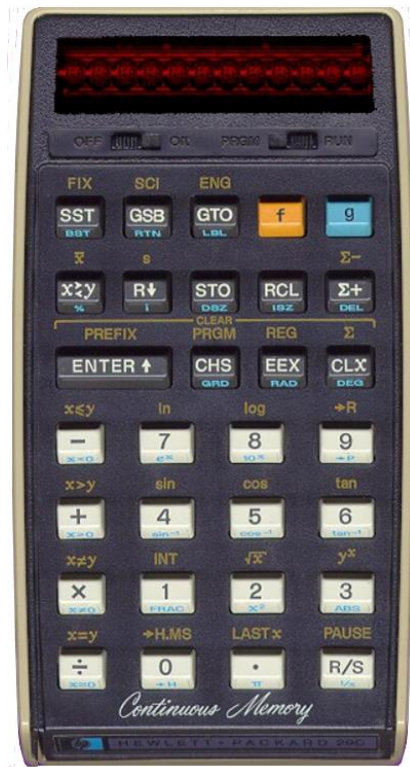


# Woodstock REPLACEMENT CPU BOARD



Project Design by Tony Nixon

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<http://www.teenix.org>

**NOTE:** This replacement board will not help repair a faulty display or keyboard.  
Some soldering is required to use these boards in the Woodstock calculators.

## Disclaimer

The material contained within this project is supplied without representation or warranty of any kind. The author therefore assumes no responsibility and shall have no liability, consequential or otherwise, of any kind arising from the use of this project or any part thereof.

PIC18LF67K40 Operating System - Source and Binary Code - Copyright A. Nixon 2024

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### Caution

Some components on the circuit board may be damaged by static electricity. Always handle any of the circuit boards by the edges.

Do not exceed 4.5V battery voltage.

**Observe correct battery polarity or damage can occur.**

## Features

- Supported models HP-21, HP-22, HP-25C, HP-27, HP-29C
- Continuous Memory storage for all models - requires no battery power
- Storage: HP-25C, 207 program files. HP-29C, 360 files, either program or data
- Continuous memory has reset
- Bluetooth connectivity
- LiPo battery powered
- Turbo Mode, fast code execution
- Internal USB battery charger with charge indicator, can run calculator as well
- Text editor for creating names for stored programs
- Decimal/Binary/Hex/Octal convertor
- Option to display program text instead of original key numbers
- Real time clock with alarm, +/- 5 PPM
- Separate count up and count down timers with alarm
- Selectable DDMMYY, MMDDYY, YYMMDD or Text date format
- Clock display in numeric or text format
- Menu activated right switch (in case user's model does not have one)
- Selectable key de-bounce
- Beeper - selectable Off, Loud or Soft
- Display setting – Bright or Dim
- 29C printer interface via Bluetooth link to PC
- Power on model display
- Temperature display
- Version display
- Selectable low battery reference
- PC interface for transferring options and program
- Compatible with Teenix Woodstock emulator
- Reprogrammable via Bluetooth, USB Serial Port Module or PIC ICSP programmer
- 3 extra programmable functions for the HP-25C
  - Beep
  - GSB 49
  - RTN
- 6 extra programmable functions for the HP-29C
  - Random Number
  - Constants
  - Beep
  - Data Swap
  - File access
  - Notes Display
- 2 inbuilt games, Tetris and 21 with music and sound effects

## Installation

**Note:** Please read these notes before attempting the install.

To open the Woodstock, remove the battery and the 2 top rubber feet. A small screwdriver can help to carefully pry them out. Then remove the 2 screws that were under the feet.



### Note

The original and new Woodstock circuit boards can be damaged by static electricity.

Handle the boards only by the edges, do not place fingers on the circuit board traces or components.

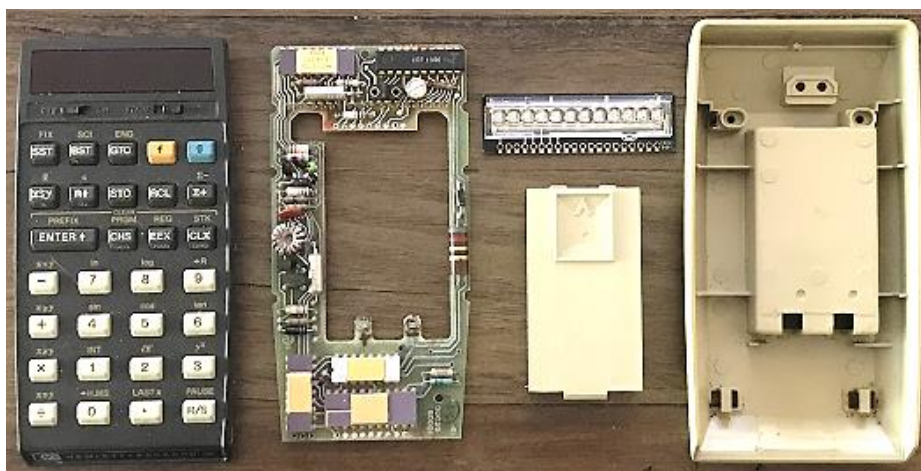
Use of a static wrist strap is recommended.

Next open the calculator cases by pushing down on the charger connectors to open the top edge of the face plate. The lower end has a locking lip holding that end in place. You should be able to dislodge the lip by pushing forward on the HP label while holding the front face raised above the casing.

Once opened, remove the original CPU board by raising it vertically from the face plate. You may have to raise the top and bottom edges in turn to separate the connecting pins. Once separated, remove the LED display module, again by raising it vertically from the circuit board.

**Note:** Handle the display board with care and try not to subject it to hard knocks.

Due to its age, the LED digits can dislodge from the circuit board underneath the magnifying bezel and may be impossible to fix if any of the tiny connecting wires break.



Unfortunately, due to the original construction of the Woodstocks, some soldering is required to complete the installation. You will need a soldering iron, de-solder braid, solder and a few basic tools for the next part of the installation.

If you do not have the expertise to do this part of the process, the boards can be sent to the project author and the pins will be transferred to the new board before dispatch. [Email](#) for details. If required, the original non-working boards will be included in the returned package.

There are 3 sections of original pins that need to be removed. During removal, secure the boards using a similar method as shown. A pair of tweezers can hold the pin while the soldering iron can melt the solder connection from the other side. When the solder melts the connection, remove the pin. Place the pins from each section into separate container to keep them safe.

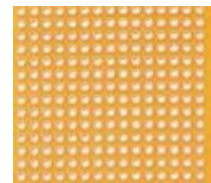


Be careful as an overly tight grip on the pin may cause it to eject from the tweezers and disappear somewhere. If this happens, it may be very difficult to find.

A flat chisel type of soldering iron tip is recommended over a pointed one. Put the connectors in a safe place to avoid loss.

Note: Board for explanation only

There may be a small circuit board supplied with the Woodstock CPU board, and this can be used as a template for mounting the pins. If not, you can use matrix board with 0.1 inch hole spacing. Cut a section to allow 25 holes in a row and about 3 holes wide. You will need to drill a row of 20 holes with a 1.3mm drill. The pins will fit securely with this drill size.



When the pins are removed, you need to use some de-solder braid and the soldering iron to remove any excess solder that may remain on the pin. If this is not done, then the pin may not fit into the new circuit board hole. Lay the pin on a flat heat proof surface, place the braid over the soldered area and press the soldering iron down on top of the braid to let it soak up the solder. When you see that no more solder is leaching into the braid, keep the soldering iron in place, and quickly use a finger nail to drag the pin out from under the braid. This will wipe the pin clean and also stop the braid from sticking onto the pin when the solder begins to cool.

The first assembly step is to solder the long pins onto the new CPU board. There are 9 pins near the top edge and 9 pins near the bottom edge. Pins can be inserted easier when holding them with some pliers as shown. Holding them with the end protruding like this can minimise bending of the pin end.



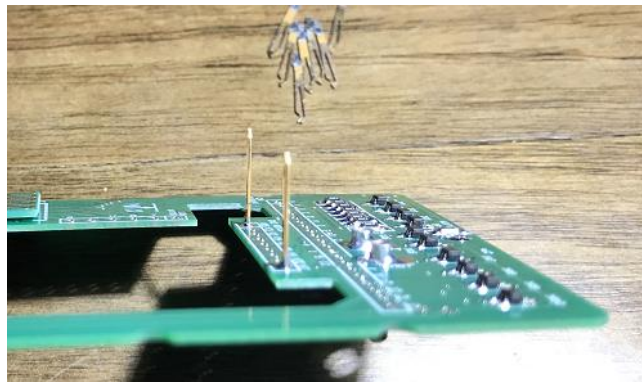
Insert a pin at one end of the 9 mounting holes and keep it as close to upright as possible and the vertical face of the pin aligned parallel to the top edge of the board. The pins should be a reasonably tight fit in the circuit board holes and should aid in holding the pins steady. There are 2 vertical prongs to each pin. Keep the longer one to the right of the circuit board.

The pin may not sit exactly vertical and may move a bit when solder is applied but that is ok. Apply the solder and iron to the top of the board.

The first solder joint is not a permanent one yet, it is just there to hold the pin in place.

Use light finger pressure to hold the top of the pin and melt the solder again. Position the pin as vertical as possible, checking both front and side. You need to be quick or the pin will get too hot to handle. If it is vertical looking from one side, move the board 90 degrees and check from the other direction. It is relatively easy to hold the pin and adjust the second vertical position without disturbing the first. Try to do this quickly or board or finger damage may result from overheating and you don't want solder creeping up the pin.

You can do the same procedure with another pin at the other end of the 9 holes, or use the perf board as a spacing template by placing it over the soldered and unsoldered pins.

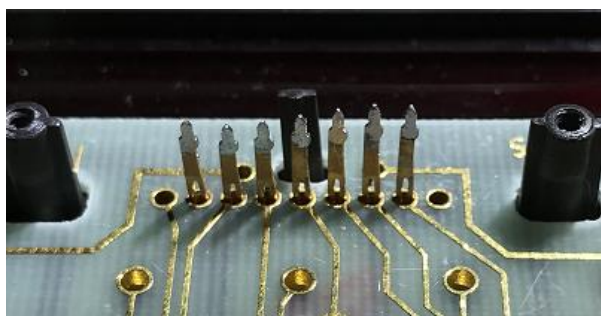


Check your work and make sure the pins are vertically aligned.

Repeat this procedure and mount 2 pins to the bottom row.



One method to finish the row is to insert the remaining 7 pins as the first two were and align them using the perf board. Once aligned, they can be soldered in place.



Another method, is once you are happy with the positioning of the 4 pins, insert 7 long pins into the keyboard as shown. Make sure they face the same way as the original 4 pins.

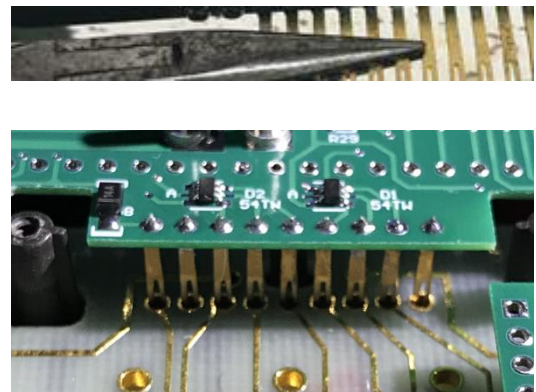
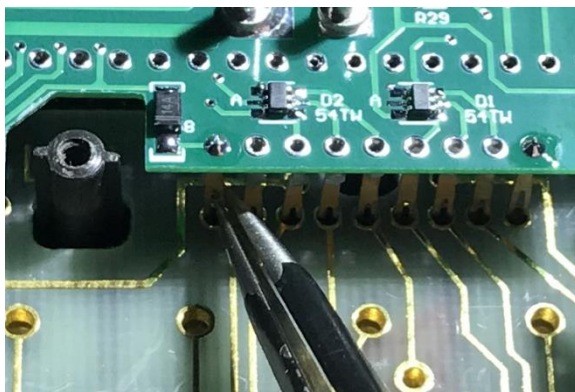


Now connect the CPU board to the keyboard by aligning the 4 pins in the correct holes and pushing down until the CPU board is seated on the keyboard. Having the board in place like this will help align the next pins.

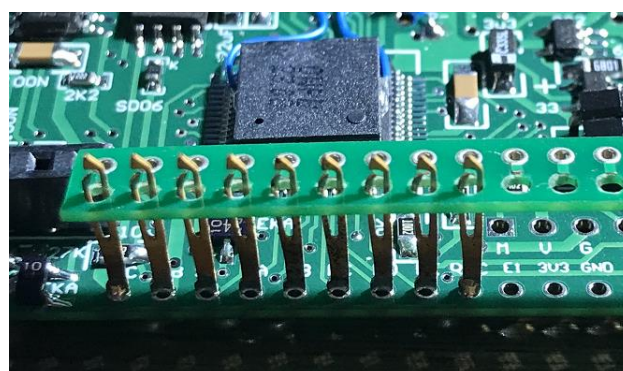


Using some tweezers, lift each pin up into the corresponding mounting hole on the CPU board. The pins can be aligned using needle nose pliers as shown.

Before soldering the additional pins, verify that the board is seated properly and that the pins are vertically aligned. When happy, solder each pin.



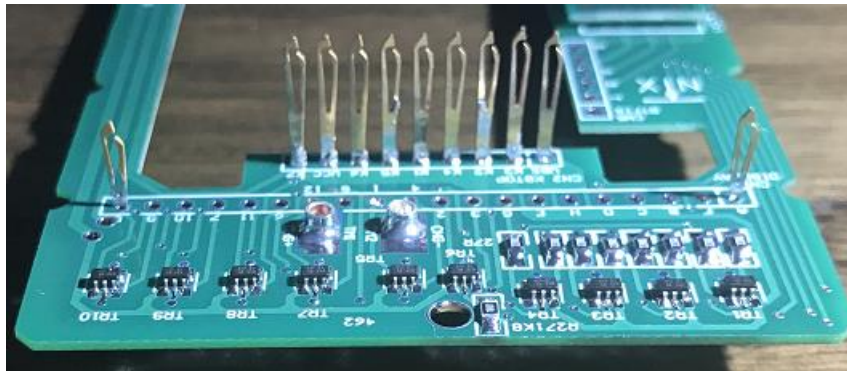
Separate the CPU board from the keyboard. Insert the remaining 7 long pins into the lower end of CPU board making sure the pins are oriented the same as the others. They may be a bit wobbly but that is ok. When the pins are in place, insert the perf board over the pins to hold them vertically aligned. Use the tweezers to line them up as before and solder them in place.



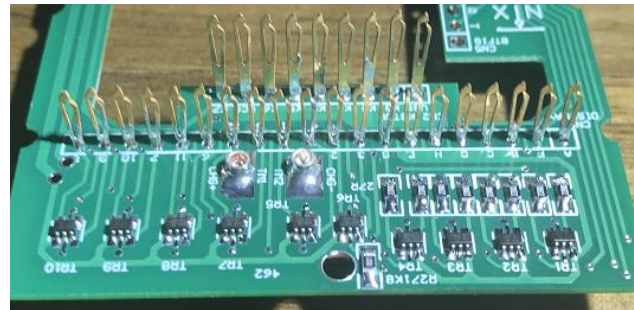
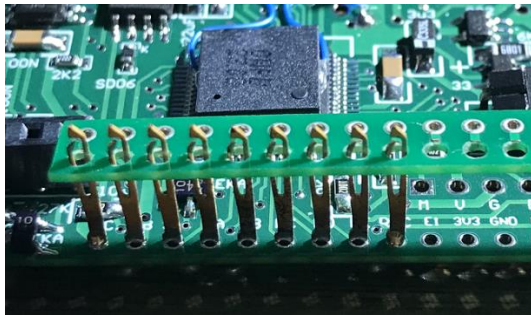
Separate the two boards again.

Insert 2 of the smaller display pins into the CPU board, one at either end of the display row of holes making sure they align with the other pins. Use the perf board to hold them in place and try to get them as vertical as possible.

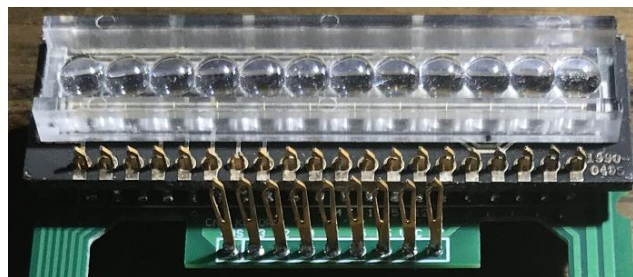
Solder these 2 pins and if necessary readjust them to be vertical.



Remove the perf board and insert 3 or 4 pins, then insert the perf board again. Align the pins and solder them in place. Repeat this procedure for the remaining pins.



You can connect the LED display next.



Now connect the CPU board to the keyboard and reassemble the calculator.

## Battery

The new CPU board battery is a LiPo type and outputs around 4V, with 800mAH capacity. Model No. 802540. It is available from the major online retailers like Ebay.

**Note: The original batteries cannot be used to power the new CPU board, nor can 2 x AAA batteries as the voltage will be too low to operate.**

The LiPo battery is fitted inside the original battery holder and replaces the 2 x NiCad batteries that were used. To do this, the battery holder must be disassembled. If this is not desirable, then there are replacement 3D printed holders available on the web.

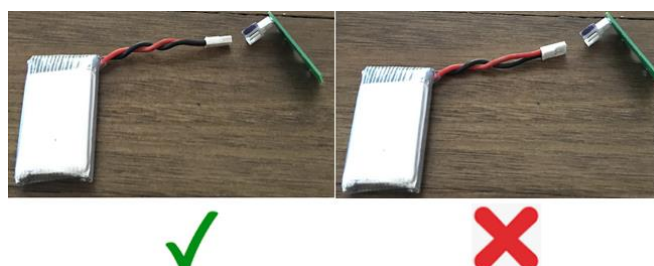


There are 2 ways to insert the new battery. One is to cut one end of the retaining centre piece as shown, or to remove the lower case cover. The lower case end is glued but can be separated by carefully dislodging it with a small screw driver or similar blade. Either way is acceptable but be careful assembling the battery and not damage the centre piece.

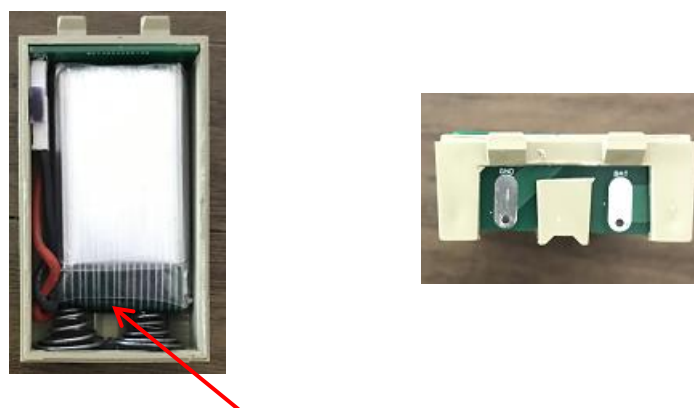


Some double sided adhesive tape or hot glue can be used to secure the battery springs to the inside end of the battery holder.

When connecting or disconnecting the battery, the calculator should be turned OFF. You **must** be sure that the battery connector is positioned in the correct way or damage will occur when the battery is connected. There are also (Red) and (Blk) indicators marked on the circuit board and connector.



Assemble the battery as shown. Twisting the battery wires will help to shorten them if they are too long.



There is another circuit board supplied that can be used to slide between the rounded battery end and the battery springs. This will keep even pressure on the battery springs.

If the case top was removed, it can be replaced by using a small amount of clear neutral cure silicone adhesive, hot glue or similar. Silicone may take some time to cure. Use the glue sparingly so the case can be separated again if need be. If the centre piece was cut, then some silicone or hot glue will fill the gap and hold it together.

With the battery assembled, it can be inserted into the base of the calculator. If the battery is discharged, the charger can be used to charge it.

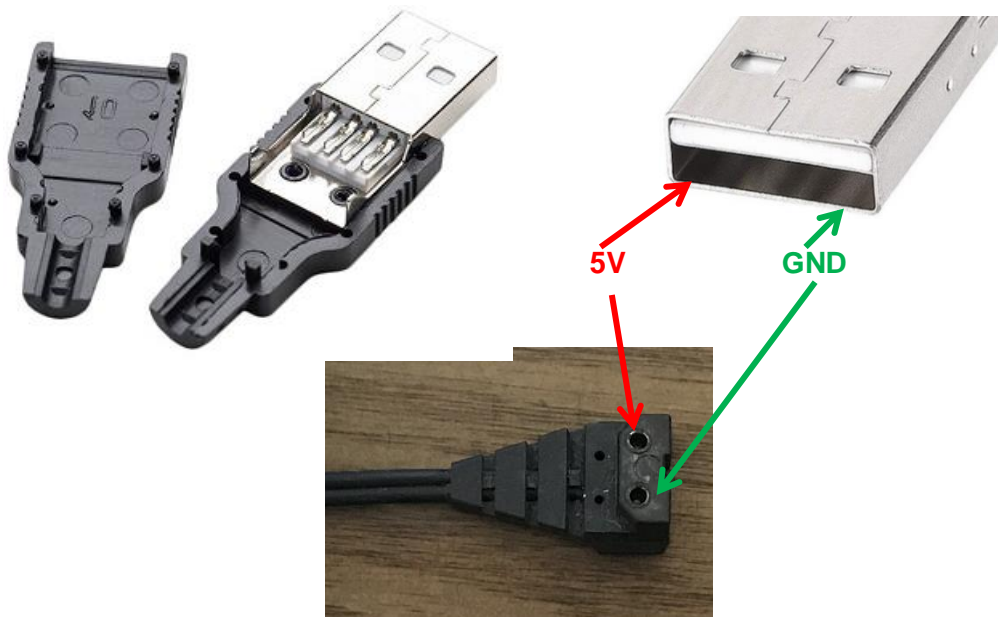
When turned ON, the display should show **0.00** and the HP-21 calculator model should be selected. If the charger is active a LED will light in the display window.

## Charging the Battery

The battery can be charged by plugging the USB charger cable into the original charge socket located under the calculator. Charging will commence as soon as the other end of the cord is plugged into an active USB socket. If the battery is being charged, and the calculator is turned ON, the Mantissa Sign digit lower LED will light. This will extinguish when charging has completed.

The USB charge cable can be purchased from Dave Eaton - [davidreaton99@gmail.com](mailto:davidreaton99@gmail.com)

Alternatively, if you have a non-working charger, and are capable, you can remove the original cable and attach a USB connector to the end.



The calculator can be used while on charge and will not damage the calculator.

If you are one of the many who do not like charging the battery while it is in the calculator, then cheap multi-port USB LiPo chargers are available on the web. However, you may have to figure out a way to connect the battery if the connectors are different.

**Note: Damage may occur when using different chargers or batteries to those specified.**

**Do not attempt to use the original Woodstock charger. It has an AC output and is not suitable.**

**NiCad, Alkaline or other batteries are not suitable.**

## Communications

The new CPU board can communicate with a PC running the `CalCom.exe` program via a Bluetooth module or via an FTDI RS-232 serial port module.

**Note:** All connections to the FTDI board or PIC programmer should be connected or disconnected while the calculator is turned OFF.

### Setting up Bluetooth

An inbuilt Bluetooth Module is used for wireless communications between the calculator and a host PC when running the `CalCom.exe` program. This will allow transferring of programs and other data between the CPU board and the PC.

Turn on the calculator and hold the [Enter] key down for about 1 second to Enable Menu Mode. If it is not showing, press the [+] key until the [PC bth yN] item appears. Press key [1, 4] to enable the connection. Press key [1, 5] to disable the connection. When Bluetooth is ON, the decimal point in the right most digit will illuminate.

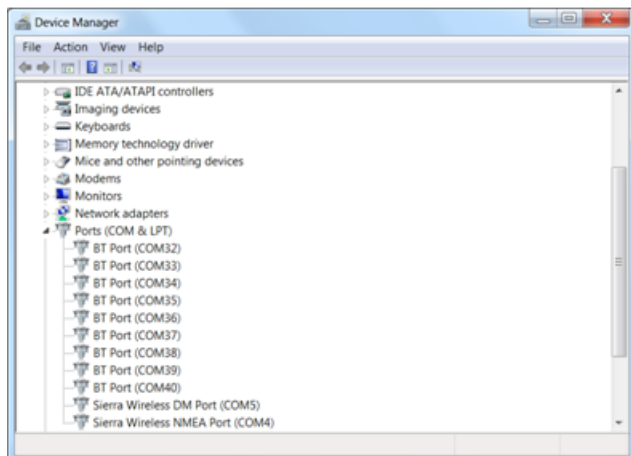
When the Bluetooth module is hunting for a master, it uses more power than normal, so it will be useful to establish a connection quickly to conserve battery power. Once a connection is established, the power requirements reduce considerably.

If your PC supports Bluetooth connectivity, then it will have its own set of procedures to enable Bluetooth and to find and pair to a Bluetooth device. If you follow those procedures, you should find the calculator Bluetooth device named `TEENIX2X` or `TEENIXWS`. When prompted to complete a connection, the password to access the calculator Bluetooth module is `0000`. After connection to this device the PC will set up the serial connection and assign a COM Port number.

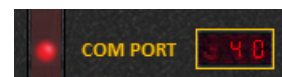
The `CalCom.exe` program will need to know this COM Port number when the calculator Bluetooth device is paired.

This number can be accessed from the Control Panel – Hardware and Sound – Device Manager – Ports (COM & LPT) – BT Port (COMx), where X will be the Port number. Multiple numbers may appear as shown in the image at right.

As many COM Port numbers can be assigned to Bluetooth, I noted the highest number first, (40 in this case), as it was probably the last to be installed.



Run `CalCom.exe` and you will get a connection error message if the operating COM Port number does not match the one assigned to the Bluetooth module. Click the [COM PORT] label and enter the COM Port number that was noted in the above procedure. Press the PC [Enter] key and If a connection is established, `CalCom.exe` will try to communicate with the CPU board. If you get an error message you will have to try another of the listed port numbers.



If a connection is established you will get a message similar to the following.

```
PC connect query - Please wait... >OK

CPU Board Type           = Woodstock - Model: HP-21
Software Version         = 1
Show Model               = No
Bluetooth                = Off
Program As Text          = Off
LED Display              = Bright
Turbo Mode               = Off
Key Debounce             = Normal
Beeper                  = Soft
Low Battery Reference    = Min
Continuous Memory        = Inactive
Switch Position          = RAD
Menu Switch              = Off
```

Once this procedure is set up, future connections should establish automatically when the CalCom.exe program starts as long as...

- Bluetooth is enabled on the PC
- The COM Port number has not changed
- The calculator is turned on and the calculator Bluetooth is enabled

**Note:** Changing calculator models will turn off the Bluetooth module. If CalCom.exe was connected, turn the calculator Bluetooth back on and click the COM Port item and press Enter to re-establish communications. Turning the calculator off before turning off Bluetooth may cause the CalCom.exe program to freeze.

When Bluetooth is on, you may notice a blue flashing light coming from under the ENTER button. This is the Bluetooth module searching for a host. The blue light will become steady when the connection is made.

## Windows 11 Users

Windows 11 may not recognise the Bluetooth module. If not, the following details may help. The following method was confirmed as working.

Go to Bluetooth devices > Devices

There is an option called Bluetooth devices discovery set as *default*, change that to *advanced*.

Click add device then Bluetooth and the calculator should appear.



## Connecting via FTDI

The FTDI USB serial port allows connection to the PC via a FTDI to USB serial converter module. These can be obtained from the internet cheaply and should come with a USB cable. If not, the cables are also widely available.

This module also allows communication with the CPU board. The reason cable communications are preferred for re-flashing the PIC processor is because the Bluetooth may not be 100% reliable. If the connection is broken during the process, the reprogramming will not complete and the processor may cease to function.



If the FTDI board is used for the first time, a driver may need to be installed and its COM Port assignment must be known.

**Important:** Before use, set the FTDI module for 5V communications  
To avoid static damage, hold the FTDI module by the board edges

Depending on the module, the 5V setting is accomplished by a slide switch or as shown, via a link. The 5V position should be marked on the module. Connect the USB cable to the FTDI board and connect the other end to a free PC USB port. The module may self-install its own driver, but if not you will have to download and install a driver from the FTDI web site. See – <http://www.ftdichip.com/Drivers/D2XX.htm>

Once installed, the PC will assign a COM Port number to this device and you need to know this number to configure the CalCom.exe program as per the Bluetooth setup.

This number can be accessed from the Control Panel – Hardware and Sound – Device Manager – Ports (COM & LPT) – USB Serial Port (COMx). X will be the Port number, which is 2 in the image at right. After noting the COM Port number, the Device manager windows can be closed.

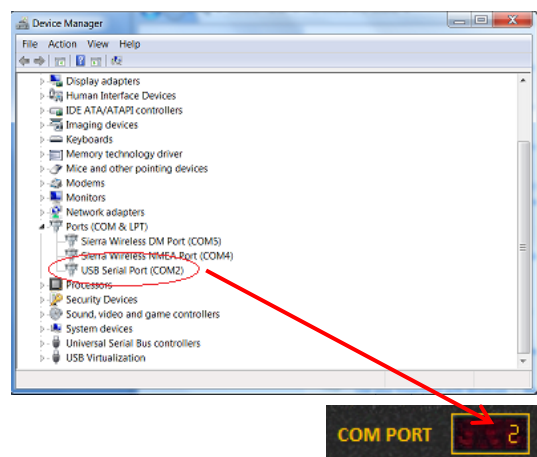
Bluetooth can be used for re-flashing, but for using FTDI or a PIC programmer, the calculator back cover needs to be removed to allow a connection to the device.

Make sure the calculator is turned OFF.

Connect a USB cable into the FTDI module to start it up and insert the module into the socket on the CPU board as shown.

Run the CalCom.exe program.

You will get a connection error message if the operating COM Port number does not match the one assigned to the FTDI board.

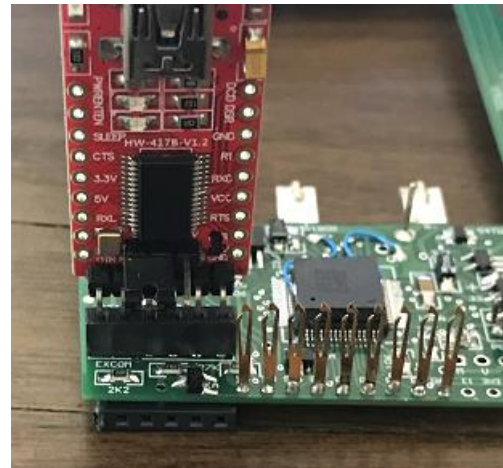


Click the COM PORT label and enter the COM Port number that was noted in the above FTDI procedure. Press the PC [Enter] key. If the connection is established, you will get a message similar to the list shown previously. If not, verify the COM Port number and change if necessary or check the USB and FTDI connections.

When inserting the FTDI module, it is best to have the CPU board supported on a table top or similar. The CPU board needs to be removed from the calculator before the FTDI board can be used. No power from the CPU board is required.

Make sure 5V operation is selected and then insert the module as shown.

When FTDI use has completed, and to avoid stress on the circuit board when removing the FTDI board, hold both CPU board sides firm near the FTDI module, wiggle the FTDI board slightly left and right while lifting it from its socket. On removal, close `CalCom.exe` then disconnect the USB cable.



Disconnecting the USB connection while the `CalCom.exe` program is running may cause it to hang because of the lost USB/Serial connection. If this occurs, it may take some time to close by itself, or you can use the Task Manager to close it.

If a disconnection occurred during a re-flash, then the PIC processor may not have been re-flashed properly and if so it probably won't work properly. Turn the calculator OFF, especially if the display has been frozen and a display LED segment is ON and overly bright. In this case, a PIC programmer will be required to get the CPU working again.

**Caution:** Do not connect the FTDI and PIC programmer at the same time.  
Do not use the FTDI module if power is applied to the CPU board.  
Do not remove the FTDI or disconnect the USB cable if data is being transferred or while re-flashing the CPU board.

**Note:** See the `CalCom` help file for information on re-flashing and data transfers.

## Re-Flashing PIC Processor

This procedure can be accomplished by using Bluetooth, the FTDI module or with a PIC Programmer. Make sure you have the latest [CalCom zip](#) file from the Teenix web site.

### Bluetooth Re-Flash

Turn the calculator on and enable the Bluetooth module. Run `Calcom.exe` and establish communications. Select [Update Driver] and click [Write]. The software should be automatically updated from the latest file in the `CalCom` directory (recommended), or you can select a file yourself.

### FTDI Re-Flash

Connect the FTDI module as described earlier. Run `Calcom.exe` and establish communications. Select [Update Driver] and click [Write]. The software should be automatically updated from the latest file in the `CalCom` directory (recommended), or you can select a file yourself.

**Note:** If Bluetooth or FTDI re-flashing failed, then only a PIC programmer can be used to re-flash the processor. Do not use the CPU board until this has happened.

## PIC Programmer Re-Flash.

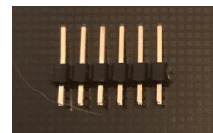
**Note** The storage memory will need a [reset](#) after this procedure completes.

If the Bluetooth or FTDI re-flash procedure failed then the PIC processor will need to be reprogrammed by a PIC programmer. The CPU board has been designed to accept a PICkit3 style programmer to do ICSP programming. Other programmers could be used if the pin connections match or an adaptor can be made to suit.

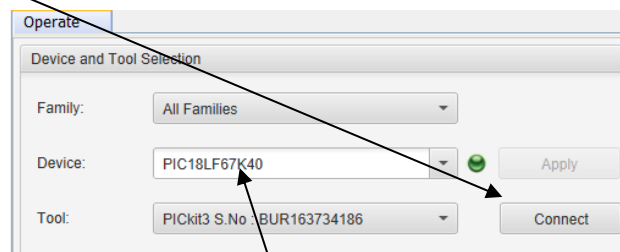
You may need to unplug the display module as any current flowing through the LEDs may upset the programmer.

**Caution:** Do not connect the FTDI board and PIC programmer at the same time.

You will need a copy of MPLAB IPE to control the PICkit3 and this is available as a free download from the [Microchip](#) web site. A 6 way IDC male connector is required to connect the PICkit3 to the CPU board. The pin spacing for this connector is 0.1". The long end should be inserted into the PICkit3.



Connect the PICkit3 to a spare USB Port and let the PC recognise the device. Run MPLAB IPE. The [Connect] button should be enabled if the PICkit3 connection is made.



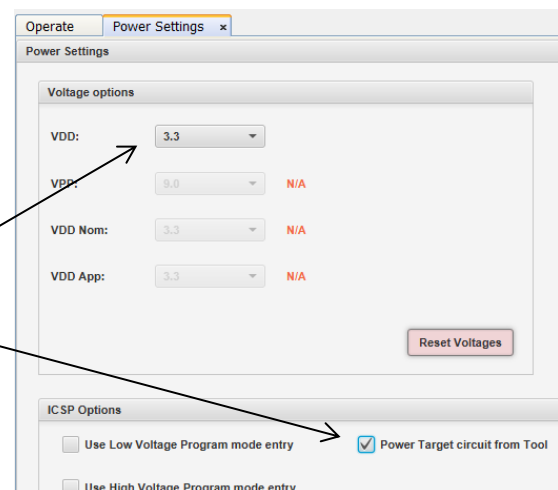
Set the MPLAB IPE Device to the PIC18LF67K40 using the drop down list, or type the name exactly as stated – (case sensitive), then click on the PIC processor item to select it.

**Important:** Note the **L** in the processor name.

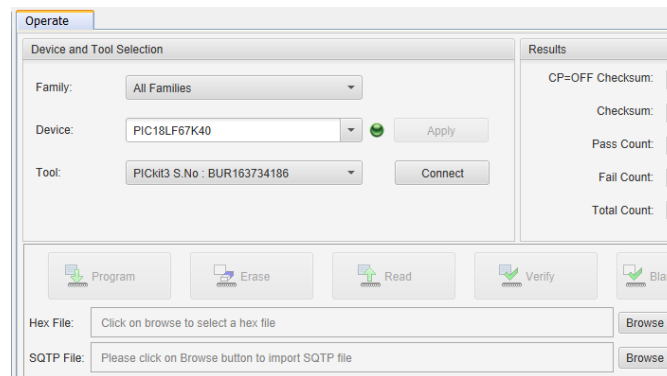
In MPLAB IPE, click the [Power] button and make sure the screen is set up as shown.

**Important:** Make sure the VDD selector is set to 3.3V and this box is checked.

Click the [Operate] Button or [Operate] Tab to get back to the main screen:



Click the [Browse] button to load the HEX file from the CalCom.exe install directory. The file format for Woodstock files is HPF20nn.hex where [nn] is the version number.



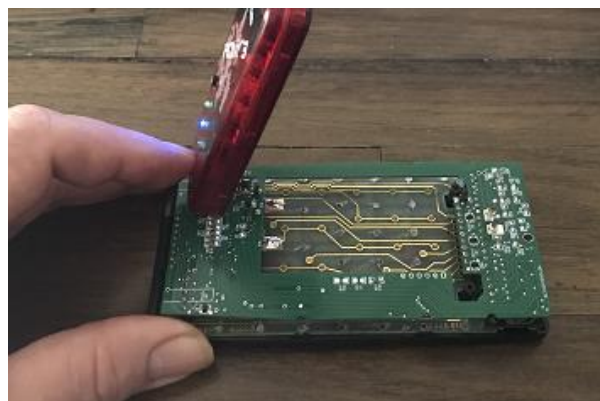
Example: HPF2002.hex (Woodstock - Version 02)

**Note:** Always check the [www.Teenix.org](http://www.Teenix.org) web site for the latest CalCom download. Use the hex file with the highest version number.

The CPU board can remain in place during re-flashing. If the programmer reports error, remove the CPU board and display module and try again. The PICKIT3 can be plugged into the holes on the circuit board using the 6 pin IDC connector as shown.



or



During the programming process, some slight downward finger pressure where indicated will ensure that the contact pins stay firm against the PCB hole edges. It will re-flash ok using this method.

Press the [Connect] button to connect with the PIC on the CPU board.

```
Connecting to MPLAB PICKIT 3...

Currently loaded firmware on PICKIT 3
Firmware Suite Version.....01.54.00
Firmware type.....Enhanced Midrange
Programmer to target power is enabled - VDD = 3.300000 volts.
Target device PIC18LF67K40 found.
Device ID Revision = a003
```

The screen should now look similar to the above. Press [Program] to re-program the PIC.

When programming has finished, remove the PICKIT3 from the CPU board and reassemble the calculator.



Initialising the storage memory.

The factory reset memory device does not come in a known reset state and therefore needs to be initialised prior to use. This has already been done prior to delivery of the CPU board.

After the PIC processor has been re-programmed fully, it will no longer be aware of the storage memory state.

Stored programs and constants can be restored, but Continuous Memory data will be lost.

Use the following procedure to restore the memory.

Start CalCom and establish communications with the calculator.

Click on the CM Reset button

Choose either of these two options:

Initialize all

This option will initialize the storage memory.  
All storage data will be lost.

Reprogram initialize

This option will let the PIC processor know that the storage memory is valid.  
All storage data will be retained.

## CPU Board Reset

The CPU board does not immediately power down when the power switch is turned off as it has some tasks to perform first. Once these procedures have been performed, the CPU will shut itself down.

If there has been a power interruption, like a brief battery disconnect if the calculator was dropped, then the processor may enter an uncommanded state. If this happens then the calculator may appear unresponsive even if the power switch is turned off then on again.

To reset the calculator fully, turn the calculator OFF, remove the battery, wait 5 seconds and re-insert the battery, then switch on. The clock should still retain the time information after this procedure.

## Menu Mode

The new calculator software has a menu system to let you save and recall programs and set operational options.

It is accessed by holding down the [Enter] key for about 1 second.



Note: Depending on the selected calculator, some menu items may not appear.

Note: Menu mode will not start if:

- A program is running
- When Continuous Memory is reset (Display shows **Error**)
- There is a system error message on the display

You should see a new display something similar to the following.



The right side of the display will have 3 bars lit if this menu item has sub menus.

To access the sub menu, click `Enter`

Another example of a sub menu is the `Beep` function. This menu item has three options to select from. [**OSL**]. Some menus have only two options.



The selected option will flash.  
In this case, the Beep is OFF.

These options are as follows:

- To turn the Beep off [**O**], press the row 1, key 3.
- To Beep Soft [**S**], press the row 1, key 4.
- To Beep Loud [**L**], press the row 1, key 5.



In this case, once an option is selected, the options menu will operate again.

Menu items that have 2 options use row 1, keys 4 and 5 only.

The following keys allow you to navigate the menu structure.

<code>Enter</code>	Selects menu item or option.
<code>CLx</code>	Jump to root menu or back to calculator mode
<code>+</code>	Select next menu item
<code>-</code>	Select previous menu item

Some menus may have other keys available and will be discussed under that menu topic.

## Menu Structure

### Root Menu

Program	Programmable Models Only
Clock	
PC Bluetooth Connection	
Options	
DHBO	
Temperature	
Version	
Calculator Model Select	
Switch L R	When menu switch activated

### Root: Program Access file transfers

Program/Data storage addresses are in 3 digit Block Number format. Blocks are 0 – 8 and numbers are 00 – 39 for HP-19C and 00 - 22. This gives storage for 9 x 40 (360) files for the HP-29C and 9 x 23 (207) files for the HP-25C.

### Program Store

See [Memory Initialize](#) if **Init Fail ?** is displayed.

Select this menu item to store a program file. If there are no steps in the program [**No Steps**] is displayed. Press any key to clear the message.

If there are steps, then you need to enter the Block and File number. When this screen pops up, enter the Block[0 – 8] and File[00 – 39] for HP-29C, [00 – 22] for HP-25C, as the address where you want the program stored and press **Enter**.

The following item lets you to enter a text (**Alpha**) or **Default** name for the program file.



If you chose **Alpha** then you can enter a name using the keyboard layout as described [here](#).

The entry screen will show a cursor at the character position and you can enter up to 20 characters. After the 10<sup>th</sup> character is entered, the screen will shift left 1 character as new characters are entered. As characters are deleted, the screen will shift right if the name is greater than 10 characters long. Press **Enter** when the desired file name is entered.

If you choose **Def** then the filename will be saved as Pgm25 (29) C\_Block\_Number

For example, if you chose Block 3, Number 15, then the default name will be:

Pgm25 (29) C 315

### Data Store - 29C only

Select this menu item to store a data file. The procedure is the same as for saving a program file, except that memory R0 to R.5 will be stored and if **Def** is selected then the default data file name will be `Dat29C_Block_Number`.

### Program Read

#### Data Read - 29C Only

Select this item to read a Program or Data file. When selected, you can either **Scroll** through the file names or enter a Block and File number (**BFN**) before choosing one.



If scrolling, use the [+] and [-] keys to look through the files. Press [Enter] to select or [CLx] to exit.

While scrolling, if the file is a Data type, then the mantissa sign segment C will illuminate.



To change to a different Block, press any key [0 – 8] for the required block.

Press [X<>Y] to swap between the displayed halves of the 20 character file name.

If a file location is empty, **Vacant** along with the Block and File number will be shown.

For the **BFN** option, enter a Block [0 – 8] and a file number [00 – 39]. Press [Enter] to select, or [CLx] to exit;

### File Title

Use this item to change a file name. The menu procedure is the same as for saving a file.

### File Free

Select this item to find the next free file location in a chosen block.

When selected, enter a block [0 – 9] and press [Enter].

If there is a free storage location it will be displayed as **bloC FL bfn**

Example: Block 1, files 00 – 09, and 21 - 39 are in use. **Bloc FL 110** will be displayed. You have to remember this location to save a file.



## File Erase

Select this item to erase a single file. You can either scroll or enter a block and file number to select the file to delete. Press `Enter` to delete or `[CLx]` to exit.

## Block Erase

Select this item to erase all the files in a block. After selecting this item, enter a Block number [0 – 8] and press `Enter` to select or `[CLx]` to exit. After selecting a Block, a confirmation message will appear. Press key [1, 4] for **No**, or key [1, 5] for **Yes**.

## Root: Clock

The clock functions are derived from a dedicated real time clock IC with an accuracy specified as 5ppm (roughly 3 seconds per month). This IC will continue to keep time while there is at least 2.5V remaining in the LiPo battery. If the battery is removed for repairs or replacement, the clock IC will remain active for about 10 seconds. If the battery is replaced within this time period, the clock data will be preserved, otherwise the data will be lost.

The clock menu item is only visible when the clock IC is detected as active

The clock can be accessed easily by clicking the `[+]` key after activating the menu, then press `Enter`. To exit the Clock press `CLx` to return to the calculator, or press `CHS` to return to the menu.

For the following functions:

	[ENTER] [CLx]	Accepts changes Discards changes
Current Time		Displays current time in 12 or 24 hour or Text mode 12    HH MM SS    A am    P pm 24    HH MM SS
Date		Displays date and day of week Mode 1        DD MM YY Mode 2        MM DD YY Mode 3        YY MM DD Mode 4        Text
Alarm Set		View the time that the clock alarm will sound
Edit t1		Edit Time The time is set in 24 hour mode Enter the time as HH MM SS using the digit keys If you make a mistake, keep entering digits and they will start to overwrite the shown time after the seconds are entered.
Edit dt		Edit Date Enter the data as: DD (01 – 31) MM (01 – 12) YY (00 – 99) The year century defaults to 20.

Edit AL	Edit Clock Alarm The alarm time is set in 24 hour mode Enter the time as HH MM SS using the digit keys If you make a mistake, keep entering digits and they will start to overwrite the shown time after the seconds are entered.	
Edit AL0	Turn Alarm On / Off	
	Key top left	ON
	Key top right	OFF
Edit dNNy	Set the Date Mode	
	Key top left	DD MM YY
	Key top middle	MM DD YY
	Key top right	YY MM DD
Edit 1224	Set the Time Mode	
	Key top left	12 Hour
	Key top right	24 Hour
Count dN	Enter selects sub menus	
Cd Init	Enter H MM for count down timer	
	Menu index jumps to Timer start	
CdStArt	Enter starts count down timer	
	Display shows timer count	
	CLx exits timer display mode	
Cd PAUSE	Pauses the count down timer	
Count UP	Enter selects sub menus	
CU Init	Menu index jumps to Timer start	
CUSrtArt	Enter starts count up timer	
	Display shows timer count	
	CLx exits timer display mode	
CU PAUSE	Pauses the count up timer	
CntrS OFF	Turns both timers OFF	

While setting the timer counters and a mistake is made, keep entering the timer digits and they will begin to overwrite the ones already entered.

Note: If an error occurs while the clock IC is being accessed, the calculator will reset.

**Cloc ACC Err** will be displayed.

If a clock access error does occur, switch the calculator OFF, wait a few seconds, then turn it back on if desired. This will reset the clock IC logic, but not affect the time.

If the clock fails to function, turn the calculator OFF and wait 30 seconds. This will reset the clock IC completely and the settings will be lost.

Root: PC Bt      YN      Bluetooth Connect

When the Bluetooth module is activated, mantissa sign LED segment A will light.



Top row key [1, 5] starts Bluetooth  
Top row key [1, 6] stops Bluetooth

Note:

When Bluetooth is disabled from the menu, CalCom.exe will close automatically. If CalCom is closed by the user, the CPU board will turn off the Bluetooth module. Breaking the link in any other way will cause the CalCom program to hang for a minute or so.

Root: Options

Options: Character Display

This allows the program steps to be displayed in text format on the display instead of the key locations.

Top row key [1, 4]	Enable	Y
Top row key [1, 5]	Disable	N

Options: Turbo

When enabled, the processor will execute HP microcode instructions as fast as possible. For functions like [PAUSE] the processor will temporarily revert to normal speed.

Top row key [1, 4]	Enable	Y
Top row key [1, 5]	Disable	N

Options: Battery Reference

The battery voltage is monitored by the processor. With this menu item you can set the point at which the battery low indication occurs.

The HP-29C shows a flashing decimal point, while the other models light the decimal points in all digits.

When adjusting the reference point, the display will give a low battery indication when the trip point has been reached. However, to show this the battery must be close to its depleted state.

[+]	Increases the trip point value
[-]	Decreases the trip point value
[CHS]	Sets the default reference value.
[Enter]	Accepts new value

### Options: Calculator ID

This item will briefly show the calculator model on the display when the calculator powers up.

Top row key [1, 4]	Enable	Y
Top row key [1, 5]	Disable	N

### Options: Debounce

Some keyboards may be a bit more noisy than others so you can set a short or long key debounce delay. Depending on the keyboard issue, such as a dirty key contact, this option may or may not help.

Top row key [1, 4]	Long	L
Top row key [1, 5]	Short (Default)	S

### Options: Slide Default

This option allows a menu activated right switch. It can be used when (say) the HP-21 is chosen and the host calculator does not have a right switch (HP-27)

Top row key [1, 4]	Active	Y
Top row key [1, 5]	Inactive	N

### Options: Clock Display

Normally the clock display is shown in digit format. When text mode is selected, the time is displayed as text.

Examples:    00 00 00    Midnight  
              12 00 00    Noon  
              01 15 00    qtr Past 1

Top row key [1, 4]	Normal	N
Top row key [1, 5]	Text	T

### Options: Display Brightness

This option sets the brightness of the LED display. It is recommended to keep the display dimmed unless ambient light conditions make it hard to view. The LED display is getting quite old and this may help to prolong its life.

Top row key [1, 4]	High brightness	H
Top row key [1, 5]	Low Brightness	L



### Options: Beeper

This menu option disables the beeper, or sets the beeper to on and the volume to soft or loud.

Top row key [1, 3]	Disable	O
Top row key [1, 4]	Soft	S
Top row key [1, 5]	Loud	L

### Options: Continuous Memory

This item can simulate a battery reset for the 25C or 29C depending on the current model selected. It can also turn off the Continuous Memory for the HP-21, HP-22, or HP-27.

#### HP-25C and HP-29C Models

Top row key [1, 5]	Battery Reset	r
--------------------	---------------	---

Once selected, you will see a [Sure ??? Ny] message.

Top row key [1, 4]	Discard request
Top row key [1, 5]	Reset

For a [y] response, the calculator will reset as though the batteries were removed. The 29C will show *Error* indicating that Continuous Memory was lost. The 25C does not have any memory reset indication.

#### HP-21, HP-22, and HP-27 Models

Top row key [1, 3]	Memory Reset	r
Top row key [1, 4]	Enable Continuous Memory	Y
Top row key [1, 5]	Disable Continuous Memory	N

If the Continuous Memory function is disabled, the memory for the selected calculator is not saved when power is turned off.

## Root: DHBO

This mode lets you view and modify the value of the X register in Decimal, Hexadecimal, Binary and Octal. DHBO starts in DEC mode and displays contents of the X register.

Various keys have new functions in this mode. The HP-29 keyboard is shown but the same key positions work with other models.

In HEX Mode

Change Modes D H B O

Shift Binary screen left

Shift Binary screen right

Enter Exit, update X register with displayed value

CHS Transfer X register to display and set Decimal mode

EEX Exit, X register not modified

CLx Reset displayed value to 0

### Active Number Keys

Decimal	0 – 9
Hex	0 – 9 A – F
Binary	0 and 1
Octal	0 – 7

Because of the display digits, the number range for DHBO mode is:

Decimal	999,999,999
Hex	3B9A C9FF
Binary	00111011 10111010 11001001 11111111
Octal	7 346 544 777

In Binary mode, the display is 32 digits wide. To allow full viewing of the number, the [+] and [-] keys can be used to scroll the display eight digits at a time. Markers with three horizontal bars can appear on each end of the display which indicate that the display can be scrolled left or right.

- Scroll Left

1 0 1 1 1 0 1 0

+ Scroll Right

### Root: Temperature

This function will display the current temperature. It is not the ambient temperature of the surrounding area, rather it is the temperature detected by a sensor in one of the IC's on the CPU board.

Press [Enter] to view the temperature.  
Press [CLx] to exit.

### Root: Version

This displays the current version number of the CPU board firmware.

### Root: Calculator Model Select

Use this option to select a calculator model to use. The selected model will have the hyphen flashing.

HP-21  
HP-22  
HP-25C  
HP-27  
HP-29C

Enter	Select model
+	Scroll upwards through models
-	Scroll downwards through models
CLx	Exit

### Root: Switch L R

If the Slide switch option is enabled in the Options: Slide Default menu item, then this menu item will become available.

Top row key [1, 4]	Menu switch is to the left
Top row key [1, 5]	Menu switch is to the right

This item can be used if the host calculator does not have a switch (HP-27) and a selected calculator is the HP-21. In this case, this menu item will allow the DEG RAD switch operation.

## Continuous Memory

The continuous memory works with all models.

Non C models can switch the CM on or OFF.  
C models can simulate a battery reset.

The system for saving the memory requires no battery power after it has been stored and will remain stored for the life of the storage IC without battery power.

The storage works the same as per the HP-25C and HP-29C owner manuals.

To make sure the memory is stored properly, do not remove the battery before turning the calculator OFF. Removing the battery before turning the calculator OFF will not save the continuous memory.

It is possible, even in the original calculators, that Continuous Memory can be corrupted when the calculator is turned OFF. For example, if the calculator is busy running a program, it may be that a memory location was being written to at switch OFF and did not fully write.

Therefore it would be a good idea to stop a running program or wait until a calculation is complete prior to switching off.

**Note:** Avoid rapid calculator on and off operations or corrupted memory may result.

It is possible that the above issue or a loose fitting battery can cause power interruptions to the processor. This may result in the processor not working properly.

If you turn the calculator OFF and you notice the display is still working but very dim, it is possible that a power glitch occurred. To remedy this, remove the battery for a few seconds and then replace it.

## Additional Program Steps

The HP-25C and the HP-29C CPU models have additional key functions, most of which can be used in run mode, and all can be entered as a program step which will execute in a running program.

### HP-25C

		Program Text	Key Display
[g] [SST]	Beep	BEEP	15 11
[g] [BST]	RTN	RTN	15 12
[g] [GTO]	GSB 49	GSB 49	15 13
<u>Beep</u>	[g] [SST]	Run Mode Yes	Running Program Yes

Regardless of whether it is turned on or off, the beeper will sound briefly when this function is executed. The volume will be as set, either soft or loud.

<u>GSB 49</u>	[g] GTO]	Run Mode No	Running Program Yes
---------------	----------	----------------	------------------------

As subroutines in the HP-25C are non-existent, this function allows a single subroutine to execute. There are not enough spare program codes to implement a subroutine anywhere in memory, so this instruction, when executed, will store the current program counter + 1 and jump to step address 49. Placing a GTO nn at this address will allow a subroutine to be located just about anywhere in the program.

<u>RTN</u>	[g] BST]	Run Mode No	Running Program Yes
------------	----------	----------------	------------------------

When executed, the return address store during a FSB 49 instruction is placed back into the program counter and execution begins from there. If a RTN instruction is executed without a return address, then the program will halt.

Example:

The subroutine returns 8 in the X register which is added twice.  
The beeper sounds once before halting.

```
01.   GSB 49
02.   +
03.   GSB 49
04.   +
05.   BEEP
06.   GTO 00
07.   GTO 00
08.   8
09.   RTN

49.   GTO 08
```

A similar file located in the CalCom install directory \files25C.



## HP-29C

The new functions use the following key sequences and are treated as a merged key code and are stored as a single program step.

[f] [f] [0]	Random Number	Text/Print	Key Display
[f] [f] [1]	Constants	RAND	14 14 72
[f] [f] [2]	Beep	CONR	14 14 62
[f] [f] [3]	Data Swap	BEEP	14 14 63
[f] [f] [4]	File access	DATS	14 14 64
[f] [f] [5]	Note Display	FILE	14 14 42
		NOTE	14 14 45

<u>Random Number</u>	[f] [f] [0]	Run Mode	Running Program
		Yes	Yes

A random number will be placed into the X register.  
The returned number has a value between 0 and 1.

Example: Generate a random number between 0 and 9.  
Press [f] [f] [0] then [10] [x] [f] [INT].

<u>Constants</u>	[f] [f] [1]	Run Mode	Running Program
		Yes	Yes

Up to 10 Constants can be accessed and are stored in special memory inside the CPU.

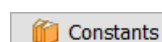
To save a constant      Enter constant, then press **ENTER** to place it into the Y register  
Press 1, followed by the Constant address 0 – 9  
Press [f] [f] [1]  
The constant will be saved into the selected constant memory  
Example: Save Y into Constant 1      [1] [1] [f] [f] [1]

To recall a constant      Enter 2, followed by the Constant address 0 – 9  
Press [f] [f] [1]  
The recalled constant will be placed into the X register.  
Example: Recall Constant 7      [2] [7] [f] [f] [1]

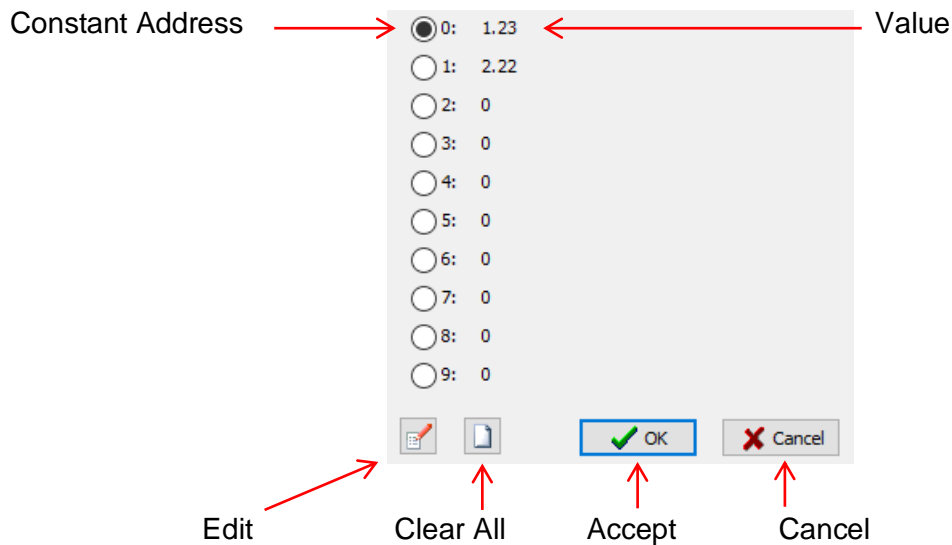
Recall from I register      Enter 3  
Press [f] [f] [1]  
The constant address come from Mantissa digit [1] in the I register (Memory location 0)  
Example:      I = 1.23      Constant 1 recalled  
                 I = 2345.99      Constant 2 recalled  
                 I = -9.345 E+99      Constant 9 recalled

The same key sequences can be entered in a program to access constants during a running program. Constants can also be modified and stored via the CalCom.exe program.

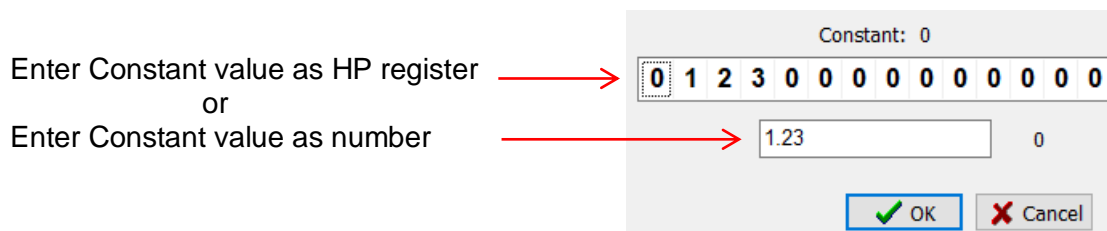
Once communications are established between CalCom and the CPU board, press the Constants button.



The constants will then be transferred from the CPU board, and after editing, transferred back to the CPU board if the [Accept] button is pressed, otherwise no changes take place,



The [Edit] button opens another screen to set the Constant value. Select the Constant to be changed prior to pressing the button.



<u>Beep</u>	[f] [f] [2]	Run Mode Yes	Running Program Yes
-------------	-------------	-----------------	------------------------

Regardless of whether it is turned on or off, the beeper will sound briefly when this function is executed. The volume will be as set, either soft or loud.

<u>Data Swap</u>	[f] [f] [3]	Run Mode Yes	Running Program Yes
------------------	-------------	-----------------	------------------------

This function will swap the Primary and Secondary registers from a separate RAM storage buffer. This effectively gives you twice the RAM number of registers available, 60 instead of 30.



The storage buffer is saved and recalled as part of the Continuous Memory.

<u>File Access</u>	[f] [f] [4]	Run Mode No	Running Program Yes
--------------------	-------------	----------------	------------------------

This function allows file access from the internal memory

File addresses are the same format as described for the [Storage](#) menu item. And are made up of a 3 digit number giving a maximum of 400 files to access.

Block Numbers	0 – 9
File Numbers	00 – 39

Files can contain either Program or Data. Program Files contain the 98 steps, and data files contain the 16 primary memory registers R0 to R.5. To access a file, the last 3 characters of the file name must match the 3 file address digits. Multiple files may have the same 3 digits, the first one found matching this data will be loaded.

Examples:	PrG29C123	Program	Blk 1	Num 23
	dAtA29C0032	Data	Blk 0	Num 32
	pgm29C 001	Default Program	Blk 0	Num 01

The required data for these functions can either be *assumed* to save keystrokes or *explicit*. The least amount of *assumed* keystrokes is the Prefix only followed by [f] [f] [3]. An *explicit* instruction requires the maximum key strokes for a full data entry followed by [f] [f] [4].

This function has 4 modes which are accessed by a Prefix number.

Prefix	Function	Required Data
1	Load Program File	File Block, Number, LBL Number
2	Load Program File	File Block, Number (program starts at Step 1)
3	Load Data File	File Block, Number
4	Save Data File	File Block, Number

Prefix 1 Load a 98 step program file and have it start from a LBL.

File Address	LBL
Block	Number
0 – 9	00 – 39
	0 – 9

All sequences assume Prefix followed by keystrokes then followed by [f] [f] [4].

Data Type	Keystrokes	Block	Number	LBL Start
Assumed	None	0	00	LBL 0
Assumed	LBL	0	00	LBL
Assumed	NumU, LBL	0	0 NumU	LBL
Assumed	NumT NumU LBL	0	NumT NumU	LBL
Explicit	Blk NumU NumT	Blk	NumT NumU	LBL

Note: Blk refers to the Storage Block number  
NumT and NumU refer to 2 digit Program Number – Tens and Units

### Examples:

```
Block[0] Number[00] LBL0 [1] [f] [f] [4]
Block[0] Number[00] LBL9 [1] [9] [f] [f] [4]
Block[0] Number[09] LBL2 [1] [9] [2] [f] [f] [4]
Block[5] Number[29] LBL7 [1] [5] [2] [9] [7] [f] [f] [4]
```

### Prefix 2 Load a 98 step program file and have it start from Step 1.

File Address  
Block Number  
0 – 9 00 – 39

All sequences assume Prefix followed by keystrokes then followed by [f] [f] [4].

Data Type	Keystrokes	Block	Number	Start
Assumed	None	0	00	Step 1
Assumed	LBL	0	00	Step 1
Assumed	NumU, LBL	0	0 NumU	Step 1
Assumed	NumT NumU LBL	0	NumT NumU	Step 1
Explicit	Blk NumU NumT	Blk	NumT NumU	Step 1

### Examples:

```
Block[0] Number[00] [2] [f] [f] [4]
Block[0] Number[03] [2] [3] [f] [f] [4]
Block[0] Number[19] [2] [1] [9] [f] [f] [4]
Block[3] Number[29] [2] [3] [2] [9] [f] [f] [4]
```

### Prefix 3 Load Data File containing the 16 Primary registers 0 to .5.

File Address  
Block Number  
0 – 9 00 – 39

All sequences assume Prefix followed by keystrokes then followed by [f] [f] [4].

Data Type	Keystrokes	Block	Number
Assumed	None	0	00
Assumed	NumU, LBL	0	0 NumU
Assumed	NumT NumU LBL	0	NumT NumU
Explicit	Blk NumU NumT	Blk	NumT NumU

### Examples:

```
Block[0] Number[00] [3] [f] [f] [4]
Block[0] Number[03] [3] [3] [f] [f] [4]
Block[0] Number[19] [3] [1] [9] [f] [f] [4]
Block[3] Number[27] [3] [3] [2] [7] [f] [f] [4]
```

Prefix 4      Save Data File containing the 16 primary registers 0 to .5.

File Address	
Block	Number
0 – 9	00 – 39

All sequences assume Prefix followed by keystrokes then followed by [f] [f] [4].

Data Type	Keystrokes	Block	Number
Assumed	None	0	00
Assumed	NumU, LBL	0	0 NumU
Assumed	NumT NumU LBL	0	NumT NumU
Explicit	Blk NumU NumT	Blk	NumT NumU

Examples:

Block[0]	Number[00]	[4]	[f]	[f]	[4]
Block[0]	Number[07]	[4]	[7]	[f]	[f] [4]
Block[0]	Number[39]	[4]	[3]	[9]	[f] [f] [4]
Block[3]	Number[14]	[4]	[3]	[1]	[4] [f] [f] [4]

## FILE Errors

Errors may occur when using the FILE instruction if, for example, you specify an invalid file address.

Example:      Save Data File at:      Block[3] Number[47]  
   [4] [3] [4] [7] [f] [f] [4]

This will generate an **Error 1** because the Number value can only be between 00 and 39.

Errors are generated the same as for the normal HP-19C operating code, but FILE errors will have a number shown in the display similar to Spice calculators.

Error	Cause
1	Invalid File Address    (Block > 8, File > 39)
2	Trying to load a file from a vacant address
3	Loading a Program File, but File is Data
4	Loading a Data File, but File is Program
5	Invalid prefix code    (not 1 – 4)
6	Trying to execute [f] [f] [4] from keyboard

<b>Note</b> [f] [f] [5]	Run Mode Yes	Running Program Yes
-------------------------	-----------------	------------------------

It may be handy to have the calculator display a note when a certain event happens during program execution. This new function allows that to happen and up to 100 notes can be stored for use.

Notes can have up to 11 characters displayed and only these listed characters can be used.

To open the Notes Editor, the HP-29C must be selected and the emulator must be in Step Mode, or it can be accessed by the CalCom program.

Enter a note by typing any of the allowed characters into the list. When completed, press OK. You will be notified if any errors occur.

0	E	b	q
1	F	c	r
2	G	d	s
3	H	f	t
4	I	g	u
5	J	h	y
6	L	i	=
7	N	j	?
8	O	l	-
9	P	n	-
A	Q	o	[spc]
C	U	p	

To enable any of these notes while a program is running you need to include the following data in your program.

A single digit number may be used to specify the note numbers 0 – 9.

A 2 digit number is required to specify the note numbers 10 – 99.

The note number is accessed from memory **r.5** in the calculator.

Any number can be in this memory location, although note [0] will be displayed for note number values outside the useable range.

During program execution, when the notes program token is encountered, the program will pause and show the selected note for a short time. The program will then continue.

Examples:

Display note number 92 during program execution

Press	9	Display	<b>01</b>	<b>09</b>
	2		<b>02</b>	<b>02</b>
	STO .5		<b>03</b>	<b>23 .5</b>
	f f 5		<b>03</b>	<b>14 14 53</b>

In run mode, display a note with the current **r.5** value directly from keyboard.

Press        f f 5

Each time this function executes, memory **r.5** will be incremented by 1. This can help with concatenating notes to form a message.

To make the program stop when a note is displayed, make the number stored in **r.5** negative.

Note: If r.5 is < 0 or > 100 then it will reset and be in the range 0 – 99 after the increment.



## Example

There are some example programs stored in the CalCom install directory `/files29C`.

Test program `test29C_000.pg` will load another file called `test29C_001.pg`.

```
01.2          02      // program file
02.0          00      // block 0
03.0          00      // file 001
04.1          01
05.FILE      14 14 04  // execute file
06.R/S          74
```

```
01.1          01
02.ENTER      31
03.2          02
04.+          51      // 1 + 2 = 3
05.0          00
06.STO .5      23 .5  // set NOTE address = 00
07.X<>Y        21      // display 3
08.BEEP      14 14 02  // beep
09.NOTE      14 14 05  // show Note 00
10.R/S          74
```

## HP-25C and HP-29C Alpha Key Mapping

When using the HP-25C and HP-29C, the program names can be entered as a default or they can be entered as text. A basic text editor is included and when enabled the keys operate as shown in the following image. When saving a file, you will get the choice of entering a text name or a default name.

The primary characters are shown on the key faces. The alternative characters are shown above the keys.

[alt] Changes between primary and alternate character sets.

[BkS] Deletes the current character.

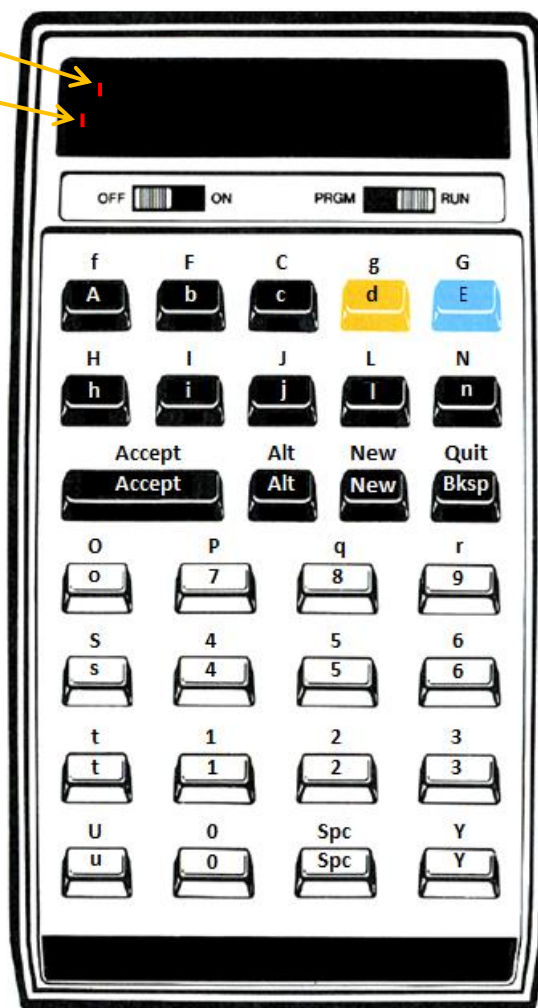
[New] Restarts the name entry

[Quit] Exits file store or rename.

[Accept] Saves the file or new name.

Lit for Alt Char Set

Lit for 2<sup>nd</sup> Display Half



## 29C Printer Interface

A printer Interface is available and interfaces to the CalCom PC program via the Bluetooth module. When active, the printer will print details similar to the HP-19C printer. The font is similar to the Topcat printers. The following print output was created during the running of a small program.

```
RTN
01      7
02  ENT↑
03      7
04      *
05  R/S
```

To operate the printer, the HP-29C model must be selected. Enable the Bluetooth link from the calculator menu and establish a connection to the CalCom program. Once the connection is established, click on the **PRINTER** item and click **WRITE**. If the connection is established the printer window will appear next to the CalCom window.

You can select NORM or TRC modes for the printer. As well as printing key presses, TRC mode will print the result of the operation followed by \*\*\*\*.

Clear Paper	Clears the printer paper
Print Paper	Print the paper using the PC printer.

There are 4 additional buttons which will print the program, memory registers, stack and the X register.

The printer will automatically disconnect if the print window or CalCom closes, or the calculator is turned off, or the calculator is switched to Prgm Mode.

For best use, wait until the current print operation has completed before closing the printer interface. If the printer is busy while closing the link, invalid data could be added to the print stream and may cause problems.

If a 29C program is running, the 4 print buttons should not be used or they may also cause print stream data conflicts.

If a problem is detected while printing, the calculator LED display will show *Print Error* and if so, can be cleared by using any key. After the key press, the calculator will reset and the Bluetooth link will terminate.

## GAMES

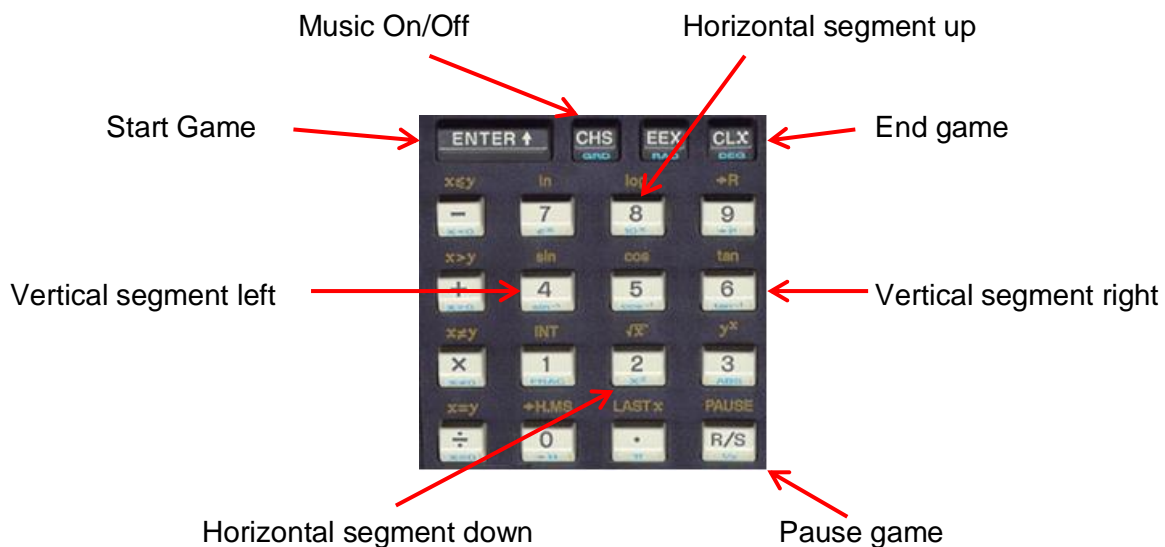
### Tetris Card Game 21

Select Games with [Enter] and scroll through the types with the [+] and [-] buttons. To choose a game, use [Enter] again. [CLx] exits the game menu and selected game.

### Tetris

This game is based on the well-known Tetris game, but this version has horizontal movement, where digit segments move from left to right. The idea is to fully light all segments of a digit and get the highest score before you lose, or just decide to quit. The game is lost when no more segments can be added to the LED display.

#### Keyboard Controls



Segments will begin moving across the display and stop moving when the end of the display, or when the following digit has the same segment set, or when a full digit has been lit.

You can move horizontal lines up or down

You can move vertical lines to the left or right of a digit.

Right vertical segment have the decimal point lit.

You cannot change lines from vertical to horizontal or vice versa.

As the game progresses, the segments will move across the screen with increasing speed. When a digit has all of its 7 segments lit, the digit will be removed from the display and the digits from the left will be moved 1 position right.

It may be interesting to hear the Tetris theme music playing, but may get tedious after a while, so it can be turned on or off as desired.

## Card Game - 21

This is a fairly common game, also known as Black Jack. The idea is for the Player to compete against the Dealer and get as close to 21 as possible. The Player can ask for as many cards as required. The dealer will deal as many cards as the processor determines. When the game starts, the Dealer and Player will receive two cards each, with the Dealers cards hidden.

To deal a card press [g], this is called a *Hit*.

To finish accepting cards, press [f], this is called a *Sit*.

Once finished accepting cards, the Dealers cards will be shown and the *Hits* and *Sit* are automatic.

If the Player or Dealer scores exceed 21 then the opponent wins.

If both Player and Dealer scores equal 21, the game will be a draw.

If the Dealer score is > 16, and both scores are equal, the Dealer will concede.

If the Dealer score is > 16, and scores are not equal, the Dealer must deal itself again.

As the game starts, a new deck will be shuffled. This deck will continue throughout the game. Once the cards have all been used, a new deck will be shuffled. Cards are displayed as follows

1 – 9	1 – 9	
10	t	
Jack	J	
Queen	q	
King	G	
Ace	A	Ace = 1
Ace	A.	Ace = 11

When prompted, press the [f] key to deal or [g] or [CLx] keys to exit.

Player Display – new deal .3 12

The first 2 digits are the player score. The following characters are the dealt cards.

Press [g]	14 12A.
Press [g]	15 12A.A

If the new card is an Ace, you will be prompted to choose the value of the card, either 1 [Key 1, 1] or 11 [Key 1, 5]. Aces with the value 11 are displayed with a decimal point following.

Pressing [X<>Y] in Player mode will show the suit of the displayed cards.

**H** Hearts      **d** Diamonds      **S** Spades      **C** Clubs

The Dealer will assign the value of any Aces that it deals.

After a game has completed, the hand scores will be shown. Press [Enter] to continue.

The game scores are shown next. Press [Enter] to continue.

Up to 99 games can be played, after which [**Game Over**] is displayed.