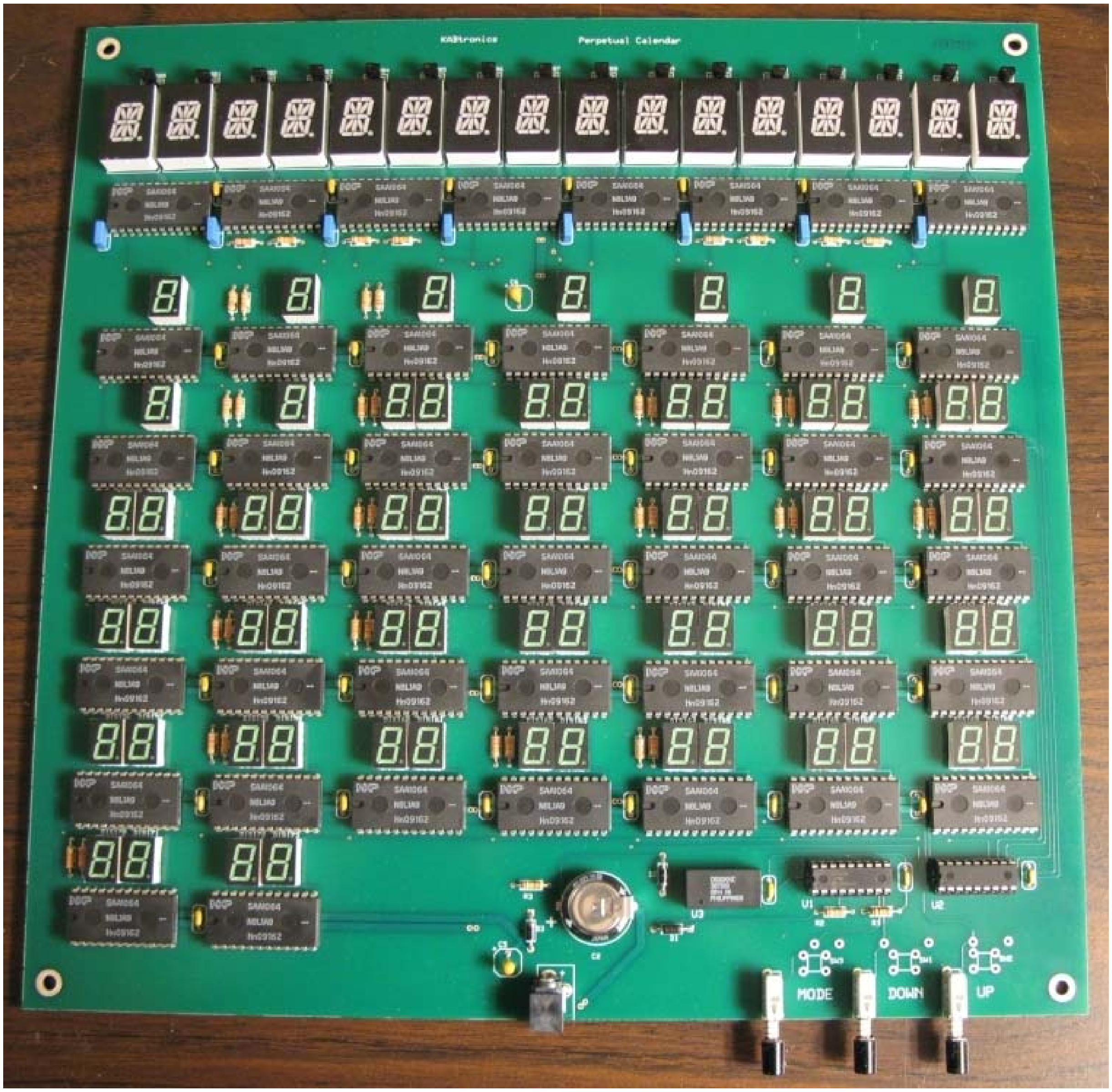
Document version 1.02 for use with PC board version 3

This is a kit to build an electronic perpetual calendar/clock.



OPERATING INSTRUCTIONS

Navigating the Menus

Use the mode button to cycle through the menu states:

- **Run**
- **Display format select**
- **Set Year**
- **Set Month**
- **Set Day**
- **Set Hour**
- **Set Minute**
- **Preset**
- **Select Test**

The clock will return to the Run state after 5 seconds of inactivity except in test mode.

Setting time and date

The plus and minus buttons advance and retreat the value in the set Year, Month, Day, Hour, Minute modes. After setting each value, you can advance to the next mode or just wait for the clock to return to the Run mode automatically.

Setting the display format

In the Display Format mode, the plus and minus buttons cycle through the display modes;

- **Month Day Year**
- **Month Year**
- **Month**
- **Month & 24 Hour Time**
- **Month & 12 Hour Time**
- **MM/DD/YYYY**
- **MM/DD/YYYY & 24 Hour Time**
- **MM/DD/YYYY & 12 Hour Time**

After you select your favorite mode, you can wait for the inactivity timeout to return to the Run mode, or advance using the mode button.

Month advance mode

The calendar can be used to display other months, as though you were flipping through pages of a calendar.

Pressing the plus and minus button while in the Run mode will enter the month advance mode. The bright selected day will be removed and the display format will go to Month & Year. This mode times out and returns to the original date after 30 seconds of inactivity.

UNPACKING/PARTS LIST

Gently unpack the contents of the box, don't open any bags or tubes of parts at this time. You will open these bags as the parts are needed. Check off the items below as you unpack. This will also serve as a chance to become familiar with the parts.

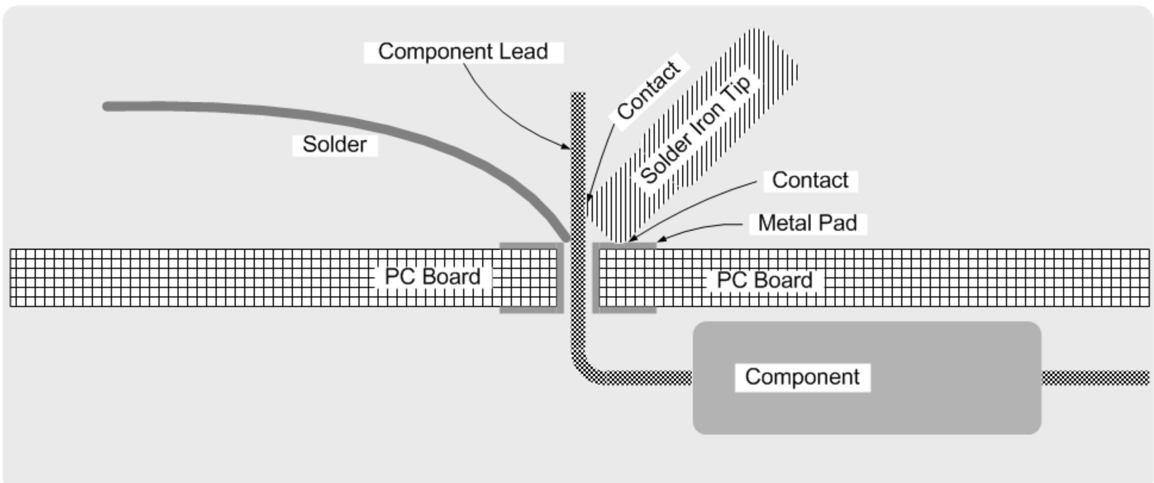
Desc	Quantity	Check
Assembly Manual	1	✔
IC,uProc PIC16F628A, DIP-18	1	
IC,uProc PIC16F648A, DIP-18	1	
IC, TCXO, 32KHz, DIP	1	
18 Pin DIP socket	2	
1 Farad Capacitor	1	
IC, SAA1064, 7segDvr	45	
LED, 16-segment .5 inch Common Anode	16	
LED, 7-segment, .4 inch Common Anode	65	
Cap, .22uF, Ceramic	41	
Cap, 0.0027uF Polyfilm	8	
Cap, 10uF,16V Tantalum	2	
Res, 22Kohm, 1/4 Watt, Cfilm	22	
Res, 33Kohm, 1/4 Watt, Cfilm	22	
Res, 150 ohm, 1/4 Watt, Cfilm	1	
Res, 1K ohm, 1/4 Watt, Cfilm	1	
Res, 10K ohm, 1/4 Watt, Cfilm	1	
Diode, Schottky	3	
NPN Transistor 2N3904	16	
Switch, N.O. Push, PC board TH mount	3	
Switch, Push, RtAng, PC board TH mount	3	
CAP, BLACK	3	
JACK, 2.5mm, Right Angle	1	
Power Supply, 5Volt 4Amp	1	
Solder and Solder Braid	3&1	
Printed Circuit Board	1	

SOLDERING

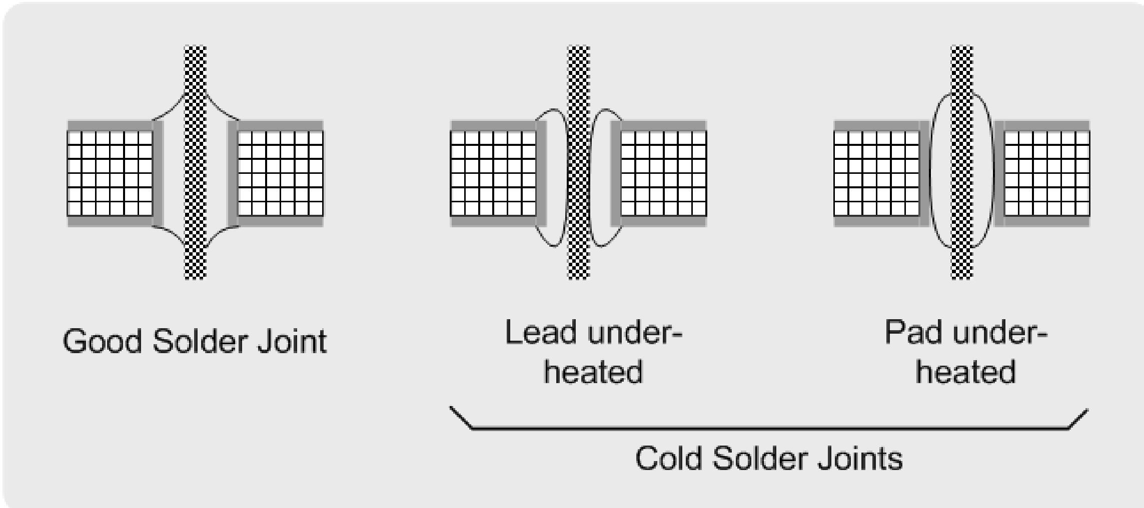
This manual can't teach the art of soldering, but here are the basics. Remember, you need to make over 2330 **GOOD** solder joints; each bad joint will be an adventure in troubleshooting.

Wet the tip of the iron with a bit of solder and wipe off the excess solder on the wet sponge occasionally, or when you notice the joint is not heating properly. The small amount of solder left on the tip helps conduct heat to the lead and the pad.

Insert the component leads and press the component flat against the PC Board. Slightly spread the leads to hold it in place when you flip the board over to expose the back side with the component lead facing up.



- Make good contact between the iron, the lead, and the pad on the board so the lead and the pad both heat up enough to melt the solder.
- It should take from 0.5 to 1 second for the joint to become hot enough to melt the solder.
- Don't overheat the joint, as soon as the solder melts and wicks into the joint remove the iron and hold still for a few seconds until the joint freezes.



A good solder joint will form a shiny curved surface bonding the lead and the pad on the PC board. If the lead wasn't heated enough to melt the solder, the solder will wick in to the pad, but will not adhere to the lead. You may notice a dark line around the lead where the solder dives down through the hole.

A similar bad joint forms when the pad wasn't heated enough to melt the solder. A cold solder joint can often be fixed by reheating the joint; sometime a little more solder will be needed.

More detailed instructions can be found on the internet with a little searching on the topic of soldering.

After inspecting the solder joint, clip off the excess lead using the diagonal cutter. Cut at the top of the solder joint; don't dig into the solder joint.

Unsoldering

A supply of de-soldering braid is supplied with the kit. If you find the need to remove a component, use the de-solder braid by pulling out a few inches and pressing the braid against the lead and the pad using the iron. You will see the solder melt and spread into the wick leaving very little solder left in the pad.

Sometimes it helps to clip the lead off the component so you can deal with each lead separately.

Optional Clean-up

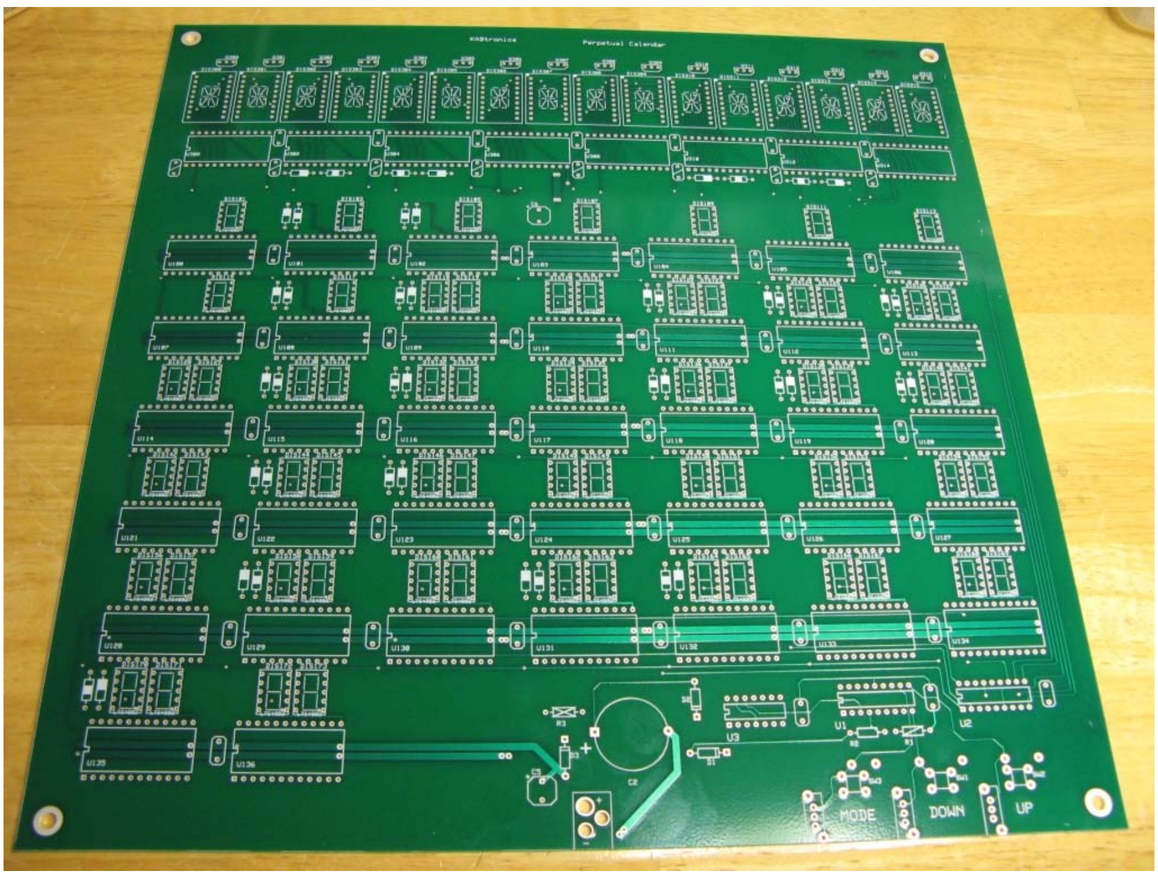
The clear sticky rosin left around the solder site can be cleaned up with alcohol and a toothbrush, but be sure to let the board dry before expecting the board to operate properly. You won't hurt the circuit by powering it up, but it won't count right until the board has completely dried. Water soluble rosin-cored solder is available at hobby stores. As for me, I don't bother to clean up the board unless the counters are not working right, then I clean off the rosin.

ASSEMBLY

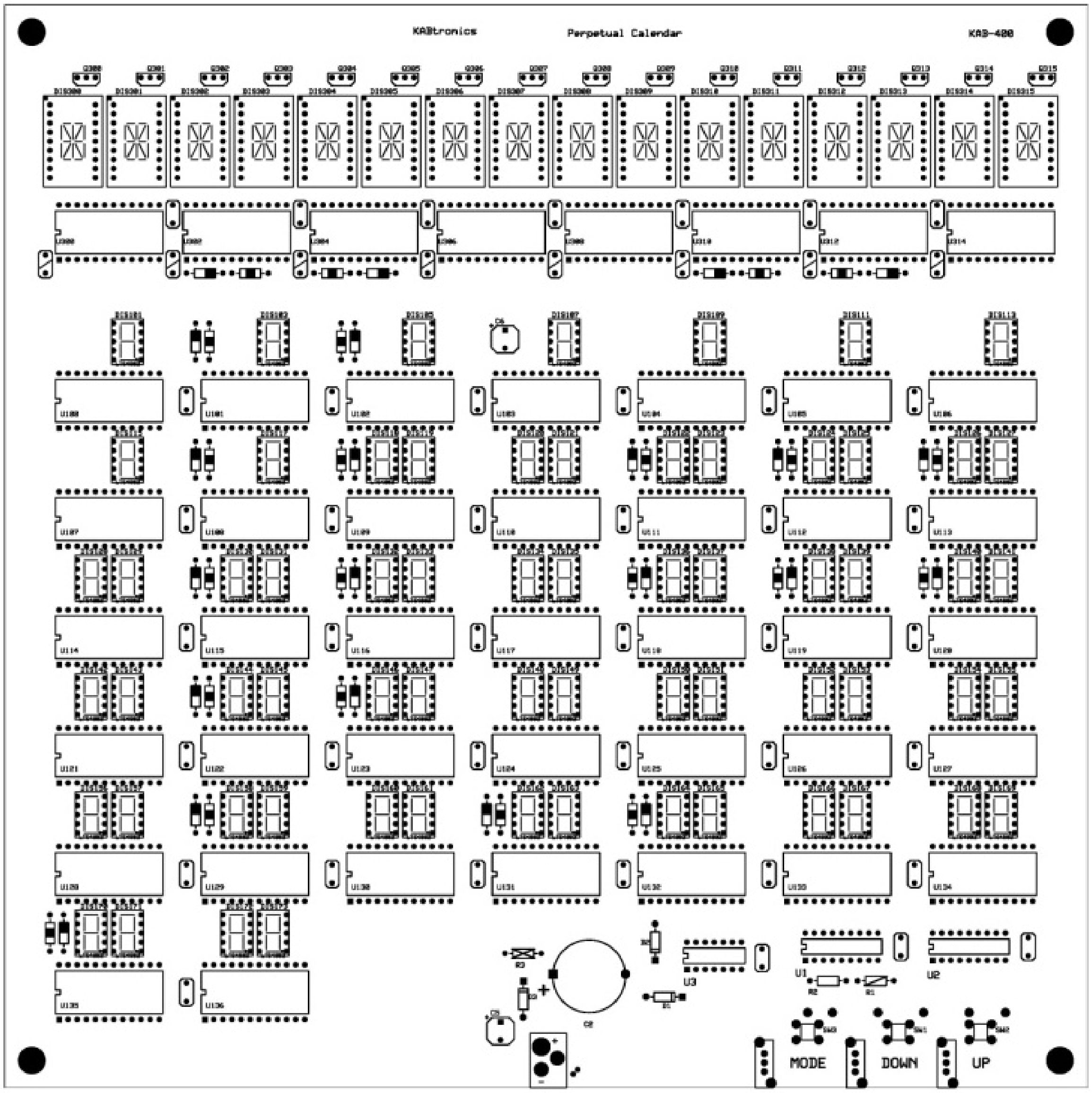
The following narrative will walk you through construction of the calendar. The build order is driven by the size of the components to allow you to flip the board over for soldering.

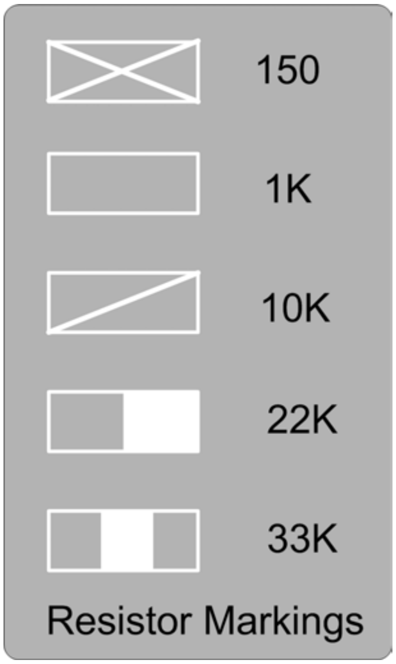
Printed Circuit Board

Notice the PC board has white symbols on one side, which is the silkscreen side. All components are loaded on this side; all soldering is done on the back side, the side without the silkscreen.



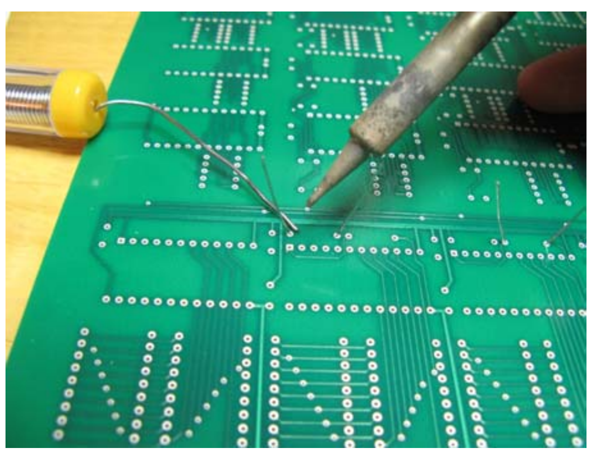
Below is a drawing of the silkscreen side.



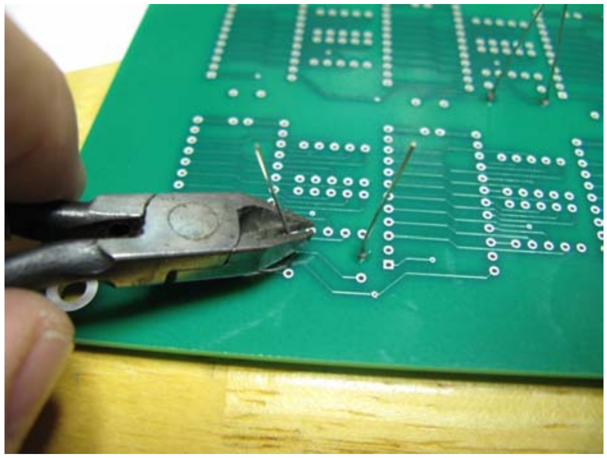


Resistors

Find the 22K resistors and load them into the locations marked as shown in the diagram above. One at a time, push the resistor snugly against the board and spread the leads slightly to hold it in place while you flip the PC board over to solder the leads in place.



Clip off the excess lead without digging into the solder joint.



Load the following parts and check the line to track your progress.

( ) all 22 of the 22K resistors (Red-Red-Orange)

( ) all 22 of the 33K resistors (Orange-Orange-Orange)

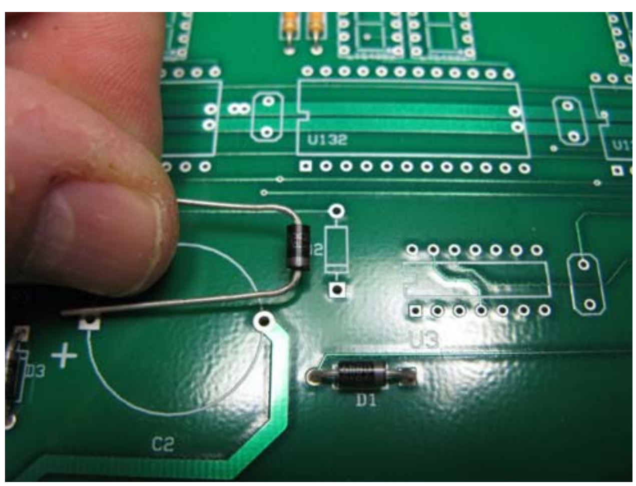
( ) the 1K resistor (Brown-Black-Red)

( ) the 10K resistor (Brown-Black-Orange)

( ) the 150 Ohm Resistor (Brown-Green-Brown)

Diodes

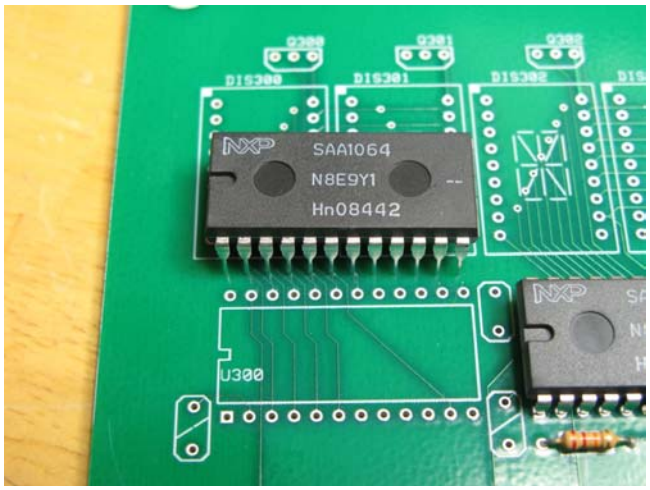
( ) load the three diodes



24 pin DIPs

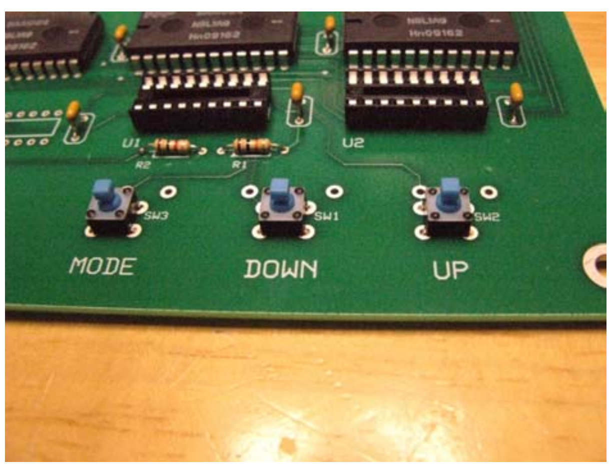
You will now load the 45 driver ICs. One at a time, match the orientation of the part with the outline on the board and load the 24 pin IC into the board. Press it snug against the PC board. Flip the board over and solder only two pins, two diagonally furthest apart.

Then, while gently pressing against the part, heat each of the two previously soldered pins. You may hear a click as the part seats flush against the board. Now you can solder the remaining 22 pins. Remember not to overheat the pins, even while reheating the pins to seat the part. You can skip the reseating step, but your components may be slightly askew. The good news is that you don't need to clip the leads.



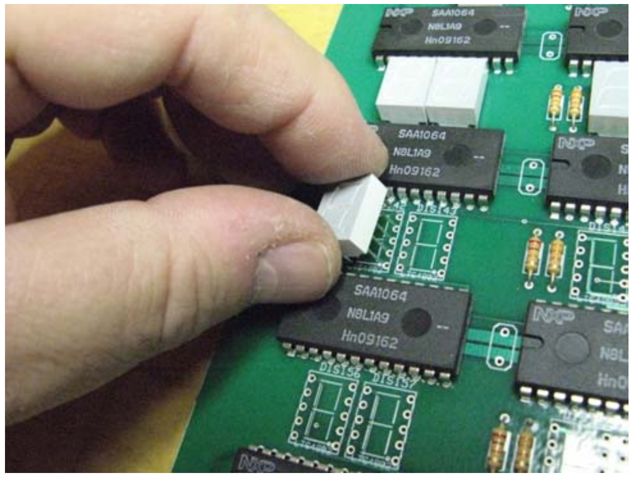
(   ) place and solder all 45 driver ICs (SAA1064) Be sure the package notch matches the symbol on the board.

18 pin sockets



(   ) Solder the two 18 pin sockets into position. Match the orientation of the socket to the symbol on the board.

7 segment Displays



The 7 segment displays need to be oriented with the decimal point on the lower right

(   ) Load all 65 7-segment displays, being careful to orient them properly. I use the seating trick described for the 24 pin SAA1064, but don’t overheat the pins.

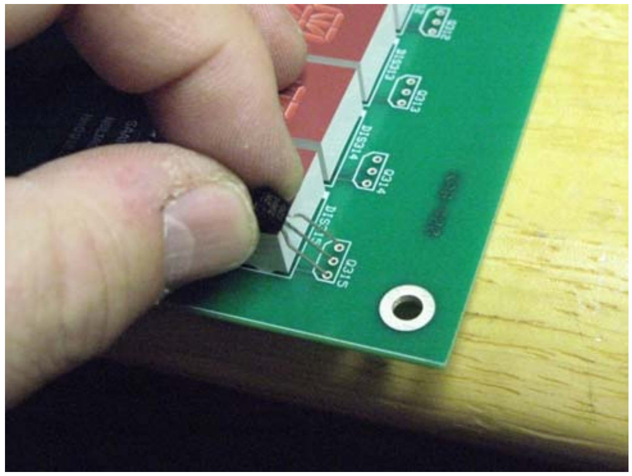
You need to clip the leads after soldering, and that will be a long and tiring job with 650 leads to clip. You will find the clipped leads going everywhere, including wedging between soldered joints and shorting out the calendar. You need to remove all the clipped leads. (For those building the green version, it appears that the green displays have shorter pins, and you can decide to skip the pin clipping for these green small displays)

16 Segment Displays

(   ) Load all sixteen 16-segment displays; once again the decimal point goes on the lower right.

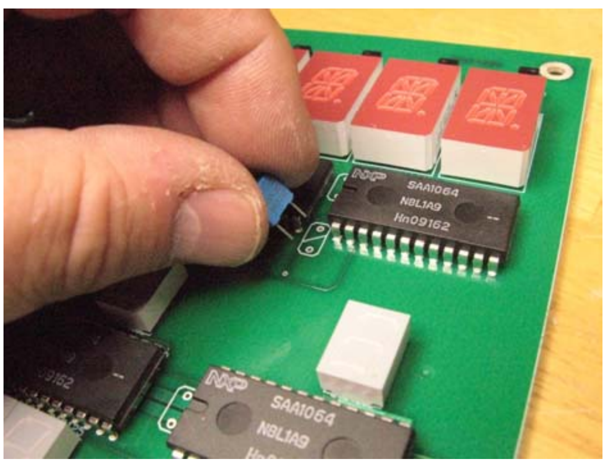
Clip all 288 leads and be sure they don’t get stuck somewhere on the back shorting out the circuit.

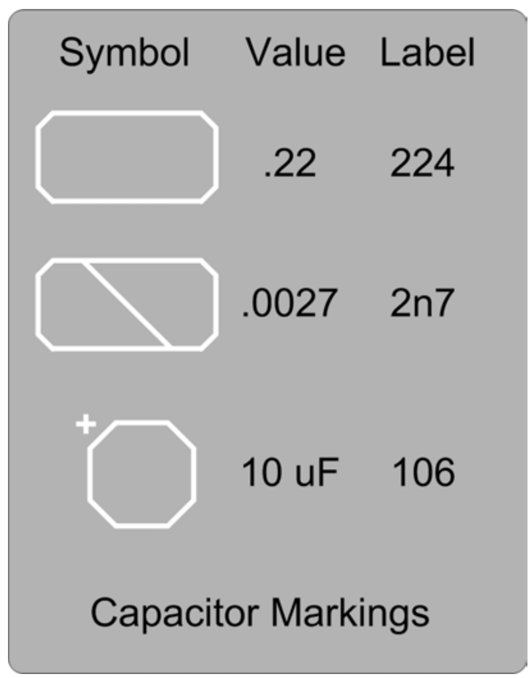
Transistors



(   ) Load all 16 of the transistors, matching the case to the symbol.

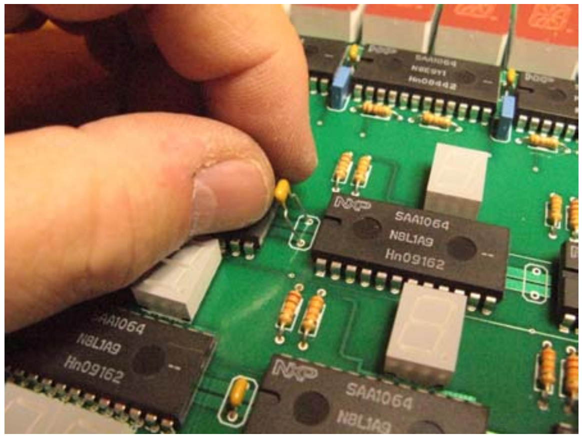
0.0027 caps





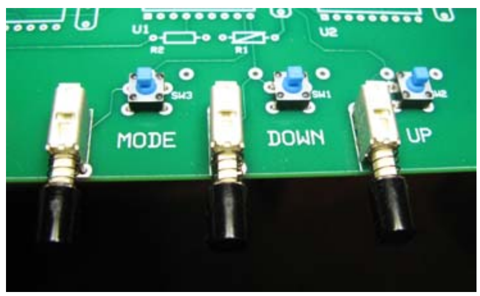
(   ) Load all 8 of the 0.0027 capacitors and clip the leads.

0.22 caps



( ) Load all 41 of the 0.22 capacitors and clip the leads.

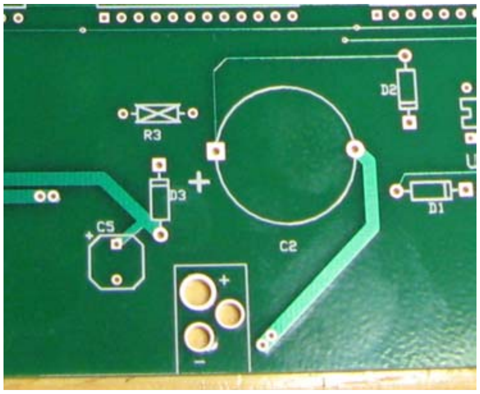
Switches



You have choices when mounting the switches. If you are mounting this calendar in the shadow-box, you can install only the right angle switches. Some shadow-box users solder the push button switches on the back of the board for access from the back and skip the right angle switches. If you are mounting this on a plaque, you can mount just the push buttons. You need to know how you are mounting the board to decide.

( ) Load the switches

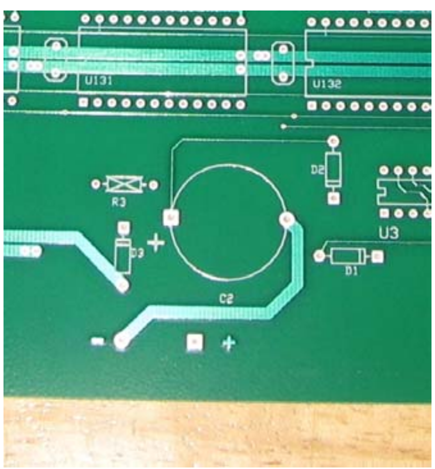
10 uF capacitors



There are two 10 uF tantalum dipped capacitors C5 and C6. C5 is near the power Jack on the bottom and C6 is centered below the top display row drivers.

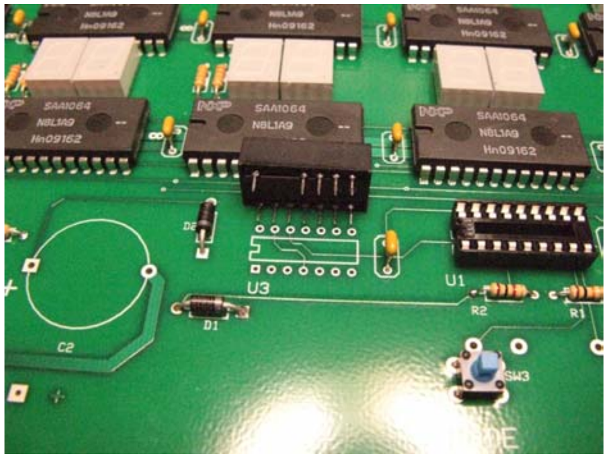
(   ) C5 - 10 uF capacitor
(   ) C6 - 10 uF capacitor

Big Capacitor



(   ) Load the 1 Farad capacitor as shown above.

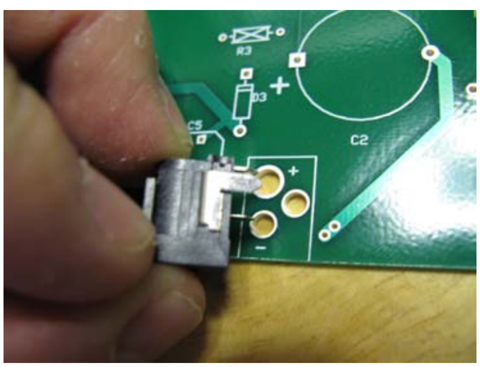
Oscillator

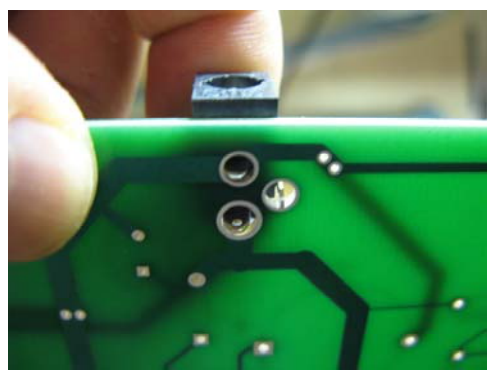


The 14 pin oscillator is missing some pins, but don’t let that bother you. Be sure to mount the part with pin one in the lower left hole near the U3 marking.

(   ) Solder the 14 pin Oscillator as shown above and clip the leads

Power Socket





Solder the Power Socket onto the board. The holes are large, fill them with solder, but don’t let is drip and burn you or short out the board. You want to be sure it mounts square to the edges on the right and left, not crooked or slanted.

Install PICs

( ) Carefully install the two uProcessor ICs, the Master goes into the left (U1 - PIC16F648A) and the slave goes into the right socket (U2 – PIC16F628A). You need to read the small print on the IC to determine which is which,

Test

Plug the AC cord into the power supply. Plug the round connector from the power supply into the clock. Now plug the 120V AC mains plug into the wall.

The clock should display ‘KABTRONICS’ for a few seconds (don’t worry, power-on is the only time you will see that shameless advertisement). Next, the clock should display the factory preset date (sometime in July 2009) using the default format.

Use the mode switch to advance to the ‘SELECT TEST’ mode.

Now, press the ‘+‘ key to enter the I2C buss test. You should see the lower display count from 1 to 37. The upper display should count 0 to F. If some digits are blank, or not in order, then you have a solder short or open affecting the I2C lines between the microprocessors and the driver chips. You could also have miss-loaded some of the 22K and 33K resistors.

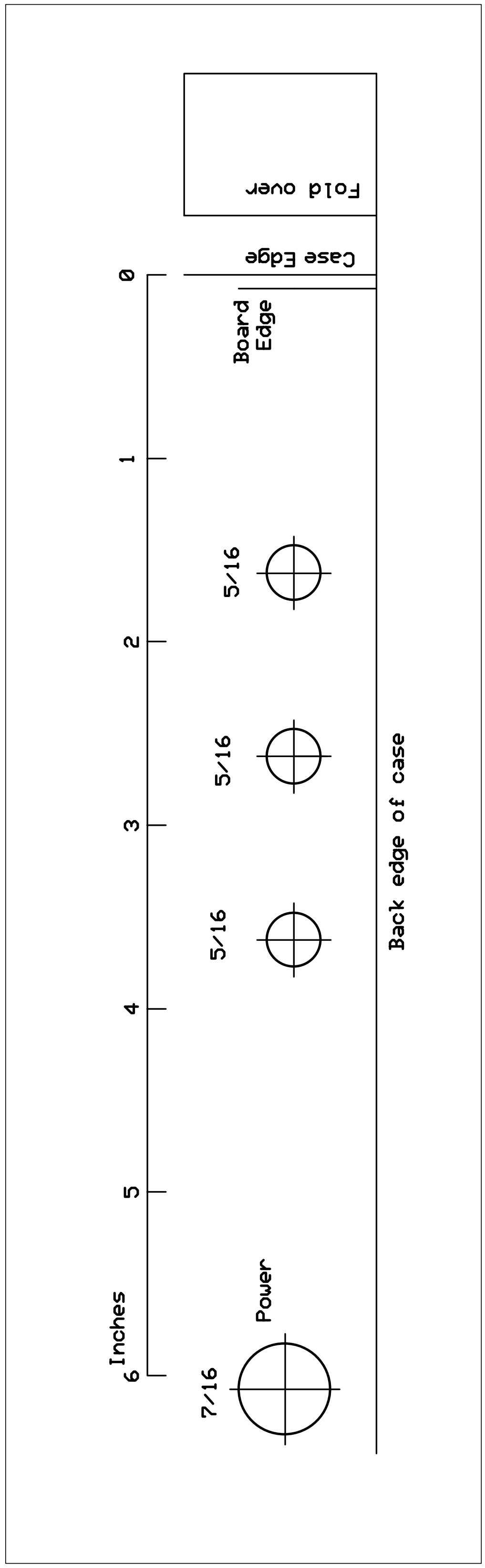
Next press the ‘**-**’ switch to enter the segment test. The 37 lower date positions should be displaying a marching segment test. One segment of each digit should be lit at a time. If you see multiple segments on in one digit, (perhaps less bright than others) you have discovered a solder short. Read the “In case of difficulty” section for debugging hints.

If you haven’t seen any of the problems mentioned above, congratulations, you are done with the electronic assembly part. Now you can mount your calendar into a case or mount it on a board.

Mounting in a Case

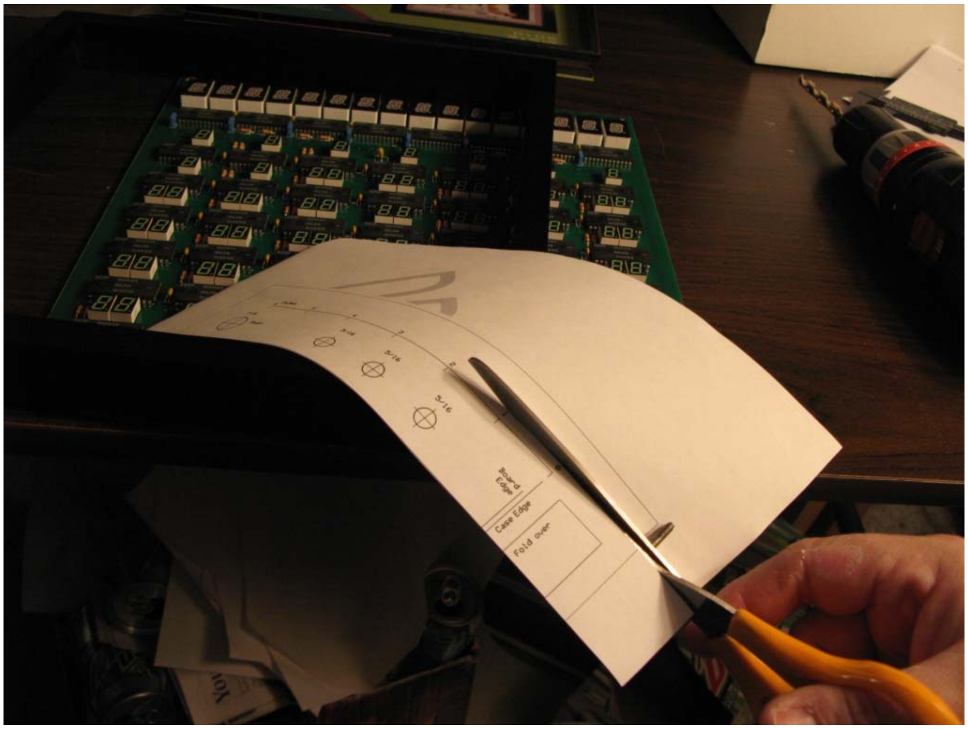
If you are mounting your calendar in a shadow case that KABtronics supplied, use the drilling template as shown. Download the manual from KABtronics.com and print just the next page to get a copy of the template, or just cut it out of your manual.

Check the scaling of your copy with a ruler against the printed 6 inch line. Be sure to place the template against the proper edges of the case. Play a bit with the calendar board by holding it in the case frame so you understand how it all fits together. The goal is to only drill it once, the right way.

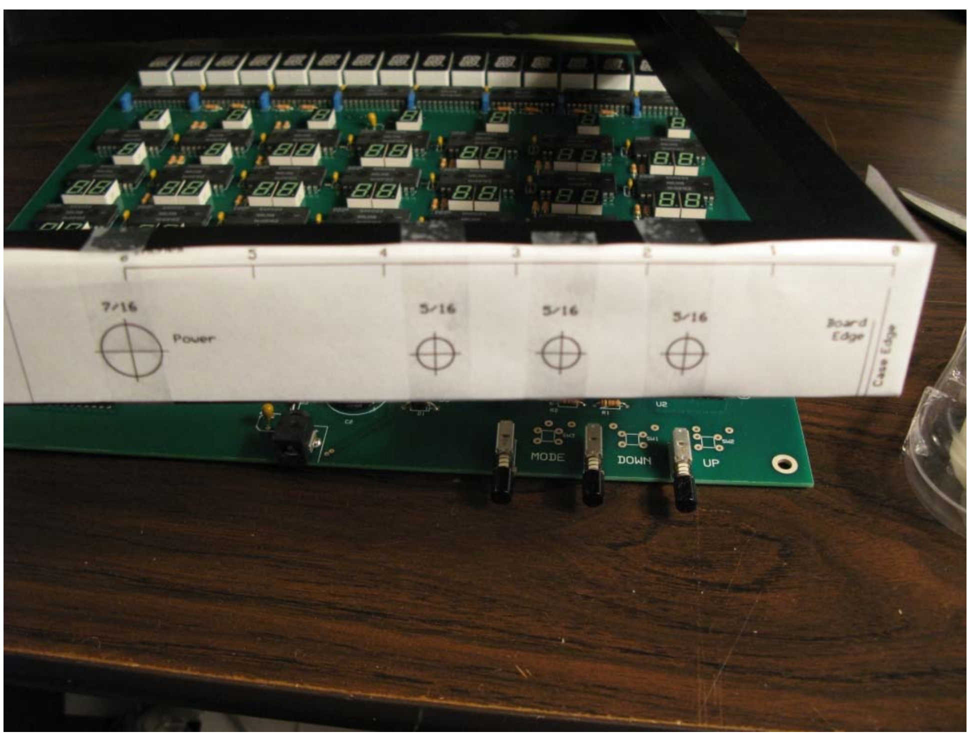

Fold over
Case Edge
Board Edge
0
1
2
3
4
5
6
Inches
5/16
5/16
5/16
Power
7/16
Back edge of case

Take the shadow case apart.

Understand where the holes need to go by holding the frame in position.

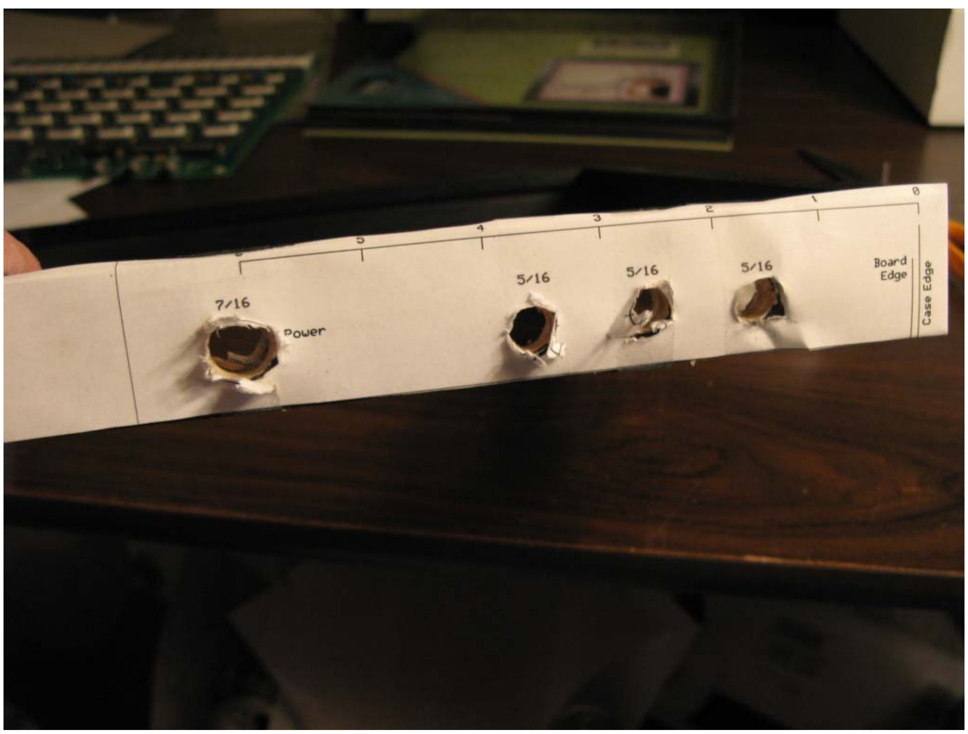


Print out the template, check the scaling, and cut it out.



Tape the template to the frame, carefully lining up the edges of the template to the back and side edges of the frame.

Drill out the holes, you can use 3/8 and ½ inch drills if you don’t have 5/16 and 7/16 bits.



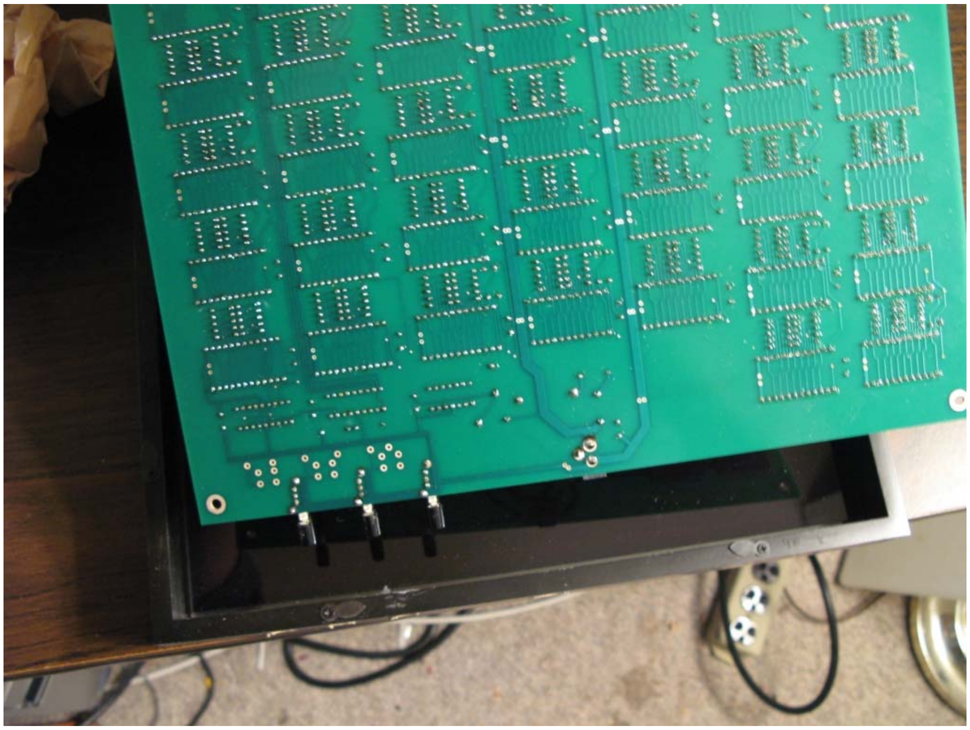
Try to do a better job than I did above.

Perhaps a drill press would do better, wish I had one…

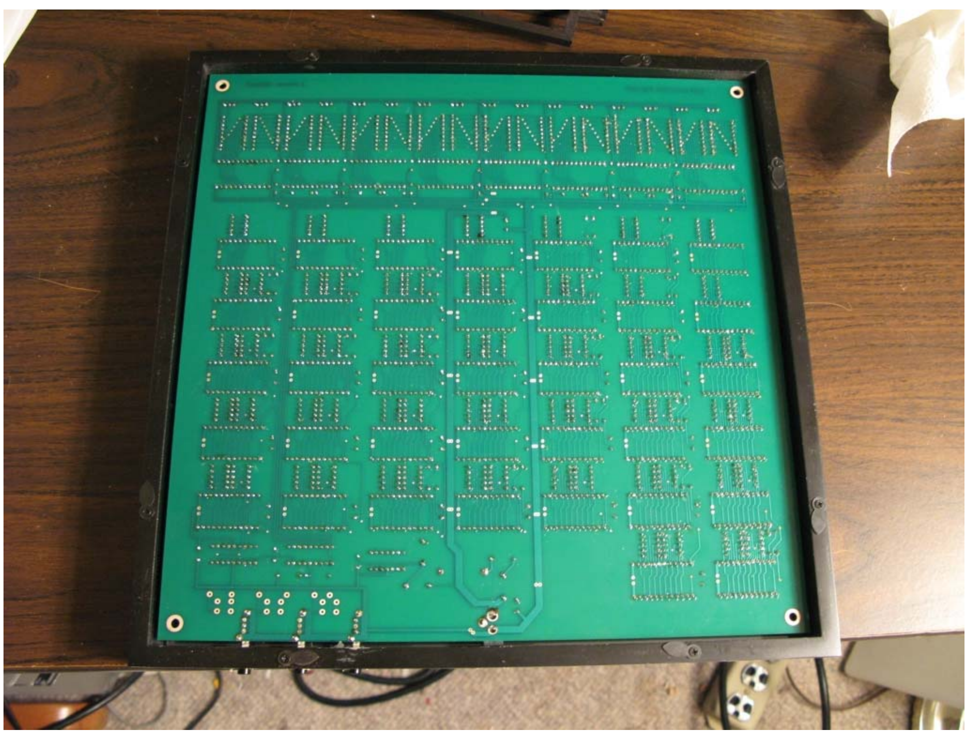
Lay the frame on its face…

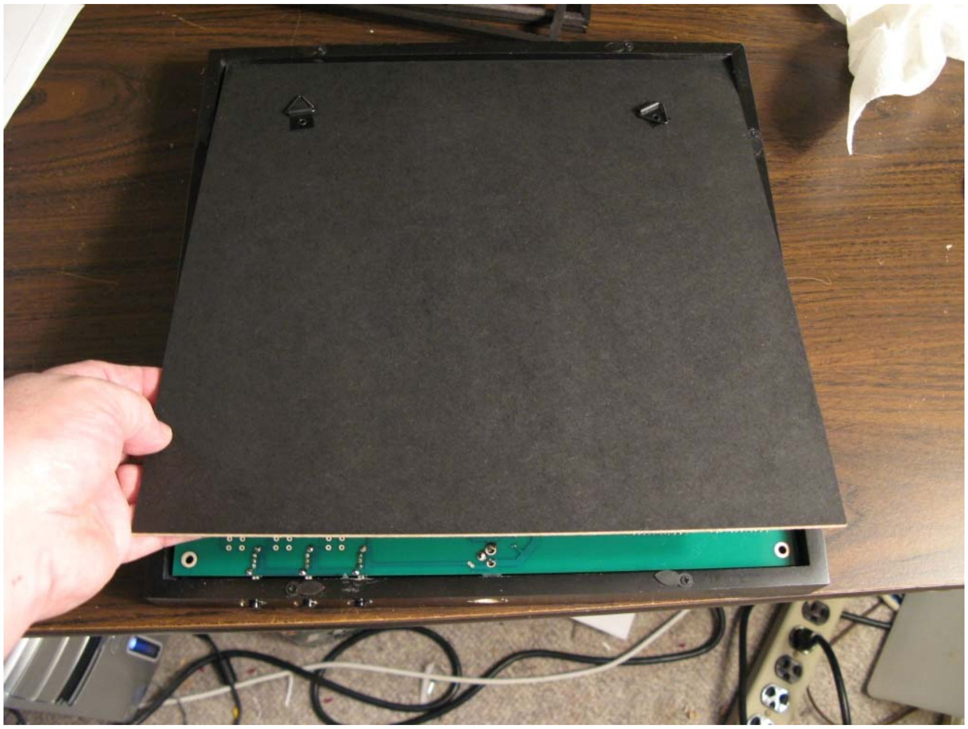
Dust off the glass front, be careful not to get fingerprints on it, You may wonder ‘why use the glass?’. I like the protection it gives the colored panel.

Peel off the paper protection and place the colored panel in place.



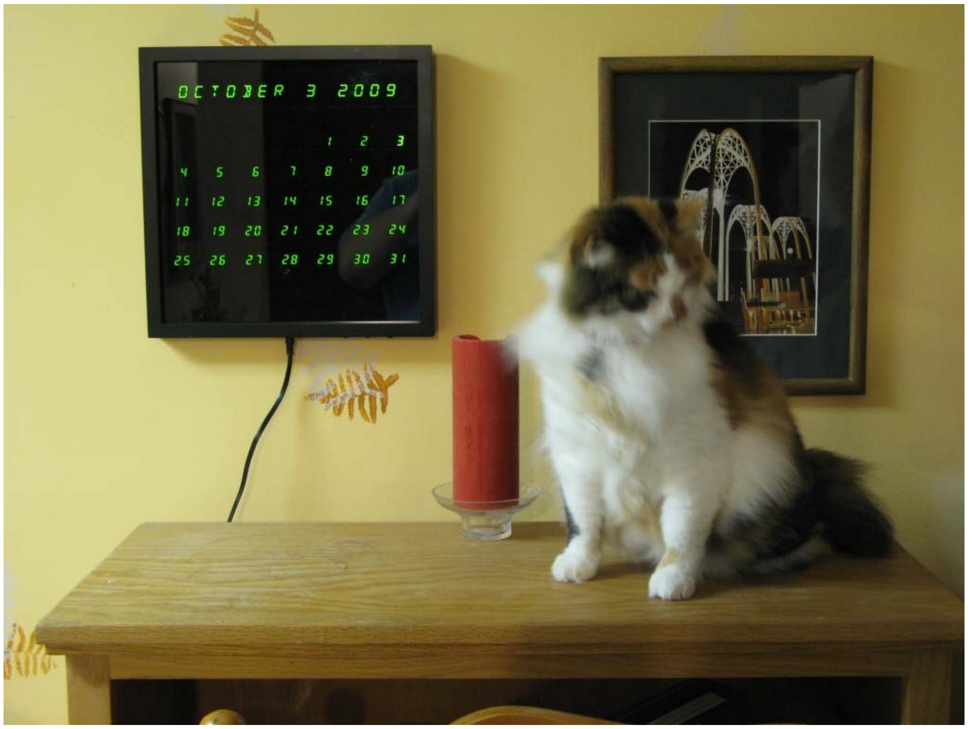
Slip the switches into the three holes and lay the PC board into the frame.





Place the rear panel over the PC board and turn the 8 latches to hold it in place.

Plug in the power and you are done.



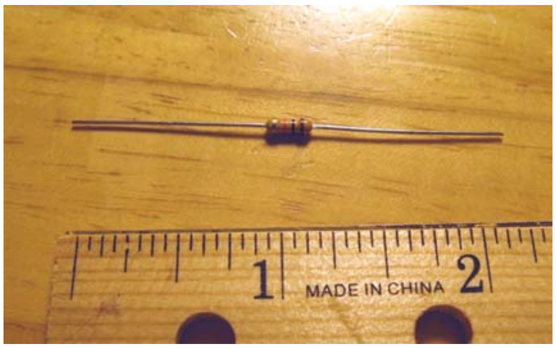
Mounting on a Plaque

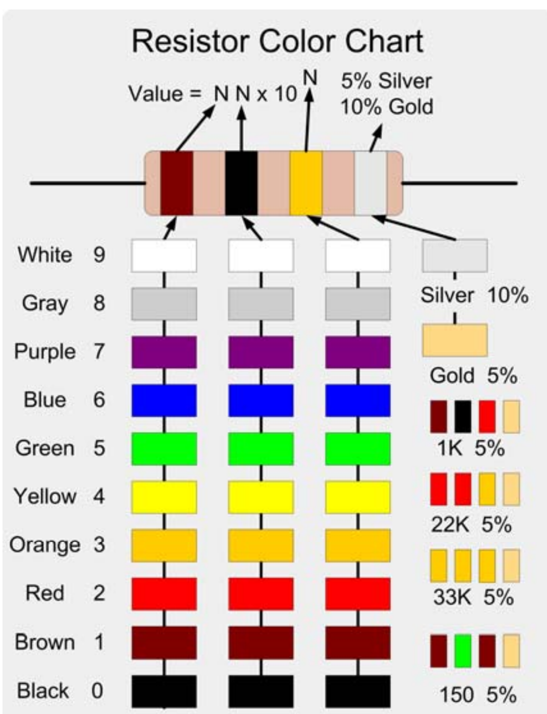
For those of you with some/all of the technology clock series and planning on continuing the theme of plaque mounted clocks - I salute you.

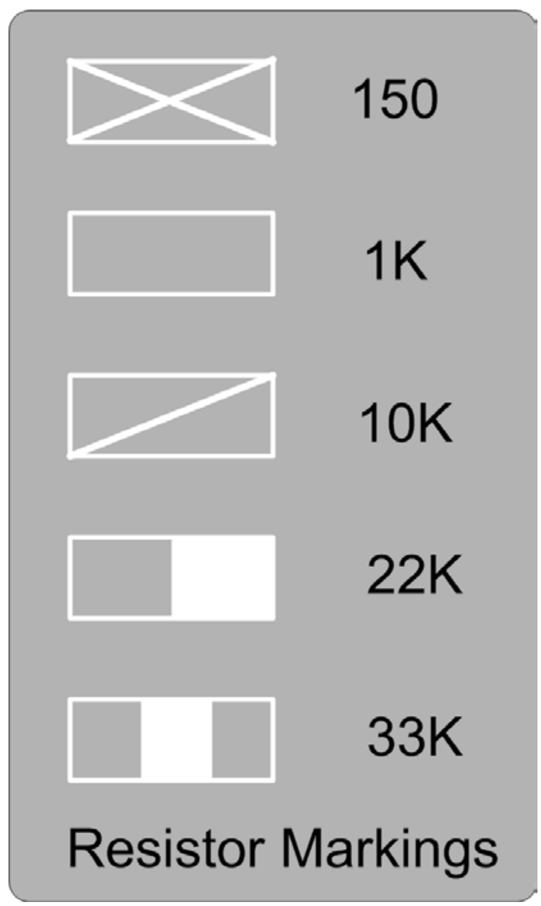
There is not a lot to say about mounting on a plaque. First, you need to make a plaque, and then mount the PC board with four #8 screws and ¼ inch standoffs (not supplied).

PARTS IDENTIFICATION

Resistors

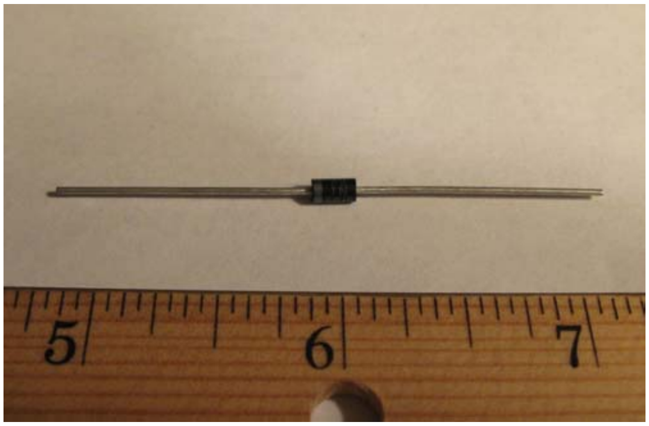






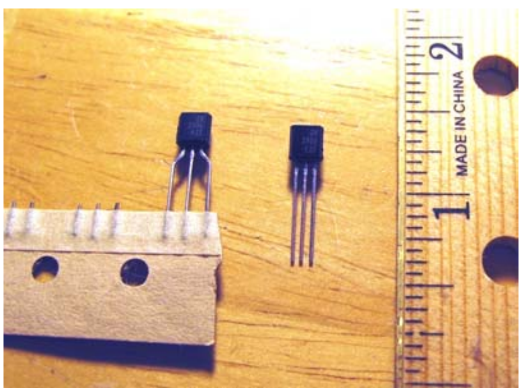
The above chart is in color only if printed on a color printer.

Diodes



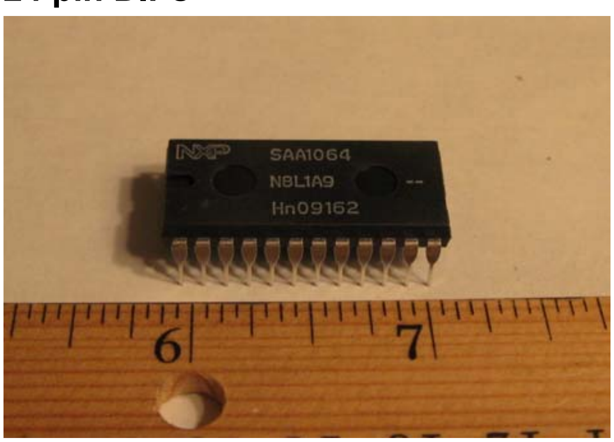
This is a polarized part; the stripe needs to match the stripe on the PC board.

Transistor



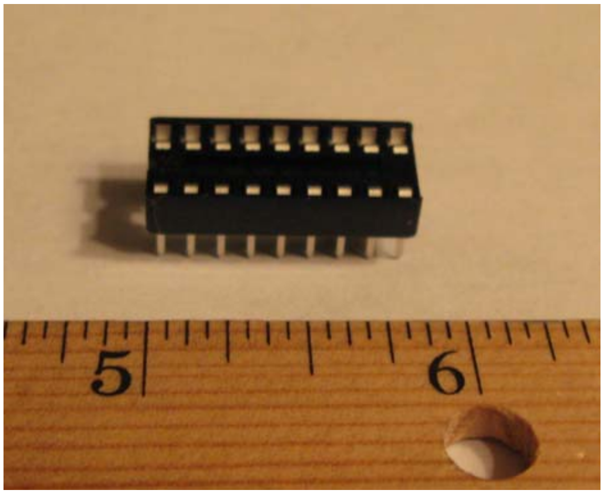
Try not to overheat this part when soldering.

24 pin DIPs



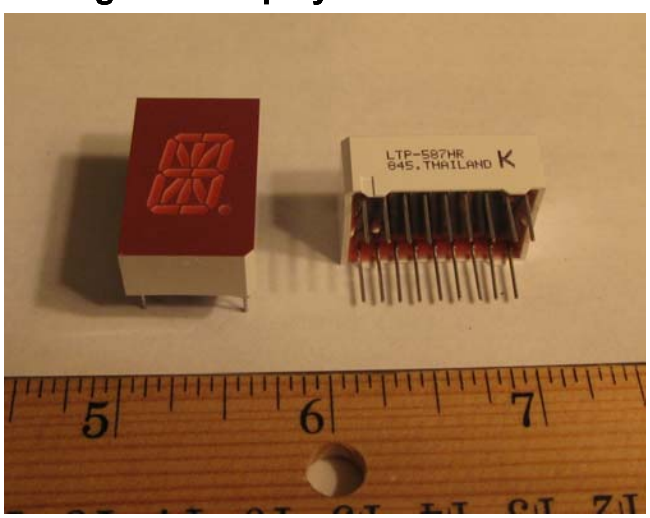
This part needs to be installed matching the markings on the board.

18 pin sockets



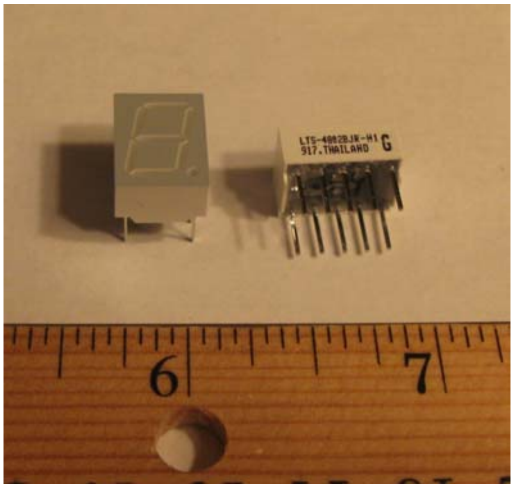
Be sure to mount this part with the marking for pin one matching the PC board.

16 Segment Displays



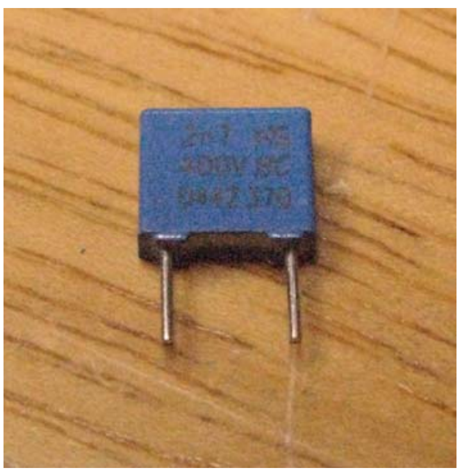
Note that Pin 1 is upper left in this picture, not the bevel on the package or the decimal point. It’s almost like they are trying to mislead you. All the displays on the board are mounted in the above orientation.

7 segment Displays



This mounts the same as the previous display.

0.027 caps



.22 caps

Both this and the 0.0027 cap are non-polarized; mount it either way

1 Farad cap

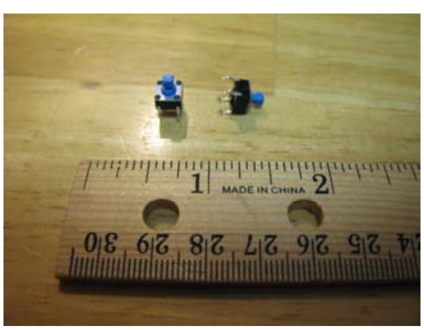
This part needs to be installed carefully, it is polarized. Look carefully at the picture in the mounting instructions. The metal strap is negative side of the capacitor.

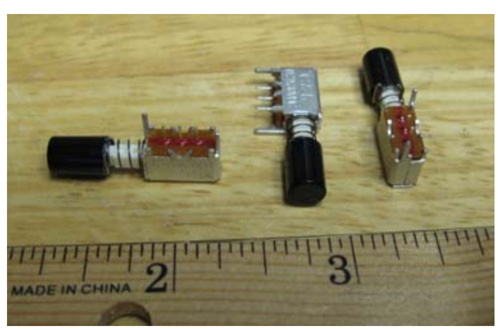
10 microfarad cap

Negative side  Positive side

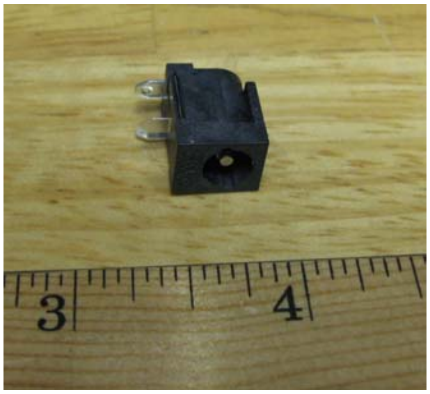
The long line identifies the positive side which need to go into the hole near the + sign.

Switches

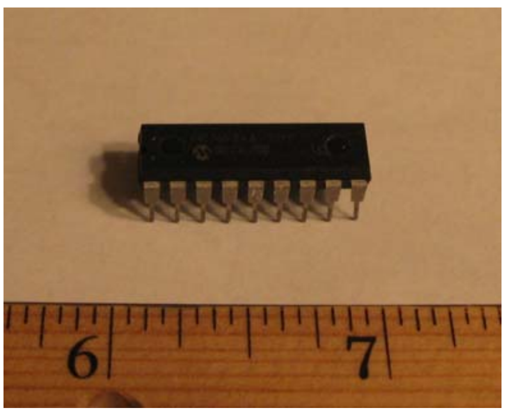




Power Socket



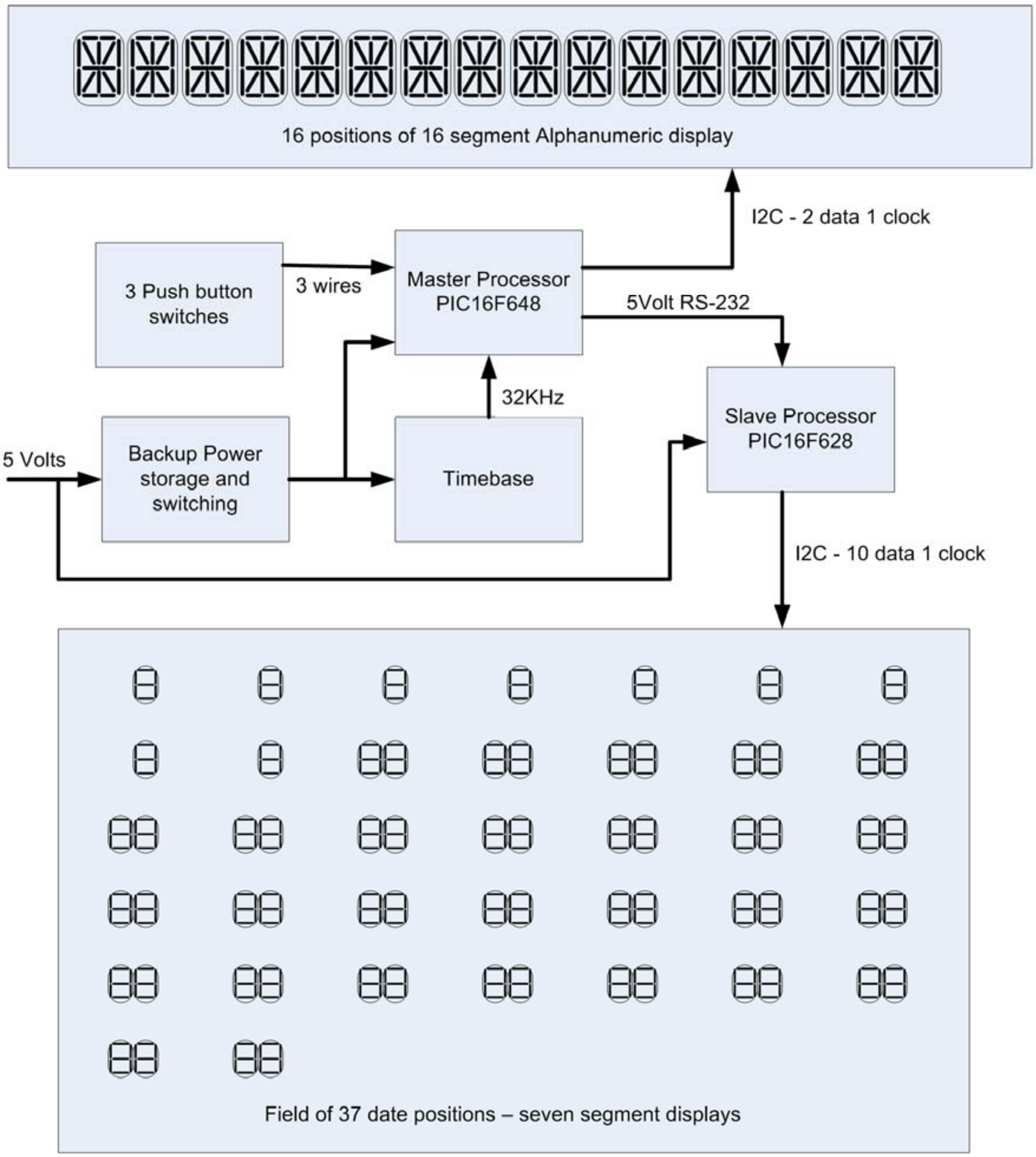
Master and Slave microprocessor IC



The master processor, U1, is a PIC16F648A. It goes in the left IC socket.
The slave processor, U2, is a PIC16F628A and goes in the right IC socket.

THEORY OF OPERATION

The block diagram below shows the top level design of the Calendar Clock.



Calendar Clock Logical Block Diagram

Refer to the above block diagram for this discussion.

This calendar runs on 5 Volts DC power, which is developed by the "Power Brick" as they are called. The power brick is a switching power supply converting the mains supply (100 to 240 Volts AC either 50 or 60 Hz) to a clean 5 volts DC.

The 5 Volts is connected directly to the LED driver ICs and to the slave microprocessor. A 1 Farad capacitor is charged by the 5 Volts and upon loss of the 5 volts the charge held in the 1 Farad capacitor is used to keep the Master microprocessor and the time-base running until the 1 Farad capacitor is drained, about ½ hour. The Master monitors the supply and switches to a power saving mode when the mains are lost.

When running in the mains-lost mode, only the time-base and Master processor are on, the Master has turned off all outputs and is watching only two lines, the time-base signal for time counting, and the 5 volt sense line awaiting the return of the 5 Volt power.

The clock is based upon the SAA1064 24 Pin LED driver. This IC can drive 16, or in multiplex mode, 32 LEDs. The outputs are current sources so resistors are not needed to set the LED current and brightness. The current level is programmed, along with the 16 or 32 segments, and the single or multiplex mode. The current level is unfortunately set on a per IC basis, so I was unable to use on IC to drive 4 digits, or two pairs or dates, since I needed to be able to highlight one date at a time.

The upper line of 16-segment alphanumeric displays are driven by a total of 8 drivers, each driver controlling 2 digits (32 segments) in multiplex mode, using 8 drivers. The drivers are addressable to one of four addresses, so I needed two address spaces, and therefore two data lines and one shared clock line to drive the upper display line.

The master processor also monitors the three switches used to set the time, date, and display format.

The lower field of dates needed 37 two digit positions (OK the first nine are one digit). Each position needed its own driver for brightness control, so 37 ICs needed 10 data lines and one clock to control the field. That many lines demanded a separate microprocessor and so the slave processor was added to do the job. It receives serial commands telling it the size of the month, the first day of the month, and which, if any, digit to highlight. It can also be told to display self-test patterns. It has nothing to say back to the Master processor so there is no return communications line.

CIRCUIT DESCRIPTION

This section describes pieces of the circuit for one of two purposes.
1) You may be interested in electronics and want to learn, or
2) You have a problem in an area, and the trouble shooting guide has brought you here.

Here's hoping for reason #1.

LED Driver

The heart of this circuit is the "SAA1064 4-digit LED-driver with I2C-Bus interface" made by NXP or Phillips.

The I2C bus is a single data line and single clock line that serially shifts in address, command, and data. The chip will only respond to its own address. The address is set to one of four by the voltage level on the address pin (pin 1). The 22K and 33K resistors set either 0, 1/3 VCC, 2/3VCC or VCC to pick the one of four addresses. Improper loading of these resistors will cause multiple drivers to respond to a command, and that will show up in the counting self-test, which was meant to make these addressing problems visible.

The lower date field is using the SAA1064 in the non-multiplex mode, each segment LED in each display is continuously on or off, depending upon the control bit sent in the I2C command to the driver. I tell you this mainly to contrast it with the following.

The upper line of alphanumeric digits is using the SAA1064 in the multiplexed mode. A capacitor, the 0.0027uF, is the base of an oscillator that drives the multiplexing. A miss-loaded 0.0027 capacitor may cause a blank display, or more likely a pair of digits will get "smeared" or "ghosted" as the multiplex circuitry miss-steps. The transistor above each display gates the current for that display; a miss-loaded transistor will either case a blank display, or will cause the smearing/ghosting again, perhaps this time only for that one display. An oscilloscope will show the triangle wave on pin 2 of the SAA1064. If an addressing or I2C bus problem prevents the SAA1064 from receiving the command to enter the multiplex mode, you won't see the oscillator waveform.

Solder splashes or other short circuits on the traces connecting the SAA1064 to the LED display may cause the current destined for one segment to get shared or diverted to the wrong segment. The segment self-test display can help spot these shorts. Unfortunately, at this time, there is no segment self-test for the alphanumeric, so use the count test for that testing.

Time Base

The time-base is a single chip (DS32kHz) temperature compensated quartz crystal oscillator providing a 32768 Hz signal to the Master Processor accurate to -2 to 2 PPM, or 1 minute of accuracy, plus or minus, per year. The time base remains powered during power outages of up to 30 – 60 minutes.

Note: the software in the master processor runs from the 128Hz interrupt derived from this time base signal. If this signal is missing, the clock will appear dead.

Master Processor

The master microprocessor connects to;

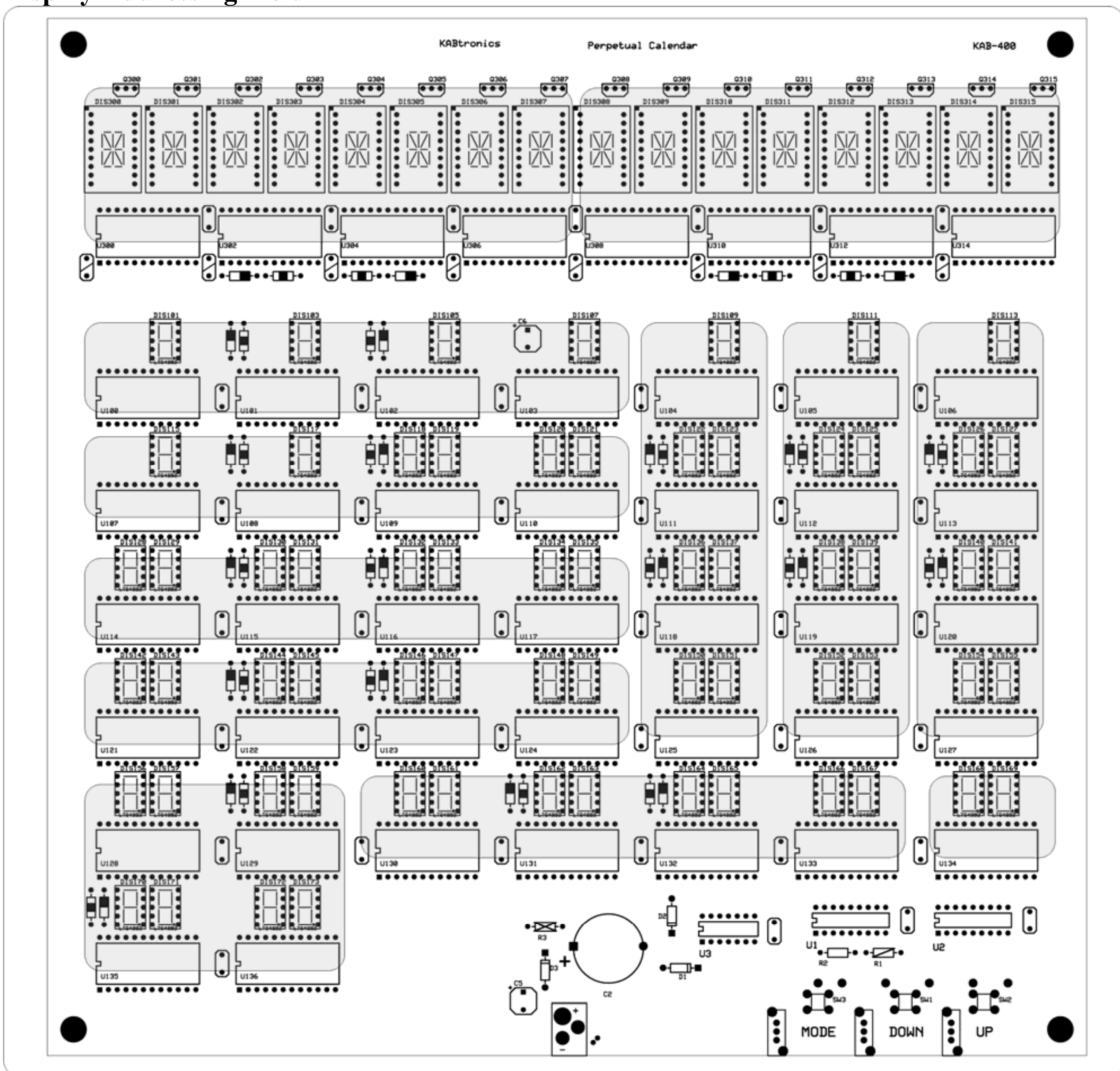
- Time base oscillator
  - Is divided by a 256 pre-scalor and causing a 128HZ interrupt
- 3 normally open push button switches
  - Shorting to ground
  - Internal pull-up resistors are switched on
- 8 SA1064 LED drivers
  - 2 data lines and one clock line
  - For each data line, one SAA1064 is addressed at each of the four allowed SAA1064 addressees
- The slave microprocessor
  - Single 5 volt RS-232 output
- The 5 volts into the PC board (ratio from R1 and R2)
  - Used to sense presence or absence of the 5 volt supply

Slave Processor

The slave microprocessor connects to;

- The master processor
  - RS-232 receiver only
- 37 LED drivers
  - 10 data lines and 1 clock line
  - 4 SAA1064 driver ICs on each data line, one at each address

Display Addressing Field



The above chart shows the grouping of I2C addressing. If all 4 displays in a group are blank, the data line is likely corrupted or shorted. If one of the displays is blank, then the driver addressing is likely wrong, probably by incorrectly loaded 22K and 33K resistors.

SOFTWARE

The software listings for the two processors are available online at kabtronics.com

Below is an outline of the Master processor software which may guide you when perusing the code.

MASTER PROCESSOR OUTLINE

Interrupt loop at 128Hz
- Advance counters: 128ths, seconds, minutes, hours, days
- Operate switch debounce counters and set switch states
- Operate power-loss debounce counter and set power-loss state

Mainline
- Clear all variables
- Set date and time to initial setting
- Set up PIC hardware: port directions, pullups, interrupts, divider, RS-232 output
- Start 128KHz interrupt
- Set main-state to powerup
- Enter main-line endless loop:
    - Check for power loss
        - Set hardware for low power
    - Else if return to power
        - Set hardware for normal operation
    - if Julian day number has changed
        - Unpack new date info from Julian and update display
    - If main-state has changed
        - Perform state entry function, likely display a prompt
        - Some states set a countdown timer to return to the display state
    - If in a mode that displays time,
        - Update time display if minutes have changed
    - If the countdown timer is operating and reaches zero,
        - Return to display state
    - If the up button has transitioned to pressed
        - Set the count down timer again to extend the count
        - Increment the variable based on main-state
    - If the down button has transitioned to pressed
        - Set the count down timer again to extend the count
        - Decrement the variable based on main-state
    - If the mode button has transitioned to pressed
        - Advance to the next main-state

IN CASE OF DIFFICULTY

AFTER you try to figure out the problem and attempt to fix it, you can email me at customerservice@transistorclock.com. Perhaps I can coach your troubleshooting experience. Please don't email me first thing when you have a simple problem, I will just tell you to RTFM if I detect you haven't exhausted the help below.

The most useful tool you have when troubleshooting is your brain.

Start with the data showing the problem. Try to isolate it.

At the top level, your problem will always be: a display is not correct.

Ponder these questions:

- Is it just a few segments wrong or is it total garbage?
- On top line or in the date field?
- Are any segments on or totally blank?
- Are the problems only within one driver IC?
- Are the problems only within one driver group?
- Are some segments showing at a different brightness than others?

Answers to the above will drive you to LED segment pins, driver addressing, I2C bus lines, microprocessor signals, etc. You can likely steer your search for the problem to a few traces, where you will find a bad solder joint, a solder splash shorting out some traces, or a miss-loaded component.

Take the time to understand the block diagram. Figure out which processor is controlling what displays. Understand the display grouping and how that relates to the I2C data and clock lines. Google I2C busses. Use the schematic to figure out this circuit works. This is what you bought the kit for; I do sell this clock assembled, if you don't what to learn how it works yet you are dreading chasing an assembly error, you should have bought the assembled clock.

Make a most likely guess at the problem, then gather more data to either support or refute your guess. Repeat until you find the problem. Resist the urge to replace components without being very sure you have a bad one.

On the other hand, by far, most problems are poor solder joints; feel free to reheat questionable joints to reflow them, sometimes a dab of additional solder will bring a bit of rosin and help the joint reflow cleanly. Just try not to over cook the ICs or LED displays.

This list is my guess at the cause of any problem in decreasing order of probability;

- Bad solder joint causing open or short to adjacent pad or trace

- Wrong component loaded or not loaded at all
- Component loaded backwards
- A clipped-off lead has stuck to the back of the board and is shorting out the circuit
- The board is resting on something conductive shorting out the circuit
- A component is bad because;
    - it was over heated when soldered (medium chance)
    - came that way with the kit (low chance)
    - was damaged by static electricity when handled (unlikely)
    - The PC board is damaged or was fabricated incorrectly (very unlikely)

So take a close look at the back of the board looking for bad solder joints and clipped leads in the area of the problem. Check for proper components and orientations. If you haven't found the problem, continue onto the specific trouble shooting section below, which will walk you through troubleshooting.

Find the first heading that describes your situation and read the help for that condition.

A) Absolutely blank, no segments are on; it looks dead to the world

Power brick battles:

Unplug the 120 Volt clock from the mains (120 Volt or 240 Volt). Be sure to plug in the power supply in this order.

1. Plug the small two pin side of the 120/240 volt lead into the power brick.
2. Plug the 5 Volt wire into the power jack on the bottom of the calendar.
3. Last, plug in the 120/240 mains plug.

The power brick has protection circuitry that may be tripped by plugging in the live 5 Volt connector, either a current pulse or a momentary shorting as the jack slides in may be causing the supply to turn off.

Next, if the calendar is still completely dead with no display at all, use your voltmeter to check for 5 Volts DC at the pins of the power Jack on the back side of the PC board. You should see 5 volts. If not, you should unplug and test the power brick by itself, without being plugged into the PC board. The inside of the power Jack it positive and the outside of the barrel is negative. Realize that the power brick will turn off if you short it out while maneuvering the voltmeter leads, don't get fooled by the touchy nature of the power brick. Reset the power brick by unplugging the 120/240 and plugging it back in.

You should be able to get to the point where you are holding the leads into and on the 5 volt power jack while your other hand plugs in the mains and you see 5 volts appear.

We've now wasted ½ a page on the silly power brick, if you still can't see 5 volts, you have a bad brick. It tested good before I sent it to you. They are available from Mouser Electronics, but they are pricey, you may want to retest yours.

B) Power Brick is good, 5 Volts does not show up on the back of the power jack.

Your board may a short between power and ground. Use your voltmeter to verify a low resistance between the power and ground pins on the power jack (without the power brick plugged in). Find and remove the short. The previous five word sentence may take a long time to execute

C) 5 Volts shows up on the PC board at the power Jack on the back of the board (Power Brick is working) but the Calendar is still blank.

Suspect backup supply:

With the 5 Volts applied to the board, check if output diode D2 of the backup supply located at the arrow below is above 3 volts. (use a voltmeter, check between ground and that diode lead) If you measure less than 3 volts, you have miss-loaded a part in the backup supply or one of the few parts is faulty.

Check master supply.

Check for over 3 volts on Pin 14 of the master microprocessor; try not to short out the adjacent pins while placing the voltmeter lead on the IC. I shouldn't have to tell you to stop and fix this if you don't see the voltage.

Check time base

The time base IC sends 32 KHz squarewave which the Master receives on pin 3. Use an oscilloscope to check for this signal. The clock will act dead without this signal.

Check 5 Volt sense

If 5 Volt sense line is miss-wired, the Master will enter hibernation and act dead. Check for about 3 volts on Pin 4 of the Master, if you don't see it, you have miss-loaded R1 or R2.

At this point, the Master is powered up and receiving a time base. The upper display line should be working and the switches should control the clock. If your upper alphanumeric line is not working, email me.

E) Upper Alphanumeric has some segments lit but something is wrong.

Some segments lit;

If some segments are not lit, but in general the digits are mostly there, you have bad solder joints or shorts on the LED segment lines between the SAA1064 Driver IC and the weirdly lit LED display.

Count is scrambled;

If the order of the count in self test is wrong or missing digits, the addressing 22K and 33K resistors described in the Circuit Description section are miss-loaded or badly soldered.

Group is blank;

If the right or left set of 8 displays shown in the Display address field figure is blank, you have a common date line being shorted or grounded.
These two data lines and the associated clock line route from the master microprocessor through the lower date field and up to the 8 SAA1064 Led drivers at the top. There can easily be a solder splash shorting the line.

F) Upper Alphanumeric line works, the lower Date field not working right

Date field is blank, no dates and no self test showing:

The slave microprocessor is not running, or is not receiving the commands from the master. Check for 5 Volts on the power pin of the slave (pin 14) . Use an oscilloscope to check for the RS-232 data on the slave processor (pin 7). You can force an RS-232 command by changing the month in the month flipping mode.

Segment test shows bad digits:

This is why there is a segment test. The trace between the display and the driver IC is open or shorted.

Count test is scrambled:

Scrambled counts are a result of the driver addressing being incorrect from miss-loaded 22K and 33K resistors. Read the Circuit description again.

Group of 4 dates is blank:

If all four displays in a group (see Display Address Fields section of the Circuit Description) are blank, then the data line to that group is shorted or open. These data lines run a pretty convoluted path while snaking about the display field from the slave microprocessor; perhaps you shorted them out with a sloppy solder job?

SPECIFICATIONS

PC board Size: 11.9 inches wide by 11.9 inches high

(Allow ¼ inch behind board and ¾ inch above when loaded for parts clearance)

Weight: Loaded PCB 1 lb 7 oz (0.65kg), (add 10 oz for power supply and AC cord)

Power consumption: About 15 watts

Temperature limits: Designed for room temperature operation, 60-100 °F

Warrantee: There is no warrantee of any kind. KABtronics wants you to succeed and be happy with your clock, so don't hesitate to email customerservice@transistorclock.com with questions if you are having difficulty.

MEMORY VOLATILITY STATEMENT

KABtronic Calendar Clock, Part number KAB-400

This device contains FLASH memory, EEPROM memory, and RAM.

There are two single chip microprocessors.

The master microprocessor (PIC16F648A) resources;

The 256 Bytes of EEPROM are not used, are inaccessible by the user, and remain in the factory cleared state.

The 4Kx14bit (28672bits) of FLASH memory hold the operating code, are programmed by KABtronics, are inaccessible by the users, and remain unchanged in operation.

The 256 Bytes of SRAM are used for program operation, and can hold date and time information, which will be set by the user.

The slave microprocessor (PIC16F628A) resources;

The 128 Bytes of EEPROM are not used, are inaccessible by the user, and remain in the factory cleared state.

The 2Kx14bit (28672bits) of FLASH memory hold the operating code, are programmed by KABtronics, are inaccessible by the users, and remain unchanged in operation.

The 224 Bytes of SRAM are used for program operation, and can hold date information, which will be set by the user.

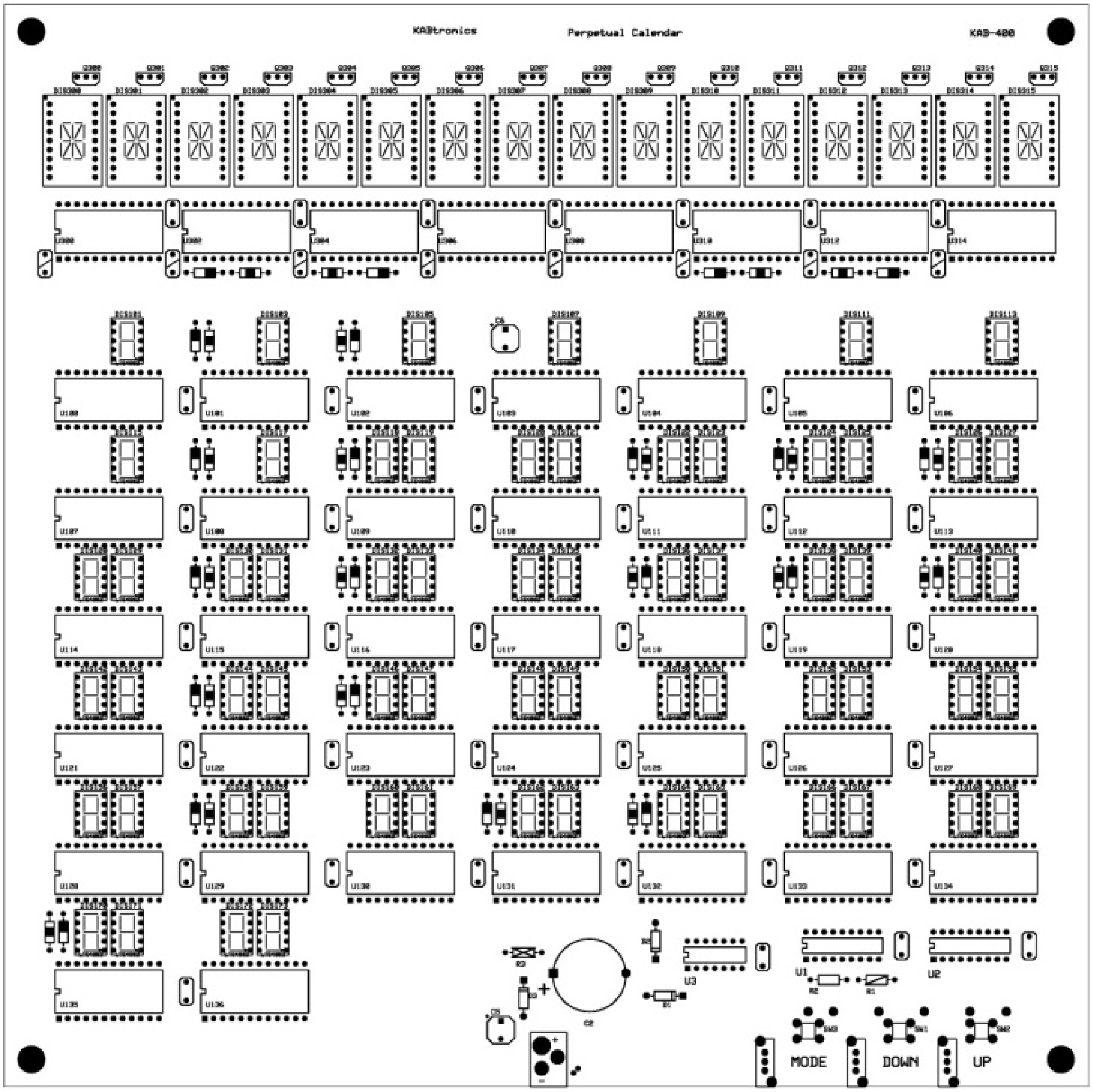
Clearing procedure – clears both microprocessors:

Any **one** of the following actions will clear the clock of stored data;

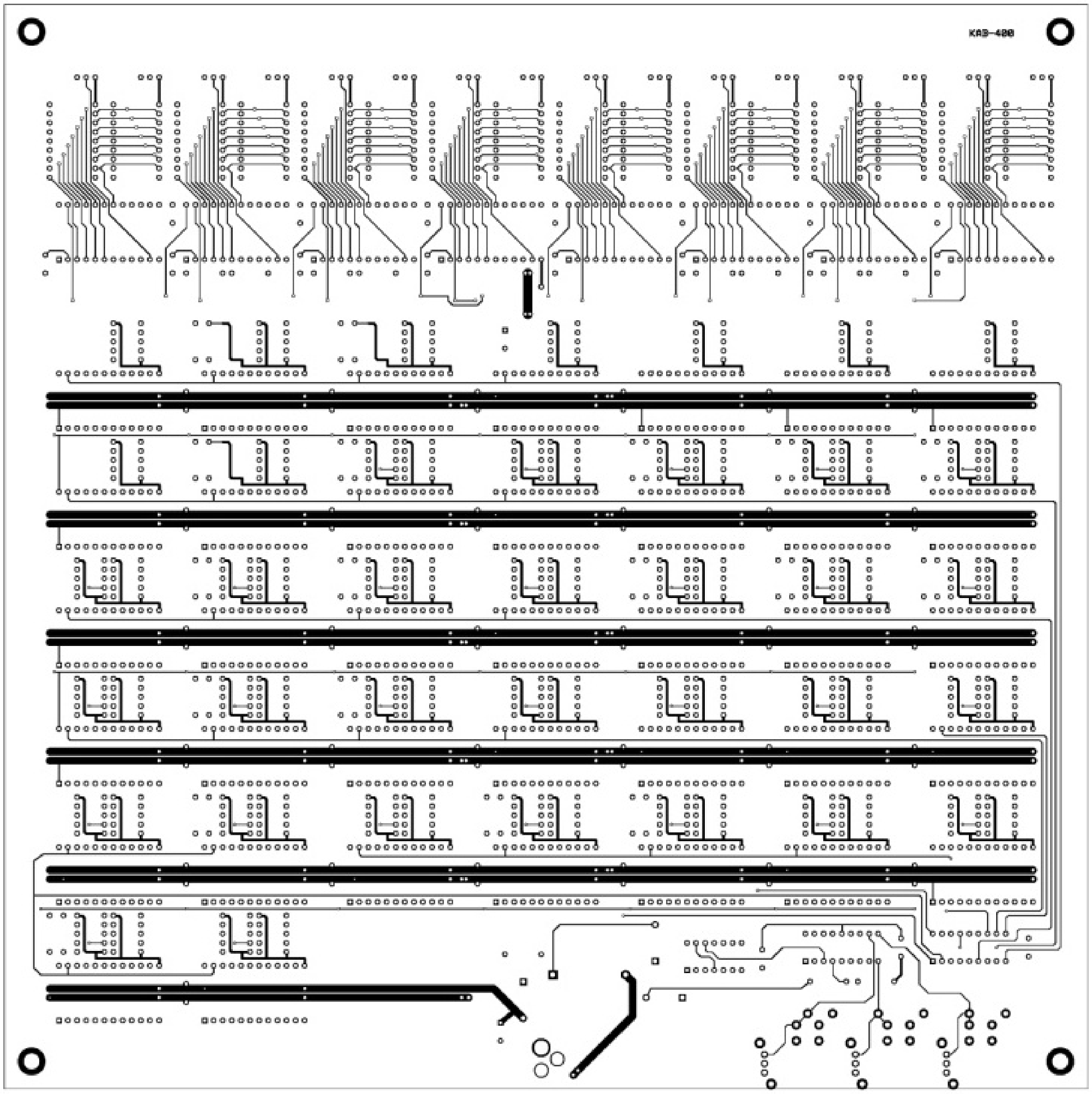
1. Use the mode button to cycle to Preset, then press + key to reset all stored data to factory preset for both microprocessors.
2. Unplug the unit and wait 24 hours to fully deplete the hold-up capacitor.
3. The 1 Farad hold-up capacitor can be shorted and depleted to cause immediate loss of data.
4. Remove the socketed single chip processors and destroy the ICs. (Contact KABtronics for replacement)

Calendar Clock
KABtronics
customerservice@transistorclock.com
8/25/2009

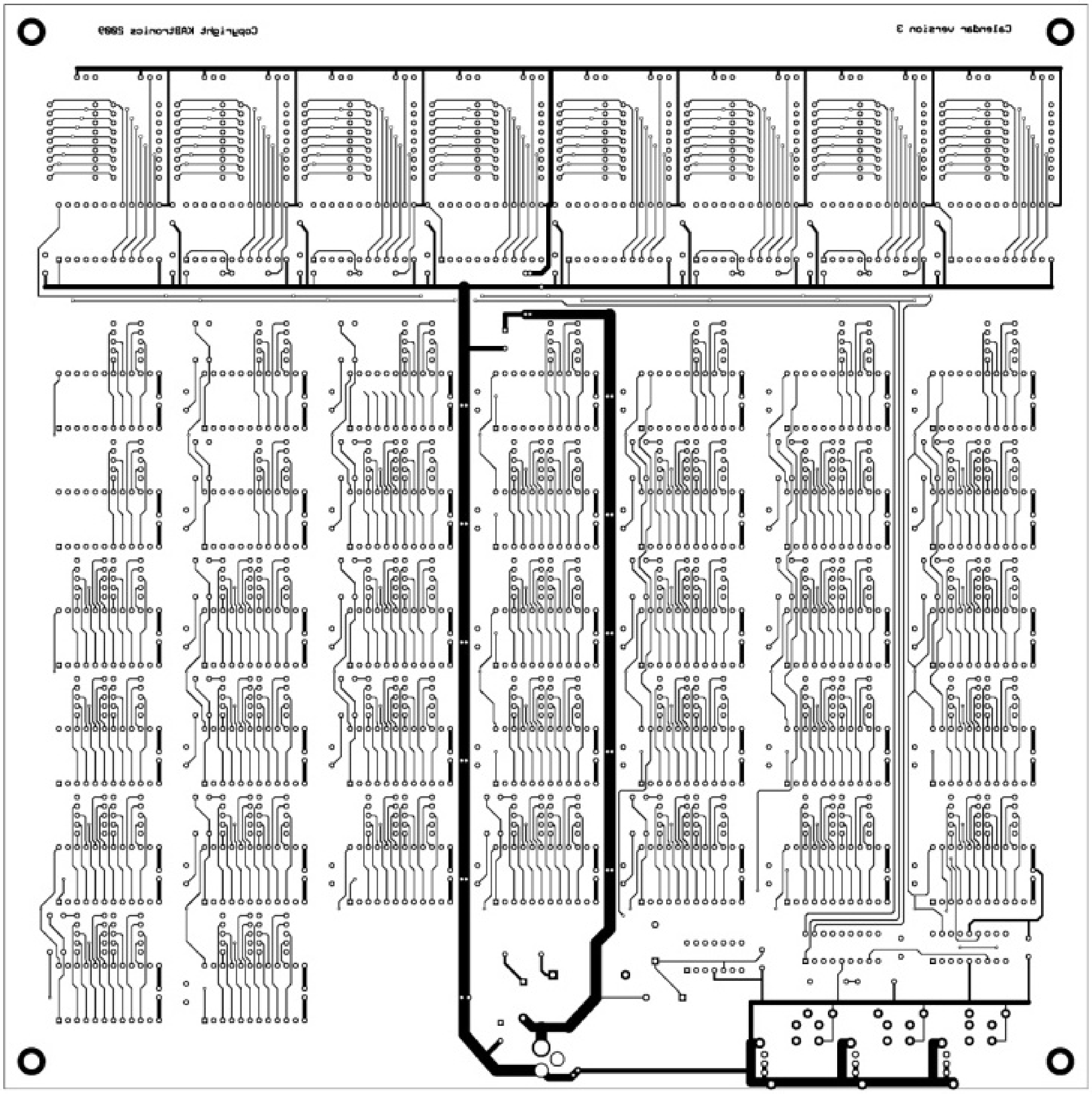
CIRCUIT BOARD VIEWS



Silkscreen

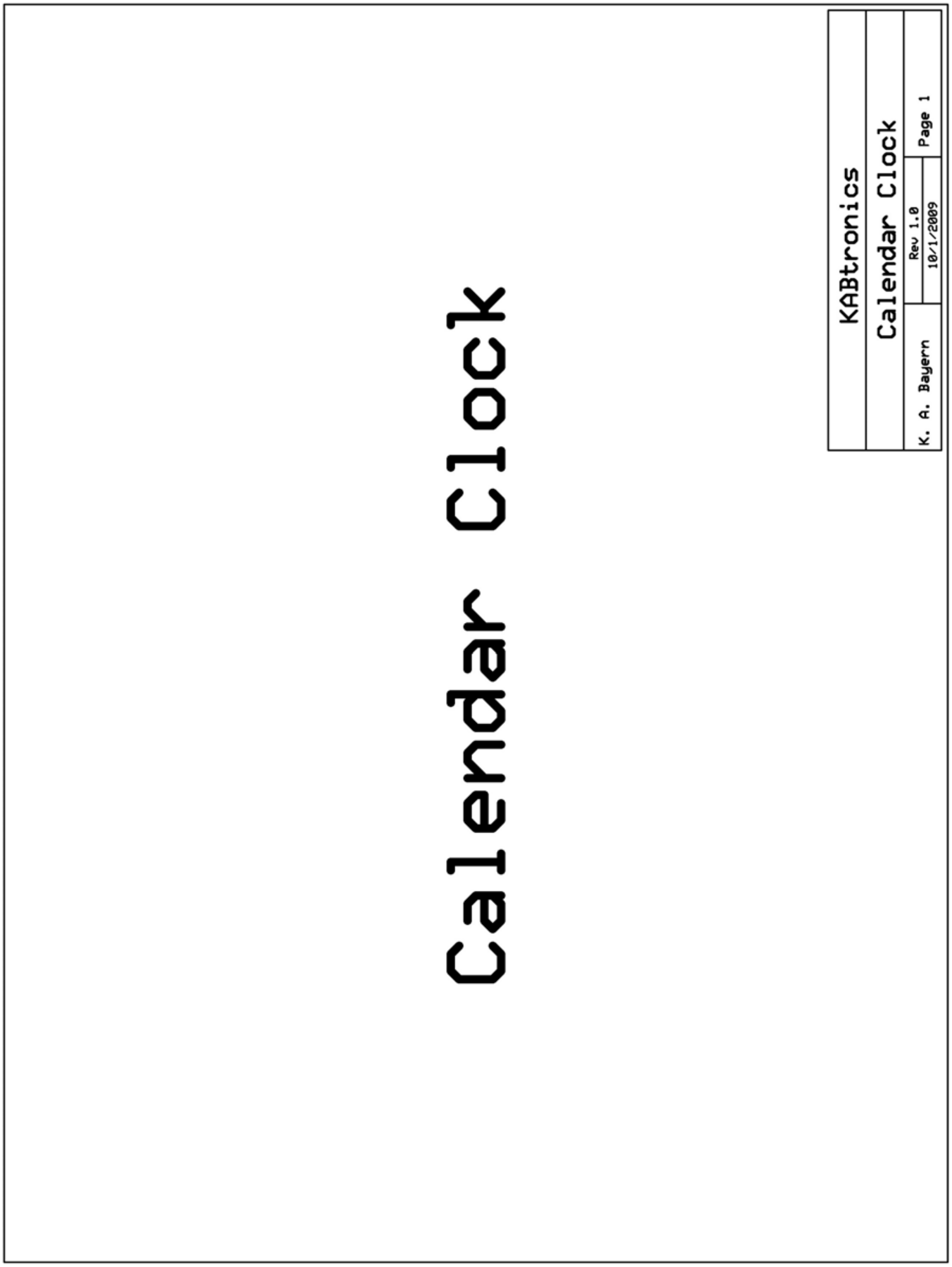


Top Copper



Bottom Copper

SCHEMATIC


Calendar Clock
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10/1/2009
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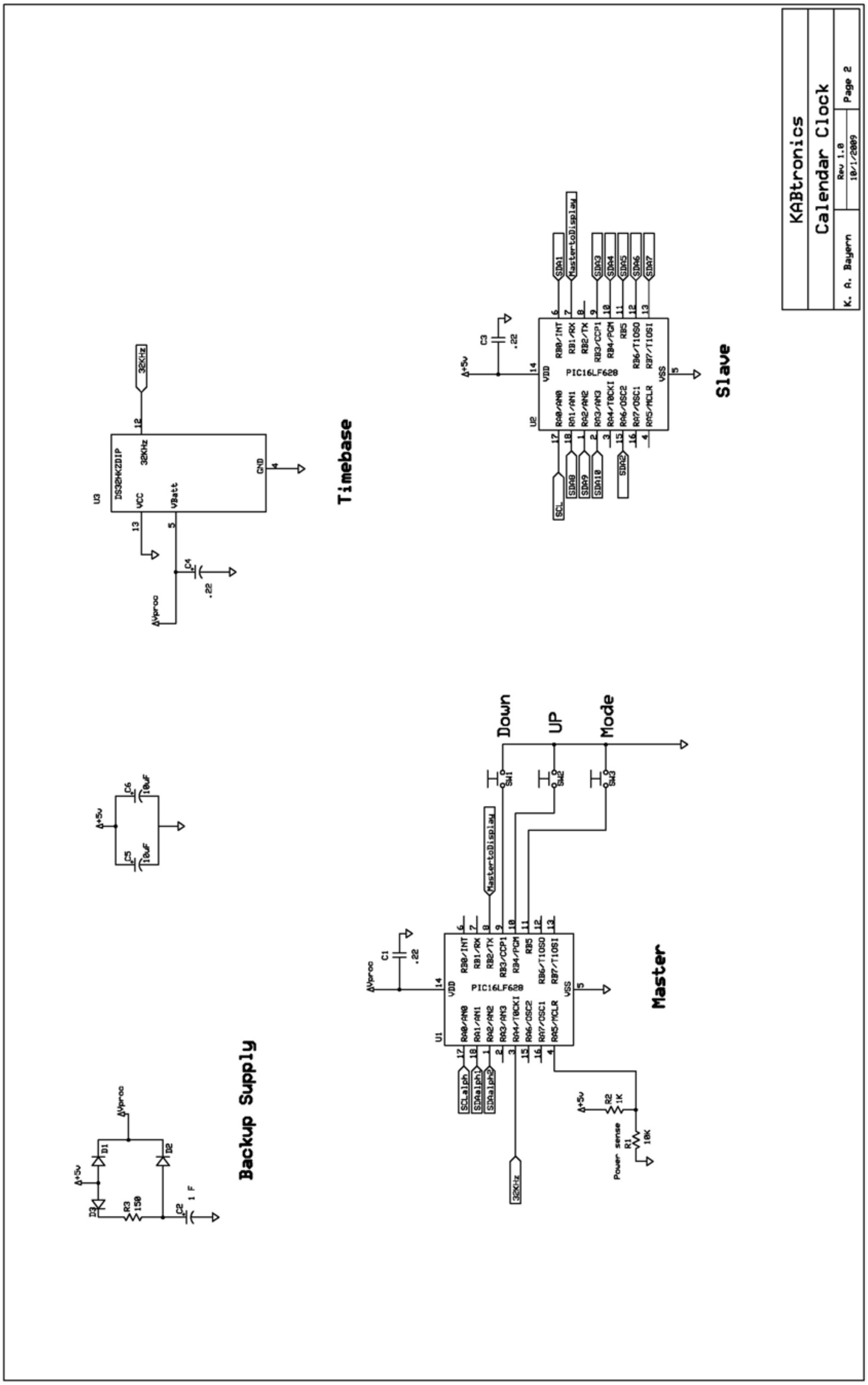
K. A. Bayern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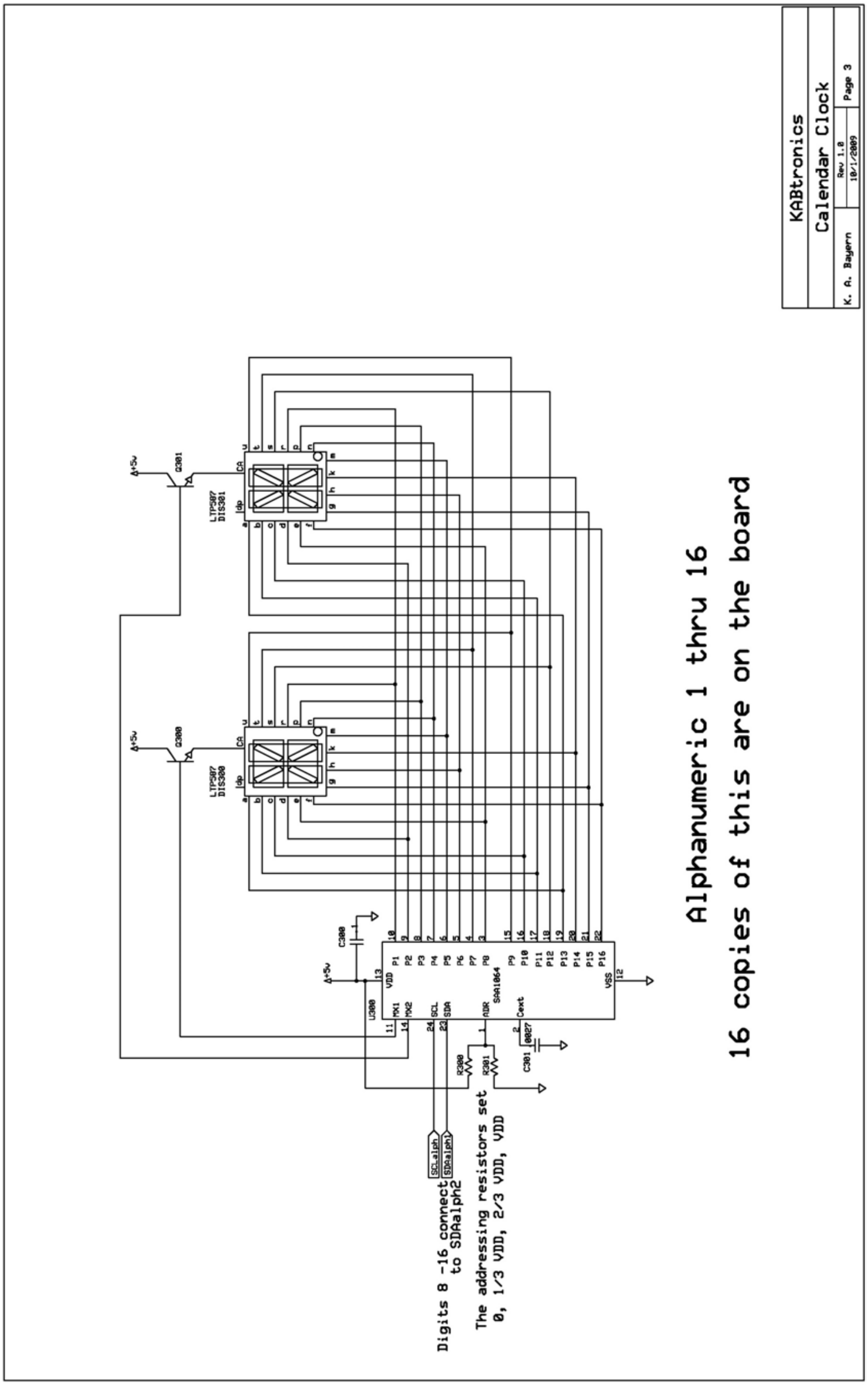
10/1/2009
Timebase
Slave
Master
Backup Supply
DS32KHZDIP
PIC16LF628
Down
UP
Mode
MastertoDisplay
Power sense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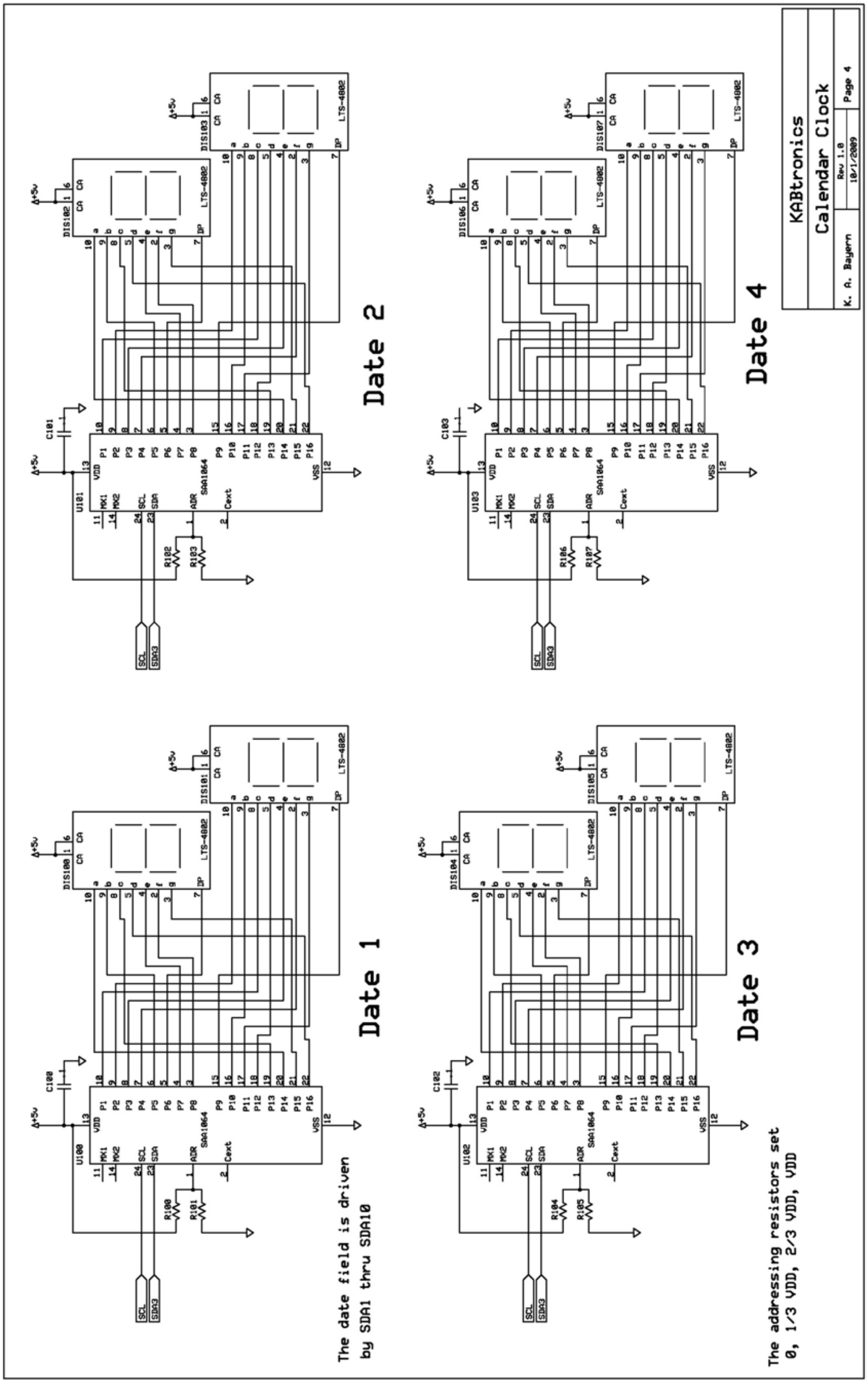
Alphanumeric 1 thru 16
16 copies of this are on the board
Digits 8 -16 connect to SDAalph2
The addressing resistors set 0, 1/3 VDD, 2/3 VDD, VDD
LTP587 DIS300
LTP587 DIS301
Q300
Q301
U300
SAA1064
C300
C301
R300
R301
SCLalph
SDAalph1


Date 1
Date 2
Date 3
Date 4
The date field is driven by SDA1 thru SDA10
The addressing resistors set 0, 1/3 VDD, 2/3 VDD, VDD
KABtronics
Calendar Clock
K. A. Bayern
Rev 1.0
10/1/2009
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