

Advertisement



REGISTER | LOGIN

Home | News | Opinion | Messages | Authors | Video | Slideshows | Teardown | Education | EELife

About Us | Subscribe

Big Data | Analog | Automotive | Embedded | Industrial Control & Automation | IoT | MCU | Medical | Memory

BREAKING NEWS

DESIGN & ANALYSIS: SEMI to Absorb EDA Trade Group

BLOG



designlines AUTOMOTIVE

Programmable Logic DesignLine Blog

How it was: Paper tapes and punched cards

Clive Maxfield

10/13/2011 05:32 PM EDT

14 comments post a comment

NO RATINGS
LOGIN TO RATE

Like 0 Tweet Share G+

Users of the early computers required some kind of reliable, cheap, and efficient media for storing and transporting large amounts of computer data...

Note: The material presented in this column is abstracted from the books I co-authored with my friend Alvin Brown: [Bebop Bytes Back \(An Unconventional Guide to Computers\)](#) and [How Computers Do Math](#).

Users of the early computers required some kind of reliable, cheap, and efficient media for storing and transporting large amounts of computer data. Two techniques that became very widely used in the early days of computing were paper tapes and punched cards...

Perforated paper products

As you can imagine, it would be somewhat inconvenient to have a computer that forgot everything it knew if its operator turned it off before stepping out for a bite of lunch. Similarly, imagine a programmer's frustration if, after spending countless hours using a Switch Panel to enter a program, the janitor carelessly disconnected the computer in order to vacuum the office. A few choice words would be the order of the day, let me tell you!

There were also a variety of other considerations. For example, since the early computers had very little memory anyway, it was necessary to have some mechanism to store large amounts of data outside of the machine's main memory. A program could then access and process small portions of the data on an as-needed basis. Also, if the operator had a number of different programs, but there wasn't enough memory to contain them all at the same time, then it was necessary to have some technique for storing the inactive programs. There was also the question of long-term archival; that is, being able to store programs and data for use sometime in the future.

Most Recent Comments



rick meritt @realjjj: You are right that Android has 85+% of the smartphone OS market by units. However, I would note analysts say Apple has about half the smartphone revenue and an even...

4/21/2018 10:27:39 AM

Yet another concern was being able to transport programs and data between computers located at different sites. For example, a programmer who created an interesting routine in Boston may well have wanted to share the fruits of his or her labors with colleagues in San Francisco. Although some flavors of early memories, such as Magnetic Core Stores, were non-volatile (they remembered their data when power was removed from the system), it was still somewhat less than practical to slip something the size of a large washing machine into an envelope and drop it into the mail.

For all of these reasons, it was obvious to everyone that it would be advantageous to have some kind of reliable, cheap, and efficient media for storing large amounts of computer data (and preferably something that weighed-in at substantially less than a ton). In order to satisfy these requirements, two techniques became very widely used: paper tapes and punched cards, both of which involved perforating paper-based products (try saying that ten times quickly).

The origin of paper tapes

By using paper tapes, like so many other aspects of computing, engineers took advantage of technology that already existed at the time. In 1837, the British physicist and inventor Sir Charles Wheatstone and his friend, the British electrical engineer Sir William Fothergill Cooke invented the first British electric telegraph.

Sir Charles was a busy man. Amongst other things, he also invented the accordion in 1829 (following which, presumably, he didn't have too many friends left) and three-dimensional photographs in the form of his *Stereoscope* in 1838.

Apropos of nothing at all, 1837 was also the year that another "Charles" – Charles Dickens – first published a story under his given name; prior to this he'd been using the pen-name "Boz".

But we digress.... Wheatstone's first telegraph made use of five wires, each of which was used to drive a pointer at the receiver to indicate different letters. In the same year, the American inventor Samuel Finley Breese Morse developed the first American telegraph, which was based on simple patterns of "dots" and "dashes" called *Morse Code* being transmitted over a single wire. Morse's system was eventually adopted as the standard technique, because it was easier to construct and more reliable than Wheatstone's.

A	..	N	---	0	-----
B	---..	O	----	1	.....
C	----.	P	-----	2	-----
D	---.	Q	-----	3	.....
E	.	R	---	4	.....
F	..---	S	...	5	.....
G	---.	T	-	6	-----
H	....	U	---	7	-----
I	..	V	---.	8	-----
J	-----	W	---	9	-----
K	---.	X	-----	,	----- comma
L	....	Y	-----	.	----- period
M	--	Z	-----	?	-----

Subset of International Morse Code

The duration of a "dash" is three times the duration of a "dot". Note that the illustration above shows only a subset of the code (although it's quite a large subset), but it's enough to give the general idea. Also note that this table shows *International Morse Code*, which is a slightly different flavor to *American Morse Code*.

Morse Code has a number of interesting features and, knowing me, you'll be lucky to escape without my mentioning at least a few of them. One tasty little nugget of trivia I simply can't resist pertains to the code for the letter "V". In his early years, Morse was more attracted to the arts than he was to science. The rumor on the street is that Morse attended a performance of Beethoven's *Fifth Symphony* on one of his trips to England. Idle speculation further has it that this performance so impressed him that the "dot dot dot

TOSHIBA
Leading Innovation >>>

AUTOMOTIVE UFS NAND
256GB EMBEDDED MEMORY

Ideal for infotainment, drivers assistance (ADAS) – and smarter vehicles.

- AEC-Q100 Grade2
- JEDEC V2.1 HS-G3
- -40C° to +105C°
- 16GB - 256GB

[Learn More](#)

Navigate to Related Links

- [Uber's First Tragedy Likely Not the Last](#)
- [How to Make Self-Driving Car Road Testing Safe](#)
- [Wireless Power Charging for EVs](#)
- [Alibaba IoT Platform Partners with NXP for Automotive](#)
- [Ambarella Gives Robocars Double Vision](#)

Download Datasheets

PART NUMBER

e.g. LM317

Search

POWERED BY

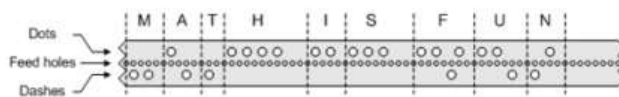
Cartoon Contest

February 2018 Cartoon Caption Contest: "I've Got the Power"

dash" code he used for the letter "V" (which is also the Roman numeral for "five") was intended to emulate the symphony's opening sequence which goes "Da Da Da Daaa".

The telegraph quickly proliferated thanks to the relative simplicity of Morse's system. A problem soon arose, however, in that operators could only transmit around ten words a minute, which meant that they couldn't keep up with peoples' seemingly insatiable desire to send messages to each other. This was a classic example of a *communications bottleneck*. Thus, in 1857, only twenty years after the invention of the telegraph, Sir Charles Wheatstone introduced the first application of paper tapes as a medium for the preparation, storage, and transmission of data.

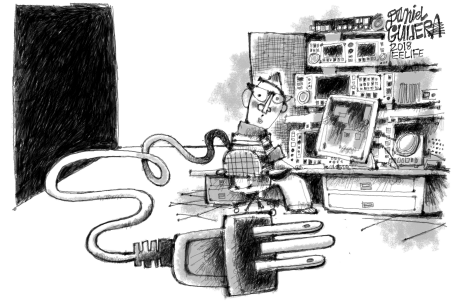
Sir Charles' paper tape used two rows of holes to represent Morse's dots and dashes. The following illustration reflects the way I originally thought this worked, but someone once informed me that the actual scheme was somewhat different (I seem to recall that a dot used one hole on one side of the feed holes while a dash used two holes on either side of the feed holes, but I may be mistaken). Unfortunately, I misplaced the original message, so if anyone knows the real-world technique please let me know and I will update my diagram).



Wheatstone's perforated paper tape

Outgoing messages could be prepared off-line on paper tape and transmitted later. By 1858, a Morse paper tape transmitter could operate at 100 words a minute.

Below is a [YouTube Video](#) showing the use of a Morse code system employing a two-channel paper tape mechanism:



When Edgar ordered his new scope, he thought "3000A" was the model number, not the current draw.

90 comments

[ALL CARTOONS](#)

Most Commented Most Popular

- 36 Is Robocar Death the Price of Progress?
- 30 Robo-Uber: What Went Wrong
- 22 Wireless Power Charging for EVs
- 20 Intel Needs New Strategies, ASAP
- 19 Uber's First Tragedy Likely Not the Last
- 18 Empowering Diversity in STEM
- 16 Robocars: Time to Discuss Safety Validation
- 15 Broadcom Bid Gets U.S. Scrutiny
- 14 Trump Presses China to Buy More U.S. Chips
- 14 5 Thoughts on GF and Sanjay Jha

[DataSheets.com](#)

[LINEAR TECHNOLOGIES](#)

NEW PART OF
[ANALOG DEVICES](#)

Like Us on Facebook



Like Page

Sign Up

Be the first of your friends to like this

EE Times on Twitter

follow us



Unsuspectingly, Sir Charles had also provided the American public with a way to honor their heroes and generally have a jolly good time, because used paper tapes were to eventually become a key feature of so-called *ticker-tape parades*.

The Printing Telegraph

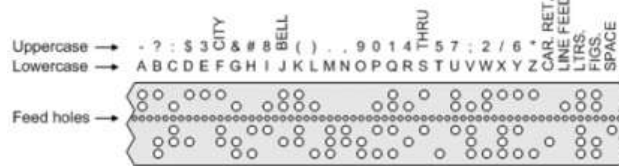
As was discussed in the previous topic, the first telegraph machines were invented in 1837 by Sir Charles Wheatstone in England and Samuel Finley Breese Morse in America. Morse's machine was eventually adopted as the standard because it was simpler, easier to construct, and more reliable.

Morse's original machines kept a record of incoming messages using an electro-mechanically-controlled pencil that made marks on a moving strip of paper. The paper was driven by clockwork, while the lengths of the marks corresponded to the dots and dashes used in Morse Code. However, operators quickly realized that they could recognize the message by sound alone, so Morse's recording devices returned to the nether regions from whence they came.

Throughout the rest of the 1800s there continued to be a strong interest in the idea of a printing telegraph. Much of the work toward realizing this dream was based on the concept of a wheel with characters embossed around the periphery. The idea was to use the incoming telegraph signals to spin the wheel by fixed steps until the correct character faced the paper, and to then propel that character onto an inked tape located in front of the paper.

There were a variety of techniques for controlling the wheel, such as a single pulse for 'A', two pulses for 'B', three for 'C', and so on, with the wheel returning to a home position after each character, but this technique was very slow in terms of words-per-minute. Later techniques used a five-bit code created by the French inventor Jean Maurice Émile Baudot in 1880, which soon became known as the *Baudot Code*.

The two-channel paper tape technique pioneered by Sir Charles Wheatstone was subsequently extended to five channels so as to handle the Baudot Code as illustrated below.



Paper tape showing the five-bit Baudot Code

Using a five-bit code, it is possible to obtain $2^5 = 32$ different combinations of holes and blanks (no holes). In the case of the Baudot Code, twenty-six of these combinations were used for letters of the alphabet, leaving eight spare combinations for an idle code, a space code, a letter-shift code, and so on.

The problem was that there weren't enough spare combinations left over to represent the numbers '0' through '9' or any punctuation characters. In order to solve this dilemma, the *letter-shift* code was used to emulate the shift key on a typewriter by instructing the receiver that any subsequent codes were to be treated as uppercase characters (in this context, "uppercase" was used to refer to numbers, punctuation, and special symbols). A second letter-shift code could subsequently be used to return the receiver to the alphabetical character set.

The five holes and blanks for each character were transmitted as a sequence of pulses and gaps, and decoded and printed at the receiving end by a variety of different techniques. Note the special characters such as BELL, which actually rang a bell on the receiver to alert the operator that something interesting was about to happen, or was in the process of happening, or had just happened.

The early systems required the operator to use a keypad with five separate keys and to simultaneously push whichever keys were required to form a character. Later systems were based on a Typewriter-style Keyboard, whereby each typewriter key activated the five transmitting keys (or a paper tape punch) to establish the correct pattern. Unfortunately, none of these systems were tremendously robust or reliable, and they all suffered from major problems in synchronizing the transmitter and the receiver such that both knew who was doing what and when they were doing it.

The original Baudot code became known as the *International Telegraph Code No. 1*. Sometime around 1900, another 5-bit code called the *Murray Code* was invented. The Murray Code eventually displaced the Baudot Code and became known as the *International Telegraph Code No. 2*. Unfortunately, everyone was hopelessly confused by this time – Murray's name sank into obscurity, while Baudot's name became associated with almost every 5-bit code on the face of the planet, including the *International Telegraph Code No. 2*.

Storing computer programs and data on paper tape

In a similar manner to Sir Charles' telegraph tape, the designers of the early computers realized that they could record their data on a

EET EE Times

@eetimes

Fundamentals of PCB Design

Whether you're an experienced schematics designer or a beginner, printed-circuit-board design and layout may be new to you. buff.ly/2H83RcR

Fundamentals on PCB De...

Whether you're a seasoned ...
techonline.com

Apr 19, 2018

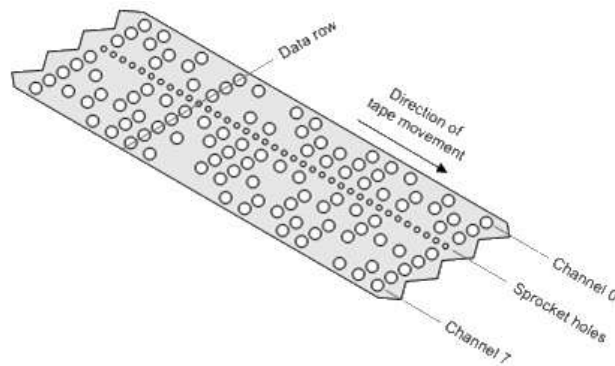
EET EE Times

@eetimes

Defining a New High-Speed, Multi-Protocol SerDes Architecture for Advanced Nodes buff.ly/2HcJyXw

paper tape by punching rows of holes across the width of the tape. The pattern of the holes in each *data row* represented a single data value or character. The individual hole positions forming the data rows were referred to as *channels* or *tracks*, and the number of different characters that could be represented by each row depended on the number of channels forming the rows.

The original computer tapes had five channels, so each data row could represent one of thirty-two different characters. However, as users began to demand more complex character sets, including the ability to use both uppercase characters ('A', 'B', 'C', ...) and their lowercase equivalents ('a', 'b', 'c', ...), the number of channels rapidly increased, first to six and later to eight as illustrated below.



Computer paper tape with eight channels

The above illustration represents one of the more popular IBM standards – a one-inch wide tape supporting eight channels (numbered from 0 to 7) with 0.1 inches between the punched holes. The first paper tape readers accessed the data by means of springy wires (one per channel), which could make electrical connections to conducting plates under the tape wherever a hole was present. These readers were relatively slow and could only operate at around fifty characters per second. Later models used opto-electronic techniques, in which a light source was placed on one side of the tape and optical cells located on the other side were used to detect the light and thereby recognize the presence or absence of any holes.

In the original slower-speed readers, the small sprocket holes running along the length of the tape between channels 2 and 3 were engaged by a toothed wheel to advance the tape. The higher-speed opto-electronic models used rubber rollers to drive the tape, but the sprocket holes remained, because light passing through them could be detected and used to generate synchronization pulses.

On the off-chance that you were wondering, the reason the sprocket holes were located off-center between channels 2 and 3 (as opposed to being centered between channels 3 and 4) was to enable the operator to know which side of the tape was which. Of course, it was still necessary to be able to differentiate between the two ends of the tape, so the operators used scissors to shape the front-end into a triangular point, thereby indicating that this was the end to be stuck into the tape reader.

Teleprinters and batch modes

These days we're used to working with computers in what we call an *interactive mode*; that is, you issue a command via the keyboard or the mouse and the computer responds almost instantly. Additionally, during the course of the program your computer may request further information from you, and both of you can interact together in real time.

This level of interaction was almost undreamed of in the not-so-distant past. Many of the first computers were controlled using a bank of switches known as a Switch Panel. Although controlling a computer by this means was interactive in its own way, it's not what we would regard as being interactive today. Furthermore, there was only one switch panel, but it could take many hours to enter a program byte by painful byte. Thus, if the switch panel had been the only way to enter programs, it would have been a pitiful sight to

see professional programmers manhandling each other in a desperate attempt to claw their way to the panel.

In reality, the computer's time was far too valuable to have it sitting around twiddling its metaphorical thumbs while operators entered programs via the switch panel. Due to their extremely high price-tags, the only way for early computers to be cost effective was for them to be performing calculations and processing data twenty-four hours a day. Thus, although it had other system-management functions, the switch panel was mainly employed to enter simple boot-strap routines when power was first applied to the system. These routines were then used to load more complex programs from external devices such as paper tape readers.

The end result was that, in order to support the most efficient use of computing resources, it was necessary for programs to be created off-line. This makes a lot of sense when you realize that it might take the computer only a few seconds to run a program that had required many hours to enter. One technique for creating a program off-line was by means of a *Teletypewriter*, which looked something like a typewriter on a stand with a large roll of paper feeding through it.

In fact, a teleprinter was essentially an electromechanical typewriter with a communications capability. In addition to the roll of paper (which was used by the operator to check what he or she had actually typed), the teleprinter could also contain other devices such as a paper tape reader/writer. (Teleprinters were often referred to as *teletype machines* or *teletypes*. However, this was a brand name (much as "Hoover" is for vacuum cleaners) for a series of teleprinters manufactured by International Telephone and Telegraph (ITT).

Below is a [YouTube Video](#) showing a Teletype Model 33 ASR equipped with an eight-channel paper tape mechanism:

Due to the fact that teleprinters were relatively inexpensive (compared to the millions of dollars invested in the computer), a typical installation usually included a large number of them, thereby allowing many people to create programs at the same time. Groups of programs were subsequently presented to the computer operators in a batch, and the computer was said to be running in a batch mode. (Things continue to evolve, and the phrase "batch mode" is now commonly used to refer to a program that's running as a background task, using whatever resources are available when interactive users aren't hogging all of the computer's capacity.)

As computers evolved and became more powerful, teleprinters began to be connected directly to them. This allowed the operators and the computer to communicate directly with each other, which was one of the first steps along the path toward the interactive way in which we use computers today.

The origin of punched cards

The practice of punching holes in cards to record data dates back to the early 1800s, when a French silk weaver called Joseph Marie Jacquard invented a way of automatically controlling the warp and

went threads on a silk loom by recording patterns as holes in a string of thin wooden boards or cards. In the years to come, variations on Jacquard's punched cards were to find a variety of uses, including representing music to be played by automated pianos and programs to be executed by computers.

The first practical use of punched cards for data processing is credited to the American inventor Herman Hollerith. During the 1880s, Hollerith decided to use Jacquard's punched cards to represent the data gathered for the American census, and to read and collate this data using an automatic machine. The resulting tabulating machines were successfully used to gather and process the data from the 1890 census, and Hollerith's company grew from strength to strength.

In addition to solving the census problem, Hollerith's machines proved themselves to be extremely useful for a wide variety of statistical applications, and some of the techniques they used were to become significant in the development of the digital computer. In February 1924, Hollerith's company changed its name to International Business Machines, or IBM.

Many references state that Hollerith originally made his punched cards the same size as the dollar bills of that era, because he realized that it would be convenient and economical to buy existing office furniture – such as desks and cabinets – that already contained receptacles to accommodate stacks of bills. Other sources consider this to be a popular fiction. Whatever the case, we do know that these cards were eventually standardized at 7.375 inches by 3.25 inches, and Hollerith's many patents permitted his company to hold an effective monopoly on punched cards for many years. (Hollerith, who was no one's fool, had quickly realized that the real money was not to be made in the tabulating machines themselves, but rather in the tens or hundreds of thousands of cards that were used to store data.)

Although other companies came up with innovative ways to bypass Hollerith's patents, they failed to capitalize on their advances, thereby giving IBM a chance to regain the high ground. For example, Hollerith's early cards were punched with round holes, because his prototype machine employed cards with holes created using a tram conductor's ticket punch. Hollerith continued to use round holes in his production machines, which effectively limited the amount of data that could be stored on each card. By the early 1900s, Hollerith's cards supported 45 columns, where each column could be used to represent a single character or data value.

This set the standard until 1924-1925, when the Remington Rand Corporation evolved a technique for doubling the amount of information that could be stored on each card. But they failed to exploit this advantage to its fullest extent, and, in 1929-1931, IBM responded by using rectangular holes, which allowed them to pack 80 columns of data onto each card. Although other formats appeared sporadically (including some from IBM), the 80 column card overwhelmingly dominated the punched card market from around the 1950s onward.

stack of cards, only to hear: *"We're a bit busy at the moment, can you come back next Monday?"*

So you left your cards with the operator and spent the weekend in delightful anticipation, but on returning the following week to collect your results, you'd probably receive a few inches of computer printout carrying the words: *"Syntax error on card 2: missing comma"*. Arrgggh – if the computer knew enough to tell that there was a missing comma, why didn't the callous beast know enough to stick one in for you? The result was that debugging even a trivial program could take weeks and weeks. In fact, by the time you eventually got a program to work, you were often hard-pushed to recall what had prompted you to write it in the first place!

Although punched cards are rarely used now, we endure their legacies to this day. For example, the first computer monitors were constructed so as to display 80 characters across the screen. This number was chosen on the basis that you certainly wouldn't want to display *fewer characters* than were on an IBM punched card, and there didn't appear to be any obvious advantage to being able to display *more characters* than were on a card.

Similarly, long after interactive terminals became commonly available, the formatting of certain computer languages continued to follow the rules laid down in the era of punched cards. To this day, many assembly languages have unnecessarily restrictive rules along the lines of *"Labels can only occupy columns 1 through 8."* Even the first high-level languages such as FORTRAN (an abbreviation of "Formula Translation") had comparable rules.

As a final example, consider the case of the program called *SPICE (Simulation Program with Integrated Circuit Emphasis)*, which is used by engineers for evaluating analog circuits. The first generation of this program appeared commercially around the beginning of the 1970s and its descendants are used to this day. The point is that it is still common practice to refer to the data used by this program as a "SPICE deck", which is a hangover from those times when such data was stored using punched cards ("deck of cards" – get it?). [Later versions of SPICE came equipped with a simple user interface called "Nutmeg." This name had no relevance other than the fact that nutmeg is a spice (Oh, how we laughed).]

Perforated paper products never die...

Finally, a word of caution. Perforated paper products never die, they simply fade away. Although the halcyon days for paper tapes and punched cards were certainly the 1960s and 1970s, do not be misled into believing that these media have completely exited the stage. In those days of yore, it was easy to spot anyone who had anything to do with computers, because their offices, briefcases, jacket pockets, and hands were usually overflowing with reels of paper tape and decks of punched cards (*"Holy paper products, Batman!"*).

However, although paper tapes and punched cards may seem delightfully antiquated, many institutions, including universities, continued to use these forms of data storage well into the 1980s, and both techniques are still to be found in the odd technological backwater to this day. Indeed, paper tapes continue to find a role to play in certain hostile environments. For example, in some manufacturing and heavy engineering facilities, computer-controlled machine tools may be located close to strong magnetic fields and electromagnetic noise. Many of today's storage technologies (such as floppy disks) tend to be corrupted in these conditions, but, much like the Energizer Bunny in the television commercials, paper tape products (especially modern varieties formed from materials such as Mylar) keep on going, and going, and going, and...

[Click Here](#) to see other articles in this "How it was..." series...

Editor's Note: *It would be great if – in addition to commenting on my articles – you took the time to write down short stories of your own. I can help in the copy editing department, so you don't need to worry about being "word perfect". All you have to do is to email your offering to me at max@CliveMaxfield.com with "How it was" in the subject line.*

I can post your article as "anonymous" if you wish. On the other hand, what would be really cool would be if you wanted to add a few words about yourself – and maybe even provide a couple of "Then and Now" pictures – for example:



On the left we see me as a young sprog – I was still a student at this time, poised on the brink of leaping into my first position at International Computers Limited (ICL). On the right we see me as I am today – a much older and sadder man, beaten down by the pressures of work and bowed by the awesome responsibilities I bear (grin).

If you found this article to be of interest, visit [EDA Designline](#) where – in addition to blogs on all sorts of "stuff" – you will find the latest and greatest design, technology, product, and news articles with regard to all aspects of Electronic Design Automation (EDA).

Also, you can obtain a highlights update delivered directly to your inbox by signing up for the EDA Designline weekly newsletter – just [Click Here](#) to request this newsletter using the Manage Newsletters tab (if you aren't already a member you'll be asked to register, but it's free and painless so don't let that stop you [grin]).

[EMAIL THIS](#) [PRINT](#) [COMMENT](#)

Comments

VIEW COMMENTS: [NEWEST FIRST](#) | [OLDEST FIRST](#) | [THREADED VIEW](#)

PAGE 1 / 2 > >>



re: How it was: Paper tapes and punched cards

Koda23 10/21/2011 6:10:07 PM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
AUTHOR

One of my first engineering jobs was at ROLM Mil-Spec Computers in Silicon Valley where I learned how to load a program on the Model 1602B minicomputer using a paper tape reader. The 1602B also had a front control panel with switches for loading and running small programs. Here's a webpage from a collector who has been able to obtain some of these computers: http://www.ph21.de/loef/My_Rolm.html

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



re: How it was: Paper tapes and punched cards

prabhakar_deosthali 10/16/2011 11:07:42 AM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
AUTHOR

This article brings some nostalgic memories of my first encounters with computers in 1974. In the Atomic energy establishment in India where I joined as a trainee engineer we had to study FORTRAN PROGRAMMING. There was a huge Russian computer which we could never see as it was in a restricted area at 15 degree centigrade. There was a huge area where about 25 card punching machines were installed. We used to punch the program on those machines, prepare our tiny deck of cards and put it into a tray for the operator. As per the batch timing we used to get the output of our programs (always some fatal errors!) The printout used to be in Russian in half legible letters. Later on a smaller computer in our lab I used paper tapes to store my programs.

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



re: How it was: Paper tapes and punched cards

Jeff.Petro 10/16/2011 10:23:23 AM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
 AUTHOR

My first experience with punch cards was in the mid 70's and a few select students in our grade 5 class got to go to the local university to see a real computer. At that impressionable age, everybody was just fascinated by this high tech storage mechanism. Stacks an stacks of cards were in boxes and the operator let us each take home some for ourselves. Now they never did make it back into a computer. We had a much grander plan. Each one had a picture drawn on it that was just slightly different than the last. So why did we do this? Let me first bring back some childhood memories of your own. Do you remember 'Big-Little' books? And do you recall the 'Flip-It' movies each one had? [insert your flashback here] Those punch cards ended up being Flip-It movies of our own. But hey, we were 10 years old and would never own a computer like that. What else would we do with them?

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



re: How it was: Paper tapes and punched cards

David Ashton 10/16/2011 9:10:31 AM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
 AUTHOR

"on the 5 level TTY there was a 'NULL' key that sent all mark and only 1 space stop pulse, so the punched tape had only a sprocket hole." Think you are right there Glen, rings a strong bell. In an earlier post I told Max...I used to have a teleprinter tape that printed out "The Ballad of Eskimo Nell". Alas, I chucked it ten years ago when I moved out of Zimbabwe, along with a lot of Nixie tubes, some Quad electrostatic speakers and other things that would now be antiques....

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



re: How it was: Paper tapes and punched cards

Roger46 10/14/2011 6:58:47 PM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
 AUTHOR

As an FCC licensed amateur radio operator since 1958 and computer user since the 1960s I've had experience with all the paper data methods discussed. The "Morse" code table you provided is actually the "International" code developed in Europe around the same time as Morse's code here in the US for land-line telegraph. The International code is what has been used on radio since Marconi's time and what I learned using a code practice oscillator and it's what I still use on the air today. Actually, amateurs still use the code extensively. it's my favorite mode of operation on the shortwave frequencies since the equipment required is very simple yet effective even at very low transmitter power levels. Back in the 60s, when I was still in high school, I had a surplus model 15 teletype machine that I used with my radio setup. It used Baudot code which is still used on the air by some hams today, but it's now digitally generated rather than the noisy mechanical methods. When I went to college in the mid 60s, I took my first programming course and, of course, could be seen carrying boxes of Hollerith cards to the computer center. After college, in my work I used Genie time-share to do filter design and punched my fortran programs into 8 level ASCII tapes with a model 33 teletype. Been there and done all of it. 73 - K9LJB k9ljb.com

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



re: How it was: Paper tapes and punched cards

zeeglen 10/14/2011 6:01:54 PM

NO RATINGS
[LOGIN TO RATE](#)

USER RANK
 AUTHOR

Yes, wonderful old memories. Thanks Max, great article. Wonder how many kids actually sit down today with a code practice oscillator to learn Morse code? David, if I recall correctly on the 5 level TTY there was a 'NULL' key that sent all mark and only 1 space stop pulse, so the punched tape had only a sprocket hole. Been a long time, could be wrong. I remember making up a punched tape to the rhythm of 'Jingle Bells' that used the machine's kerchunk and bell sounds. Took a lot of planning and repeats, any screwups could not be fixed with the erasing letters code (5 holes) since that would destroy the rhythm. But it was a boring night shift in the Arctic, so I had lots of time to get it to work. Also remember the joke "Some girls like to hug and kiss, but my girl likes to go like this..." followed by several alternating repetitions of the figures/letters codes. Anyone familiar with the old TTYs knows the resulting print carriage mechanical movement. This could never be duplicated on a modern video display. I still have several feet of

fan folded 8 level tape (bit 8 = parity) left over from old times. I'm going to try to decode the first few bytes to see if I can remember what it is. Probably something from college daze...

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



USER RANK
AUTHOR

re: How it was: Paper tapes and punched cards

R G. Neale 10/14/2011 4:14:59 PM

NO RATINGS
[LOGIN TO RATE](#)

Max the M - I am afraid I do not have a physical example of an 80 column round-hole punched card, The reference below mentions the company Powers Samas, that later changed its name to ICT then ICL and an 80 Column card <http://www.computerhistory.org/revolution/punched-cards/2/4>
Quote ♦ In 1928 IBM switched to rectangular holes on 80-column cards. Powers-Samas in the UK continued to use round holes, and over the years had cards with 21, 26, 40, 65, and 80 columns. In the 1970s IBM introduced a 96-column card with very tiny round holes. ♦ Example of a Sperry Rand and Univac using punched cards with round holes can be found in these references.
<http://www.fourmilab.ch/documents/univac/cards.html>
<http://www.westwoodworks.net/HowItWas/BeforeComputers/index>

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



USER RANK
AUTHOR

re: How it was: Paper tapes and punched cards

Max The Magnificent 10/14/2011 2:28:18 PM

NO RATINGS
[LOGIN TO RATE](#)

I'd forgotten that you could use the hole combinations associated with different characters to spell out words on the paper tape It's amazing how much we forget -- that's why I started this series of articles -- the funny thing is that while I'm writing things down I start to remember more and more tidbits of trivia...

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



USER RANK
AUTHOR

re: How it was: Paper tapes and punched cards

Max The Magnificent 10/14/2011 2:25:34 PM

NO RATINGS
[LOGIN TO RATE](#)

I never saw those round-hole cards -- I must have missed them -- I joined ICL in 1980 -- do you have any examples in your possession?

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)



USER RANK
AUTHOR

re: How it was: Paper tapes and punched cards

David Ashton 10/13/2011 10:33:42 PM

NO RATINGS
[LOGIN TO RATE](#)

Nice article Max, brings back many memories. I used to deal with Baudot code tape a lot, and figured out how to use the dot patterns to print readable text on the tape using the holes like dot matrix printers. for instance to make an "O" you'd type CZZC. I forget how I managed to put the spaces in with no dots punched. So you could, for example, send someone a tape which said "HAPPY BIRTHDAY" though it would print out complete jibberish on the printer. It only worked over direct links or Telex, when I tried it though our message system the message handler put in extra CR and LF characters and messed it up.

[Reply](#) [Post Message](#) [Messages List](#) [Start a Board](#)

PAGE 1 / 2 > >>

GLOBAL NETWORK

[EE Times Asia](#) | [EE Times China](#) | [EE Times India](#) | [EE Times Japan](#) | [EE Times Taiwan](#) | [EDN Asia](#) | [EDN China](#) | [EDN Taiwan](#) | [EDN Japan](#) | [ESM China](#) |

Working With Us: [About](#) | [Contact Us](#) | [Media Kits](#)

[Terms of Service](#) | [Privacy Statement](#) | [Copyright © 2018 AspenCore All Rights Reserved](#)