Design-the-Calculator Contest Entry
from the
Philadelphia Area HP Handheld Club
(Established 1978 as the Philadelphia Area Chapter of PPC)

**Hardware**

Calculator Case: Roughly same physical length and width of HP48, but uniformly thick from top to bottom. Opens in a clamshell style similar to the HP18C/19B calculators with the hinge on the left side of the case. When closed, the keyboard and display are protected. The left side optionally folds completely around to the back of the machine to provide one-handed vertical-format use with either the left or right side facing upward toward the user.

Keyboards/Displays: Inside the left-hand portion is a backlit touch-screen LCD covering virtually its entire surface. The right side of the case, on the surface facing the user is a thin frame around a roughly quarter-inch deep depression which houses snap-in keyboards just slightly smaller in length and width than the outside case. These keyboards electonically connect with the case via connector(s) lying inside the depression. A mechanical keyboard release mechanism lies somewhere on the outer frame edge. (See diagrams.)

Two keyboards are provided with the unit:
  (1) A vertically oriented calculator keyboard plug-in which also contains an LCD at the top, similar in length and width to the HP48's display, but higher resolution; and
  (2) A horizontally-oriented QWERTY typewriter keyboard covering the entire plug-in's surface (without a display) and thus allowing wider keys for touch typing purposes.

When the vertical keyboard/LCD plug-in is in place, the machine senses this and initializes the left-hand touch-screen LCD with vertical text in a "portrait" orientation. The calculator may then be used open with both sides visible to the user or folded back on itself with one side visible.

When the horizontal typewriter keyboard plug-in is in place, the system is automatically initialized as such and the touch-screen LCD starts up as a horizontal display in a "landscape" orientation.

One design option would be to have both keyboards on a single plug-in on opposite sides, with two connectors located on opposite edges. With the connector socket on one side of the depression in the calculator's case, a different plug-in connector would make contact depending upon which side was up, and thus notify the machine which side was to be in use.

Another option would be to have the lefthand LCD touch-screen be detachable from the hinge in order to be replaced by another screen such as a color version of the LCD.

Power: The machine would be powered by batteries, which would be accessible through a battery door on the rear of the case at the bottom. An optional AC/DC adapter with battery eliminator mechanism could be attached in place of the batteries.

Expandability and Connectivity: Several sockets would be located on the rear of the case, behind small removable doors to allow plug-in enhancement or expansion modules.

    At least two (and possibly as many as four) sockets would be for memory expansion. These could be RAM, ROM or otherwise. The plug-in modules would be very small, a la the HP41C modules or the recently-announced Siemens Multimedia Cards (MMC). Expansion memory capacities would go up to several megabytes per module.

    At least one additional socket would be available for wired I/O devices, perhaps for different plug-ins which would add either serial or parallel communications with external systems.

    One more socket would be available to plug in a two-way high-speed infrared communications module, utilizing the latest IrDA protocols.

    At the top of the case would be a dedicated socket for connecting a cable to a computer.

Another socket would provide access to system firmware, which could be upgraded by removing and replacing the firmware module.

One additional larger socket would allow the system CPU/core logic to be detached and replaced with a more advanced processor when one became available. The initial CPU of the system would be a very-low-power, high-speed processor such as the StrongARM.

A docking station is an optional peripheral, into which the machine mechanically attaches. The station contains several PC card slots for connecting to networks, SCSI ports, GPS systems, etc.

**Firmware**

This machine would have two personalities built into it; When used in a vertical format mode (with the vertical keyboard/LCD plug-in), it would be an advanced high-speed scientific programmable calculator. When the horizontal QWERTY keyboard was attached, the machine would take on the personality of a high-end palmtop computer/organizer. This would allow dual use without requiring two machines to be carried. The touch-screen would provide optional softkeys for either personality of the unit.

Calculator Mode: While in calculator mode, the smaller LCD would act as a display for typical numeric computation. The machine would continue on the RPL tradition of the HP28/48, but with much higher speed and memory capacity. The touch-screen LCD would allow custom keyboards and displays to be allocated for user-defined applications. In addition, this larger display could be utilized for advanced graphics applications. With the two sides folded back on themselves, an alternate mode could be activated whereby the touch-screen took the place of the hard keyboard, and all standard calculator functionality could be accessed from the LCD. In addition, handwriting recognition would be available for the user to manually enter numeric and mathematical data which would be interpreted and incorporated into calculations.

Computer Mode: While in computer mode, the system would behave similar to the HP620LX, with word processing, spreadsheet, database, organizer and other functionality immediately available. Handwriting recognition would be provided so manually-entered notes could optionally be converted to electronic text. Numeric, graphic and/or text-based data from either the calculator or computer modes would be available in both modes so information could be exchanged at will. Additionally, the computer-mode applications could be accessed from the calculator configuration, despite the fact that the left-hand LCD would be oriented the other way.

**Desktop Computer Based Companion Applications**

Along with the unit would be supplied a cable for connecting to a larger computer. Computer software which also accompanied the machine would allow several modes for calculator-computer communication and interactivity:

(1) First, complete two-way communication would be made possible so as to allow data synchronization between the computer and the calculator.
(2) Next, the full suite of applications which run in the calculator would be available also on the computer as well. That way, data to be shared between computer and calculator would be generated in the exact same way on either machine.
(3) A computer-based software development system, available at introduction time would allow development and debugging of calculator applications on the computer for later downloading to the handheld device.
(4) Lastly, the computer's software could be made to detect when the calculator was connected, so the handheld unit could be used as a keyboard input device for use with the computer. While using the computer, if some mathematical computations were needed, the calculator could be used to run those calculations while the actual computation took place in the computer's CPU.

Submitted by Jake Schwartz, Vince Calkins, Eric Hafler and Jerry Dob of the Philadelphia Area HP Handheld Club
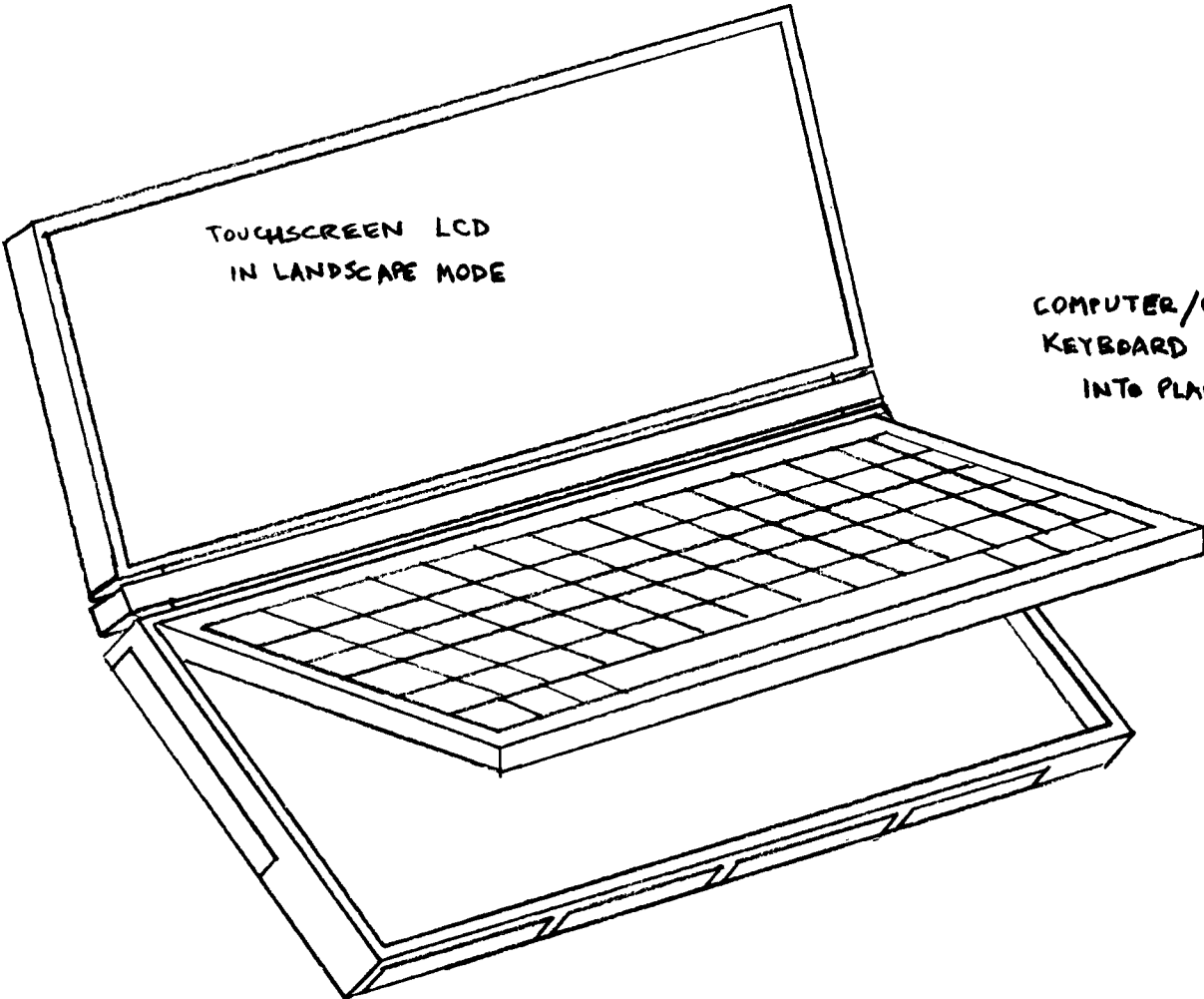
Four diagrams follow this page: (1) View of the open case with calculator keyboard in place; (2) View of the case with qwerty keyboard being inserted; (3) The back of the closed machine showing all its various ports; and (4) A view of the optional docking station with its many PC Card slots.
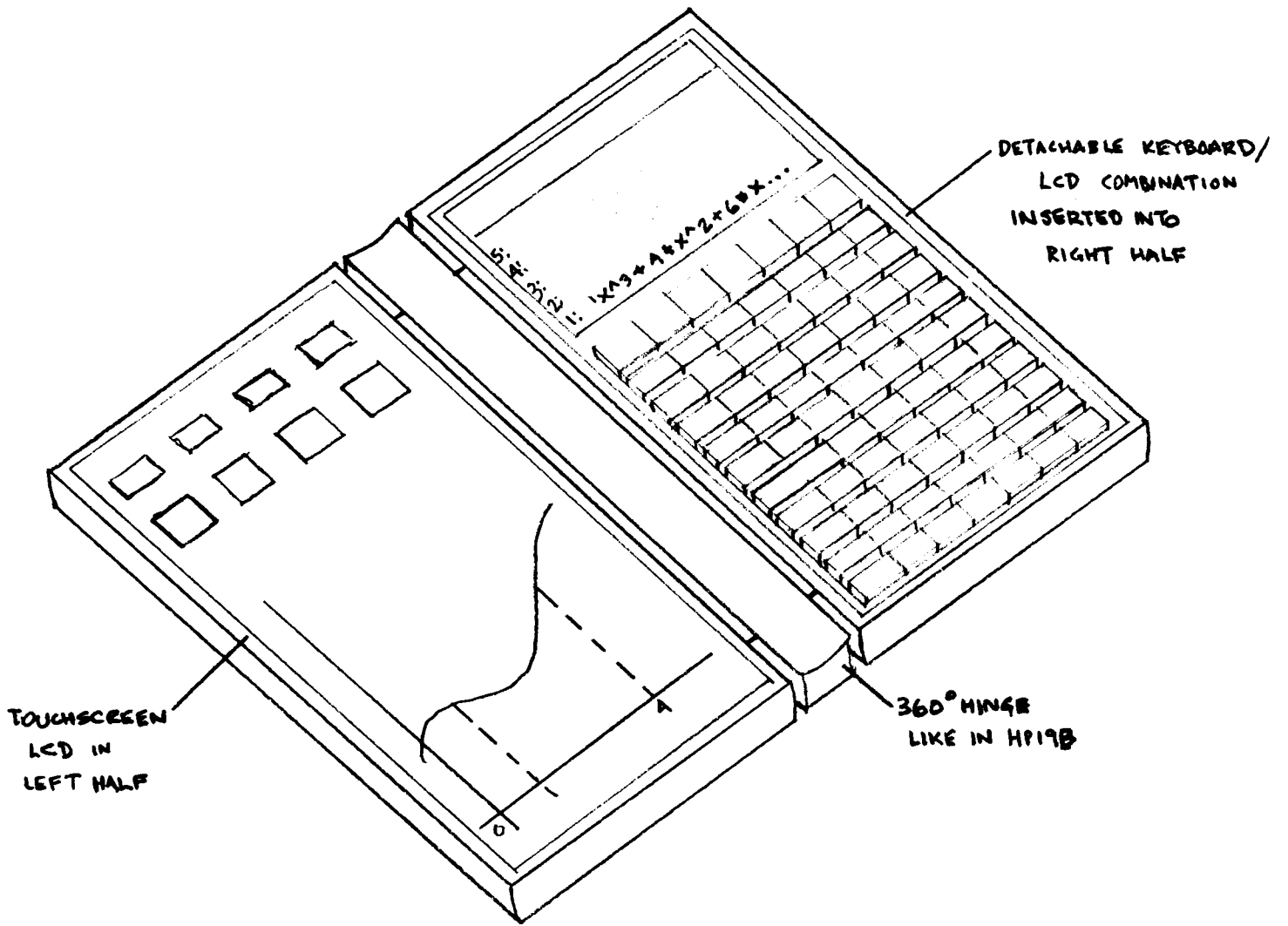
DETACHABLE KEYBOARD/
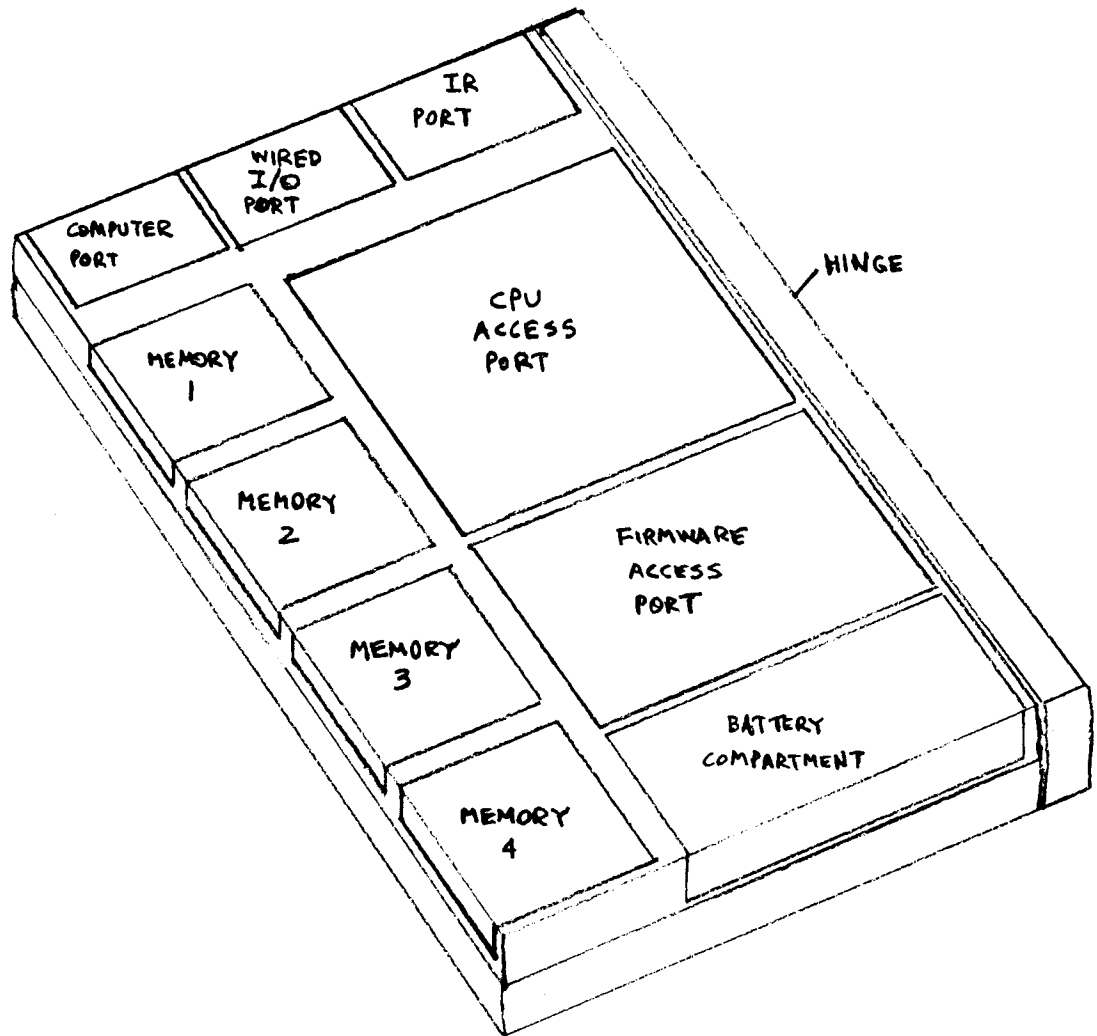LCD COMBINATION
INSERTED INTO
RIGHT HALF

$\dot{x} \cdot \dot{x} \cdot \ddot{x} \cdot \ddot{x}$: $1xA^9 + A^8x^2 + 69x \cdots$

TOUCHSCREEN
LCD IN
LEFT HALF

360° HINGE
LIKE IN HP19B

TOUCHSCREEN LCD
IN LANDSCAPE MODE

COMPUTER/QWERTY
KEYBOARD LOWERING
INTO PLACE

IR
PORT

WIRED
I/O
PORT

COMPUTER
PORT

HINGE

MEMORY
1

CPU
ACCESS
PORT

MEMORY
2

FIRMWARE
ACCESS
PORT

MEMORY
3

MEMORY
4

BATTERY
COMPARTMENT

REVERSE VIEW OF RIGHT HALF
(MACHINE CLOSED)
SHOWING VARIOUS PORTS
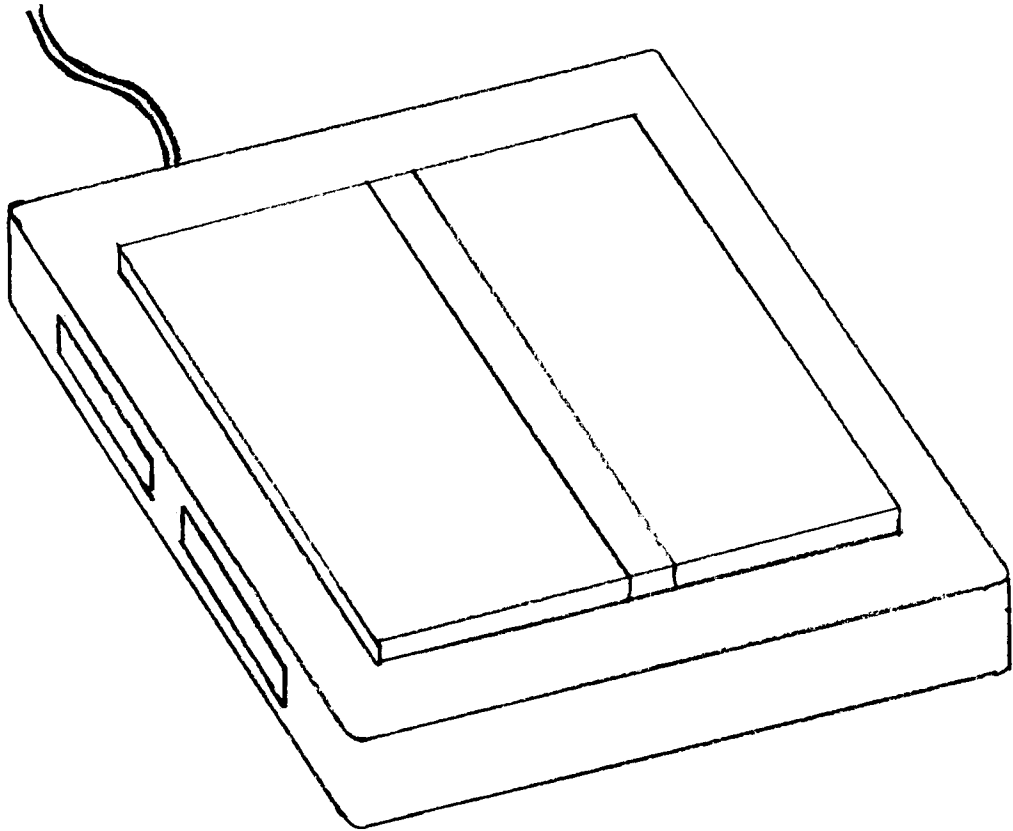
CALCULATOR IN DOCKING STATION w/4 PCMCIA SLOTS
(TWO ON EACH SIDE)