WHICH COMPUTER?

Burroughs B80: a bargain system which grows and grows -

– you can buy a B80 for less than £14,000, yet it can grow into a giant system with little change to software. We examine this approach.

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The Burroughs B80 computer system.

BURROUGHS obviously employed a good industrial designer for the B80 project. The system has an L-shaped workstation with very clean lines and a good deal of uncluttered working space. The cabinet to the left of the operator contains bins into which the cassette and floppy disc drives can be slotted; the console display sits in the apex of the L, close enough to be perfectly legible but well out of the way of the work; and the spacious keyboard and muffled printer are located directly in front of the user.

The B80–30 models have the one-megabyte floppy disc as standard, so the cabinet on the left contains space for two diskette drives and two cassette units in its case. The B80–40 does not have built-in disc storage—the B80 cartridge disc drives are free-standing, as are the add-on diskette options, so the cabinet on such configurations has space for up to four cassette drives.

The keyboard is laid out in accounting machine style, with error message lights and control keys which will be familiar to users of Burroughs L Series VRCs. The keyboard includes 24 user-definable program select keys, another facility on the VRCs which appears to be well-liked by users.

Printer choice

There is a choice of printers on the workstation and neither is the kind of compact, slow-speed unit typically offered. Instead, you can have a 60cps matrix printer—a bi-directional printer offered with other Burroughs products, including the top end of the L range, the L9000—or a much more sophisticated 180cps printer, designed specially for the B80.

It has long been a tenet of Burroughs design that systems should have at least two printers wherever possible, to accommodate system messages without interrupting output printing. The impressively-sophisticated operating system of the B80 and the amount of system information it can generate make this an even more desirable requirement on this machine. So two plug-in line printers which can be operated in addition to the console printer are offered.

The 180cps console printer option is itself provided with the facility for multiple outputs. It can be supplied with two or three separate pin feeds. The principal one takes paper up to 27in. wide and prints a line of up to 256 characters.

Versatile

There is an extra feed on its left with 50 print positions and paper up to 6in. wide; in addition, there can be another to the right which prints 168 positions on paper up to 18in. wide.

It need hardly be said that this makes for considerable versatility. The narrow paper can be printing system information while customer documentation such as invoices is being output alongside related management information on the third paper feed.

The B80 can be configured with no VDU at all, though this is probably unlikely. In a minimal system of that kind the pin-feed on the left would be used as the output device for system messages.

Burroughs packaged the B80 configurations so that it is difficult to estimate exactly how much the additional flexibility of multiple pin-feeds adds to the cost of the system. The sample prices we requested, however, for a configuration with Self Scan display and twin 1MB shows very little premium for it:

B80 with 60 cps printer and
single pin-feed £13,500

B80 with 180 cps printer
and three pin-feeds. .£14,500

Self Scan

When a display is configured in the system, the standard model is a 256-character Self Scan unit. This is a cable-connected plasma panel display which differs from the more usual CRT display. For one thing, the Self Scan is thin and flat—plasma, or 'gas discharge' technology, forms characters by stimulating electrically a series of gas-filled cells, and the gas in them illuminates to form a dot of colour. An appropriate pattern of dots delineates a particular character.

Burroughs offers a conventional CRT display, the TD830. CRT units normally can display more characters on a screen and that has largely accounted for the longevity of CRT technology. The 830 can display up to 1,920 characters, plus an extra 'status line' of 80 character positions for use by system messages.

The TD730, another free-standing VDU available on the B80, is a larger Self Scan terminal. It displays up to 480 characters. As with the console screen, its display offers bigger and more legible characters than those on the CRT screen, but again there are fewer of them per screen.

Little restriction

On the other hand, all displays on the B80, including the system console, feature scrolling. In page mode, the output for a VDU is held in memory as separate 'pages', each equivalent in size to the capacity of the screen. Scroll mode treats the memory as contiguous and the screen size is seen as no more than a kind of window on to a much larger memory store.

So although you might be able to see only a limited number of characters at any time—256, 480 or 1,920 depending on which B80 display you have—that is not as much of a restriction as it might appear.

The basis of the B80 is

The B80 with three disc units, two printers and four cassette drives.

THE Burroughs B80 has been called the most important product from the company in the last decade. It had its formal launch some months ago but acquired only recently the commercial applications software which is allowing the company to promote it heavily.

As a stand-alone business minicomputer system, the B83 might seem like a powerful argument for not buying an IBM System/32. But can it make the most of that power?

what is sometimes called its Bartonian architecture. Barton was the chief designer of what became the B700. That computer was characterised by a novel approach to executing software, with microprogrammed interpreters being loaded into the system every time a different language or a operating system was required.

In this case the fundamental operating characteristics of the computer were changed for each operational environment. The system software did not have to include any redundant or irrelevant facilities, and the computer could be tailored effectively to fit the programs it runs.

This approach is featured in the B80 and other small Burroughs systems. The kernel operating system resides in the computer more or less permanently and when a specific programming language is to be implemented, a specialised set of functions is loaded from diskette or disc. Those functions are what Burroughs calls an interpreter and on the B80

SAMPLE PRICES

processor
64KB memory
keyboard
Self Scan display console
60 cps printer
2 1MB diskettes

MCP
Cobol
UTL
DCS
———————
£13,500 plus £1,100 per year
——— maintenance.

processor
128KB memory
180 cps printer
3 paper feeds
keyboard
Self Scan display console
2 1MB diskettes
2 cassettes
2 9.2MB cartridge discs
250 lpm line printer
4 TD830 VDUs

MCP
Cobol
RPG
UTL
MPL
DCS
———
£54,555 plus around £4,600
——— per year maintenance

this means there are separate interpreters for Cobol, RPG, the emulation of the L series VRCs, and the communications languages.

Multiple interpreters can operate concurrently under the MCP operating system. In practice, it means that several languages can be machine-resident at the same time. When the B80 is being used under ACSYS to run VRC programs, only one interpreter at a time can be active, and that would be L series Cobol or one of the two VRC assemblers.

Clever

The processor is a microprocessor, not quite at the top of its technology but optimised by some clever technical attributes like overlapped instructions, buffered addressable I/O channels, and hardware interrupts. None of those are exclusive to Burroughs, and neither, for that matter, is micro-programming to change the characteristics of the machine.

The overlapped instruction means that the processor can be fetching the next instruction while it is still decoding the preceding one and executing the one before that. The system includes up to 11 buffered I/O channels, though in its basic form only eight can be used—there is an extra-cost I/O extender to utilise the lot.

Buffering I/O obviously maximises throughput, since it ties up fewer system resources and in some measure allows operations to proceed in parallel. The hardware interrupt system also contributes in that it obviates the need for the processor constantly to be scanning the I/O buffers.

Again, hardware interrupts are nothing special in terms of minicomputer technology, but it makes for a sensible approach to the design of the small system.

The disc storage with the B80 is the other significant feature. The one-megabyte floppy disc is an extremely interesting development, produced specially for the B80. It looks like a conventional enough floppy disc and it measures 7.25 in, like a conventional diskette, but it stores data on both sides and at double standard densities, so that the capacity of what Bur-

roughs calls the Super Mini Disc is slightly over one megabyte.

The drive produced for it is also a cut above the usual. The average access time is one-third faster; data is transferred nearly half as fast again by comparison with the standard diskette. The double-density, double-sided diskette is not exceptional to Burroughs, but early B80 users do not appear to find the super-sensitivity reported of some other 1MB floppies. Data errors were no more frequent than with normal floppies at the installations we contacted.

The B80–30 can have two built-in drives for this Super Mini Disc. All B80 models optionally can attach up to two more dual-drive subsystems as free-standing units, which means a total of up to 6MB on-line.

Disc option

Burroughs also has a free-standing floppy disc option for what it calls Industry-Compatible Standard Mini Discs. They have previously been offered with the VRCs and the B700. Burroughs sees them very much as secondary storage, to be used only as a transfer medium for exchanging data with systems which do not have the 1MB diskette and cannot accept cassette data economically.

Up to four data cassettes can be incorporated into the workstation. They would normally be used to load data from an off-line data prep system—the AE501, probably —and to enter B80 programs, including some maintenance

and test functions. They are unlikely to be used for on-line storage, but could presumably be used for security dumps of disc files in an emergency, though each cassette stores only 330K bytes maximum, and the fastest data can be written to them is 1KB per second.

The provision of cassettes is aimed partly at the L series user. The B80 cassette reader can operate in NRZI or PE modes; the VRCs utilise NRZI recording but the industry standard is PE. An industry-standard PE cassette unit cannot read the NRZI cassettes from an L series VRC. How much of a consideration this should be is debatable—cassettes are hardly the preferable medium on this kind of system, even for an ex-VRC user, when both floppy and hard disc are available.

The VRC emulator on the B80 enables cassette files from a VRC to be loaded at a B80 and transferred on to its 1MB diskettes. They then run as conventional sequential-access files and there need be no change to programs transferred from a VRC.

Those hard discs are of only one type, dual-drive cartridge units offered as free-standing cabinets. They are, however, in two capacities—4.6 or 9.2 MB per unit—and a choice of three average access rates is offered. All discs on the B80 are removable.

Two additional disc subsystems may be configured on to the basic set-up of a B80 model. That means the B80–30, with its two built-in

Data storage on the B80

type	data cassette	standard diskette	SMD diskette	9480–12 disc	9480–22 disc	9481 disc
capacity per unit	330KB	243KB	1MB	4.6MB	4.6MB	9.2MB
average access	not applicable	343ms	266ms	80ms	145ms	100ms
data transfer	1KBps	31KBps	45KBps	194KBps	194KBps	194KBps
system price	—	—	£11,148 (for two drives)	£16,800	£15,940	£18,100

Note: The system prices quoted are for a B80 with 60cps printer and the relevant storage configured in the standard package to give some idea of the difference between the discs. Note that the SMD price includes two of the drives, so that £11,148 buys two megabytes of storage.

floppies, can attach up to 18.·4MB of external hard disc storage. The model 40 can have the 9·2MB as its standard medium, and adding two more lifts its maximum to 27.6MB.

Those discs offer performance and capacity which is respectable rather than impressive.

Eight channels

The basic B80 has eight I/O channels. Four of them are taken up by the standard input–output components, as follows:

- —console (visual display for output, keyboard for input)
- —printer (which could be 60 characters per second or 180)
- —cassette subsystem (can drive two cassettes in configurations which use the 1MB super mini discs; systems with conventional floppies or the cartridge discs can have four cassette drives on this channel)
- —disc subsystem (this can attach one dual cartridge disc storing 4·6 or 9·2 megabytes, or one or two floppy disc drives—the conventional version, or the 1MB super model).

That leaves four I/O channels, but there is an I/O extender option which adds three more.

The remaining channels can then be configured with one additional disc subsystem, two line printers, or one communication line apiece. You cannot have more than two extra disc subsystems, however, on a B80; that makes a maximum disc capacity of 27·6MB per configuration, assuming that all disc subsystems are driving the 9·2MB cartridge disc.

There is also an upper limit on line printers—you cannot attach more than two. Since the console printer can be as fast as 180cps, three speedy printers per system should be enough for most applications.

There is a maximum of four communications lines. They can be used to interface remote terminals or communicate with a remote processor in synchronous or asynchronous mode. Alternatively, they can be used to attach local terminals.

The communications lines are limited to 9,600 baud,

which approximates to a maximum throughput of 960 characters per second. That permits several VDUs to share a single line. Benchmarks have indicated that at least six displays can be run happily on one line without significant degradation in performance.

Three basic I/O terminals are proffered, though Burroughs will stress that any standard terminal from its catalogue can be attached to the B80. The three are the AE501, the TD730, and the TD830.

Burroughs announced a suite of business management systems with the B1700 and the basic application principles of those commercial packages have subsequently been implemented on the B700, B1800, and B800. The B80 will also get them in an Anglicised version and with the work being done by an outside software house. In fact, Burroughs went to CAP for the B80 implementation of BMS, which in view of that company's reputation augurs well for the result.

Head start

It should be stressed, of course, that CAP wrote B80 BMS under contract to Burroughs. Normally, there would be no direct contact between the software house and the B80 customer as part of the system acquisition. It is in the nature of software packages and of commercial operation, however, that amendments will always be necessary, so CAP expertise in B80 might well be attractive to the potential user looking for some expert applications work to get a B80 up and running.

CAP is not the only software house, however, with a head start in B80 systems. CMG has already implemented applications on the machine for customers.

The BMS package covers the basic business applications —sales, bought and nominal ledger; payroll; and order processing. The order processing naturally includes invoicing. The sales ledger offers open-item accounting among its less usual facilities.

These are real-time transaction processing packages. Several other BMS applications are also being converted

from packages available on the existing B700/800 and B1700/1800.

Our brief poll among users of the smaller Burroughs machines suggests that the BMS suite is well liked.

Incidentally, the initials CMS are widely used by Burroughs to promote the B80. CMS is Computer Management System, and as such it is an umbrella term for the B80 system software, as opposed to applications packages. Under CMS are the Languages, MCP, DCS, and the utilised.
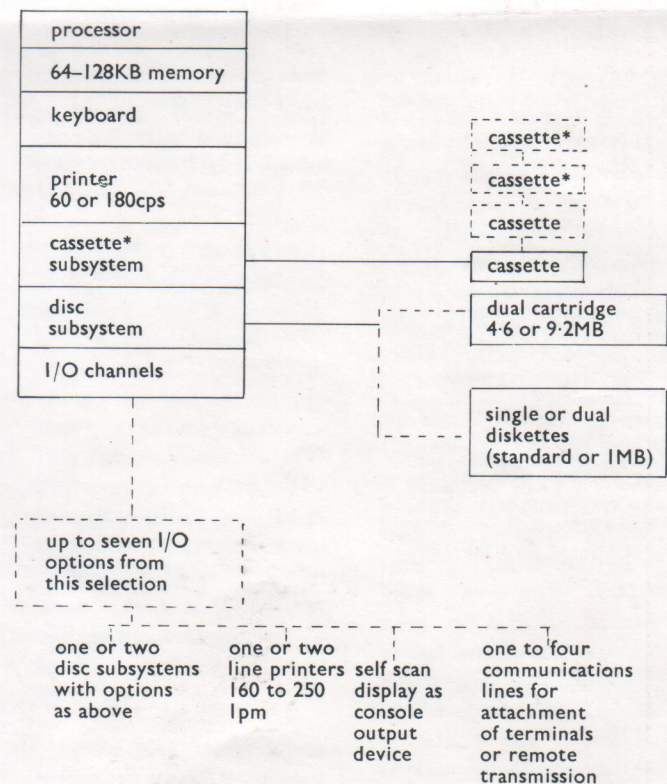
Processor and Memory

8-bit word. MOS memory of 64–128K bytes, expandable in 16KB increments. Memory cycle time is 1 microsecond

The process is nine LSI chips on a single printed circuit card, which makes it considerably more compact than most CPUs. It runs at one million cycles per second, which is reasonably fast; internal operations are also speeded up by the 'look-ahead' instruction overlapping (see text).

MCP needs 32KB and RPG and Cobol under MCP both take 40KB minimum. The ACSYS operating system emulates only VRC operation and so needs less memory for itself.

The B80 processor is also used in the AE501 (and other AE models), the TC5100 intelligent terminal, and the S1000 document processing system.

Configuration summary

| processor |
| 64–128KB memory |
| keyboard |
| printer 60 or 180cps |
| cassette* subsystem |
| disc subsystem |
| I/O channels |

cassette*
cassette*
cassette
cassette
dual cartridge 4·6 or 9·2MB
single or dual diskettes (standard or 1MB)

up to seven I/O options from this selection

one or two disc subsystems with options as above

one or two line printers 160 to 250 lpm

self scan display as console output device

one to four communications lines for attachment of terminals or remote transmission

Options indicated by dotted lines
* ... only one or two cassettes are configured on systems which use the integral 1MB diskettes. Only Model 40 has cassette as standard: an extra I/O option can alternatively be configured on Model 30.

System Console

256-character plasma display (8 lines of 32 characters in a 5×7 matrix)

Self-Scan display is a Burroughs trademark. The scrollable VDU displays 64 characters—no lower case—as red letters on a dark ground; it is used for system messages, responses to operator file enquiries, and to reflect keyboard input. The display is not strictly necessary but will probably be offered on most systems.

Keyboard (59 typewriter keys, 24 program select keys, 13 numeric keys, four special-function keys)

Based on the keyboard used for AE501 and L series VRCs among other Burroughs products.

Integral printer: can be 60 cps impact printer with 7×7 matrix, printing in 150 positions on paper up to 15 in. wide

Alternative printer is 180cps with 7×9 matrix, printing up to 256 positions on paper 27 inches wide. A third pin feed providing 168 print positions on 18 inch paper is optional

Both printers, in theory, are bi-directional, which maximises their output speed, and both will print an original, plus five carbon copies. A 64-character set is standard; 96 characters—which include lower-case—is an option. The current version of MCP does not support bi-directional printing on the 180cps unit: a future release will provide for this.

Workstation

System console as above, with built-in cassette drives and (B80–30) integral 1MB floppy disc drives

B80–30 has two cassette units, model 40—which uses 'hard' discs in its standard configuration—has four cassettes and no floppies.

TD 730 display terminal (8 lines of 32 characters) has 128-character set—lower-case as well as upper—and communicates at 9,600 bps

Scrollable Self-Scan display. Both this and the 830 (below) use the same electronics, with 4K or 8KB of local memory and optional built-in cassettes.

TD 830 display terminal (24 lines of 80 characters plus one status line) can have 64 or 128 character sets. It, too, communicates at 9,600 bps

More conventional CRT display, also scrollable. Status line is for system messages. CRT allows for more characters per screen and more highlighting features than the 730.

AE501 Audit Entry Data Preparation System is a key-to-cassette unit with its own microprocessor and 28KB of memory. Data is entered at its keyboard and validated before being stored on cassette (one or two drives); subsequently it can be transmitted as a batch to a computer (the B80, in this case) at 9,600 bps. Alternatively, a data cassette can be physically taken to the B80 and loaded

Incorporates the same microprocessor as the B80. Similar but newer models are AES11 (key to NRZ1 or PE cassette) and AES13 (key to 1MB diskette).

other standard Burroughs terminals can be attached

Including AE412/422, 3740-compatible key-to-diskette systems which can be on-line. These use the standard diskette.

Printers

Console printers at 60 or 180 cps (see above)

Chain-driven line printer at 160 or 210 lines per minute, using 17in. paper and printing in 132 positions. 48, 64 or 96 character sets.

TC4000 60 cps buffered printer, local or remote and with or without keyboard optional are cassette and Self-Scan display

Typical buffer is 256 characters but up to 6,144 characters of local memory is possible.

Mass Storage

Integral data cassettes storing about 330KB each

Between one and four cassette drives can be configured on B80–30, one or two on B80–40. Used for data transfer (e.g. from AE501), for program loading, and for maintenance and test functions.

Burroughs Super Mini Disc drives

Double-density, double-sided floppy disc drives with average access of 266 milliseconds—faster than conventional diskette—and data transfer at 45KBps. One or two integral drives on B80–30; free-standing versions available as add-on options for all B80 models.

These drives are formatted to store 180 bytes per sector, with 32 sectors per track and 88 tracks per side. With two sides that gives a maximum capacity of 1,013,760 million bytes per diskette.

Industry-Compatible Mini Disc drives

Free-standing floppy disc drives with a dual drive unit or two single drives interfaced to one controller—and one I/O port. They are standard single-density, single-sided diskettes storing 243KB each (128 bytes per sector, 26 sectors per track, 77 tracks per diskette). Average access time is 343 milliseconds; data transfer is at 31KBps.

Dual cartridge disc subsystem—4·6 or 9·2MB total capacity, access times 80 or 145 ms for 4·6MB and 100 ms for 9·2MB

Free-standing units which run two removable disc cartridges. Formatted to store 180 bytes per sector. Maximum capacity per B80 system is 27.6MB, which would be three 9·2MB drives; the B80–40 has any of these three disc units configured as standard in place of the built-in one-megabyte floppy disc drives.

Other Peripherals

"Standard Burroughs peripherals may be attached"

Peripherals also work with B800 and B1800, so upgrade is simply a processor exchange.

System Control Software

MCP Master Control Program

Virtual memory multiprogramming operating system which drives between three and 10 programs simultaneously, depending on configuration.

ACSYS

Emulates sequential storage on the L series VRCs—cassette data from VRCs is transcribed on to diskette or disc for the B80 and then run in sequential access mode. ACSYS supports only programs written in the assembly languages or the Cobol from the VRCs.

DCS Data Control System

File definition and enquiry language which provides most of the house-keeping required to create and maintain files; it also manages interactive data entry, file enquiries, and report generation. It supports data entry from cassette as well as keyboard.

UTL Utilities

Comprises 12 stand-alone utilities including sort, analysis of and reports on disc space utilisation, file copies, dumps, modifications, tape-to-disc transfers.

Reporter

Simple report generator language allowing user to customise management and other reports.

CONCLUSIONS

- The B80 is an ambitious attempt by Burroughs to develop a low-cost small business computer with on-line data storage. It is a genuine entry-level machine offering a clear upgrade path through the B800 and B1800. The use of MCP and Cobol are the essential elements here.

- Considered on its own merits, the B80 still impresses. In particular, the ease of operation has been commended. The operating system messages are unobtrusive but clear, the utilities very easy to understand and the keyboard attractively and sensibly designed. Its layout invites the user to press single keys rather than to type laborious commands.

- The internal organisation is equally impressive. The processor is not precisely at the leading edge of technology in terms of its performance, and an average cycle time of one microsecond is relatively slow for MOS memory, but the clever use of microprogramming and features such as the overlapping of instructions have enabled Burroughs to maximise throughput on this architecture.

- The double-sided, double-density diskette is another attractive facility, allowing data storage in random-access mode and in extremely compact form, without the price penalty of going to hard discs.

- Diskette in any case is a cheap, fairly robust and easily-transported way of storing data and programs.

- The B80 does not differentiate between files held on the Super Mini Disc and those on hard disc. All are treated equally, with neither the programmer nor the operating system having to cater for the physical organisation of data on different media.

- Both the 1MB diskette and the cartridge discs employ the same formating rules and the same 180-byte sectors—there are no device-specific commands. Note, however, that this does not apply to standard diskette and the cassette interface.

- Against this catalogue of praise must be placed a number of caveats. The system does not offer a large disc, presumably to prevent too much overlap with bigger Burroughs systems. There might be applications where a £26,000 130MB disc unit could usefully be attached to a single-user B80, but Burroughs would presumably direct such enquiries towards the B800. The B800, incidentally, is scheduled for review in its own right early next year.

- The B80 Bartonian approach to language interpreters is an elegant and efficient solution to the problem of executing code. It has been pointed out, however, that compilation can be tedious, particularly with Cobol. This seems to be a seven-pass compiler on the B80, and that means 1,000 lines of code have taken 45 minutes to compile for one user. Another has reported 2,000 lines taking 50–60 minutes.

- On the other hand, DCS is rated highly by development programmers. It appears to be easily learned and easy to use. Care must be taken, however, not to overstrain its capabilities. It is intended for data entry and the creation and maintenance of files, and for that it has proved a sound tool.

- The B80 has no back-up power supply, which could be critical. One of the few technical drawbacks to MOS memory is its volatility, which means the contents of memory are lost when power is shut off—a point emphasised dramatically by recent power cuts. More frequent are fluctuations in the electricity supply, which can also cause some contamination of data in memory. The provision of a back-up power supply, usually a battery, could save the time, cost and effort of re-entering and re-running data and programs.

- The message is that the B80 is not necessarily an appropriate machine for system development projects using Cobol. It might be better to develop programs for it in this language on a larger Burroughs system. The transferability of Burroughs Cobol is useful there, of course. Burroughs tells us that there are imminent plans to speed up the Cobol on the B80.

- There has been some criticism recently about Burroughs support, but it is our impression that support for the B80 will be adequate at the very

least. One extremely important consideration is the order for 2,000 B80s from the National Westminster Bank; they are being installed in branches around the country, and it is clear that neither NatWest nor Burroughs could afford to tolerate anything less than sound support on a nation-wide basis.

- Some aspects of support were especially commended by the users we polled. They liked the training courses, with operator training singled out as "very well prepared" and "impressively personalised to ensure that everyone grasped the point".

- Users also seem to like the MCP operating system, its operational procedures in particular.

- On the whole the B80 looks a strong contender if you are considering a small system—in which case it should probably be on your shopping list if you are considering the type of floppy disc system we reviewed in October.

- Competition must be much keener towards the middle of its range, where the likes of System/34, ICL System Ten, NCR 8230/8250 and a host of minicomputer-based configurations are being promoted heavily. Burroughs argues that is where the B800 becomes competitive and where the upwards-compatibility of the B80 begins to count.

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