How to get one: *CEDS makes the PiDP-10 for us, as a kit ($370) or assembled & tested ($495)*

Get a 10

Build & Use the PiDP-10:

Building Instructions

Download Manual

Optional Hacks

How to Use

The ITS Reconstruction Project:

ITS Reconstruction

The PiDP10 development blog:

Development Blog

The user group:

PiDP-10 Google Group

Obsolescence Guaranteed

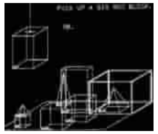
The Guardian -- CuriousMarc's PiDP-10 YouTube episode

PDP-10 Replica: The PiDP-10

DEC's 1968 mainframe that became a hacker playground at the MIT AI Lab

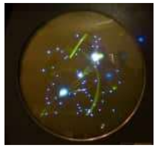
Software Highlights

To show that mainframes, too, can be fun :-)



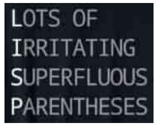
Shrdlu

The first AI to understand a 3D world, obey English commands



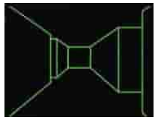
Spacewar!

The first videogame ever, on a radar tube display



Lisp & emacs

Emacs was born on the 10, where Lisp grew up



Mazewar

Play maze war with friends across the world. Networked!

Chess (Mac Hack)

First program to win against a human in a tournament. Graphics!

Game of Life

The original - Bill Gosper's own source code to play with

Adventure & Zork

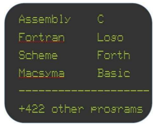
All of them. All the original PDP-10 versions. You are in a cave.

The MIT AI Lab, with a PDP-10 at its heart, was hugely important in computer history, with many 'firsts' on its record. Over the past decade, a group of enthusiasts did a full reconstruction of the Lab's hardware and software as it stood in the 1970s. The PiDP-10 gives a physical shape to this project, we regard it as a 'computer history capsule'. A self-contained, compact replica that gives an experience as close as possible to the real machine and the AI Lab. But now at home, perhaps even in the living room.

Our goal is not to show computer history, but to keep hands-on experience of it alive. The PiDP-10 lets you operate highlights of the AI Lab hardware, the ITS operating system, and hundreds of applications as they evolved during the late 1960s and 70s. One particular example is Shrdlu: the first demonstration of AI that in the 70s, triggered the first massive wave of interest in the field.

Filght Simulator

Not quite the same as Microsoft's FS



...And much, much more

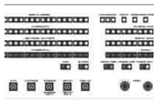
Click here for the list of recovered ITS software

Hardware Highlights

The MIT AI Lab had lots of useful hardware to keep the PDP-10 occupied with. A sample of virtual hardware that's also built in to the PiDP-10 replica:

Type 340 Display Tube

High Res graphics on a radar tube - vectordot graphics



PDP-6

Shared the PDP-10's memory banks through a neat hack

Interface Message Processor

The IMP router, heart of the early internet

Knight TV terminals

The default terminals at MIT, driven by a PDP-11

Background Story

In 1968, the PDP-10, model KA10, brought DEC into the world of mainframe-class machines. The PDP-6 had already defined the architecture four years earlier: a 36 bits CPU with a rich, very complex instruction set that feels completely esoteric today. Alas, the PDP-6 was notoriously unreliable. It took the PDP-10 before DEC got it right.

The fact that it was designed for real-time multiprocessing set it apart from other mainframes: this was the Big Iron that you used interactively on a terminal. No batch processing with punch cards. Thus, hackable. Its TOPS-10 operating system was groundbreaking, starting the lineage of RT-11 (PDP-11), OS/8 (PDP-8), CP/M and in the end of the line, MS-DOS. But TOPS-10 was much more powerful than the microcomputer OSes it inspired, properly multi-user, multi-tasking.

VT05

DEC's first terminal, pretty but dumb

VT-52

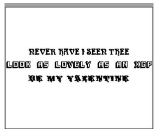
The industry-standard terminal - ugly but smart

Tektronix 4010

Ultra high res graphics. Using zero memory: a storage tube!

Datapoint 3300

Deluxe terminal with graphics. Home of mazewar.



XGP Laser Printer

First laser printer, do your academic papers on PiDP-10

Teletype Model 33

We keep the worst for last. But the PiDP-10 includes the audio!

Not included, alas

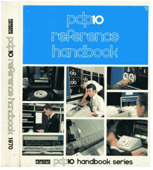
The famous robot arm. You'll have to put the sugar cube in your coffee yourself.

The PDP-10 at the LCM in Seattle, where we could verify our front panel's exact behaviour

Famous from computer lore, the PDP-10 was also the breeding ground for the early Hacker Culture at MIT, made famous by Levy's book Hackers. At the Artifical Intelligence Lab, the Ten was at the heart of a large collection of connected hardware, and its ITS operating system became a playground for computer scientists and hackers alike. MacLisp, emacs, the earliest AI demos, they were born on ITS. An operating system so esoteric that the debugger doubled as the command line, and although massively multi-user, connected to the early internet, open for all to visit – it had no password or security. Anyone from anywhere could join for a game of multi-user Mazewar on it – or crash the whole system. Which nobody seemed to do as it was just too easy to be cool.

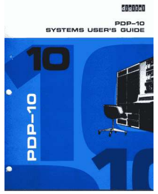
Books

Click the covers to get you started, but bitsavers.org and Google will find many more good books!



System reference manual

Great bed-time reading, the system and CPU in great detail

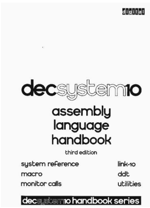


System users guide

For the early 1967 Monitor system (pre TOPS-10)

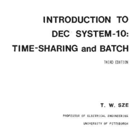
TOPS-10 manual set

The OS, Cobol, Fortran, Assembler etc



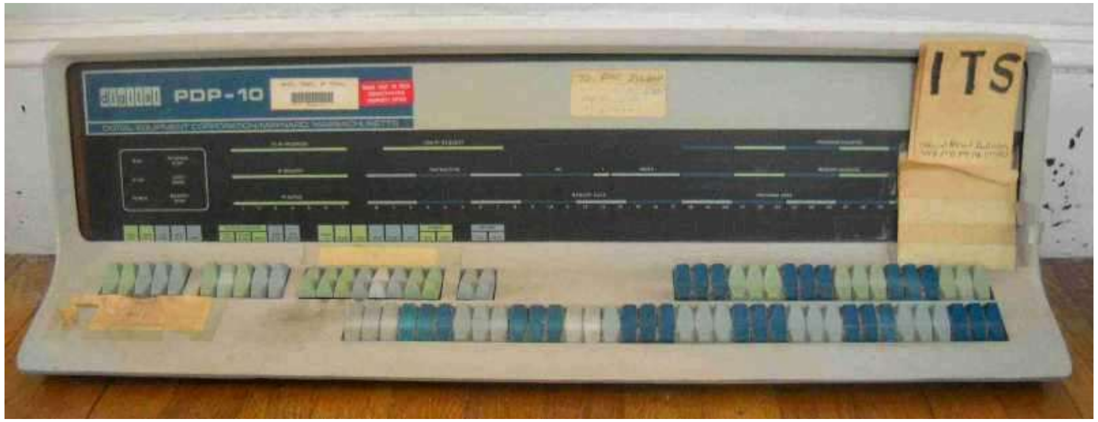
Assembly language hbk

Good bed-time reading. 1973 System & CPU reference.



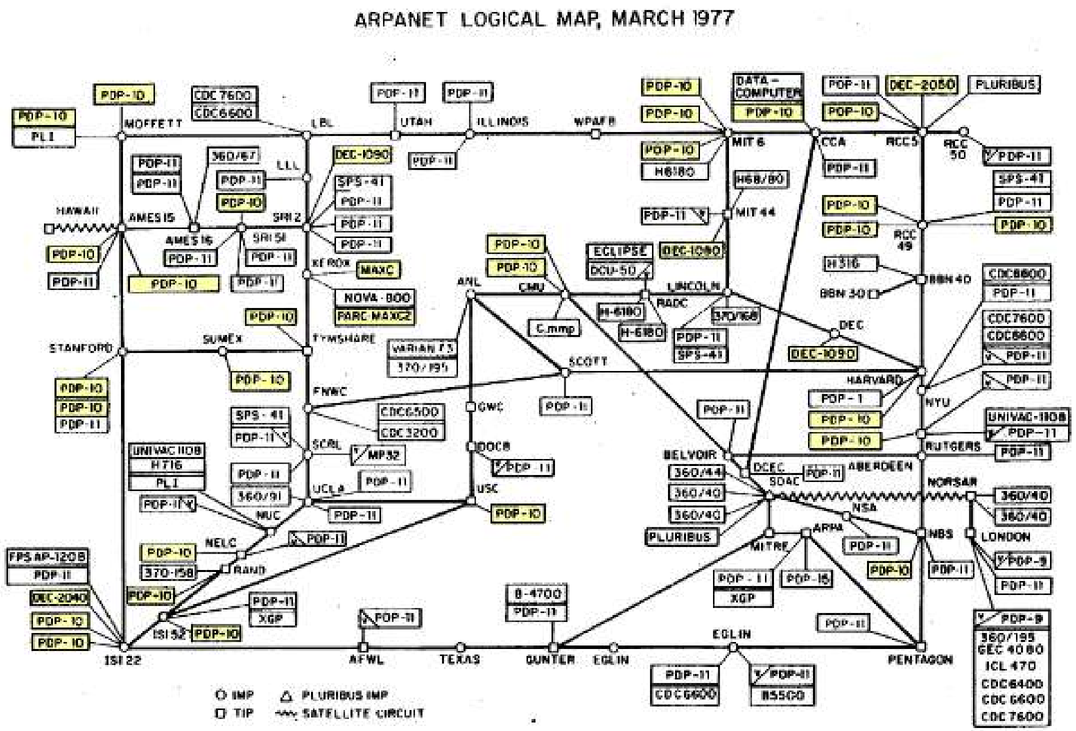
Intro to DECsystem10

Written for students at Univ. Pittsburgh, good intro



The original MIT PDP-10 console, a bit worse for wear after a decade of hackers' gefingerpoken

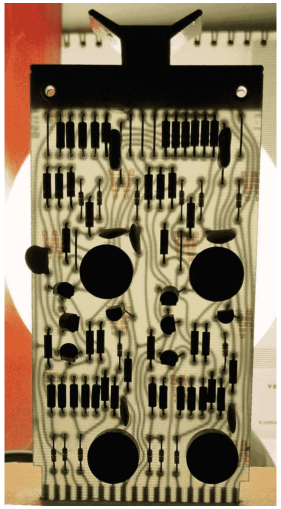
Free software was born here, Stallman was one of the ITS hackers. But, funny enough, Microsoft as well: Bill Gates and Paul Allen wrote Micro Soft Basic on a PDP-10 at Harvard, running their homebrew 8080 emulator. Allen's love for the PDP-10 drove him to a full restoration of a KA10 in the 2010s. And in fact, when that restored machine came to life, it gave us the one and only opportunity to check our our replica against a live real machine. Sadly, Allen passed away just before the restoration was completed, and the future of The Last KA10 looks dim now. Making us even more grateful for that tiny time slot in which we could perfect the replica's behaviour.



The Ten also played a key role in early networking. MIT had its own Chaosnet running early on, and soon, with the Interface Message Processor (IMP), it connected to the ARPANET, that would evolve into the modern-day internet. All the PDP-10s in this chart of the ARPANET in March 1977 are marked in yellow. As the IMP is included in the PiDP-10 simulator, plans are afoot to recreate this early ARPANET snapshot with a group of PiDP-10 and -11s.

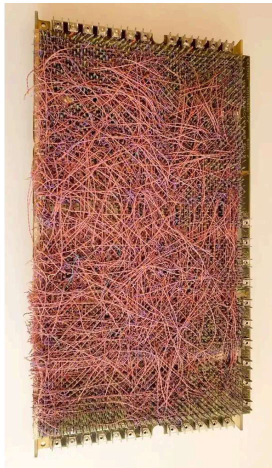
Technical Specs

The Ten was renowned for its refined 36-bit architecture (each word being 36 bits wide). The instruction set was huge, encompassing arithmetic, logical, and control operations with various addressing modes to enable fast data manipulation and control flow handling. The architecture relied on a microcoded control unit for instruction execution, featuring separate instruction and data spaces. With a 36-bit word size and addressing, it offered access to a then-astonishing 256 kilowords (over a megabyte in 8-bit bytes) memory address space. Its puny clock speed of around 0.6 MHz is misleading in today's terms – the 36 bit instructions packed a lot of punch in a cycle. I/O subsystems included magnetic tape drives, disk drives, printers, card readers, and communication interfaces.



The PDP-10 predates chips, it is made out of circuit boards ('flip chips') with simple transistors, etc.

They are plugged into back planes, with wires making up the circuit. Amazingly, this was quite reliable.



Why you need one at home

Paul Allen wanted one at home, so it must make sense. It is simply the only mainframe ever that became a playground for hackers. As a result, hundreds of applications, games, high-res graphics demos (on a repurposed radar tube) and AI projects are installed on the reconstructed ITS disk images. Controlling ITS is not all that hard, and mastery of it is rewarded by this huge playground of available software, much of it prototyping for the first time applications that we now take for granted.

So, it's fun. The only mainframe ever that became a geek playground. But the historical significance should not be ignored – Free Software, the Hacker Ethos, early AI programming, it is fascinating to see that at your fingertips. It's also a networked machine, so the ~~ARPANET~~ Internet is at your fingertips. And don't think you need to be a computer genius to operate a 1960s mainframe, either. The benefit of hindsight helps: things that were once novel and mysterious become fairly obvious to people who've grown up with computers...

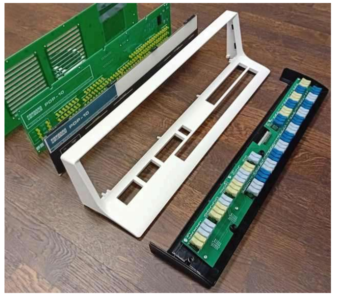
What to do with a mainframe in your living room?

What to do with a mainframe in your living room?

Replica Details

Hardware:

We replicated the KA10's iconic looks through an injection-molded case. Over half a meter wide, the front panel drives 124 lamps and 74 switches. The simulator was written by Rich Cornwell as part of the simh project. And, normally, runs on a built-in Raspberry Pi 5. Depending on the workload that you put on the simulated PDP-10, in fact, the PiDP-10 will be a dual-hearted machine. You can concurrently use the Pi Inside as a regular Linux system. Giving the PiDP-10 more justification to reside in the living room; it can double as network storage, media server or whatever else you'd like to do with a Pi. As long as you do not put more than 10 or so concurrent users on your PDP-10, the Pi will handle both roles seamlessly.



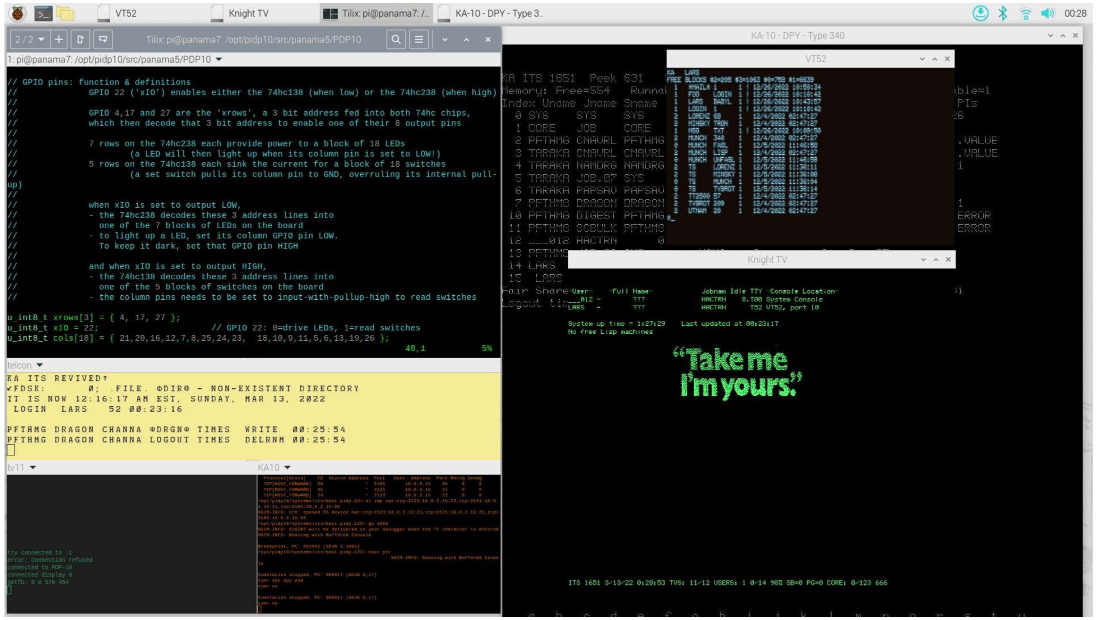
Exploded view of the kit prototype. It's not that hard to build yourself a mainframe.

Software:

TOPS-10 is one boot option. It brings you into an environment that pretty much defined the standard for later OSes that ran on simpler hardware. Yes, this is at the root of the evolutionary tree that led to MS-DOS. But TOPS-10 was much more powerful, harnessing a multi-user, multi-tasking OS with a full set of programming languages and applications. Oh, and you can play the original Adventure, among other terminal games.

However, ITS will be the more appealing operating system to boot up in the 21st century. The PiDP-10's purpose was to give physical shape to the ITS reconstruction project of Lars Brinkhoff et al. Simulated is not just the PDP-10 itself, but also lots of related hardware in the AI Lab. Such as a PDP-6 that shared its expensive memory with the 10, a couple of PDP-11s, a range of terminals and even the IMP device: the famous network router that first morphed the ARPANET into Internet. The PiDP-10's simulated environment is, in fact, almost the entire MIT AI Lab, not just the PDP-10 itself. The ITS reconstruction project is an infinitely deep rabbit hole if you want to dig into it, encapsulating the work of hundreds of hackers at MIT in the 1960s and 70s.

In case you think there's nothing to see on 1960s mainframes, here's a look at the default PiDP-10 display:



Tweets by Oscar_CEDS

PiDP-10 Google Group

the community

Details on the PiDP-10 replica

Oscar's PiDP-10 site

ITS Reconstruction Project

a labour of love for the past 15 years

simh PDP-10 simulator

The PiDP-10's brain

ITS Boot Camp

and live ITS login as well!

ITS Manual (WIP)

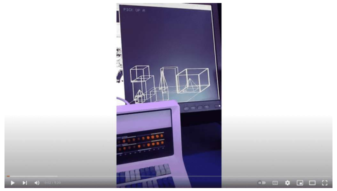
find your way around IT

Turist's guide to ITS

old but useful first impression of ITS

MIT Museum

on location where it happened



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