

AUERBACH

**Guide to
Small Business
Computers**



AUERBACH COMPUTER TECHNOLOGY REPORTS

AUERBACH looseleaf reference services provide all of the essential information you need for the evaluation and selection of EDP systems, data communications devices, peripherals, software, and time sharing services. In addition to comprehensive reports on individual equipment, each service contains tables and charts for rapid comparisons of components and configurations, capabilities and limitations, prices, performance, and other features that can make your EDP operation more profitable. Listed below are the major units of AUERBACH Computer Technology Reports.

- *Standard EDP*—An eight-volume set which provides encyclopedic, highly detailed reports on the major U. S. computer systems. Hardware and software are evaluated in standardized formats that enable you to directly compare competing alternatives. Benchmark problems are used to measure overall system performance in typical commercial and scientific applications. Updated monthly.
- *EDP Users' Notebook*—A three-volume, current awareness Notebook for the user of U.S. computer systems. It contains detailed reports on general-purpose computers, small business computers, and minicomputers; commercial system software packages, major and independent peripherals; and data communications terminals. In addition, it provides search charts which pinpoint the characteristics and capabilities of 1,000 different computer systems, peripherals, and communications terminals. Designed as a working tool for the DP manager. Updated monthly.
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- *Software Reports*—A service on proprietary software packages presenting detailed information on the operation and implementation of specific software packages as well as in-depth definitional reports on computer applications. Comparison charts assist the user in the selection of packages. Updated monthly.
- *Minicomputer Reports*—Covers small business computers, minicomputers, and intelligent terminals. The information is presented in detailed reports and easy-to-use comparison charts. Current pricing for each minicomputer is also listed. An abridged Notebook service is also available for both the Domestic and International markets. Updated monthly.
- *Input/Output Reports*—In 3 volumes, the Reports cover a wide range of computer support equipment, storage and retrieval systems, microform readers/printers, plotters, industrial and retail data collection, and phototypesetters. The information is presented in analytical reports on individual products as well as easy-to-use comparison and pricing charts. Updated monthly.
- *Microform*—Single-volume coverage of COM, CIM, readers/printers, retrieval systems, microform camera, processors, and duplicators. Same detailed reports and chart data as Volume 3 of Input/Output Reports. Updated monthly.
- *Desk Reference Series*—Computer Characteristics Digest, Minicomputer Characteristics Digest, and Data Communications Equipment Digest. Each is a concise compilation of comparison charts and price data from the corresponding looseleaf Computer Technology Reports. The Digests meet the need for convenient, single-volume references that are used as quick sources of the products and services available. They are completely revised and reissued every 6 months.
- *Data Processing Manual*—A new service that helps you solve daily problems in general management, DP administration, system development, standards, practices, and documentation, operations, and technology. A practical and handy set that is constantly useful. In portfolio format, issued monthly.

AUERBACH GUIDE to

Small Business Computers

The material contained in this publication
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an analytic reference service that provides
comprehensive coverage of
the information processing industry.

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PREFACE

PREFACE

The prudent traveler to a foreign land packs a guidebook along with his checkbook, operating on the principle that what you don't know is almost certain to hurt you. Most small businessmen trying to come to grips with the world of the computer are entering a strange new land, which may be full of opportunity but also has its share of hazards. The novice needs advice and guidance, yet the vast bulk of the available literature concerns itself with medium and large computer systems, and is usually presented at a level that can only be digested by the technically sophisticated.

The AUERBACH Guide To Small Business Computers presents information in several levels of detail. A special report explains to the small businessman how to go about evaluating and selecting his own SBC. Each major SBC and some minor ones are covered in a separate analytical report.

The reader can look through the Table of Contents for a system which interests him. If the reader wants a quick view of the SBCs available on today's market, he should check the search chart. Should he want a brief overview of a specific system, he can consult the specification charts, which compare physical characteristics and performance for each system component. For more detailed information on a manufacturer's components, the reader should go to the individual product reports. One of a user's main concerns in choosing an SBC will be price, so the different vendor cost arrangements have been combined into a single price list, which also includes information about vendor-maintenance charges. When the user has evaluated the SBCs and selected the ones that seem most likely to fulfill his needs, he can consult the list of suppliers for addresses and phone numbers.

This selection guide presents the following information:

- Device Reports
 - Text: describes characteristics of various small business computer systems. Each product report begins with a summary and then discusses configuration, software, design features, performance, maintenance, and company history.
 - Product Specifications: a chart that summarizes information on the components' performance, capacity, and design.

- Charts — provide a quick way to compare the SBCs covered in the product reports.
 - Search: lists the major peripheral devices and programming languages for all SBCs available on the market. The reports are a selection of this material.
 - Specification: highlights of each component's technical specifications; use these to get a quick side-by-side comparative overview of each SBC system.
- Pricing Data — discusses each vendor's lease/purchase arrangement, conversion-to-purchase options, and any overtime or maintenance restrictions. Detailed price lists are also included.
- Suppliers: an alphabetical directory of SBC vendors.

To use the guide effectively, it is important to know what information is contained in each product report. Separate sections discuss a device's advantages and marketing, configuration possibilities, facilities requirements, performance characteristics, and service. The company's background is also covered.

The Summary or Overview gives the name of the company marketing the SBC, its special capabilities or unique features and their significance to the user, as well as the user group most likely to benefit from a particular SBC. The Performance section evaluates the SBC's competitive position, performance capabilities, special strengths and weaknesses, as well as its impact on other systems in the marketplace. The company history is also included, telling the date the firm was established, its major business, and noting the growth of its SBC line.

The Configuration Guide identifies the major system components, states their performance as well as any relevant interface requirements, and lists available options. This section also gives information on such factors as capacities of main and auxiliary storage, data structure, and speeds of input/output devices.

The Software section identifies the major software available to the SBC under consideration. This includes discussions of the applications software offered by the vendor.

Since maintenance is another important aspect in selecting an SBC, a section of each report specifies the company providing maintenance and its experience.

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SEARCH CHART

Small Business Computers

MANUFACTURER AND MODEL NUMBER	Year of First Delivery	COVERED IN			MAX MAIN MEM	AUX STORAGE AND PERIPHERALS							PROG LANGUAGES			MAJOR MARKETS						
		Small Business	Minicomputers	Intelligent Terminals		Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States
Adler TA 10	71	X			X		X				X				X	X	X	X	X		X	
Adler TA 100	68	X			X		X	X	X	X	X				X	X	X	X	X	X		X
Adler TA 1000	73	X			X	X	X	X	X	X	X				X	X	X	X	X	X		X
ADS 2100	68	X			X		X	X	X	X	X				X	X	X	X	X	X		X
Allied Bus. Sys. Multibus	72	X			X	X	X	X			X	X			X	X			X			X
Bandata 4100	72	X			X				X		X									X		
Bandata 4200	71	X			X		X	X	X		X			X	X				X			
Basic Four 300	71	X			X	X	X	X	X	X	X			X	X	X			X		X	X
Basic Four 350	71	X			X	X	X	X	X	X	X			X	X	X			X		X	X
Basic Four 400	71	X			X	X	X	X		X	X			X	X	X			X		X	X
Basic Four 500	71	X			X	X	X	X	X	X	X			X	X	X			X		X	X
BCL Molecular 18	X				X	X	X	X	X	X	X	X	X	X			X		X		X	X
BCL SADIE				X					X	X	X			X					X			
BCL SUSIE	X			X					X	X	X			X					X			
Burroughs 700	73	X			X	X	X		X	X		X	X	X		X	X	X	X	X	X	X
Burroughs 1728	73	X			X	X	X		X	X		X	X	X		X	X	X	X	X	X	X
Burroughs 1712	X				X	X	X		X			X	X	X		X	X	X	X	X	X	X
Burroughs 1714	X				X	X	X		X	X		X	X	X		X	X	X	X	X	X	X
Burroughs 1726	X				X	X	X		X			X	X	X		X	X	X	X	X	X	X
Burroughs L2000	X			X				X	X	X		X			X	X	X	X	X	X	X	X
Burroughs L3000	X			X					X	X	X		X			X	X	X	X	X	X	X
Burroughs L4000	70	X			X				X	X	X		X			X	X	X	X	X	X	X
Burroughs L5000	70	X			X				X	X	X		X			X	X	X	X	X	X	X
Burroughs L7000	71	X			X	X		X	X	X	X		X			X	X	X	X	X	X	X
Burroughs L8000	X			X			X		X	X		X			X	X	X	X	X	X	X	X
Cascade Concept II Series	X			X	X	X		X	X	X	X		X	X						X		
Cascade Data 80/20	70	X			X				X	X	X		X			X				X		
Cascade Data 80/30	70	X			X				X	X	X		X			X				X		
Cascade Data 80/40	71	X			X	X		X	X	X	X		X			X				X		
Computata 500	X			X			X	X	X	X				X	X	X						X
Condon CB 100	X			X	X	X			X		X			X	X					X		
CTM 70	72	X			X				X	X	X			X	X		X					X
Datsaab D 5/10	X			X					X	X	X			X								X
Datsaab D 5/20	X			X	X	X			X	X	X			X								X
Datsaab D 5/30	X			X	X	X			X	X	X			X								X
Eldorado Electrodata Mdl 140	X			X	X	X		X	X	X	X			X						X		
Facit 6501	72	X			X	X		X	X	X	X			X		X	X	X	X	X	X	X
Facit Addo M15	73	X			X	X		X	X	X	X			X		X	X	X	X	X	X	X
Feiler	X			X			X		X	X				X								X
Four-Phase IV/40	73	X			X	X			X	X	X	X	X	X					X			X

SEARCH CHART — SMALL BUSINESS COMPUTERS

MANUFACTURER AND MODEL NUMBER	Year of First Delivery	COVERED IN			MAX MAIN MEM	AUX STORAGE AND PERIPHERALS							PROG LAN-GUAGES			MAJOR MARKETS						
		Small Business	Minicomputers	Intelligent Terminals		Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States
Four-Phase IV/70	71	X			X	X	X		X		X	X	X		X						X	
Fujitsu Facom Mate	71	X			X	X	X			X	X	X	X									X
Hermes Datasystem 210	73	X			X	X	X	X			X	X			X	X	X	X	X			X
Honeywell 53	68	X			X	X	X		X		X	X				X	X	X			X	X
Honeywell 55	66	X			X	X	X		X		X	X				X	X				X	X
Honeywell Series 100, Mdl 15	71	X			X	X	X		X	X	X	X	X	X	X						X	
Honeywell Series 50, Mdl 58	70	X			X	X	X		X		X	X	X	X	X						X	
Honeywell Series 200, Mdl 105	71	X			X	X	X		X	X	X	X	X	X	X						X	
Honeywell Series 200, Mdl 115	70	X			X	X	X		X	X	X	X	X	X	X						X	
Honeywell Series 2000, Mdl 2020	72	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
Honeywell 58	69	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Honeywell G105	69	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Honeywell G115	66	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Honeywell G118		X			X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X
Honeywell G120	66	X				X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
Honeywell G130	68	X				X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
Honeywell H115	70	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-GDC 505	72	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-2000 S	71	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-5000	70	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-6000	70	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-7000	72	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-8000	70	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hohner-9000	72	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hitachi Hitac 1	70	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
Hitachi Hitac 80/10	70	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM System/3 Mdl 6	70	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM System/3 Mdl 10	70	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM System/3 Model 15	74	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM 360/20 Submdl 5	69	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM 360/20 Submdl 6	71	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
IBM 370/115	74	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
ICL 1901	66	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
ICL 1901A	68	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
ICL 1901S	73	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
ICL 2903	74	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
ICS C-640	72	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IME 10001	73	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Insel MAEL 4000	70	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
ISE 10/32	73	X			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X

MANUFACTURER AND MODEL NUMBER	Year of First Delivery	COVERED IN			MAX MAIN MEM	AUX STORAGE AND PERIPHERALS						PROG LAN- GUAGES			MAJOR MARKETS							
		Small Business	Minicomputers	Intelligent Terminals	Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States	Other
ISE 20/64	73	X			X						X				X	X	X				X	
ISE 3000	72	X			X		X	X			X				X	X	X				X	
Kienzle System 800	65	X			X			X	X	X	X				X	X	X	X	X		X	
Kienzle 4300	73	X			X				X	X	X				X	X	X	X	X		X	
Kienzle 4500	73	X			X				X	X	X				X	X	X	X	X		X	
Kienzle 5000	68	X			X		X		X	X	X				X	X	X	X	X		X	
Kienzle 5600	69	X			X		X		X	X	X				X	X	X	X	X		X	
Kienzle 6000E	72	X			X	X		X	X	X	X				X	X	X	X	X		X	
Kienzle 6000M	72	X			X	X		X	X	X	X				X	X	X	X	X		X	
Kienzle 6000R	72	X			X			X	X	X	X				X	X	X	X	X		X	
Kienzle 6000S	68	X			X		X	X	X	X	X				X	X	X	X	X		X	
Kienzle 6100	72	X			X	X	X	X	X	X	X				X	X	X	X	X		X	
Litton 1220/1221		X			X					X	X					X	X	X	X	X	X	
Litton 1231		X			X				X	X	X				X	X	X	X	X	X	X	
Litton 1241		X			X		X			X	X					X	X	X	X	X	X	
Litton 1252		X			X		X			X	X					X	X	X	X	X	X	
Litton 1281		X			X			X	X	X	X				X	X	X	X	X	X	X	
LogAbax LX 2200	70	X			X		X		X	X	X				X	X	X	X	X	X	X	
LogAbax LX 4200	71	X			X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	
LogAbax LX 4100	72	X			X			X		X	X				X	X	X	X	X	X	X	
Mitsubishi Denke Melcom 81	68	X			X					X					X						X	
Mitsubishi Denke Melcom 82	68	X			X					X	X				X						X	
Mitsubishi Denke Melcom 83	69	X	X		X		X	X		X	X				X	X	X	X	X	X	X	
Mitsubishi Denke Melcom 84	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	
Mitsubishi Denke Melcom 88	71	X			X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	
NCR Century 50	71	X			X	X	X		X	X		X	X		X	X	X	X	X	X	X	
NCR Century 75, 101, 150		X			X	X	X		X	X		X	X		X	X	X	X	X	X	X	
NCR Century 100	68	X			X	X	X		X	X		X	X		X	X	X	X	X	X	X	
NCR 399																						
NCR N-500	65	X			X		X	X		X	X				X	X	X	X	X	X	X	
Nihon-Denke Neac 1210	67	X			X					X	X				X						X	
Nihon-Denke Neac 1240	67	X			X	X			X	X	X	X	X	X	X						X	
Nihon-Musen Jac 322	67	X			X				X	X	X				X						X	
Nihon-Musen Jac 322A	67	X			X	X			X	X	X				X						X	
Nihon-Musen Jac 110	67	X			X				X	X	X				X						X	
Nihon-Musen 110G	68	X			X				X	X	X				X						X	
Nihon-Musen 110K	69	X			X					X	X				X						X	
Nihon-Musen 120	70	X			X	X			X	X	X			F	X						X	
Nihon-Musen 120M/520	70	X	X		X	X	X		X	X	X			F	X						X	
Nihon-Shingo Pasca 3000	70	X			X	X			X	X					X						X	

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		Small Business	Minicomputers		Intelligent Terminals	Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States
Nixdorf System 820/15	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Nixdorf System 820/25	70	X			X		X	X	X	X	X		X		X	X	X	X	X	X	X	X
Nixdorf System 820/35	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Nixdorf 820/135	73	X			X		X	X	X	X	X	X			X	X	X	X	X	X	X	X
Nixdorf System 840/15	72	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Nixdorf System 840/25	72	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Nixdorf System 840/35	72	X			X		X	X	X	X	X		X		X	X	X	X	X	X	X	X
Nixdorf System 880/45	73	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Nixdorf System 880/55	71	X			X		X	X	X	X	X		X		X	X	X	X	X	X	X	X
Nixdorf System 880/65	72	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nixdorf System 880/85	72	X			X		X	X	X	X	X		X		X	X	X	X	X	X	X	X
Obbomatic		X			X																	
Oki-Denki Okiminitac 500		X			X										X							X
Oki-Denki Okiminitac 510		X			X										X							X
Oki-Denki Okiminitac 610		X			X										X							X
Oki-Denki Okiminitac 710		X			X					X	X				X							X
Olivetti P602	71	X			X		X	X		X	X				X	X	X	X	X	X	X	X
Olivetti P603	73	X			X		X	X		X	X				X	X	X	X	X	X	X	X
Olivetti P652	73	X			X		X	X		X	X				X	X	X	X	X	X	X	X
Olivetti Auditronic 730	71	X			X					X	X				X	X	X	X	X	X	X	X
Olivetti Auditronic 770	69	X		X	X				X	X	X				X	X	X	X	X	X	X	X
Olympia KC 7000	73	X			X										X	X	X	X	X	X	X	X
Philips Electrologica P350S		X			X										X	X	X	X	X	X	X	X
Philips Electrologica P351	70	X			X										X	X	X	X	X	X	X	X
Philips Electrologica P352	70	X			X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
Philips Electrologica P353		X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Philips Electrologica P354		X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Philips Electrologica P356		X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Philips Electrologica P358	71	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Philips Electrologica P359	71	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Praetor (Hohner) 5000	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Praetor (Hohner) 6000	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Praetor (Hohner) 8000	70	X			X		X	X	X	X	X				X	X	X	X	X	X	X	X
Qantel Answer System		X			X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Remington Rand OCS 1	72	X			X		X					X			X	X	X	X	X	X	X	X
Ricoh Ricom-8	71	X	X		X	X				X	X				X							X
Ricoh Typer 600		X			X					X	X				X							X
Ricoh Typer 240		X			X					X	X				X							X
Ricoh Typer 200		X			X					X	X				X							X
Ricoh Typac 16 B		X			X					X	X				X							X

MANUFACTURER AND MODEL NUMBER	Year of First Delivery	COVERED IN			MAX MAIN MEM	AUX STORAGE AND PERIPHERALS						PROG LAN- GUAGES			MAJOR MARKETS							
		Small Business	Minicomputers	Intelligent Terminals	Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States	Other
Ricoh Typac 8 B		X			X						X											X
Ruf Series 70	70	X			X	X	X	X	X	X	X				X		X					
Ruf Datensystem 40/41	73	X			X		X		X	X	X				X		X					
Ruf Datensystem 40/71	73	X			X		X	X	X	X	X				X		X					
Ruf Datensystem 70/11-14	70	X			X		X		X	X	X				X		X					
Ruf Datensystem 70/71-74	70	X			X		X	X	X	X	X				X		X					
Ruf Datensystem 80/15	73	X			X	X	X	X	X	X	X				X		X					
Ruf Datensystem 80/75	73	X			X	X	X	X	X	X	X				X		X					
Ruf Praetor 3000	69	X			X				X	X	X				X			X				X
Ruf Praetor 4000	69	X			X					X	X				X		X					X
Ruf Praetor 5000	69	X			X	X	X	X	X	X	X				X		X					X
Ruf Praetor 6000	69	X			X	X	X	X	X	X	X				X		X					X
Ruf Praetor 8000	69	X			X	X	X	X	X	X	X				X		X					X
Sharp Hayac - 3000	X				X																	X
Siemens System 404/3	70	X	X		X	X			X	X	X	X	X	X	X	X						X
Siemens System 4004/16	68	X			X		X	X	X	X		X		X	X	X	X	X	X			X
Siemens System 4004/26	68	X			X		X	X	X	X		X		X	X	X	X	X	X			X
Singer 5800	71	X			X			X		X	X					X	X	X	X	X		X
Singer System Ten	70	X			X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
Sumlock Comptometer R Series	70	X			X		X		X	X	X					X	X	X	X	X	X	X
Sumlock R3000	72	X			X				X	X	X				X				X			
Sumlock R4000	72	X			X				X	X	X				X				X			
Sumlock R5000	71	X			X		X		X	X	X				X				X			
Sumlock R6000	71	X			X		X		X	X	X				X				X			
Sumlock R8000	71	X			X		X	X	X	X	X				X				X			
Toshiba Tosbac 1250		X			X		X		X	X	X	X			X							X
Toshiba Tosbac 1200		X			X		X			X	X	X			X							X
Toshiba Tosbac 1100 D		X			X					X	X	X			X							X
Toshiba Tosbac 1100 E		X			X					X	X	X			X							X
Toshiba Tosbac RT-150	71	X			X					X	X	X			X							X
Triumph-Adler TA 10	71	X			X		X		X	X	X				X	X	X	X	X	X		X
Triumph-Adler TA 100	68	X			X		X	X	X	X	X				X	X	X	X	X	X		X
Triumph-Adler TA 1000	73	X			X	X	X	X	X	X	X				X	X	X	X	X	X		X
Uchida-Yoco Usac 2500	68	X			X	X	X		X	X	X				X							X
Uchida-Yoco Usac 1500	69	X			X	X	X		X	X	X			X								X
Uchida-Yoco Usac 720	71	X			X	X	X	X		X	X				X							X
Uchida-Yoco Usac 400	70	X			X	X	X			X	X				X							X
Uchida-Yoco Usac 300		X			X										X							X
Uchida-Yoco Usac 5010	61	X			X	X	X			X	X				X							X
Ultimacc Tape System	70	X			X	X	X			X	X	X			X				X			X

SEARCH CHART — SMALL BUSINESS COMPUTERS

MANUFACTURER AND MODEL NUMBER	Year of First Delivery	COVERED IN		MAX MAIN MEM	AUX STORAGE AND PERIPHERALS							PROG LANGUAGES			MAJOR MARKETS							
		Small Business	Minicomputers		Intelligent Terminals	Under 32K Bytes	32K Bytes and Over	Disc/Drum	Magnetic Tape	Magnetic Ledger	Punched Cards	Paper Tape	Char Printer	Line Printer	Cobol	RPG	Other	Fed. Rep. of Germany	France	Italy	United Kingdom	United States
Ultimacc Disc System	71	X																				
Unidata Business System	71	X			X	X	X		X	X	X				X						X	
Univac 9200	67	X			X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Univac 9200 II	X	X			X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
USAC System 720	73	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Wagner WACTRONIC	70	X			X			X		X	X				X	X						
Wagner WAC 40	72	X			X	X	X	X	X	X	X		X	X	X	X	X	X				
Wagner WAC 400	72	X			X	X	X	X	X	X	X		X	X	X	X	X	X				

EVALUATION AND SELECTION

Small Business Computers

INTRODUCTION

There is no ideal computer on the market, there is no small business computer with the lowest possible price/performance ratio, and there is not a computer that is best for a particular user application. On the other hand, there are many good computers available, there are many computers with good price/performance ratios, and there are probably several computers that can do a particular job well.

The problem is, how does one find which computers can do the job for the least overall cost? Unfortunately, selecting a computer for a specific job is not easy. However, if done without panic and without haste, the rewards of the search can include raising the staff's technical competence, understanding the individual application better, and building a firm foundation for the decision making that will accompany future developments in the application.

The wise selection of a computer depends on the selector's full knowledge of the application. A number of people are usually involved, and cooperation among the ultimate users is essential. This group of end users must develop a set of criteria for selecting a suitable computer; and these criteria must reflect the needs of each user's application area, expressed in computer terms. Because it is human nature for each to consider his needs more important than anyone else's, some member of the selecting group must be responsible for leading the group towards satisfactory compromises.

Developing selection criteria is an educational process, which can be the hardest part of the selection procedure. Application areas must be viewed in terms of how they are presently handled, what can be done better by computers, and what can be done in the future. Each person in the group must learn, from the functional point of view, what computers can do; he must come to understand that computers vary in architecture because manufacturers have designed them differently for good reasons, and he must learn to think of applications vis-a-vis computers.

The computer salesman does have something to contribute and what he says should be considered as input to the development of selection criteria and as an information source for his computer's characteristics. However, the potential user who lets computer salesmen tell him what his selection criteria should be is guaranteeing a less than satisfactory system barring a statistical accident, and is removing the solid foundation his personnel need to use the system satisfactorily once it has been installed.

The architecture of computers varies for good reasons; the computer salesman will detail these, but he cannot be expected to discuss the compromises his firm made to attain that architecture at a reasonable cost.

Architecture is not the only criterion in evaluating a small business computer. Cost is another factor as is the vendor's ability to support the installation with adequate maintenance service.

SMALL BUSINESS COMPUTER ARCHITECTURE

The major factors that distinguish one small business computer from another are the central processor and memory, input/output structure, interrupt systems, available peripheral devices, and software.

Central Processor and Memory

The central processor and memory determine to a large extent the computing power of a computer system. Important memory characteristics are word length, cycle rate, and size. Ideally, the word length should correspond to the data precision required by the application. The cycle rate determines the speed of the computer, but the user must beware of considering cycle rate alone. Also he should consider whether the instruction set's efficiency meets his specific application. What use is lightning-speed addition if a communications interface is needed and two or three input/output instructions are required for each input/output operation?

The memory size determines the complexity and size of programs the computer can run and the type of software that can be supported. Additional features that may be important are memory parity for checking data accuracy and memory protection for preventing important data from being inadvertently erased or modified.

Input/Output Structure

The input/output structure is a major factor in determining how efficiently a computer can distribute its processing power between input/output operations and internal processing demands. With an adequate balance the computer can optimize throughput (i.e., enter data into main memory, perform calculations or data manipulation, and output results to a suitable peripheral device).

The amount of processor time devoted to input/output operations is a function of the number of peripheral devices in the system, their frequency of use, and the execution time of the software

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input/output handler routines. Input/output requirements for the application must be carefully analyzed and the criteria defined to eliminate from consideration all computer systems that do not have the minimum input/output facilities for a particular function.

The basic input/output facility for a small business computer consists of a channel shared by a number of peripheral devices (party-line). The input/output channel consists of data lines and control lines that synchronize the operation of the central processor and slower-speed peripheral devices.

Important factors in considering how well an input/output channel will satisfy your needs are the number of devices the channel can support, the input/output instructions, and the facilities for determining which devices need servicing. In addition, the maximum allowable distance that devices can be placed from the central processor can be particularly important to small business environments, especially if the processor will be centrally located for access by peripheral devices distributed throughout various offices.

One of the most important factors in determining input/output rates and evaluating the input/output structure for a particular application is the means for identifying the device that requires service. Generally, this can be achieved via software only or in combination with hardware.

Software routines are available for polling each device, testing its readiness for information transfer, and transferring data between the device and the computer. If many devices are connected to the input/output bus, the necessity of executing a device identification software routine can markedly increase the response time to a service request, use processor time and memory space, and cut down the number of peripheral devices the system can handle. Because of these problems, a large number of small business computer systems include groups of external priority interrupt lines as options; each line can interface to one or possibly two devices and thus eliminate a long device identification software routine.

The function of an interrupt system is to signal the processor that something requires attention. A priority interrupt system establishes a hierarchy for the attention-getting signals. Interrupt signals normally suspend execution of the program in progress when the current instruction is finished and begin executing the interrupt servicing routine selected by the contents of a core location dedicated to the interrupt line.

Peripheral Devices Available

Most small business computer manufacturers do not make their own peripheral devices but buy standard devices and provide the controllers and interfaces to their particular system. Most peripheral devices used with small business computers are essentially the same as those used with larger computer systems. Whereas the high cost of these peripherals is not an inordinately large fraction of the overall system cost for medium to large-scale computers, they can be fairly costly compared to small business computer central processor costs. However, manufacturers are beginning to produce these devices specifically for smaller applications. As a result each year their cost diminishes and they are now becoming more practical for use with small business computers.

Peripheral devices available for small business computers consist of input devices, output devices, and auxiliary storage memory that provides bulk storage to augment the central processor's memory.

Data Input. Data input provides the mechanism for entering the data to be processed. Three approaches most commonly used in small business computer systems for the data input function are console keyboards, punched paper tape, and punched card. Console keyboards are used in the interactive mode of operation in which the operator enters transaction data directly into the system. Input speeds are primarily a function of the operator's keying rate, typically two to four characters per second. Punched paper tape and cards are used in the batch mode of operation. Tapes or cards are prepared off-line on equipment independent of the central processor. Tape and card approaches provide faster speeds than the keyboard since the data rate is determined by the reading speed of an electromechanical device as opposed to that of an operator. Recently, however, magnetic tape cassettes have been replacing paper tape.

Printed Output. Printed output is the mechanism for presenting the processing results to the user. Three principal types of printed output units are available in small business computer systems — carriage, serial, and line. The carriage printer is limited in its printing rate by the mechanical movement of the carriage past the print station while the serial printer is restricted by the mechanical movement of the print unit across a line. Greater speeds are achieved with line printers than with carriage or serial printers. Typical capabilities available are 5 to

20 and 10 to 85 characters per second for carriage and serial printers, respectively, and 100 to over 1,000 lines per minute for line printers.

Auxiliary Storage. The auxiliary storage subsystem provides the mechanism for maintaining and accessing a master file of accounts. The access rate to master-file records is an important indicator of the total throughput of a small business computer system since it determines the number of records which can be processed. The extensive range of performance capabilities in this subsystem generates broad variations in the performance of small business computer systems.

Four approaches most commonly used in small business computer systems for the master file function are: magnetic ledger cards, punched cards, magnetic tape, and magnetic disc. Magnetic ledger cards provide the minimum capability for a master file. The access rate to records is limited to less than one every 4 seconds with an operator retrieving each card and to approximately one record per second with an automatic card reader. While very slow in potential system throughput, the ledger card provides the capability to maintain an easily retrieved printed audit trail of all transactions relative to an account. This feature is an important advantage in many business applications.

Punched cards provide a higher access rate to the master file than magnetic ledger cards. However, punched card access rates are still limited by manual handling of the card decks and by the mechanical movement of cards in a reader. Magnetic tape and disc provide the highest performance in the auxiliary storage subsystem.

A precise comparison of the performance capabilities of the latter two alternatives for auxiliary storage is complex because many variables affect their performance. However, disc systems offer one unique advantage; they permit data to be accessed randomly rather than sequentially as with the other systems.

As a result, disc systems are more flexible and provide higher computer system throughput than tape, largely because they require fewer sorting and merging operations on the data files. Disc performance does have a price, in some cases from three to four times as much as tape systems with comparable storage, or as much as one cent per character of storage, but most users find that cost outweighed by the sharply improved performance.

Interfaces Available

A number of small business computer manufacturers provide interfaces to standard data communications devices and to sense and signal modules; these can turn an external device on/off or can sense the on/off state of an external device. Some of the larger manufacturers provide extensive amounts of data communications equipment as well as the software to support the equipment.

If the application requires interfaces to special-purpose devices, the selection criteria should include interface requirements. The cost of designing special interfaces can raise the price of an overall system to several times the initial small business computer cost.

Software

Software development for a specific application is the most frequently underestimated item in the computer budget. Because the cost of small business computers is small, most manufacturers do not provide much system software. The selection criteria should include the required software. Also consider the desired features for future as well as current needs.

If the manufacturer writes off software production costs in the hardware price, the system cost increases. On the other hand, if the user needs system software not produced by the manufacturer, the cost for its development must be added to the price of his computer. This cost will be much higher than if the manufacturer distributed a software charge over many computers. In other words, well-conceived system software is much cheaper to buy from the manufacturer than to develop, and the selection criteria should reflect this view.

What are the software selection criteria? Because software criteria are tied to an application area as closely as hardware criteria, they can vary from application to application. Despite the previous disclaimers, certain general software characteristics should be included in the software criteria.

Small hardware configurations lend themselves most readily to applications where repetitive tasks are performed. Because programs may require changing from time to time, however, even the smallest hardware configuration should have the facilities for changing programs and for developing programs and incorporating them

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in the system. The more the selection committee anticipates software changes, the more weight the group should give to the ease with which programs can be changed.

Utility routines should be supplied to debug source code and to edit output code. Input/output handlers should be provided. Loaders should be furnished to load all software supplied with the system and to load application programs.

Important system software components also include assemblers, compilers, and operating systems.

Assemblers. Assemblers are language translation programs that convert symbolic source language into numeric machine language usually with a one-to-one correspondence. The source language translated by an assembler is called the assembly language and is highly dependent on the computer's instruction set.

Assembly language programming is too complex for most small business computer users to perform themselves. However, assembly language capability can still be important for users who utilize packaged applications software rather than write their own programs. The flexibility of the packaged software is usually directly related to that of the assembly language.

Compilers. A compiler also translates source code into machine language, but each written statement in the computer language is translated into several machine instructions. Generally, the term "programming language" specifies the source language translated by compilers. Although programming languages are designed to be independent of any specific machine format, in most cases this goal is not completely achieved.

Compiler languages usually consist of terminology and procedures specifically to help the user write programs in a language capable of expressing concepts and relationships with which he is familiar. As a result, unless he is indeed a novice, the small business computer user can generally expect to write some programs in these languages. The two most common and useful programming languages available to business applications are Cobol, whose programs are stated in precise, easily learned English words and phrases, and RPG, a report generating language for producing programs that write reports in varying formats. Another language commonly encountered is Basic, which is used for interactive time sharing applications. Basic is so simple to learn and use that the novice programmer can begin writing programs almost immediately.

Operating Systems. An operating system is a comprehensive software facility consisting of a selection of routines that contribute to the efficient and convenient running of programs on a computer by assigning most housekeeping tasks to the computer and removing them from manual operator control.

A primary motivation for the use of operating systems results from the ability of computers to perform instructions at speeds that are orders of magnitude faster than a human being can ever achieve manually. Because of the complexity and variety of tasks an operating system is required to perform, however, the coding comprising an extensive operating system can occupy a significant portion of computer memory. Consequently, the development and growth of operating system technology are closely related to improvements in both computer memory and software technology.

The software that constitutes an operating system consists of a monitor or executive routine and a number of special-purpose housekeeping routines automatically controlled by the master routine. Actual facilities, however, vary widely. Some operating systems, designed to run on a minimum configuration system, provide only the bare essentials for controlling the operation of a computer; the user must code and insert any additional facilities desired. Other operating systems provide virtually complete control over the operating functions; operator communications with these operating systems is normally through job control statements entered via a dedicated systems device, such as a card reader, or perhaps through the console keyboard.

Operating systems for small business computers are particularly important for systems that include mass storage devices or are involved in interactive time sharing applications. However, a number of manufacturers don't offer operating systems, but incorporate control facilities via special hardware.

KNOW YOUR VENDOR

With increasing frequency, data processing personnel are selecting their equipment on the basis of vendor reputation. The ingredients that determine a vendor's reputation are hard to define. In fact, two equally perceptive users may strongly disagree about the qualities of a specific vendor or his products. However, there are factors that will help you determine a vendor's stability and responsiveness to his customers' needs.

You can gauge the past performance of a vendor by checking how long the firm has been in business. Presumably, an established firm has been providing satisfactory products to its customers. Additionally, the firm will probably remain in business and continue to provide service, maintenance, and product upgrading. However, a new product can have bugs even if introduced by an established vendor, so you should know when the product was first delivered. Then you can decide whether it's been in the field long enough to perform satisfactorily.

As part of your investigation of the firm, find out the location of its sales offices. You'll tend to get better service from a local vendor. Since the vendor is not necessarily the manufacturer, investigate this point and learn the manufacturer's history. For example, what other equipment does the manufacturer produce? Does he also sell equipment to other manufacturers who use his product as components in their own systems? (This particular market is commonly called OEM for original equipment manufacturer.)

A significant OEM market can be a plus factor in favor of the vendor. OEM business expands a manufacturer's production volume, lowers his costs, and can improve his profitability via a more positive cash flow. As a result, the manufacturer is more financially sound and has a greater probability of survival. In addition, OEMs tend to make more technical demands than end users. Consequently, a manufacturer's involvement with OEM business leads to increased technical expertise and further product improvements.

A large company can usually offer considerably more services than a small manufacturer. Yet, a novice user will be small potatoes to those same giants, whereas his trade may be more important to a smaller outfit. The vital point to keep in mind is that once the deal is concluded, you should try to avoid being little more than an account number to the computer manufacturer. So, from the outset, try to gauge each supplier's future interest in and responsiveness to your problems, based on as much face-to-face discussion as possible.

We've presented general guidelines, but it's a good rule to make a full investigation of the vendor. If you're not satisfied with the vendor's credentials, look elsewhere.

INSTALLATION AND MAINTENANCE

The quality of a vendor's maintenance and service facilities can be as difficult to quantify

as its reputation. But as mentioned in the discussion of vendor history, guidelines can give you some feeling for the type of service you can expect.

A number of vendors don't have their own maintenance facilities. Instead they contract with third-party firms to provide installation and maintenance service. This type of arrangement is a fairly recent innovation. According to our contacts in the user community, third-party maintenance firms generally offer no better or worse service than received from a vendor's maintenance personnel. The quality of service depends upon the specific firm.

It's very necessary to have good cooperation and scheduling between your staff and vendor field service personnel during the computer's installation. Unforeseen pitfalls can sometimes develop and delay installation. Before the equipment arrives, try to have some assurance against unexpected bugs. For example, rather than discontinue your old operation, continue with it until the new installation is working. However, this approach can sometimes be expensive since you'll be paying for two installations while only one is being used. A less expensive approach would be to check whether the vendor has a backup system located nearby. In case of delays, the backup system can be used while the new system is debugged. Even after installation, a backup system located nearby can prove useful in case your system malfunctions. In fact, if you know that a system similar to yours is located within a reasonable traveling distance, try to arrange reciprocal privileges, with each installation included in the other's disaster plans.

Another aspect of installation that should not be overlooked is the type of training provided by the vendor. Although most training can be provided by the vendor at his classroom facility, the vendor should also be expected to provide on-site training as part of the installation procedure. Training should be detailed and supported by first-rate manuals covering both the hardware and software. Well-organized, well-written documentation is also vital if your computer is ever to be used to its full potential.

Maintenance can include a variety of services. Ask the vendor to enumerate them. Are parts replaced free of charge? How often is preventive maintenance performed and when — prime shift only or at the user's convenience? How long must you wait between placement of a service call and arrival of a technical representative? Are there additional costs, such as traveling expenses? If so, how are these costs

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calculated? In determining expected down-time, find out the distance between your firm and a spare-parts depot.

A service representative can respond to your call in a short time if he's located nearby, so a list of the cities housing service centers is important. Additional information that impacts a firm's service capabilities includes the number of service representatives employed and the different levels of employee experience. Do customer engineers have prior experience with small business computers? How are customer engineers trained (formal class, on-the-job-training, etc.)?

PRICING CONSIDERATIONS

Most vendors offer a variety of pricing arrangements. The optimum price can vary, but it reflects a balanced mixture of lease duration, maintenance and overtime terms, and cost. Generally, vendors offer a choice of short-term leases that are renewable at less than yearly intervals or longer fixed-term leases that can extend from over one year to (in some cases) five years.

Short-term contracts benefit users who decide to cancel in favor of more technologically advanced or less expensive equipment because there is no penalty. Short-term leases can also be advantageous for users who want to operate a vendor's equipment on a trial basis to test the vendor's service and maintenance capabilities as well as the reliability and performance of the equipment. On the other hand, short-term leases have disadvantages. It is usually more expensive to rent by month than for a longer term. Additionally, the user is subject to more frequent price changes if he renews his lease during each short-term interval.

Although long-term leases (extending above one year) involve smaller monthly rental rates, do you want to commit yourself so far in advance? You are protected against price increases, but you can also be prevented from taking advantage of any price decreases.

If a customer breaks his lease, he incurs a penalty. Most vendors explicitly state the penalty for cancelling, but there's still a certain amount of latitude. One vendor assures us that his company doesn't exact a penalty for upgrading if his firm provides the new equipment. The company's spokesman also said that no penalty would be applied if his firm didn't market the upgrade equipment. In this case the vendor is offering a verbal guarantee, and could change his mind after you sign an agreement. However, a

check of the vendor's history and reputation should indicate his credibility.

If you decide to purchase the equipment after leasing it, can any of the rental money be applied to the purchase price? In other words, does the vendor offer a conversion-to-purchase option? If he does, you should know the formula. For example, a vendor may allow a customer to apply all rental payments to the purchase price. Other vendors set limits based on a percentage of the purchase price, the lease's duration, or the amount of rental already paid.

The overtime charge is another feature that varies in different vendors' leases. Some vendors offer unlimited usage. Others base the rental terms on a fixed number of hours per month, and charge an additional fee for use of the equipment beyond the specified time. Because overtime charges can be significant, remember to consider them when pricing a small business computer system.

Maintenance is usually included in the lease price, but maintenance hours vary and the price changes accordingly. Just like other employees, maintenance personnel expect to be paid a larger salary for working weekends and evenings. Consequently, the customer generally pays higher maintenance fees for service outside the normal five-day, 40-hour working week. Unfortunately, the normal working week is "prime time" for most computer installations. This results in a tradeoff decision. Should you pay extra for on-call maintenance during hours that won't interrupt your installation's activity, or should you pay a smaller fee and risk system downtime during your most productive hours? That decision depends on your own constraints and requirements.

CONCLUSION

Evaluating and selecting a small business computer is not a simple task. However, its complexity can be minimized if you proceed correctly. First, define the type of jobs your small business computer will be expected to perform. Next, establish a price ceiling based upon how much money you are willing to pay for getting the job done. Finally, match a system to these criteria.

To draw on the data processing experience of other businesses, check Table 1, which presents a summary of EDP costs encountered among five major industry groups. The table defines five standard SBC configurations, lists the typical size EDP staff employed and total annual EDP expenditures for each configuration, and relates

the company size within each industry group to each SBC configuration by listing a range of the number of personnel employed.

As an additional aid, we have prepared a

checklist for use during your evaluation and selection procedure. This should help you narrow the selection to several roughly similar computer systems, which can be studied further to gauge their relative value.

Table 1. SBC Configurations and EDP Costs for Five Major Industry Groups

Characteristics	Product Identifier				
	SBC-1	SBC-2	SBC-3	SBC-4	SBC-5
Data Input	Keyboard	Keyboard	Keyboard and/or low-speed punched card	Medium-speed punched card	High-speed punched card
Printed Output	Carriage printer	Serial printer	Serial or low-speed line printer	Low- or medium-speed line printer	High-speed line printer
Storage Media	Magnetic ledger	Serial (single-track) magnetic tape	Punched card, disc, or 7- or 9-track magnetic tape	Disc and/or magnetic tape	Disc and/or magnetic tape
Average Sales Price (\$)	20,000	40,000	60,000	82,500	113,000
Typical Rental (\$/mo)	300-600	600-1,200	1,200-1,600	1,600-2,200	2,200-3,000
Typical Size of EDP Staff	1-2	1-3	3-4	4-6	6-8
Total Annual EDP Expenditures (\$)	10,000-17,500	17,500-40,000	40,000-53,000	53,000-73,500	73,500-100,000
Employee Range					
Financial	13-23	24-53	54-70	71-97	98-131
Wholesale	32-56	57-129	130-171	172-237	238-322
Manufacturing	50-87	88-200	201-265	266-368	369-500
Retail	74-130	131-296	297-392	393-545	546-740
Transportation, Communications, and Public Utilities	38-66	67-151	152-200	201-278	279-378

EVALUATION AND SELECTION

SMALL BUSINESS COMPUTER SELECTION CHECKLIST

CORPORATE DATA

Headquarters _____ name
_____ address
_____ city, state
_____ telephone

National marketing contact _____ name
_____ title
_____ telephone

Local sales office _____ name
_____ address
_____ city, state
_____ telephone

Local marketing contact _____ name
_____ title
_____ telephone

Date system first announced _____
Date system first delivered _____
Number installed _____

Current System Users

<u>Configuration</u>	<u>Corporate Name</u>	<u>Address</u>	<u>Telephone</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Questions for References

Is vendor pleasant to deal with _____, have a good record of resolving problems _____, meet commitments _____, deliver system on time _____.

Vendor's Control over Product

Does he design _____, manufacture _____, inspect _____, test _____, recondition _____.

If subject to other firm's: Name _____,

Address _____, Telephone _____,

Functions performed _____.

HARDWARE SYSTEM

Central Processor

Model _____

Word size (bits) _____, Main memory size (Kbytes) _____,

Cycle time (μ sec) _____, Add time (μ sec) _____,

No. of instructions _____, Hardware multiply/divide _____,

Hardware multiple precision _____, No. programmable registers _____.

Addressing: Indirect _____, indexed _____, relative _____.

Interrupts: Hardware/software _____, no. levels _____.

Data Input/Output

<u>Type</u>	<u>Input/Output</u>	<u>Model No.</u>	<u>Speed</u>
Punched card	_____	_____	_____
Punched paper tape	_____	_____	_____
Magnetic cassette	_____	_____	_____
Line printer	_____	_____	_____
Character printer	_____	_____	_____
Other	_____	_____	_____

EVALUATION AND SELECTION

Auxiliary Storage

	<u>Model No.</u>	<u>Capacity</u>	<u>Speed</u>
Disc	_____	_____	_____
Drum	_____	_____	_____
Tape	_____	_____	_____
Magnetic Ledger	_____	_____	_____
Other	_____	_____	_____

SOFTWARE

	<u>Name</u>	<u>Description</u>
Assembler	_____	_____
	_____	_____
Compiler	_____	_____
	_____	_____
	_____	_____
	_____	_____
Operating System	_____	_____
	_____	_____
Application Library	_____	_____
	_____	_____
	_____	_____

USER SUPPORT

Coding Assistance	_____	
	<u>Title</u>	<u>Length (days)</u>
Training Courses	_____	_____
	_____	_____
	_____	_____
	_____	_____

	<u>Title</u>	<u>Type</u>
Documentation	_____	_____
	_____	_____
	_____	_____
	_____	_____

MAINTENANCE

Preventive

How often performed _____, days of week _____, hours _____.

Emergency

Quoted response time (hours) _____, hours of availability _____.

Customer Engineer Experience

Training: formal _____, on the job _____.

Prior experience: previous work with small business computers _____.

Backup Facilities

Location of alternate site with comparable installation _____
 _____.

Location of spare-parts depot _____.

PRICING POLICY

Installation charge _____

Cancellation penalties _____

Upgrade and downgrade: alternatives _____,
 restrictions _____,
 penalties _____.

Effect of future price change _____

Delivery guarantees _____

Performance guarantees _____

Purchase options _____

Order cancellation before delivery _____

Acceptance period (days) _____

Policy on replacement hardware _____

SPECIFICATION CHART

Small Business Computers

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SPECIFICATION CHART

Small Business Computers

SYSTEM IDENTITY	Basic/Four Model 300/350/400/500				Burroughs L2000/3000				
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	300/350/400/500 8 2 Core 8K-64K 1.0				NA 64 Integral Magnetic disc 1,024 5				
SOFTWARE Assembler Operating System Compilers	No Yes Basic				Yes Yes Cobol				
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps	
	2100 2200	2.1M 4.2M		NA NA	NA				
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps	
	6100 6200 6201 6202	Reel (9) Reel (7) Reel (7) Reel (7)	800 556/800 200/800 200/556	10,000 10,000 10,000 10,000	None				
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm	
	4100 4200	Reader (80-col) Reader (80-/96-col)		400 400/800	A595/596 A149	Reader Punch		100 19	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed	
	3100 3300	Dot matrix Line	132 132	165 cps 200 lpm	NA	Serial	150	20 cps	
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps	
	5100 5200	Reader Punch		300 75	A9122 A9222	Reader Punch		40 40	
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe		
	None					None			
OTHER PERIPHERALS; COMMENTS	Accounting machine terminal (Models 300/400/500); video display terminal (Model 350)								

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Burroughs L4000/5000				Burroughs L7000			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 64 Integral Magnetic disc 1,280 5				NA 16 Integral Magnetic disc 2,560-8,704 5			
SOFTWARE Assembler Operating System Compilers	Yes Yes Cobol				Yes Yes Cobol			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	NA				NA	5,120	15,360	
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps
	None				None			
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	A595/596 A149	Reader Punch		100 19	A149 A9114	Punch Reader		19 200
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA	Serial	255	20 cps	NA A9289	Serial Line	150/255 132	20 cps 60 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	A9122 A9222	Reader Punch		40 40	A9122 A9222	Reader Punch		40 40
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	Yes L5000 Only				Yes			
OTHER PERIPHERALS; COMMENTS								

- Not Applicable

NA Not Available

SYSTEM IDENTITY	Burroughs B700 Series Model 705 and 711				Burroughs B1700			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	705/71 8 2-8 Core 32K-40K 1.0				B1712 24 - Integrated circuit 6K-40K bytes 0.666			
SOFTWARE Assembler Operating System Compilers	No Yes Cobol; RPG				Yes Yes Cobol; RPG; Fortran; Basic			
DISC cartridge	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	A9480 A9481	4.6 mb 9.2 mb		193K 193K	9480	2.3M		NA
MAGNETIC TAPE cassette drive	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	A9490-25 A9491-2	Cassette 9	100 100	1,000 10,000	9381 Series	Reel (9)	800	10K/18K/ 36K
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	A9114-1 A9119-1 A9419-2 A9419-6	80-col 96-col 96-col rdr/pnch 96-col rdr/pnch		200 300 300/60 300/60	9115/9116 9119 9210 9319	Reader Reader Punch Read/punch/print		300/600 300 100 300/60
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	A9249-1 A9249-2 A988 A9247-2	Chain Chain Chain Train	132 132 120 120	90/60 lpm 180/120 lpm 164 lpm 400 lpm	9240 9245 9247 9249	Line Line Line Line	132 132 132 132	475/700 lpm 300/400 lpm 750 lpm 90/180 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	A9122-1 A9222-1	11/16 or 1 in. 11 or 1 in.		40 40	None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
					None			
OTHER PERIPHERALS; COMMENTS	AE300 Audit Entry				MICR reader-sorters; data communications			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Burroughs B1700				Burroughs B1700			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	B1714 24 — Integrated circuit 16K-65K bytes 0.666				B1726 24 — Integrated circuit 24K-98K bytes 0.666			
SOFTWARE Assembler Operating System Compilers	Yes Yes Cobol; RPG; Fortran; Basic				Yes Yes Cobol; RPG; Fortran; Basic			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	9480	2.3M		NA	9480 9486 9371	2.3M 47.8M From 7M		NA NA NA
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	9381 Series	Reel (9)	800	10K/18K 36K	9381 Series	Reel (9)	800	10K/18K 36K
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	9115/9116 9119 9210 9319	Reader Reader Punch Read/punch/print		300/600 300 100 300/60	9115/9116 9119 9210 9319	Reader Reader Punch Read/punch/print		300/600 300 100 300/60
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	9240 9245 9247 9249	Line Line Line Line	132 132 132 132	475/700 lpm 300/400 lpm 750 lpm 90/180 lpm	9240 9245 9247 9249 9240-3	Line Line Line Line Line	132 132 132 132 132	475/700 lpm 300/400 lpm 750 lpm 90/180 lpm 1,040 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS								

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Cascade Data System 80/20				Cascade Data System 80/30					
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	8000 8/16 1 Core 8K-16K/4K-8K 0.900				8000 8/16 1 Core 8K-64K/4K-32K 0.900					
SOFTWARE Assembler Operating System Compilers	Yes Yes RPG				Yes Yes RPG					
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps		
	None				None					
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps		
	4001	Cartridge	600 bpi	750	4001	Cartridge	600 bpi	750		
	4005	Cartridge	1,800 bpi	2,250	4005	Cartridge	1,800 bpi	2,250		
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm		
	None				6050	Reader		300		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed		
	6001	Serial Line	132	30 cps	6001	Serial Line	132	30 cps		
	6020		128	200 lpm	6010		132	90 lpm		
				6020	128		200 lpm			
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps		
	6080 6070	Punch Reader		60 300	6080 6070	Punch Reader		60 300		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe			
	None					None				
OTHER PERIPHERALS; COMMENTS	Console keyboard				Console keyboard					

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Cascade Data System 80/40				Eldorado Electrodata 140			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	8000 8/16 1 Core 8K-64K/4K-32K 0.900				ee200 8/16 256 Core 8K-32K 1.2			
SOFTWARE Assembler Operating System Compilers	Yes Yes RPG				Yes Keyboard exec Eldorado String Processor (ESP)			
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	4011	5M	195K	2002 IOMEC	5M	48K		
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	4001	Cartridge	600 bpi	750	Sykes	Cassette	1,000 bpi	456
	4005	Cartridge	1,800 bpi	2,250	Pec Pec	7 9	556/800 800	10K 10K
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	None			Documentation 200	Reader	300		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	6001 6010 6020	Serial Line Line Line	132 132 128	30 cps 90 lpm 200 lpm	Potter Data Printer	Line Line	132 132	132 lpm 600 lpm
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	6080 6070	Punch Reader	60 300	Digi-tronics	Reader	300		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe	Model	Capacity, char/stripe				
	None		None					
OTHER PERIPHERALS; COMMENTS	Console keyboard							

- Not Applicable

NA Not Available

SYSTEM IDENTITY	HIS Series 50 Model 58				HIS Series 100 Model 15			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	58-1 8 1-8 Core/ROM 5K-10K/7K 1.2/0.35				IMI560 8 3 Core 16K-64K 2 or 4			
SOFTWARE Assembler Operating System Compilers	Yes Yes Mini-Cobol				Yes Yes Cobol; Fortran; RPG			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	DSS 058	1.73M	156K/250K		DSS 164	2.8M	312K	
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				MTS 163/ 166	Reel (7; 9)	200/556/ 800; 800/ 1,600	60K
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	NA CPA 050	Reader Punch		100/200 120	NA NA CRZ 111	Reader Punch Reader		400/600 200 400
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA	Line	96/128	100/200 lpm	PRT 110/ 120/130	Line	120	600/780 1,100 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				PTR 100 PTP 120	Reader Punch		500 150
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Communications controller; digital display; optical mark reader				Magnetic ink document sorter; communications controller; console			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	HIS Series 200 Model 105				HIS Series 200 Model 115			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	106 6 2 or 3 Core 16K-32K 3.5				116 6 2 or 3 Core 16K-32K 2.75			
SOFTWARE Assembler Operating System Compilers	Yes Yes Cobol; RPG; Fortran				Yes Yes Cobol; RPG; Fortran			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	170-2 173-2	4.6M 9.2M	147,500 147,500		155 172 171 276-2	3.6M 9.2M 4.6M 74.8M	147,500 208,000 —	
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	204B-23/ 24	Reel (7)	200/556/ 800	9,200	204B Series	Reel (7/9)	200/ 1,600	149,300
CARDS	Model	Type	Peak Speed, cpm		Model	Type	Peak Speed, cpm	
	123 214-1 214-2	Reader Punch Reader/punch	400 100-400 400/100- 400		123 214-1 214-2 123-2 123-4	Reader Punch Reader/punch Reader Reader	400 100-400 400/100- 400 600 1,050	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	112-3	Line	120	650 lpm	112-3 122	Line Line	120	650 lpm 650-1,100 lpm
PAPER TAPE	Model	Type	Peak Speed, cps		Model	Type	Peak Speed, cps	
	209-2 210	Reader Punch	600 120		209-2 210	Reader Punch	600 120	
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Communications controller; console; MICR reader/sorter; OCR reader/sorter				MICR reader/sorter; OCR reader/sorter; remote terminals; teller terminals; console			

- Not Applicable

NA Not Available

SYSTEM IDENTITY	IBM System/3 Model 6				IBM System/3 Model 10			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	5406 8 Internal Core 8K-16K 1.52				5410 8 Internal Core 8K-49K 1.52			
SOFTWARE Assembler Operating System Compilers	No Yes Basic; RPG II				Yes Yes RPG II; Cobol; Fortran			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	5444 Models 1, 2, 3	2.45M	199K		5444 Mdl 1, 2, 3/A1, A2, A3; 5445	2.45M 2.45M 20.4M	199K 199K 312K	
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				3411/3410 Mdl 1 3411/3410 Mdl 2 3411/3410 Mdl 3	Reel (9) Reel (9) Reel (9)	1,600 1,600 (or 800) 1,600 (or 800)	20K 40K (or 20K) 80K (or 40K)
CARDS	Model	Type	Peak Speed, cpm		Model	Type	Peak Speed, cpm	
	5496	On-line data recorder	22		1442 Models 6, 7 5424-A1 5424-A2	Reader/punch Reader/punch Reader/punch	300/60; 400/120 250/60 500/120	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	5213 Models 1, 2, 3 2222 Models 1, 2	Serial Ledger card (serial)	132 220	85 cps 85 cps	1403 Models 2, N1 5203 Models 1, 2, 3 5471	Line Line Printer-keyboard	132 96 125	600/1,100 lpm 100/200/ 300 lpm 15.45 cps
PAPER TAPE	Model	Type	Peak Speed, cps		Model	Type	Peak Speed, cps	
	None				None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	CRT display station; MICR reader; off-line card sorter				Data entry keyboard; MICR reader; optical mark reader; off-line card sorter			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	IBM System/360 Model 20 Submodel 5				IBM System/360 Model 20 Submodel 6			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	2020 Submodel 5 8 Integrated channels Core 8K-32K 2.0				2020 Submodel 6 8 Integrated channels Core 8K-16K 3.6			
SOFTWARE Assembler Operating System Compilers	Yes No RPG				Yes No RPG			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	2311 Model 11 2311 Model 12	5.4M 2.4M		81,000 82,080	2311 Model 11 2311 Model 12	5.4M 2.4M		81K 82,080
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	2401/1 2401/2 2401/4 2415 Series	9;7 9;7 9;7 9;7	800* 800* 1,600* 800/ 1,600*	30K 60K 60K 15K or 30K	2415 Series	9;7	800/ 1,600; 200/556	15K (or 30K)
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	1442/5 2501/A1, A2 2520/A1 2520/A2, A3 2560 MFCM	Punch Readers Reader/punch Punches Reader/punch		91-360 600/1,000 500 500/300 500/91	1442/5 2501/A1, A2 2520/A1 2520/A2, A3 2560 MFCM	Punch Readers Reader/punch Punches Reader/punch		91-360 600/1,000 500 500/300 500/91
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	1403/2, 7 1403/N1 2203/A1	Line Line Line	132/120 132 120/144	600 lpm 1,100 lpm 350 lpm	1403/2, 7 1403/N1 2203/A1	Line Line Line	132/120 132 120/144	600 lpm 1,100 lpm 350 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	MICR reader; communications controller; Selectric typewriter. *All 7-track densities include 200 and 556; 2401 Mod 4 also has 800 on 7-track.				MICR reader; communications controller; Selectric typewriter			

- Not Applicable

NA Not Available

*For 9-Track Only

SYSTEM IDENTITY	Litton Automated Business Systems Models 1220/1221/1231/1241/1252				Litton Automated Business Systems Model 1281			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 40 16 Drum 2K-4K 0.5				NA 40 16 Drum 2K-4K 0.5			
SOFTWARE Assembler Operating System Compilers	Yes Yes No				Yes Yes No			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	None				None			
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				None			
CARDS	Model	Type	Peak Speed, cpm		Model	Type	Peak Speed, cpm	
	None				64	Reader	120	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	20/30	Serial	192	35 cps	20/30 33	Serial Serial	192 192	35 cps 35 cps
PAPER TAPE	Model	Type	Peak Speed, cps		Model	Type	Peak Speed, cps	
	NA	Reader/punch	50		NA	Reader/punch	50	
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	Yes				Yes			
OTHER PERIPHERALS: COMMENTS	Drum auxiliary memory for Models 1241, 1252							

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	NCR Century 50			NCR Century 100				
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	615-50 8 0 or 1 Rod (thin-film) 16K-32K 0.8			615-100 8 2 Rod (thin-film) 16K-32K 0.8				
SOFTWARE Assembler Operating System Compilers	Yes Yes Basic; Cobol; Fortran IV; Neat/3			Yes Yes Basic; Cobol; Fortran IV; Neat/3				
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	655-101	8.4M	108K	655-101	8.4M	108K		
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	633	Reel (9)	800/ 1,600	40K/80K	633	Reel (9)	800/ 1,600	40K/80K
	633-117	Reel (7)	200/556/ 800	10K/28K/ 40K				
	633-119	Reel (9)	800	40K				
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	682-100	Reader	300	682-100 686/687	Reader Punch	300 80-240/ 100		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	640-122	Line	132	200 lpm	640-102	Line	132	450 lpm
	640-132	Line	132	300 lpm				
	640-102	Line	132	450 lpm				
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	662-100	Reader	1,000	622-100 660-101 665-101	Reader Reader Punch	1,000 1,500 200		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe		Model	Capacity, char/stripe			
	None			None				
OTHER PERIPHERALS; COMMENTS								

- Not Applicable

NA Not Available

SYSTEM IDENTITY	NCR N-500				Codon CB100 Distribution Management System			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	C-517-1 48 1 Core 200-400 1,080				CB100 12 12 Core Disc 32K 13.5K 1.4			
SOFTWARE Assembler Operating System Compilers	Yes No No				DEAL Distribution Extended Assembler COS Codon Operating System RPG			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	None				CB 100	6.4M		1562K
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				CM 800	9	800/ 1,600	36K/72K
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	C-582-1 C-577-1	Reader Punch		100 100	None			
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	C-541	Line	96	125 lpm	CB 101 CB 102 CB 104 CB 105	Drum Drum Matrix Matrix	80 132 80 132	350 lpm 250 lpm 30 cps 165 cps
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	C-562-1 C-563-1 C-571-1 C-572-1	Reader Reader Punch Punch		650 50 120 30	—			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	N-500				None			
OTHER PERIPHERALS; COMMENTS					Up to 12 CRTs; 1,200 or 4,800 baud			

— Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Qantel Q Series				Qantel Q Series					
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	QA-2 8 12 Integrated circuit 4K 1.5				QB-2 8 12 Integrated circuit 8K 1.5					
SOFTWARE Assembler Operating System Compilers	Yes No No				Yes No No					
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps		
	MD-2	7.6M		142.5K	MD-2	7.6M		142.5K		
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps		
	MF-1	Reel (9)	800	10K	MF-1	Reel (9)	800	10K		
	MG-1	Reel (9)	800	10K	MG-1	Reel (9)	800	10K		
	MT-1	Car- tridge	1,600	5K	MT-1	Car- tridge	1,600	5K		
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm		
	AC-1	Reader		300	AC-1	Reader		300		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed		
	PD-1	Serial	132	132 or 220 cps	PD-1	Serial	132	132 or 220 cps		
	PB-1	Line	136	200 lpm	PB-1	Line	136	200 lpm		
	PC-1	Line	132	600 lpm	PC-1	Line	132	600 lpm		
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps		
	AD-1	Reader/punch		50	AD-1	Reader/punch		50		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe			
	None					None				
OTHER PERIPHERALS; COMMENTS	Communications controllers				Communications controller					

- Not Applicable

NA Not Available

SYSTEM IDENTITY	Qantel Q Series				Qantel Q Series			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	QC-1 8 12 Integrated circuit 16K 1.5				QD-1 8 12 Integrated circuit 32K 1.5			
SOFTWARE Assembler Operating System Compilers	Yes No No				Yes No No			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	MD-2	7.6M	142.5K		MD-2	7.6M	142.5K	
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	MF-1	Reel (9)	800	10K	MF-1	Reel (9)	800	10K
	MG-1	Reel (9)	800	10K	MG-1	Reel (9)	800	10K
	MT-1	Cartridge	1,600	10K	MT-1	Cartridge	1,600	10K
CARDS	Model	Type	Peak Speed, cpm		Model	Type	Peak Speed, cpm	
	AC-1	Reader	300		AC-1	Reader	300	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	PD-1	Serial	132	132 or 220 cps	PD-1	Serial	132	132 or 220 cps
	PB-1	Line	136	200 lpm	PB-1	Line	136	200 lpm
	PC-1	Line	132	600 lpm	PC-1	Line	132	600 lpm
PAPER TAPE	Model	Type	Peak Speed, cps		Model	Type	Peak Speed, cps	
	AD-1	Reader/punch	50		AD-1	Reader/punch	50	
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Communications controller				Communications controller			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Singer System Ten			Singer System Ten				
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	20-102 6 1-2 Core 10K-30K 3.3			20-104/20-106 6 2-20/3-20 Core 20K-110K 3.3				
SOFTWARE Assembler Operating System Compilers	Yes No RPG			Yes No RPG				
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	42	8M	229K	40 42	10M 8M	229K 229K		
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps
	None				45	Reel (7; 9)	800/556; 800	20K
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	None			30 35	Reader Punch	300 100		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	52	Line	132	110 lpm	50 52	Line Line	132 132	450 lpm 110 lpm
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	None			60 65	Reader Punch	275 150		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe		Model	Capacity, char/stripe			
	None			None				
OTHER PERIPHERALS; COMMENTS	Workstation 70; CRT 80; FAC; Disc Controller; I/O Channel			Workstation 70; CRT; FAC; JIS 100; Attend. Term. 105; Data Term. 900; Communications Term. 7102; SCA & ATA (20-106 only); Digital Clock				

- Not Applicable

NA Not Available

SYSTEM IDENTITY	Ultimacc Systems Disc Systems				Ultimacc Systems CRT/Disc Systems			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	Nova 1200 16 15 Core 8K-32K 1.2				Nova 1200 16 15 Core 8K-32K 1.2			
SOFTWARE Assembler Operating System Compilers	Yes Yes Basic; Fortran IV				Yes Yes Basic; Fortran IV			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	KBD1	5M		200K	CRD1	5M		200K
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				None			
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	None				None			
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA NA	Line Line	132 136	135 lpm 300 lpm	NA NA	Line Line	132 136	135 lpm 300 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Video (CRT) display station; teletype- writer; card and paper tape equipment also available				Teletypewriter; card and paper tape equipment also available			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Ultimacc Systems Tape System				Cascade Data Concept II Series			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	Nova 1200 16 1 Core 4K-32K 1.2				8001-8013 8; 16 — Core 8K-64K; 4K-32K; 16K-65K 0.900			
SOFTWARE Assembler Operating System Compilers	Yes Yes Basic; Fortran IV				Yes Yes RPG			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	None				412	5M		195,000
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	TRI-DATA 4196	Car- tridge	300 bpi	1.9K	421 4005	9 —	800/1,600 1,800	6000- 18,000 —
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	None				650 660	Reader Optical Reader		300 300
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	Litton Model 30	Serial	192	30 cps	601 610A 620 —	Console Matrix Line Line	132 132 128 —	30 cps 165 cps 200 cps 600 cps
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				760 675	Reader Punch		300 75
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None							
OTHER PERIPHERALS; COMMENTS					695-CRT 640 char display; 696-CRT 1,280 char display			

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Univac 9200				Univac 9200 II			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	9200 8 Opt mux Plated wire 8K-16K 1.2				9200 8 Std mux; opt selector Plated wire 8K-32K 1.2			
SOFTWARE Assembler Operating System Compilers	Yes Yes RPG; Fortran; Cobol				Yes Yes RPG; Fortran; Cobol			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	8410	3.2M		100K	8410 8411 8414	3.2M 7.25M 29M		100K 156K 312.5K
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps
	None				Uniservo VIC Uniservo12	Reel (7; 9) Reel (7; 9)	200/556/ 800;800 200/556/ 800;800/ 1,600	34.2K 68K
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	0711-00 0603-04	Reader Punch		400 75-200	0711-00 0603-04 0711-02 0716-97 0604-00 0604-99	Reader Punch Reader Reader Punch Punch		400 75-200 600 1,000 200 250
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	0762-00	Line	96 (min)	250 lpm (min)	0762-00 0768-00 0768-99 0762-02	Line Line Line Line	96 (min) 132 132 132	250 lpm (min) 900/1,100 lpm 1,200/1,600 lpm 840-2,000lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	0920-00	Reader/punch		300/110	0920-00	Reader/punch		300/110
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Card controller; remote batch terminal; data communications controllers; optical document reader				Card controller; remote batch terminal; data communications controllers; optical document readers; selector channel			

-- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Philips Business Systems P 351				Burroughs L8000			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	— 64 None Core 200 3.0				8200; 8300; 8400; 8500 16 6 MOS/LSI semiconductor 4,000-48,000 1.5			
SOFTWARE Assembler Operating System Compilers	PAL — —				No No Cobol			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	None				NA			
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				A 9490-25	Cassette	100	1000
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	Integrated	Reader		72	NA A 9114-1	96-col 80-col reader		NA 200 cpm
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	Integrated	Console	164	22.5 cps	A 9249-1 NA	Line Line	132 132	90 180
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				NA	5-, 6-, 7-, or 8-channel		NA
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Integrated card reader for reading in programs				Forms handler; communications; edged punched card; magnetic record reader (single or dual track)			

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Philips Business Systems P 352 and P 354				Philips Business Systems P 356, P 358, and P 359			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	— 64 None Core 400-1,000 3.0				— 64 4 Core 400-1,000 3.0			
SOFTWARE Assembler Operating System Compilers	PAL No SOL				PAL No SOL			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	P 140 P 141	256K 256K		NA NA	P 140 P 141	256K 256K		NA NA
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	P 160	Cassette	NA	NA	P 160	Cassette	NA	NA
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	Integrated P 110 P 115	Reader Punch Reader		72 50 270	P 115 P 110 Integrated	Reader Punch Reader		270 50 72
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	Integrated P 150	Console Serial	164 128	22.5 cps 22.5 cps	P 150 Integrated	Serial Console	128 256	22.5 cps 22.5 cps
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	P 120 P 125	Punch Reader		50 50	P 120 P 125	Punch Reader		50 50
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				— —	336 672 digits		
OTHER PERIPHERALS: COMMENTS	Integrated card reader for reading in programs; communications line adapter				Integrated card reader for reading in programs; communications line adapter			

— Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Victor Comptometer 820/07				Victor Comptometer 820/08			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 64 (core); 18 (rod) 1 Core; rod cell 16K; 512K 2.0				NA 64 (core); 18 (rod) 2 Core; rod cell 16K; 512K 2.0			
SOFTWARE Assembler Operating System Compilers	Yes No No				Yes No No			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	None				None			
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None				None			
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	None				None			
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA NA	Serial Dot matrix	132 —	15.5 cps 165 cps	NA NA	Serial Dot matrix	132 —	15.5 cps 165 cps
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None				090	Punch		25
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS								

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Victor Comptometer 820/10				Victor Comptometer 820/21					
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 64 (core); 18 (rod) 2 Core: rod cell 16K; 512K 2.0				NA 64 (core); 18 (rod) 5 Core: rod cell 16K; 1K 2.0					
SOFTWARE Assembler Operating System Compilers	Yes No No				Yes No No					
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps		
	None				None					
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps		
	732	Cassette	556	136	732	Cassette	556	136		
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm		
	031/800	Reader/punch		120/15 or 38	031/800	Reader/punch		120/15 or 38		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed		
	NA NA	Serial Dot Matrix	132 —	15.5 cps 165 cps	NA NA	Serial Dot Matrix	132 —	15.5 cps 165 cps		
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps		
	035/090	Reader/punch		200/25	035/090	Reader/punch		200/25		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe			
	None				None					
OTHER PERIPHERALS; COMMENTS										

— Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Victor Comptometer 820/23				Victor Comptometer 820/25					
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 64 (core); 18 (rod) 3 Core; rod cell 16K; 1K 2.0				NA 64 (core); 18 (rod) 4 Core; rod cell 16K; 1K 2.0					
SOFTWARE Assembler Operating System Compilers	Yes No No				Yes No No					
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps		
	None				None					
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps		
	732	Cassette	556	136	None					
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm		
	031/800	Reader/punch		120/15 or 38	None					
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed		
	NA NA	Serial Dot Matrix	132 —	15.5 cps 165 cps	NA NA	Serial Dot Matrix	132 —	15.5 cps 165 cps		
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps		
	035/090	Reader/punch		200/25	None					
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe			
	Yes				Yes					
OTHER PERIPHERALS; COMMENTS										

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Victor Comptometer 820/30							
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	NA 64 (core); 18 (rod) 6 Core: rod cell 16K; 1K 2.0							
SOFTWARE Assembler Operating System Compilers	Yes No No							
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	None							
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	732	Cassette	556	136				
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	031-800	Reader/punch	120/15 or 38					
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA NA	Serial Dot Matrix	132 —	15.5 cps 165 cps				
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	035/090	Reader/punch	200/25					
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe	Model	Capacity, char/stripe				
	Yes							
OTHER PERIPHERALS; COMMENTS								

— Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Digital Equipment Datatypes 300 Series				Digital Equipment Datatypes 500 Series					
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	PDP-8 family of computers 12 (2 char/wd) OMNIBUS Core 8K-32K 1.2				PDP-11 family of computers 16 (2 char/wd) UNIBUS Core or semiconductor 16K-128K 0.9					
SOFTWARE Assembler Operating System Compilers	None COS 300 Dibol (Mini-Cobol)				3 choices of operating systems: (1) COS 500 includes Macro assembler, RPG II, and Fortran IV compilers. (2) CTS 500 includes Basic-Plus compiler. (3) CDMS includes MUMPS compiler.					
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps		
	RK05-AA DECpack cartridge	3.2M		250K	RK05-AA RP03-AS (t/s)	2.4M (8-bit char) 40M (8-bit char)		188K 271K		
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps		
	TD8-EM	Reel	178	17K	TU 56 TU 10-EE TU 10-FE	3.9 9 7	140 800 200/556/ 800	10K 36K 9K-36K		
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm		
	CRF-8 (opt)	Reader		300	CR11	Reader		300		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed		
	LS8-EA LE8-JA (opt)	Line Line	132 132	60-210 lpm 245-1, 110 lpm	LS11-A LP11-JA (opt)	Line Line	132 132	60-210 lpm 245-1, 110 lpm		
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps		
	PC8-E	Reader Punch		300 50	PC11	Reader Punch		300 50		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe				Model	Capacity, char/stripe			
	None					None				
OTHER PERIPHERALS: COMMENTS	VT05 CRT keyboard; optional binary synch communications; foreground/background capability with 4 data entry terminals and batch processing				VT05 CRT keyboard; LA30 DECwriter data terminal; LT33-DC teletype ASR 33 hard- copy terminal with paper tape rdr/pnch. CTS 500 supports 16 time sharing users; CDMS up to 10 on-line users.					

- Not Applicable

NA Not Available

SYSTEM IDENTITY	HIS Series 2000 Model 2020				HIS Series 2000 Model 2030			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	2021 6 3 or 4 Core 24K-65K 2.75				2032 6 6 Core 40K-98K 2.0			
SOFTWARE Assembler Operating System Compilers	Yes Yes Cobol; Fortran; RPG				Yes Yes Cobol; Fortran; RPG			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	NA	9.2 to 149.6 mb/ controller		NA	NA	9.2 to 512.0 mb/ controller		500
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps
	204-B Series	9	200/556	10/20/30	204-B Series NA	9 9	200/556 200/556/ 800/1,600	10/20/30 149.3
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	NA NA	Reader Punch		400, 600, 1050 100-400	NA NA	Reader Punch		400, 600, 1050 100-400
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA	Line	NA	450, 650, 950, 1,100 lpm	NA	Line	NA	300, 450, 650, 950, 1,100 lpm
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	NA NA	Reader Punch		NA NA	NA NA	Reader Punch		NA NA
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None							
OTHER PERIPHERALS; COMMENTS	OCR; MICR; communications				OCR; MICR; communications			

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Burroughs B 1700				Singer System Ten			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	B 1728 24 — Integrated Circuit 16K-65K 0.667				20-101 60 3 Core 3K 3.3			
SOFTWARE Assembler Operating System Compilers	No Yes Cobol; Fortran; RPG; Basic				Yes No RPG			
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	NA	8.1M		NA	42	4M		229K
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	NA NA	9 7	NA NA	96K 72K	None			
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	NA NA	96-col Rdr/Pch 80-col Rdr/Pch		NA 800/300	31 35	Reader Punch		1,000 100
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA NA	Line Line	48 NA	400 lpm 1,040 lpm	53; 54 55; 56	Line Line	120 120	125; 200 300; 400
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	NA NA	Reader Punch		1,000 100	None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	Multiline controller, disc cartridge, MICR, console printer				Work station, CRT display, control adapters			

— Not Applicable

NA Not Available

SYSTEM IDENTITY	Four-Phase IV/40			Four-Phase IV/70				
CENTRAL PROCESSOR & WORKING STORAGE	CPU Model No. 4300; 4500 Word Length (bits) 24 I/O Channels 8 Type of Storage MOS/LSI Capacity (words) 24K Cycle Time (μ sec) 2			7001; 7002 24 8 MOS/LSI 8K; 32K 2				
SOFTWARE	Assembler Yes Operating System Yes Compilers Cobol			Yes Yes Cobol				
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	NA NA	290M (floppy) 2.5M (cartridge)	NA NA	NA NA NA	290M (floppy) 2.5M (cartridge) 50M (7002 only)	NA NA NA		
MAGNETIC TAPE	Model	Type (trks)	Char/In.	Peak Xfer, cps	Model	Type (trks)	Char/In.	Peak Xfer, cps
	None				NA NA NA	7 9 9	556/800 800 1,600	NA NA NA
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	None			NA	Reader	300		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	NA NA	Serial Line	132 132	30 cps 300 lpm	NA NA NA	Serial Line Line	132 132 132	30 cps 300 lpm 245-700 lpm
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	None			None				
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe	Model	Capacity, char/stripe				
	None		None					
OTHER PERIPHERALS; COMMENTS								

- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	IBM System/3 Model 15				IBM System/370 Model 115			
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	5415 8 Integrated attachments MOSFET 128K 1.5				3115 32 Intgrtd chnls; adptrs; opt byte mltplxr MOSFET 40K (160K bytes) 0.48			
SOFTWARE Assembler Operating System Compilers	Yes Yes RPG II, Cobol, Fortran				Yes Yes RPG II, Cobol Fortran, PL/1			
DISC	Model	Capacity, char/pack	Peak Xfer, cps		Model	Capacity, char/pack	Peak Xfer, cps	
	5442-A2 5445-1	4.9M 20.48M	199K 312K		3348 Mdl 35 Mdl 70	34.9M 69.8M	864K 864K	
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	3410/3411 Mdls 1 2 3	7;9 7;9 7;9	1,600/ 800/556 /200 (all models)	20K 40K 80K	3410/3411 Mdls 1 2 3	7;9 7;9 7;9	1,600/ 800/556 /200 (all models)	20K 40K 80K
CARDS	Model	Type	Peak Speed, cpm		Model	Type	Peak Speed, cpm	
	5424-A1 -A2 1442-6 -7 2560 MFCU	Read/Punch/Print Read/Punch Read/Punch	250/60/60 500/120/120 300/80 400/160 500/91		5425-A1 -A2 2560 MFCU	Read/Punch/Print Read/Punch	250/60/60 500/120/ 120/500/91	
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	1403-2 -5 -N1	Line Line Line	132 132 132	465 lpm 600 lpm 1,100 lpm	3203-1 -2 5203-3	Line Line Line	132 132 96; 120; 132	600 lpm 1,200 lpm 300 lpm
PAPER TAPE	Model	Type	Peak Speed, cps		Model	Type	Peak Speed, cps	
	None				None			
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None				None			
OTHER PERIPHERALS; COMMENTS	CRT display station; MCR; OCR				CRT display station: communications modems			

- Not Applicable

NA Not Available

SYSTEM IDENTITY	NCR Century 101			Qantel System				
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	615-101 32 2; 1 multiplexor Core 4K-16K 1.2			QA-2, QB-2, QC-1, QF-1, QD-1 8 12; 1 multiplexor Core 32K 1.5				
SOFTWARE Assembler Operating System Compilers	Yes NEAT/3; Fortran; Cobol; Basic; RPG			Yes RPG				
DISC	Model	Capacity, char/pack	Peak Xfer, cps	Model	Capacity, char/pack	Peak Xfer, cps		
	655-201 656-101 656-102	4.2M 4.9M 4.9M	108K 312.5K 312.5K	MD-1 ME-1 MP-1	7.6M 30.7M 61.4M			
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	633-117/119 633-111 633-211 633-311	7;9 9 9 9	200/556 /800 1,600 1,600 1,600	10/28/40K 80K 144K 144K	MF-1 MJ-1 MK-1 ML-1 MM-1	9 9 9 9 9	800 800 800 1,600 1,600	10K 20K 20K 40K 40K
CARDS	Model	Type	Peak Speed, cpm	Model	Type	Peak Speed, cpm		
	682-100 686 680-201 687-301	Reader Reader; Punch Reader Punch	300 560/750/800; 60-294 1,200 100	AC-2	Reader	500		
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	640-102 640-300 649-150	Line Line Line	132 132 132	450/900 lpm 1,200 lpm 150 lpm	PO-1 PB-2 PC-1 PE-1	Serial Line Line Line	132 132 24-132 132	100 lpm 200 lpm 1,120 lpm 1,800 lpm
PAPER TAPE	Model	Type	Peak Speed, cps	Model	Type	Peak Speed, cps		
	622-100 660-101 665-101	Reader Reader Punch	1,000 1,500 200	AD-1	Reader/Punch	50		
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe	Model	Capacity, char/stripe				
	None		None					
OTHER PERIPHERALS; COMMENTS	MICR, OCR			CRT display, control console, communications controller, key numeric input module				

-- Not Applicable

NA Not Available

SPEC CHART — SMALL BUSINESS COMPUTERS

SYSTEM IDENTITY	Singer 6800 System							
CENTRAL PROCESSOR & WORKING STORAGE CPU Model No. Word Length (bits) I/O Channels Type of Storage Capacity (words) Cycle Time (μ sec)	20 60 2 Core 30K 3.3							
SOFTWARE Assembler Operating System Compilers	Yes No RPG							
DISC	Model	Capacity, char/pack		Peak Xfer, cps	Model	Capacity, char/pack		Peak Xfer, cps
	42	4M		229K				
MAGNETIC TAPE	Model	Type (trks)	Char/ln.	Peak Xfer, cps	Model	Type (trks)	Char/ln.	Peak Xfer, cps
	None							
CARDS	Model	Type		Peak Speed, cpm	Model	Type		Peak Speed, cpm
	None							
PRINTERS	Model	Type	Columns	Peak Speed	Model	Type	Columns	Peak Speed
	52	Line	132	110 lpm				
PAPER TAPE	Model	Type		Peak Speed, cps	Model	Type		Peak Speed, cps
	None							
MAGNETIC STRIPE LEDGER CARDS	Model	Capacity, char/stripe			Model	Capacity, char/stripe		
	None							
OTHER PERIPHERALS; COMMENTS	Model 70 Workstation; Model 80 CRT							

— Not Applicable

NA Not Available

PRICE DATA

Small Business Computers, A-C (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
	BASIC/FOUR				L4311-409	(384 user words)	448	13,590	NA
	CENTRAL PROCESSOR & WORKING STORAGE				L4311-609	(512 user words)(2)	481	14,590	NA
					L4312-909	(768 user words)(2)	514	15,590	NA
350	Central Processing Unit (8K; with video display terminal; 2100 disc system; 3100 printer)	680	30,900	183	L5000	Processors (with keyboard)			
					L5012-619	(608 user words)	660	19,990	NA
400	Central Processing Unit (8K; with video display terminal and/or accounting machine terminal; 2100 disc system; 3100 printer)	702	31,900	186	L5112-689	(608 user words)(2)	710	21,500	NA
					L5112-619	(608 user words)(2)	759	22,900	NA
500	Central Processing Unit (8K; with video display terminal and/or accounting machine terminal; 2100 disc system; 3100 printer)	724	32,900	189		INPUT/OUTPUT FOR L2000/3000/4000/5000			
						<u>Punched Card</u>			
	MASS STORAGE				A595	Card Reader	97	2,950	NA
2200	Disc System (4.2 mc)	219	9,950	60	A596	Card Reader	115	3,490	NA
					A509	Card Punch Control Unit	33	1,000	NA
					A149	Card Punch (GPV product)	120	5,990	NA
	INPUT/OUTPUT					<u>Card/Tape</u>			
	<u>Printers</u>				A581	Paper Tape/Edge Punched Card Reader	46	1,390	NA
3101	Printer (60 lpm)	142	6,450	55	A562	Paper Tape/Edge Punched Card Perforator	52	1,590	NA
3400	Printer (200 lpm)	219	9,950	66		<u>Magnetic Tape</u>			
	<u>Punched Card</u>				A1495	MTU and Controller	365	11,500	NA
4100	Card Reader (400 cpm; 80 col)	98	4,450	61		<u>Document Reader</u>			
4200	Card Reader (400 or 800 cpm; 80/90 col)	109	4,950	61	A4005	Magnetic Record Reader (L5000 only)	148	4,490	NA
	<u>Paper Tape</u>					CENTRAL PROCESSOR & WORKING STORAGE			
5110	Paper Tape Reader (300 cps)	98	4,450	26	L7000	Processors (with console)(3)			
5200	Paper Tape Punch (75 cps)	98	4,450	26	L7300-300	Processor	495	15,000	62
	<u>Magnetic Tape</u>				L7300-350	Processor	500	15,150	63
6100	Magnetic Tape System (9-track; 800 bpi)	175	7,950	68	L7400-400	Processor	541	16,400	64
6200	Magnetic Tape System (7-track; 800/556 bpi)	175	7,950	68	L7400-450	Processor	546	16,550	65
6201	Magnetic Tape System (7-track; 800/200 bpi)	175	7,950	68	L7500-501	Processor	843	25,550	86
6202	Magnetic Tape System (7-track; 556/200 bpi)	175	7,950	68	L7500-551	Processor	848	25,700	86
					L7500-502	Processor	888	26,900	94
					L7500-552	Processor	893	27,050	95
	DATA COMMUNICATIONS					<u>Processor Options</u>			
7200	Video Display Terminal (Models 400 and 500)	109	4,950	23	A2311	Extended Memory Controller	42	1,275	3
7400	Executive Display Terminal	54	2,450	20	A5400	Scratchpad Memory Module (32 words)	15	45	1
	*****				A7311	Extended Memory Module Control	6	175	1
					A7312	Cable for Third Extended Memory Module	7	200	1
					A9371	Extended Memory Module (2,048 words)	83	2,500	5
	BURROUGHS L SERIES					INPUT/OUTPUT FOR L7000			
	CENTRAL PROCESSOR & WORKING STORAGE					<u>Punched Card</u>			
L2000	Processors (with keyboard)				A3111	Card Reader Control	10	310	1
L2000-008	(128 user words)	243	6,995(1)	NA	A9114	Card Reader	70	2,120	20
L2000-208	(256 user words)	276	7,995(1)	NA	A8111	Card Reader Code Conversion (BCL)	2	60	
L2101-008	(128 user words)	280	8,490	NA	A8112	Card Reader Code Conversion (EBCDIC)	2	60	
L2101-208	(256 user words)	313	9,490	NA					
L2101-408	(384 user words)	346	10,490	NA	A3211	Card Punch Control	31	775	3
L2101-608	(512 user words)(2)	379	11,490	NA	A 149	Card Punch	120	5,990	28
L2301-008	(128 user words)	290	8,790	NA	A8211	Card Punch Code Conversion (BCL)	2	60	
L2301-208	(256 user words)	323	9,790	NA	A8212	Card Punch Code Conversion (EBCDIC)	2	60	
L2301-408	(384 user words)	356	10,790	NA					
L2301-608	(512 user words)(2)	389	11,790	NA					
L2302-908	(768 user words)(2)	455	13,790	NA					
L3000	Processors (with keyboard)					<u>Card/Tape</u>			
L3111-008	(128 user words)	326	9,890	NA	A3121	Paper Tape/Edge Punched Card Reader Control	14	425	2
L3111-208	(256 user words)	359	10,890	NA	A3222	Paper Tape/Edge Punched Card Punch Control	14	425	2
L3111-408	(384 user words)	392	11,890	NA	A9222	Paper Tape/Edge Punch Card Punch	38	1,165	12
L3111-608	(512 user words)(2)	425	12,890	NA	A2321	Card/Tape Subsystem Controller	33	1,000	4
L3311-008	(128 user words)	336	10,190	NA	A6321	Card/Tape Subsystem Buffer No. 2 or No. 4	5	165	1
L3311-208	(256 user words)	369	11,190	NA	A6322	Card/Tape Subsystem Buffer No. 3	12	350	1
L3311-408	(384 user words)	402	12,190	NA					
L3311-608	(512 user words)(2)	435	13,190	NA					
L3312-908	(768 user words)(2)	495	14,190	NA					
L3231-307	(256 user words)	297	8,990	NA					
L3231-608	(320 user words)	363	10,990	NA					
L3331-608	(288 user words)	396	11,990	NA					
L4000	Processors (with keyboard)					<u>Printers</u>			
L4111-009	(128 user words)	372	11,290	NA	A9249	Line Printer	264	8,000	432
L4111-209	(256 user words)	406	12,290	NA	A3243	Line Printer Controller	17	500	30
L4111-409	(384 user words)	439	13,290	NA					
L4111-609	(512 user words)(2)	472	14,290	NA					
L4311-209	(256 user words)	415	12,590	NA					

PRICES — SMALL BUSINESS COMPUTERS, A-C (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
BURROUGHS L SERIES (Contd.)					Magnetic Tapes				
<u>Document Reader</u>					A 9490-25	Cassette Tape Subsystem (1st station includes controller)	55	1,940	
A9161	Magnetic Record Reader (single-track)	148	4,490	25	A 1495-1	MTU (2-port)	365	11,500	
A9162	Magnetic Record Reader (dual-track)	161	4,890	25	A 1495-2	MTU (4-port)	373	11,750	
					A 1495-3	MTU (6-port)	381	12,000	
					A 1495-4	MTU (8-port)	389	12,250	
					A 2392	Data Collection MTU Controller	28	1,000	
Notes:					<u>Magnetic Record Reader</u>				
(1) Prices given are for 3-month warranty. Same styles can be purchased with 1-year warranty for \$7,350 and \$8,350.					A 9161-1	352-Digit Data Track	148	4,790	
(2) User words may be fewer, depending on firmware requirements.					A 9162-1	704-Digit Data Track	161	4,990	
(3) Available user words on L7000 processors depend on interpreter requirement.					A 7141	Upgrade Kit (to upgrade A 9161 magnetic record reader to 704-digit data track)			500
*****					<u>Consoles</u>				
CENTRAL PROCESSOR & WORKING STORAGE					A 9361	Magnetic Record Handler (stacker w/hold; includes PF29)	42	1,500	
L8000	Accounting Computers with				A 9362	Magnetic Record Handler (feeder/stacker/hold; includes PF29)	78	2,790	
L8200-100	15-1/2" Rear Feed Forms Handler (4 Kb)	394	12,990		PF 21	RF, Single Synch (15-1/2")	7	250	
L8200-200	15-1/2" Rear Feed Forms Handler (4 Kb; 1 cassette tape station)	424	13,990		PF 22	RF, Single Asynch (15-1/2")	7	250	
L8300-100	15-1/2" Front Feed Forms Handler (4 Kb)	409	13,490		PF 23	RF, Dual (15-1/2")	14	500	
L8300-200	15-1/2" Front Feed Forms Handler (4 Kb; 1 cassette tape station)	440	14,490		PF 24	FF, Single Synch (15-1/2")	7	250	
L8400-100	26" Front Feed Forms Handler (4 Kb)	446	14,690		PF 25	FF, Single Asynch (15-1/2")	7	250	
L8400-200	26" Front Feed Forms Handler (4 Kb; 1 cassette tape station)	476	15,690		PF 26	FF, Dual (15-1/2")	14	500	
L8500	Magnetic Record Computers with				PF 27	FF, Single Synch (26")	7	250	
L8541-100	26" MMR Forms Handler (6 Kb; 352-digit data track)	667	21,990		PF 28	FF, Single Asynch (26")	7	250	
L8541-200	26" MMR Forms Handler (6 Kb; 352-digit data track; 1 cassette tape station)	697	22,990		PF 29	FF, Dual (26")	14	500	
L8541-104	26" MMR Forms Handler (6 Kb; 352-digit data track; solid platen)	637	20,990		BURROUGHS B 700 SYSTEMS				
L8541-204	26" MMR Forms Handler (6 Kb; 352-digit data track; solid platen)	667	21,990		CENTRAL PROCESSOR & WORKING STORAGE				
L8542-100	26" MMR Forms Handler (6 Kb; 704-digit data track)	697	22,990		B 705	Processor (incl 16K bytes main memory; console control; wiring for 40-Kb)	420	15,425	70
L8542-200	26" MMR Forms Handler (6 Kb; 704-digit data track; 1 cassette tape station)	727	23,990		B 711	Processor (incl I/O base; 16K bytes main memory; console control, wiring for 40 Kb)	600	20,650	80
<u>Processor Options</u>					<u>Processor Options</u>				
A 4011	2-Kb Memory Module (up to 16-Kb total)	31	1,100		A1306	I/O Expansion Feature	25	1,000	4
A 4011-1	2-Kb Memory Module (over 16-Kb)	21	810			Upgrade B 705 to B 711 Processor	180	5,225	
A 2011	24-Kb Extended Memory Pot	21	750		B11-32	Total Memory (32K bytes)	122	5,300	16
A 2012	32-Kb Extended Memory Pot	22	800		B11-40	Total Memory (40K bytes)	180	9,000	24
A 7341	Upgrade Kit (to upgrade an L8000 MMR console, 704-digit MMR capacity)		1,500		B11-48	Total Memory (48K bytes; B711 only)	205	10,600	32
A 7351	Upgrade Kit (to convert any Series L8000 to the corresponding single data comm TC 3500 style)		1,500		<u>B 700 Packaged Systems</u>				
*****					B 706	Audit Entry System (incl 0.5-Mhz processor with 32-Kb memory; 26" systems console printer; 4.6-mb dual disc cartridge drive; necessary I/O device controls)	1,061	43,350	177
INPUT/OUTPUT					B 716	Audit Entry System (incl 1-Mhz processor with 32-Kb memory; 26" systems console printer; 4.6-mb dual disc cartridge drive; necessary I/O device controls)	1,241	48,575	187
<u>Punched Card</u>					B 707	Audit Entry System (incl 0.5-Mhz processor with 32-Kb memory; 26" console printer; 4.6-mb dual disc cartridge drive; 90-lpm line printer; magnetic tape cassette subsystem; audit entry computer system; necessary I/O device controls)	1,820	66,065	309
A 9114-1	Reader (200-cpm; 80-col)	78	2,790		B 717	Audit Entry System (incl 1 Mhz processor with 32-Kb memory; 26" systems console printer; 4.6-mb dual disc cartridge drive; 90-lpm printer; magnetic tape cassette subsystem; audit entry computer system; necessary I/O device controls)	2,000	71,090	319
A 9119-1	Reader (300-cpm; 96-col)	85	3,500		B 708	Card System (incl 0.5-Mhz processor with 32-Kb memory; 26" systems console printer; 4.6-mb dual disc cartridge drive; 90-lpm line printer; 96-col card/read/punch/printer; 96-col card data recorder; necessary I/O device controls)	1,745	70,865	360
A 9419-2	Reader/Punch Data Recorder (300/60; 96-col)	240	9,490						
A 9419-6	Multipurpose Card Unit (300/60; 96-col)	285	11,390						
A 2331-1	Control (for A 9119-1)	25	900						
A 2331-2	Control (for A 9419-2)	53	1,900						
A 2331-3	Control (for A 9419-6)	59	2,100						
<u>Card Tape</u>									
A 9222-1	PPT/EPC Punch (40-cps)	53	1,990						
A 9122-1	PPT/EPC Reader (40-cps)	42	1,590						
A 2322	PPT/EPC Control	28	1,000						
<u>Printers</u>									
A 9249-1	Line Printer (90-lpm)	240	8,500						
A 9249-2	Line Printer (180-lpm)	280	11,200						
A 2361-1	Controller	39	1,400						
A 2361-2	Controller	42	1,500						

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
BURROUGHS B 700 SYSTEMS (Contd.)					B1714	Processor (includes I/O base; 16K bytes main memory; console; table; corner table)	780	34,225	95
B 718	Card System (incl 1 Mhz processor with 32-kb memory; 26" systems console printer; 4.6-mb dual disc cartridge drive; 90-lpm line printer; 96-col card reader/punch/printer; 96-col card data recorder; necessary I/O device controls)	1,925	76,090	370	Processor Options				
MASS STORAGE					A1305	I/O Expansion Feature	30	1,500	5
<u>Discs</u>					For B 1712 Only				
A9480-12	Dual Cartridge Drive (4.6-mb)	365	15,450	53	B1012-24	Total Memory (24K)	150	5,000	10
A9481-12	Dual Cartridge Drive (9.2-mb)	480	21,600	72	B1012-32	Total Memory (32K)	400	12,000	16
B489	Control (for A9480-12)	19	675	14	B1012-40	Total Memory (40K)	550	17,000	27
B489-1	Control (for A9481-12)	38	1,200	14	For B 1714 Only				
A9985-2	Disc Cartridge (for A9480 drives)		170		B1014-24	Total Memory (24K)	200	6,500	13
A9985-3	Disc Cartridge (for A9481 drives)		225		B1014-32	Total Memory (32K)	400	12,500	18
					B1014-40	Total Memory (40K)	550	20,000	25
					B1014-49	Total Memory (48K)	700	26,000	36
					B1014-57	Total Memory (56K)	850	32,000	48
					B1014-65	Total Memory (64K)	1,000	38,000	61
					MASS STORAGE				
					<u>Discs</u>				
					Disc Cartridge Drives (60-msec avg seek time; 20-msec avg latency; 80-msec avg data access time)				
					A9480-1	Single-Cartridge Drive (2.3-mb)	250	10,000	31
					A9480-2	Dual-Cartridge Drive (4.6-mb)	365	15,450	53
					A9481-1	Single-Cartridge Drive (4.6-mb)	310	13,200	47
					A9481-2	Dual-Cartridge Drive (9.3-mb)	480	21,600	72
					A1480	Control (for A9480-1 and A9480-2 Drives)	90	2,700	14
					A1481	Control (for A9481-1 and A9481-2 Drives)	100	3,500	15
					A9985-2	Disk Cartridge (for A9480 Drives)	-	170	-
					A9985-3	Disk Cartridge (for A9481 Drives)	-	225	-
					INPUT/OUTPUT				
					<u>Punched Card</u>				
A9114-1	Card Reader (80-col; 200-cpm)	78	2,790	21	A9115	Reader (80-col; 300-cpm)	110	4,500	25
B111	Control (for A9114-1)	22	750	5	A9116	Reader (80-col; 600-cpm)	195	6,500	35
A9119-1	Card Reader (96-col; 300-cpm)	85	3,500	25	A1115	Control (for A9115)	45	900	7
B311	Control (for A9119-1)	25	850	2	A1116	Control (for A9116)	55	1,200	8
A9419-2	Card Reader/Punch/Print (96-col; 300-cpm read; 60-cpm punch)	240	9,490	71	A9119-1	Reader (96-col; 300-cpm)	85	3,500	25
A9419-6	Card Reader/Punch/Print (96-col; 300-cpm read; 60-cpm punch; 6 pocket sorting)	285	11,390	85	A1119-1	Control (for A9119-1)	45	900	7
B311	Control (for A9419-2, A9419-6)	25	850	2	A9210-1	Punch (100-cpm; 80-col)	250	12,000	67
					A1210-1	Control (for A9210-1)	90	4,320	14
					A9319-2	Reader/Punch (reads 300 cpm; punches/prints 60 cpm; 96-col)	200	7,990	60
					A9319-4	Reader/Punch (reads 500 cpm; punches/prints 120 cpm; 96-col)	310	11,190	91
					A1319-2	Control (for A9319-2)	65	1,900	10
					A1319-4	Control (for A9319-4)	70	2,300	11
					<u>Consoles</u>				
B9343-1	Front Feed Forms Handler (15-1/2")	143	5,500	21	Recorders				
B9343-2	Front Feed Forms Handler (26")	160	7,500	24	A9419-2	Reader/Punch Data Recorder (reads 300 cpm; punches/prints 60 cpm; 96-col)	240	9,490	71
PF24	FF, Single Synch (15-1/2")	7	250		A9419-6	Reader/Punch Data Recorder (reads 300 cpm; punches/prints 60 cpm; 6-pocket sorting at 300 cpm; 96-col)	285	11,390	85
PF25	FF, Single Asynch (15-1/2")	7	250		A1419-2	Control for A9419-2	65	1,900	10
PF26	FF, Dual (15-1/2")	14	500		A1419-6	Control for A9419-6	70	2,100	11
PF27	FF, Single Synch (26")	7	250		Printers				
PF28	FF, Single Asynch	7	250		A9240-1	Printer (475-lpm 132 PP)	475	19,500	174
PF29	FF, Dual (26")	14	500		A9240-2	Printer (700-lpm 132 PP)	625	31,000	179
					A9245-16	Printer (300-lpm 132 PP)	475	20,000	149
					A9245-19	Printer (400-lpm 132 PP)	575	23,000	154
					A9247-3	Printer (750-lpm 132 PP)	710	35,000	138
					A9249-1	Printer (90-lpm 132 PP)	240	8,500	60
					A9249-2	Printer (180-lpm 132 PP)	280	11,200	70
					A1240-1	Control (for A9240-1)	50	1,400	9
					A1240-2	Control (for A9240-2)	70	1,500	11
					A1245-16	Control (for A9245-16)	50	1,400	8
					A1245-19	Control (for A9245-19)	70	1,500	11
					A1247-3	Control (for A9247-3)	215	2,800	44
					A1249-1	Control (for A9249-1)	35	1,000	5
					A1249-2	Control (for A9249-2)	40	1,100	6
					A9949-2	Format Tape Reader (for A9247-3; 12-chnl)	61	3,050	15
					<u>Paper Tape</u>				
A9122-1	Reader (40-cps)	42	1,490	10	Printers				
A9222-1	Punch (40-cps)	53	1,890	13	A9340	Console Printer	55	2,640	15
B121-1	Control (for A9122-1)	22	750	2	A1340	Control (for A9340)	60	1,800	5
B221	Control (for A9222-1)	22	750	2	CONSOLE PROCESSOR & WORKING STORAGE				
					<u>Printers</u>				
A9249-1	Printer (90 lpm; 132 PP)	280	8,500	60	BURROUGHS B 1712/B 1714 SYSTEMS				
A988	Printer (164 lpm; 120 PP)	370	11,200	117	CENTRAL PROCESSOR & WORKING STORAGE				
A9249-2	Printer (180 lpm; 132 PP)	280	11,200	70	B1712	Processor (includes I/O base; 16K bytes main memory; console; table; corner table)	560	27,225	90
A9247-2	Printer (400 lpm; 120 PP)	460	19,500	100					
A9247-12	Printer (400 lpm; 120 PP)	485	20,500	100					
B243	Control (for A9249-1)	16	625	5					
B245	Control (for A988)	12	450	5					
B243-1	Control (for A9249-2)	36	1,600	5					
B244	Control (for A9247-2, A9247-12)	45	2,000	5					
A9949-2	12-Channel Format Tape Reader Option (for A9247-2, A9247-12)	61	3,050	15					
A9942-2	Add'l 12 PP (for A9247-2, A9247-12)	40	2,000	10					
A9942-9	Add'l Train Module (for A9247-2, A9247-12)	65	3,500	18					
					<u>Magnetic Tapes</u>				
A9490-25	Magnetic Tape Cassette (10 ips)	55	1,940	6					
A9491-2	Tape Unit (10-Kb; NRZ 9-chnl; 800-bpi)	215	8,600	21					
B391	Control (for A9491-2)	30	1,250	30					
B392	Control (for A9490-25)	24	800	3					

PRICES — SMALL BUSINESS COMPUTERS, A-C (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$
BURROUGHS B 1712/B 1714 SYSTEMS (Contd.)					MASS STORAGE				
<u>Magnetic Tapes</u>					<u>Discs</u>				
A9381-12	18-Kb Cluster (2-station; NRZ; 9-channel; 800-bpi)	525	25,200	179	Disc Cartridge Drives (70 msec avg seek time; 20 msec avg latency; 90 msec avg data access time)				
A9381-13	18-Kb Cluster (3-station; NRZ; 9-channel; 800-bpi)	570	26,960	200	B9480-1	Single-Cartridge Drive (2.3-mb)	250	10,000	31
A9381-14	18-Kb Cluster (4-station; NRZ; 9-channel; 800-bpi)	680	32,160	241	B9480-2	Dual-Cartridge Drive (4.6-mb)	365	15,450	53
A9381-22	36-Kb Cluster (2-station; NRZ; 9-channel; 800-bpi)	700	33,600	205	B9481-1	Single-Cartridge Drive (4.6-mb)	310	13,200	47
A9381-23	36-Kb Cluster (3-station; NRZ; 9-channel; 800-bpi)	900	43,200	236	B9481-2	Dual-Cartridge Drive (9.2-mb)	480	21,600	72
A9381-24	36-Kb Cluster (4-station; NRZ; 9-channel; 800-bpi)	1,100	52,800	267	B1480	Control (for B9480)	90	4,320	15
A9491-2	10-Kb Tape Unit (NRZ; 9-channel; 800-bpi)	215	8,600	21	B1481	Control (for B9481)	90	4,320	15
A1381	Tape Cluster Control	250	6,000	38	B9985-2	Disk Cartridge (for B9480) (purchase only)	NA	170	NA
A1491-2	Tape Control (10-Kb)	200	3,900	30	B9985-3	Disk Cartridge (for B9481) (purchase only)	NA	225	NA
<u>Sorters</u>					Disc Pack Drives (30-msec avg seek time; 12.5 msec avg latency; 42.5 msec avg data access time)				
A9135-2	8-Pocket (900 doc/min; E13-B; off-line sorting)	1,000	45,500	431	B9486-2	Dual Drive (95.5-mb)	950	45,600	123
A9135-3	12-Pocket (900 doc/min; E13-B; off-line sorting)	1,300	55,900	467	B1486	Control (for B9486-2)	920	44,160	143
A9136-5	8-Pocket (600 doc/min; E13-B; off-line sorting)	700	34,000	225	B9974-1	Disk Pack (for B9486-2)	25	575	NC
A9136-6	12-Pocket (600 doc/min; E13-B; off-line sorting)	850	39,000	270	Head-per-Track Memory Banks (incl 1 EU)				
A1135	Control (for A9135)	150	6,000	30	B9371-7	Storage (7-mb, 20-msec)	600	28,800	215
A1136	Control (for A9136)	150	6,000	30	B9371-14	Storage (14-mb, 40-msec)	750	36,000	210
DATA COMMUNICATIONS					Head-per-Track Memory Bank Add-On Units				
A1351	Single-Line Control	50	2,000	8	B9374-10	Storage (14-mb, 40-msec)	550	26,400	94
<u>Line Adapters</u>					B9374-17	Storage (7-mb, 20-msec)	400	19,200	115
A1650-1	Asynch Data Set Connect (up to 1,200 bps)	50	1,500	8	B1374	Control (for Head-per-Track Memory Banks)	200	9,600	12
A1650-2	Asynch Data Set Connect (up to 1,800 bps)	65	1,800	10	INPUT/OUTPUT				
A1650-5	Asynch Direct Connect (up to 2,400 bps)	50	1,500	8	<u>Punched Cards</u>				
A1650-6	Asynch Direct Connect (up to 4,800 bps)	65	1,800	10	Card Readers (80-col)				
A1650-7	Asynch Direct Connect (up to 9,600 bps)	80	2,100	12	B9111	800-cpm	325	16,250	85
A1651-1	Synch Data Set Connect (up to 2,400 bps)	50	1,500	8	B9112	1,400-cpm	450	21,600	129
A1651-2	Synch Data Set Connect (up to 4,800 bps)	65	1,800	10	B9115	300-cpm	110	4,500	25
A1651-3	Synch Data Set Connect (up to 9,600 bps)	80	2,100	12	B9116	600-cpm	195	6,500	35
A1652-1	Asynch Data Set Connect (for TTY)	50	1,500	8	B1111	Card Reader Control (for B9111 and B9112)	45	2,160	7
A1652-5	Asynch Direct Connect (for TTY)	50	1,500	8	B1115	Card Reader Control (for B9115 and B9116)	45	2,160	8
Notes:					B9917	Card Counter (for B9111 and B9112)	5	240	NC
Maintenance rates are higher outside metropolitan area.					B9918	Postal Money Order Feature (for B9111/2)	30	1,440	5
*****					B9919	40-Column Read Switch (for B9111 and B9112)	—	—	—
BURROUGHS B 1726 SYSTEM					B9119-1	Card Readers (96-col; 300-cpm)	85	3,500	25
CENTRAL PROCESSOR & WORKING STORAGE					B1119	Control (for B9119-1)	45	2,160	7
B1726	Processor (includes I/O base; 24K bytes main memory; 2,048 bytes control memory; console; and table)	1,740	78,300	140	B9210-1	Card Punch (80-col; 100-cpm)	315	18,425	67
<u>Processor Options</u>					B1210	Control (for B9210-1)	90	4,320	14
B1097-3	Corner Table	15	720	NC	B9319-2	Card Reader/Punches (96-col) (Reads 300 cpm; punches/prints 60 cpm)	200	7,990	60
B1305	I/O Expansion Feature (2 allowed)	30	1,500	5	B9319-4	(Reads 500 cpm; punches/prints 120 cpm)	310	11,190	91
<u>Control Memory Options</u>					B1319	Control (for B9319)	70	3,360	11
B1026-2	Additional 2,048 Bytes	400	9,600	30	B9419-2	Card Reader/Punch/Data Recorder (reads 300 cpm; prints/punches 60 cpm; keyboard; 96 col)	240	9,490	71
<u>Main Memory Options</u>					B9419-6	Multipurpose Card Unit (reads 300 cpm; prints/punches 60 cpm; keyboard; 96-col)	285	11,390	85
B1026-32	32K Bytes	85	5,400	10	Control (for B9419)				
B1026-40	40K Bytes	205	10,800	16	<u>Printers</u>				
B1026-49	48K Bytes	325	16,200	22	B9340	Console Printer	55	2,640	15
B1026-57	56K Bytes	460	21,600	28	B1340	Control (for B9340)	60	2,230	5
B1026-65	64K Bytes	610	27,000	35	B9240-1	475-lpm (132 PP)	475	19,500	174
B1026-81	80K Bytes	935	42,190	47	B9240-2	700-lpm (132 PP)	625	31,000	179
B1026-98	96K Bytes	1,285	57,380	60	B9240-3	1,040-lpm (132 PP)	900	43,500	195
					B9247-3	750-lpm (132 PP)	750	35,000	148
					B1240	Control (for B9240-1, 2, or 3)	60	2,880	9
					B1247	Control (for B9247-3)	90	4,320	14
					B9949-2	12-Channel Format Tape Reader (for B9247-3)	NA	NA	NA
					<u>Magnetic Tapes</u>				
B9381-12	18-Kb Cluster (2-station; NRZ; 9-channel; 800-bpi)	525	25,200	179					
B9381-13	18-Kb Cluster (3-station; NRZ; 9-channel; 800-bpi)	570	26,960	200					
B9381-14	18-Kb Cluster (4-station; NRZ; 9-channel; 800-bpi)	680	32,160	241					

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$
BURROUGHS B 1726 SYSTEM (Contd.)					B1650-5	Asynch Direct Connect (up to 2,400 bps)	50	1,500	8
B9381-22	36-kb Cluster (2-station; NRZ; 9-channel; 800-bpi)	700	33,600	205	B1650-6	Asynch Direct Connect (up to 4,800 bps)	65	1,800	10
B9381-23	36-kb Cluster (3-station; NRZ; 9-channel; 800-bpi)	900	43,200	236	B1650-7	Asynch Direct Connect (up to 9,600 bps)	80	2,100	12
B9381-24	36-kb Cluster (4-station; NRZ; 9-channel; 800-bpi)	1,100	52,800	267	*****				
B9390-3	18/50-Kc Mag Tape Unit (7-channel; 200/556-bpi)	330	15,860	149	CASCADE DATA CONCEPT II SERIES				
B9491-2	10-kb 9-Channel Tape Unit	215	8,600	21	BASIC CONFIGURATIONS				
B1381	Tape Cluster Control	250	6,960	38	Tape Systems				
B1390	18/50-Kc 7-Channel Tape Control	250	6,960	38	3010	Computer System (16K)	—	27,500	188
B1491	10-kb Tape Control	200	9,600	30	3011	Computer System (16K with Matrix Printer)	—	33,500	258
Sorters					Disc Systems				
Reader Sorters					4010	Computer System (16K; 5M disc)	—	38,500	220
B9131-1	13-Pocket (1,000 doc/min)	1,200	57,600	461	4011	Computer System (16K; 5M disc)	—	39,900	286
B9134-1	4-Pocket (1,625 doc/min; requires B9938-1)	1,025	49,200	333	4020-C	Computer System (24K; 1 1,280-char CRT)	—	48,500	280
B9136-5	8-Pocket (600 doc/min; E13-B; off-line sorting)	700	34,000	225	4021-C	Computer System (same as 4020-C but with larger Console Printer)	—	49,900	345
B9136-6	12-Pocket (600 doc/min; E13-B; off-line sorting)	850	39,000	270	4030-M	Multi-Programming System (32K; 1 1,290-char CRT)	—	53,000	301
For 9131-1					Notes:				
B1131	Control	150	6,480	23	Rental arrangements are not available. Maintenance prices are based on the average use of 175 hours per month.				
B9930-1	Mobile Carrier and Tray	6	240	NC	*****				
B9930-2	Document Tray (purchase only)	NA	15	NA	CODON CB100				
B9931-1	Item Separation (B9131)	20	960	NC	CENTRAL PROCESSOR & WORKING STORAGE				
B9932	Endorser (factory installed)	200	9,000	50	CB100	Basic System (with 10-cps console printer; one video data terminal; 24K-char core; 1 dual disc drive — 6.4 MM char, and standard software)	1,010	47,360	243
B9934	Start/Stop Bar (B9131)	7	275	NC	MASS STORAGE				
B9935	Special Field Ending	10	450	NC	Discs				
B9935-4	Canadian Check Feature (B9131)	NA	180	NC	DSK 2	Add'l Disc Drives (6.4 MM char ea)	NA	NA	NA
B9936	Override Code (specify type)	10	450	NC	INPUT/OUTPUT				
B9937	Validity Checking-Sort Field	10	450	NC	Magnetic Tape				
B9938	Reverse Override (specify type)	10	450	NC	CM800	Magnetic Tape (800-bpi; 7/9-trk)	NA	NA	NA
B9939-1	Resettable Counter	5	240	NC	Printers				
B9939-2	Nonresettable Counter	5	240	NC	CB101	Printer (350-lpm; 80-col)	NA	NA	NA
For B9134-1					CB102	Printer (250-lpm; 132-col)	NA	NA	NA
B1134	Control	200	6,480	30	CB105	Printer (165-cps; 132-col)	NA	NA	NA
B9930-3	Mobile Carrier	NA	150	NC	DATA COMMUNICATIONS				
B9930-4	One-Tray Document Rack	NA	600	NC	CB302	Video Data Terminal (with 64 x 20 screen; audio error alert and 10-key pad)	NA	NA	NA
B9932-1	Endorser	200	9,000	51	CB302R	CB302 (with telephone interface for remote operation)	NA	NA	NA
B9932-4	Batch Ticket Detector	10	480	1	CM2035	Bi-Sync Communication Adapter	NA	NA	NA
B9932-5	Short Document Read Feature (factory installation only)	10	480	2	Notes:				
B9932-6	Short Document Module Expander (factory installation only)	5	240	NC	Sold in tailored basic configurations only. Monthly rental is based on 5-year lease.				
B9933-1	Two-Field Basic Off-Line Sort	25	1,200	5	*****				
B9933-2	Two-Field 8-Pocket Off-Line Sort	30	1,440	5					
B9933-3	One-Field Expanded Off-Line Sort (max 8)	5	240	NC					
B9933-4	Extended Sort Control	50	2,400	15					
B9933-5	Zero Kill	10	480	1					
B9933-6	No Field — No Digit	10	480	1					
B9933-7	Digit Override	10	480	1					
B9933-8	Digit Edit	10	480	1					
B9933-9	Field Override	10	480	1					
B9933-10	Field Edit	10	480	1					
B9935-2	Four-Pocket Module (up to 16 pockets)	300	14,400	36					
B9936-1	Stacker Overflow	10	480	1					
B9937-1	Valid Character Check	5	240	1					
B9938-1	Multitrack E13-B Read	375	18,000	56					
B9939-3	Resettable Item Counter	5	240	1					
B9939-4	Nonresettable Item Counter	5	240	1					
B9939-5	Running Time Meter	5	240	1					
For B9136-6									
B1136	Control	150	6,480	23					
B9931-3	Extended Sort Control	NA	NA	NA					
B9931-4	51-Column Card Read	NA	NA	NA					
B9931-5	Valid Character Check Option	NA	NA	NA					
DATA COMMUNICATIONS									
B1351	Single Line Control	50	2,000	8					
Line Adapters									
B1650-1	Asynch Data Set Connect (up to 1,200 bps)	50	1,500	8					
B1650-2	Asynch Data Set Connect (up to 1,800 bps)	65	1,800	10					

PRICE DATA

Small Business Computers, D-H (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	
	DIGITAL EQUIPMENT, DEC DATA-SYSTEMS					Services provided with purchase include installation of hardware and software, training courses; but do not include maintenance.				
	CENTRAL PROCESSOR & WORKING STORAGE					Lease prices include maintenance.				
Series 300, Model 320	PDP-8 Processor; 4 DECTape Drives; 1 CRT Keyboard; One 60-lpm Line Printer; and COS 300 Operating System	942 (5-yr lease)	29,035	333						
Series 300, Model 330	PDP-8 Processor; 1 RK05 Disc Cartridge; 2 DECTape Drives; 1 CRT Keyboard; One 60-lpm Line Printer; and COS 300 Operating System	1,060 (5-yr lease)	32,585	375	140	ELDORADO ELECTRODATA MODEL 140				
Series 300, Model 340	PDP-8 Processor; 2 RK05 Disc Cartridges; 1 CRT Keyboard; One 60-lpm Line Printer; and COS 300 Operating System	1,090 (5-yr lease)	32,685	403		CENTRAL PROCESSOR & WORKING STORAGE				
Series 500	In this series, the model number is based on the model of the PDP-11 computer used; for example, Model 520 priced here uses PDP-11/20, and other models such as Model 540 would use the PDP-11/40 processor					Basic Processor (8K memory; 3 read/write cassette drives; selective typewriter with forms tractor) Memory (4-61K)	—	18,750	109	
Model 520	PDP-11/20 Processor; 1 CRT Keyboard; 1 Card Reader; One 60-lpm Line Printer; 2 RK05 Disc Cartridges; and COS 500 Operating System.)	1,530 (5-yr lease)	52,528	430		MASS STORAGE	—	2,000	12	
	MASS STORAGE					<u>Discs</u>				
RK05-AA	DECpack Disc Cartridge		5,100			Disc Controller (up to 4 disc drives)	—	1,450	80	
RP03-AS	Fixed-Head (time sharing) Disc Drive		20,000			Moving Head Disc (5 mb)	—	12,000	70	
	INPUT/OUTPUT					INPUT/OUTPUT				
	<u>Punched Card</u>					<u>Magnetic Tapes</u>				
CRF-8	Punched Card Reader		4,500			IBM-Compatible Magnetic Tape Controller (7 or 9-track)	—	2,000	12	
CR11	Punched Card Reader		4,500	50		IBM-Compatible Magnetic Tape Transport (7 or 9-track; 7-in. reels)	—	4,600	27	
	<u>Paper Tape</u>					IBM-Compatible Magnetic Tape Transport (7 or 9-track; 10-1/2-in. reels)	—	6,100	36	
PC8-E	Paper Tape Reader/Punch		3,900	30		<u>Punched Card</u>				
PC11	Paper Tape Reader/Punch		3,900	30		Card Reader and Controller (300 cpm)	—	3,300	19	
	<u>Printer</u>					<u>Printers</u>				
LS8-EA	Line Printer with Control		5,200			Line Printer and Controller (132 cols; 60 lpm)	—	4,300	25	
LE8-JA	Line Printer with Control		17,500	75		Line Printer and Controller (132 cols; 135 lpm)	—	6,750	39	
LS11-A	Line Printer with Control		5,200			Line Printer and Controller (132 cols; 600 lpm)	—	14,200	83	
LP11-JA	Line Printer with Control		17,500			10-Key Auxiliary Keyboard and Interface	—	800	5	
	<u>Magnetic Tape</u>					Notes:				
TD8-EM	Dual DECTape Drive (including controller)		5,000			Leases available through leasing firms, but not from manufacturer.				
TU56/TC11	Dual DECTape Drive (including controller)		8,700			*****				
TU10-EE	DEC MAGTape Drive (9-track industry-compatible drive; 800 bpi)		6,950	70		HONEYWELL SERIES 50, MODEL 58				
TU10-FE	DEC MAGTape Drive (7-track industry-compatible drive; 800/556/200 bpi)		6,950	70		CENTRAL PROCESSOR & WORKING STORAGE				
	<u>Terminals</u>					58MOD1				
VT05-B	CRT Keyboard Terminal		2,795	35		Central System (5,000-byte processor; keyboard; 100 cpm card reader; 100 lpm, 96-column printer; 10 position visual display)	842	31,620	181	
LA30	DECwriter Data Terminal (teletype)		2,795	30		<u>Processor Options</u>				
	DATA COMMUNICATIONS					AMK050	Additional 5,000 Bytes of Memory	208	7,740	45
LT33-DC	ASR 33 Synch Terminal (teletype) (hard copy terminal with paper-tape reader/punch)		1,620			CRS050	200-cpm Option (for card reader)	198	7,350	43
	Notes:					OMR050	Optical Mark Reading Option (for card reader)	62	2,320	14
	Prices are given for the Model 520 configuration with the COS 500 Operating System, which is intended for batch processing. Prices will vary according to the processor used, the peripherals, and the operating system selected. CTS 500 is a time-sharing operating system, while CDMS is a Commercial Data Management System.					PMK051	128-Column Option (for printer)	42	1,550	10
						PMK053	200-lpm Option (for printer)	114	4,260	26
						PSC100	Manual Switch Console (includes 1 PSU100)	166	6,480	27
						PSU100	Manual Switch (for switching 2 peripheral controls to same central processor)	42	1,632	6
						PSC101	Manual Switch Console (includes 1 PSU101)	166	6,480	27
						PSU101	Manual Switch (for switching 1 peripheral control between 2 central processors)	42	1,632	6
						MASS STORAGE				
						<u>Discs</u>				
						DSS058	Disc Storage Subsystem (3.46 mb)	499	25,920	188
						ADS158	Additional Disc Storage (2.3 mb)	135	3,360	22
						ADS258	Additional Disc Storage (5.76 mb)	239	6,000	32

PRICES — SMALL BUSINESS COMPUTERS, D-H (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
	HONEYWELL SERIES 50, MODEL 58 (Contd.)				CSO600	Card Reader Upgrade (to 600 cpm)	47	1,440	16
ADS358	Additional Disc Storage (5.76 mb)	416	17,160	94		<u>Paper Tape</u>			
ADS458	Additional Disc Storage (5.76 mb)	416	17,160	94	PRT100	Paper Tape Reader (500 cps)	125	4,520	28
	<u>INPUT/OUTPUT</u>				PRT110	Paper Tape Punch (60 cps)	114	4,080	27
	<u>Punched Card</u>					Printer and Control (300 lpm; 104 PP)	432	15,120	108
CPA050	Card Punch (40 cps)	104	3,870	26	OPT075	Extension of Print Positions to 120	36	1,300	9
PCP050	Print Option (for CPA050)	31	1,160	6	OPT076	Extension of Print Positions to 136	73	2,545	18
SLC055	Single-Line Communications Controller	229	8,520	49	OPT080	Fast Skip (63 ips)	73	2,545	18
PLF055	Polling/Selection Mode (for SLC055)	62	2,320	14	PRT110	Printer and Control (600 lpm; 104 PP)	629	22,080	156
CS100	Off-Line Card Sorter	83	3,880	26	OPT077	Extension of Print Positions to 120	47	1,635	12
P112	Off-Line Keypunch	114	4,150	46	OPT078	Extension of Print Positions to 136	94	3,270	24
	Note:				OPT079	Fast Skip (63 ips)	73	2,545	18
	All monthly rental prices include maintenance.					<u>Printers</u>			
	*****				PRT120	Printer and Control (780 lpm; 120 PP)	936	32,835	232
	HONEYWELL SERIES 100, MODEL 15				OPT085	Extension of Print Positions to 136	104	3,650	26
	<u>CENTRAL PROCESSOR & WORKING STORAGE</u>				OPT086	Fast Skip	73	2,545	18
1M156D	16K Processor	1,971	79,590	287	PRT130	Printer and Control (1,100 lpm; 120 PP; fast skip)	1,144	40,175	283
1M156F	24K Processor	2,283	92,190	325	OPT087	Extension of Print Positions to 136	104	3,650	26
1M156H	32K Processor	2,595	104,790	362	MRS101	MICR Reader-Sorter	1,248	43,800	282
1M156L	48K Processor	3,635	146,790	443		<u>DATA COMMUNICATIONS</u>			
1M156P	64K Processor	4,259	171,990	524	SLC100	Datanet 10 Single-Line Communications Controller (half-duplex; synch; up to 2,400 bps; ASCII code)	218	9,320	17
	<u>Processor Options</u>				SLC102	Datanet 12 Single-Line Communications Controller (half-duplex; synch; up to 50,000 bps; ASCII code)	312	12,100	52
MSOP115	CPU Upgrade (required for 1M156L and 1M156P)	218	8,820	32	SLC111	Single-Line Communications Controller (half-duplex; asynch; up to 1,200 bps; ASCII code)	218	8,592	33
	<u>MASS STORAGE</u>				SLC112	Single-Line Communications Controller (half-duplex; synch; up to 150,000 bps; ASCII code)	312	12,288	47
	<u>Discs</u>				SLC113	Single-Line Communications Controller (half-duplex; synch; up to 2,400 bps; ASCII code)	218	8,592	33
DSS164	Disc Storage Subsystem (5.7 mb)	634	29,280	210	SLC114	Single-Line Communications Controller (half-duplex; synch; up to 150,000 bps; ASCII code)	218	8,592	33
ADS164	Capacity Upgrade (for DSS164) (5.7 mb)	239	6,000	32	SLC115	Single-Line Communications Controller (half-duplex; synch; up to 2,400 bps; excess 3 code)	218	8,592	33
ADU164	Additional Disc Pack Drives for DSS164 (11.4 mb)	676	28,600	159		Note:			
DSC130	Disc Control (up to 5 drives)	312	13,055	30		All monthly rental prices include maintenance.			
DSU130	Disc Drives (2.98 mc)	286	10,705	56		*****			
DSS161	Disc Storage Subsystem (15.36 mc)	1,695	48,360	198		HONEYWELL SERIES 200 MODELS 105 AND 115			
DSU160	Additional Disc Pack (for DSS160) (7.68 mc; up to 6 can be added to DSS161)	645	15,780	80		<u>CENTRAL PROCESSOR & WORKING STORAGE</u>			
	<u>INPUT/OUTPUT</u>				105	Central Processing Unit (16K; power supply; control panel)	555	27,170	83
	<u>Magnetic Tape</u>				106-1	(24K; power supply; control panel)	1,032	46,560	154
MTS163	Magnetic Tape Subsystem (control and 1 tape unit; add up to 7 units; 9-track, 30 kc/sec)	832	34,416	89	106-2	(32K; power supply; control panel)	1,453	60,060	216
MTH163	Magnetic Tape Unit (9-track, 30 kc/sec)	312	12,240	48	1014	8-Bit Code Handling Instruction	27	1,250	3
OPT173	7-track Compatibility (200/556/800 bpi)	26	1,008	4	1019	Simultaneous Use of Third R/W Channel	68	3,025	11
OPT183	200/556/800 bpi Recording Densities	208	8,832	17	115	Central Processing Unit (16K; power supply; control panel)	1,118	50,020	168
OPT193	800 bpi Recording Density	26	1,008	4	116-1	(24K; power supply; control panel)	1,430	63,985	215
MTS166	Magnetic Tape Subsystem (control and 1 tape unit; add up to 7 units; 9-track, 60 kc/sec)	1,248	51,744	131	116-2	(32K; power supply; control panel)	1,742	77,905	262
MTH166	Magnetic Tape Unit (9-track, 60 kc/sec)	468	18,528	69	1014	8-Bit Code Handling Instruction	27	1,250	3
OPT176	7-track Compatibility (200/556/800 bpi)	26	1,008	4	1019	Simultaneity for Third R/W Channel	130	5,810	13
OPT186	200/556/800 bpi Recording Densities	208	8,832	17	1044	Direct Transcription	63	2,250	6
OPT196	800 bpi Recording Density	26	1,008	4		<u>Processor Options</u>			
	<u>Punched Card</u>				212-1	Central Processor Adapter (for connection of any 2 Series 200 processors)	445	18,000	48
CRZ100	Card Reader and Control (300 cpm)	156	5,760	32	212-2	Central Processor Memory-to-Memory Transfer Unit	445	18,000	48
CRZ111	Card Reader and Control (400 cpm; includes 2 stackers)	239	8,880	48	213-3	Interval Timer	100	3,600	11
CRZ120	Card Reader and Control (600 cpm; includes 2 stackers)	286	10,320	65	071	Interval Selector	63	2,250	6
CPZ101	Card Punch and Control (200 cpm)	328	11,670	77	213-4	Time-of-Day Clock	226	9,000	26
CPZ103	Card Punch and Control (300 cpm)	629	22,420	148	220-1	(with printer)	226	9,000	26
CRP100	Card Reader/Punch and Control (300/300 cpm; includes 3 stackers)	614	21,510	153	220-3	(replaces control panel on 105/115)	340	13,500	38
OPT024	51-Column Adapter (for CRZ111)	52	2,016	9	008	Pin-Feed Drive	27	1,125	6
OPT025	51-Column Adapter (for CRZ120)	36	1,300	9					

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
	HONEYWELL SERIES 200 MODELS 105 AND 115 (Contd.)				044	Direct Transcription	32	1,125	5
					045	90-Column Card Reading Capability (for 223)	131	5,025	18
	MASS STORAGE					Paper Tape			
	<u>Discs</u>				209-2	Paper Tape Reader and Control (600 frames/sec)	367	14,625	43
170-2	Disc Storage for Model 105				210	Paper Tape Punch and Control (120 frames/sec)	257	10,125	34
173-2	Disc Storage Subsystem	499	20,460	151	1021	NCR-Type Reel Hubs	NC	NC	NC
	Disc Storage Subsystem (18.4M char)	832	34,320	188	1022	NAB-Type Reel Hubs	NC	NC	NC
070	Direct Access Time Speedup	42	1,760	5					
173	Disc Pack Drive (for 173-2; 9.2M char)	416	17,160	94					
	Disc Storage for Model 115					Printers			
157C	Disc Control (for 155 Disc Pack Drive)	281	11,700	32	112	Printer for Model 105			
257C	Disc Control (for 155 Disc Pack Drive)	322	13,500	38	1032	Printer (300 lpm)	493	20,250	149
155	Disc Pack Drive (3.6M char)	389	14,910	69		Extension of Print Positions from 120 to 132	63	2,250	15
171	Disc Pack Drive (4.6M char)	335	12,875	75	112-3	Printer (650 lpm; 1019-1 req'd)	909	35,070	244
172	Disc Pack Drive (9.2M char)	478	21,220	81	1037	Extension of Print Positions from 120 to 132	63	2,250	15
276-2	Disc Storage Subsystem (74.8M char)	1,498	67,200	271					
074	Write Protect	21	900	4		Printers for Model 115			
076	Dynamic Disc Addressing	26	1,050	3	122-3	Printer (650 lpm; 120 print positions)	909	35,070	244
079	Central Processor Finished (for 172 and 276-2)	32	1,350	6	122-4	Printer (950 lpm; 120 print positions)	1,198	46,200	286
276	Disc Pack Drive (for 276-2; 37.4M char)	515	23,040	98	122-6	Printer (1,100 lpm; 120 print positions)	1,340	51,660	299
	INPUT/OUTPUT				1034	Extension of print positions from 120 to 132	63	2,250	15
	<u>Magnetic Tapes</u>				222-3	Printer and Control (650 lpm; 120 print positions)	1,015	40,500	271
103A	Magnetic Tape for Model 115 Only	542	21,490	87	222-4	Printer and Control (950 lpm; 120 print positions)	1,433	57,375	384
103F	Tape Control (includes one 204B-13) Tape Control (includes one 204B-21; controls up to four 204B-21 and 22 units)	792	31,080	118	222-6	Printer and Control (1,100 lpm; 120 print positions)	1,522	60,975	393
203B-1	Tape Control (up to eight 204B-1, 2, 3, 4 units)	476	18,360	51	222-7	Printer and Control (300 lpm; 120 print positions)	650	25,410	185
203B-2	Tape Control (up to eight 204B-5 units; no interrupt)	476	18,360	51	032	Extension of Print Positions from 120 to 132 (for 222-3, 4 and 6)	106	4,500	30
203B-2A	Tape Control (up to eight 204B-5 units)	476	18,360	51	034	Numeric Print (for 222-3)	141	5,625	15
293B-4	Tape Control (up to eight 204B-7, 8 units)	476	18,360	51	035	Numeric Print (for 222-4)	32	1,125	4
203B-6	and 203B-6A Tape Control (up to eight 204B-9 units)	476	18,360	51	036	Print Buffer (for 222-3, 4, 6 and 7)	236	9,100	34
203D-1	Tape Control (up to eight 204D-1 units)	759	29,400	84	1032	Extension of Print Positions from 120 to 132 (for 222-7)	63	2,250	15
203D-3	Tape Control (up to eight 204D-3 units)	864	33,600	96	1033	8-Channel Format Tape (for 222-7)	32	1,125	4
050	IBM Format Feature (for type 203B)	63	2,250	6		Optical Document Reader			
051	IBM Code Compatibility Feature (for type 203B)	63	2,250	6	042	Optical Document Reader and Control	1,768	67,200	464
052	IBM 7-Channel Tape (for type 203D)	166	5,500	16		Optical Mark Read	333	12,600	87
056	Dynamic Tape Addressing	26	1,050	2		MICR			
059	Density Switch (for 203D, 103F)	21	670	2	232	MICR for Model 115			
1052	EBCDIC Code Translator (for type 203D)	104	4,100	11	236-1	MICR Reader-Sorter and Control	1,361	56,250	324
1055	IBM Magnetic Tape Compatibility (for type 103F)	63	2,160	6	236	MICR Control (for 236)	-	14,950	32
20-B-1	Magnetic Tape Unit (200/556 bpi)	396	15,120	89	236-2	MICR Reader-Sorter (16 pockets; 1,625 doc/min)	-	96,600	564
204B-2	Magnetic Tape Unit (200/556 bpi)	343	12,960	75	236-3	Multilevel E13B Recognition	-	19,300	72
204B-3	Magnetic Tape Unit (200/556 bpi)	560	21,600	126	236-4	Endorser	-	10,120	65
204B-4	Magnetic Tape Unit (200/556 bpi)	506	19,440	114	236-5	Expansion Unit (16 additional pockets)	-	5,060	13
204B-5	Magnetic Tape Unit (200/556 bpi)	791	30,240	176	236-6	Expansion Module (4 additional pockets)	-	15,180	47
204B-7*	Magnetic Tape Unit (556/800/1,200 bpi)	448	17,280	100	236-7	Mobile Carrier	-	175	NC
055	Recording Density (1,200 bpi)	53	2,100	6	236-8	Short Document Read Capability	-	690	2
204B-8*	Magnetic Tape Unit (556/800 bpi)	675	25,920	151	236-9	Short Document Module Expansion	-	460	2
204B-9*	Magnetic Tape Unit (556/800/1,200 bpi)	896	34,560	200	236-10	Batch Ticket Detector	-	690	2
054	Recording Density (1,200 bpi)	26	1,300	2	236-11	Resettable Item Counter	-	460	2
204B-14	Magnetic Tape Unit (556/800 bpi)	295	12,175	69	236-12	Basic Off-Line Sort	-	1,610	6
204B-22	Magnetic Tape Unit (220/556 bpi)	338	12,800	86	236-13	Expanded Off-Line Field Sort	-	460	2
204D-1	Magnetic Tape Unit (800/1,600 bpi)	417	15,960	91	236-14	Digit Override	-	690	2
204D-3	Magnetic Tape Unit (800/1,600 bpi)	601	23,100	131	236-15	Digit Edit	-	690	2
	<u>Punched Card</u>				236-16	Zero Kill	-	690	2
123	Card Reader (400 cpm)	223	9,000	62	236-17	Field Override	-	690	2
	Adapter (51 col)	32	1,125	8	236-18	Field Edit	-	690	2
214-1	Card Punch (100-400 cpm)	381	14,700	108	236-19	No Field/No Digit Outsort	-	690	2
214-2	Card Reader/Punch (400 cpm read- ing; 100-400 cpm punching)	439	16,800	125	236-20	Stacker Overflow	-	690	2
					236-21	Valid Character Check	-	460	2
						Extended Sort Control	-	2,760	20
						DATA COMMUNICATIONS			
						Single Channel Communication Controls			
123-2	Punched Card for Model 115 Only	281	11,475	82	281-1A	W. U. Telex	168	6,750	28
123-4	Card Reader (600 cpm)	375	14,490	108	281-1B	TWX CE (8-level teletypewriter)	168	6,750	28
1043	Card Reader (1,050 cpm)	32	1,125	8	281-1C	5-Level Teletypewriter	168	6,750	28
223	Card Reader and Control (800 cpm)	344	13,500	92	281-1D	8-Level Teletypewriter	168	6,750	28
223-2	Card Reader and Control (1,050 cpm)	392	15,120	113	281-1E	TWX CE (IBM 1050)	168	6,750	28
043	Adapter (51 col)	48	1,800	6	281-1H	Voice Lines (for DATA SPEED 2)	168	6,750	28
					1061	Interface (for VIP 765)	NC	NC	NC
					1062	Interface (for VIP 775 and 785)	NC	NC	NC

PRICES — SMALL BUSINESS COMPUTERS, D-H (U. S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
HONEYWELL SERIES 200 MODELS 105 AND 115 (Contd.)					285-8A	Audio Response Expansion (2 lines)	100	3,825	11
281-1K	W. U. 180 Baud (IBM 1050)	168	6,750	28	285-8C	Audio Unit (31 elements; 6 lines)	649	24,750	71
281-1KTP	KEYTAPE/Communicator (private; 115 only)	168	6,750	28	285-8D	2-Line Expansion (31 elements)	37	1,350	5
281-1KTS	KEYTAPE/Communicator (network; 115 only)	168	6,750	28	285-8F	Audio Unit (63 elements; 6 lines)	854	32,625	91
281-1R	VIP Series Displays, Asynch	226	8,930	38	285-8G	2-Line Expansion (63 elements)	48	1,800	5
281-1TC	Burroughs TC-500	226	8,930	38	285-8J	Audio Unit (189 elements; 6 lines)	1,351	51,750	146
281-2B	Voice Lines	205	8,100	33	285-8K	2-Line Expansion (189 elements)	53	2,050	5
281-2BSC	IBM Binary Synch Communications Device	258	10,125	43	Notes:				
1060	Extended Speed (281-2B)	52	2,055	14	If specified at time of order, 204B-7, 8, 9 can record at 200/800 bpi.				
1061	Interface (for VIP 765, 281-2B)	NC	NC	NC	All monthly rental prices include maintenance.				
1062	Interface (for VIP 775 and 785) (281-2B)	NC	NC	NC	*****				
1070	2,000 bps (281-2B, -2BSC)	NC	NC	NC	HONEYWELL 2020/2030				
1071	2,400 bps (281-2B, -2BSC)	NC	NC	NC	CENTRAL PROCESSOR & WORKING STORAGE				
1072	3,600 bps (281-2B, -2BSC)	22	840	9	2021	Central Processor (includes control panel and power supply)			
1073	4,800 bps (281-2B, -2BSC)	22	840	9	-1	24K	670	30,450	200
1074	5,400 bps (281-2B, -2BSC)	22	840	9	-2	28K	935	40,800	220
1075	7,200 bps (281-2B, -2BSC)	22	840	9	-3	32K	1,125	46,920	240
1076	9,600 bps (281-2B, -2BSC)	22	840	9	-4	40K	1,160	64,240	295
281-2D	Voice Lines (IBM 7702, 1013)	258	10,125	43	-5	48K	2,030	81,180	337
281-2F	Telpak A	258	10,125	43	-6	56K	2,405	96,140	354
281-2R	VIP Series Displays, Synch	274	10,765	45	-7	64K	2,775	110,880	372
281-137P	150 Baud (8-level teletypewriter)	168	6,750	28	2032	Central Processor (includes control panel, power supply)			
281-137S	Voice Lines (8-level teletypewriter)	168	6,750	28	-1	40K	2,640	100,800	325
Multi-Channel Communications Controls for Model 115					-2	48K	2,890	110,250	360
286-1	MCCC (for 2 to 3 lines)	237	9,450	41	-3	56K	3,165	120,750	395
286-2	MCCC (for 4 to 15 lines)	358	14,400	60	-4	64K	3,410	130,200	435
286-3	MCCC (for 16 to 63 lines)	447	18,000	75	-5	80K	3,880	141,000	455
086	Parity Check and Generation	63	2,250	10	-6	96K	4,345	158,000	475
087	Long Check	63	2,250	10	Processor Options				
286-4	Message-Mode MCCC (for 2 to 32 half-duplex lines)	893	34,000	149	001	Fourth Read/Write Channel (available only at 40K memory and above; for 2020 only)	63	2,160	5
286-5	Message-Mode MCCC (for 33 to 63 half-duplex lines)	1,288	51,750	224	002	Type 275-0S/2000 Pkg. (for 2030 only)	165	6,000	18
285-1A	W. U. Telex	37	1,350	8	003	Type 277-0S/2000 Pkg. (for 2030 only)	715	26,000	91
285-1B	TWX CE (8-level teletypewriter)	48	1,800	9	004	Cycle Speed-up (2.75 us to 2.5 us; for 2020 only)	275	10,000	30
285-1C	5-Level Teletypewriter	37	1,350	8	018	Expansion of Disk Control (for 2030 only)	63	2,160	5
285-1D	8-Level Teletypewriter	48	1,800	9	INPUT/OUTPUT				
285-1E	TWX CE (IBM 1050)	48	1,800	9	Magnetic Tapes				
285-1H	Voice Lines (for DATA SPEED 2, VIP 765)	48	1,800	9	Magnetic Tape Unit (half-inch tape; 500 bpi)				
285-1K	W. U. 180 Baud (IBM 1050)	48	1,800	9	204B201	10 kc	220	8,800	44
285-1KTP	KEYTAPE/Communicator (private lines)	48	1,800	9	204B301	20 kc	275	11,000	55
285-1KTS	KEYTAPE/Communicator (switched network)	48	1,800	9	204B401	30 kc	305	12,100	61
285-1M	Data Station (288-1 central control station)	48	1,800	9	Magnetic Tape Subsystem (includes tape control unit and tape drives)				
285-1N	100 wpm ASCII TWX Service	48	1,800	9	204B200	Three 204B201 Tape Drives	715	28,600	150
285-1PD	Teller Terminal (Direct)	105	3,930	16	204B300	Three 204B301 Tape Drives	880	35,200	176
285-1PM	Teller Terminal (Remote)	84	3,130	14	204B400	Three 204B301 Tape Drives	1,020	40,700	203
285-1R	VIP Series Displays, Asynchronous	105	3,895	16	Printers				
285-1TC	Burroughs TC-500	105	3,895	16	112-2A	Printer (450 lpm; 132 print positions)	692	26,820	190
285-2B	Voice Lines	74	2,700	12	222-2NA	Printer and Control (450 lpm; 132 print positions)	867	33,120	238
285-2BSC	IBM Binary Synchronous Communications Device	121	4,500	18	Notes:				
1060	Extended Speed (285-2B only)	52	2,055	14	All monthly rental prices include maintenance.				
1061	Interface (for VIP 765; 285-2B only)	NC	NC	NC	*****				
1062	Interface (for VIP 775 and 785; 285-2B only)	NC	NC	NC					
1070	2,000 bps (285-2B, -2BSC)	NC	NC	NC					
1071	2,400 bps (285-2B, -2BSC)	NC	NC	NC					
1072	3,600 bps (285-2B, -2BSC)	22	840	9					
1073	4,800 bps (285-2B, -2BSC)	22	840	9					
1074	5,400 bps (285-2B, -2BSC)	22	840	9					
1075	7,200 bps (285-2B, -2BSC)	22	840	9					
1076	9,600 bps (285-2B, -2BSC)	22	840	9					
285-2D	Voice Lines (IBM 7702, 1013)	121	4,500	18					
285-2R	VIP Series Displays, Synch	142	5,270	24					
285-3A	Voice Lines DATA SPEED 5	100	3,600	15					
285-4A	Voice Lines DATA SPEED 5	100	3,600	15					
285-5A	Switched Circuits Auto Dialing	48	1,800	9					
285-137P	150 Baud (8-level teletypewriter)	48	1,800	9					
285-137S	Voice Lines (8-level teletypewriter)	48	1,800	9					
285-8	Audio Response System for Model 115 Audio Response Adapter (6 lines)	440	16,875	49					
082-1	Tone Answer Back Option (2 lines)	21	675	2					
082-2	Voice Answer Back Option (2 lines)	21	675	2					
083-1	Voice Cylinders (31 elements; phrases only)	-	2,050	-					
083-2	Voice Cylinders (31 elements; words and phrases, or words only)	-	2,550	-					
083-3	Voice Cylinders (63 elements; phrases only)	-	3,200	-					
083-4	Voice Cylinders (63 elements; words and phrases, or words only)	-	3,600	-					
083-5	Voice Cylinders (189 elements; words only)	-	3,600	-					

PRICE DATA

Small Business Computers, I-M (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint \$
	IBM SYSTEM/3 Model 6					<u>Displays</u>			
	CENTRAL PROCESSOR & WORKING STORAGE				2265-001	Display Station	170	5,430	40
5406	Processing Units with Keyboard (disc systems)				2265-002	Display Station	170	5,430	40
5406-B2	8K	590	28,745	125	4766	Alphanumeric Keyboard (for -001)	29	900	5
5406-B3	12K	705	34,545	130	7960	2265 Attachment (for -002)	75	3,675	2
5406-B4	16K	820	35,245	130		DATA COMMUNICATIONS			
	<u>Processor Options</u>				2074	Binary Synchronous Communications Adapter	265	12,985	65
1550	Command Keys 9-16	20	980	1	1315	Auto Call	40	1,960	1
5732	Processing Unit Expansion	35	1,725	6	4703	Internal Clock	25	1,960	1
7081	Serial I/O Channel	150	7,350	5	7477	Station Selection	20	980	1
	MASS STORAGE				7850	Text Transparency	20	980	1
	<u>Discs</u>				3872-001	Modem (2,400 bps)	85	2,975	24
5444-001	Disk Storage Drive	164	8,550	47	3875-001	Modem (7,200 bps)	240	8,400	70
5444-002	Disk Storage Drive	270	10,280	47	4875-001	Modem (4,800 bps) point-to-point	-	4,460	20
5444-003	Disk Storage Drive	164	8,550	47	4875-002	Modem (4,800 bps) multipoint tributary	-	4,850	23
6378	Second Disk Attachment	47	2,515	5		*****			
	INPUT/OUTPUT					IBM SYSTEM/3 Model 10			
	<u>Punched Card</u>					CENTRAL PROCESSOR & WORKING STORAGE			
129-001	Card Data Recorder (reading 80-column cards at 50 cpm, and punching at 12-50 cpm; applies to all 129 models)	125	6,125	38	5410	Processing Units (card systems)			
129-002	Card Data Recorder	140	6,860	42	5410-A2	8K	328	16,110	38
129-003	Card Data Recorder	150	7,350	43	5410-A3	12K	434	21,300	42
1020	Accumulate	20	980	3	5410-A4	16K	555	22,040	42
1025	Additional Accumulate Program Levels	5	245	1	5410-A5	24K	800	39,220	56
3215	Direct Punch Control	6	295	1	5410-A6	32K	1,040	39,960	56
3610	Expansion Feature	10	490	-	5410-A7	49K	1,360	57,870	78
5570	Production Statistics	10	490	1	5410	Processing Units (disc systems)			
6065	Reading Board Extension	-	20	-	5410-A12	8K	461	22,600	84
7503	Card Input/Output Attachment	75	2,625	11	5410-A13	12K	565	27,790	88
8705	Verifying Read Control	6	295	1	5410-A14	16K	685	28,540	88
9671	Special Character Arrangement ASCII	150 S	80	-	5410-A15	24K	930	45,710	102
9677	Special Character Arrangement EL	150 S	80	-	5410-A16	32K	1,170	46,450	102
5486-001	Card Sorter	90	4,690	38	5410-A17	49K	1,490	64,360	124
5486-002	Card Sorter	121	5,370	58		<u>Processor Options</u>			
1225	Alphabetic Sorting	7	222	1	3500	Dual Program	116	5,720	1
2370	Auxiliary Card Counter	10	515	3	5501	Power Supply Expansion	50	2,250	1
7245	Sort Suppress/Digit Select	10	515	1	5732	Processing Unit Expansion A	37	1,820	3
5496-001	Data Recorder	155	7,600	54	5733	Processing Unit Expansion B	20	800	1
3210	Data Recorder Attachment	40	1,960	2	5734	Processing Unit Expansion C	55	2,200	1
7061	Self-Checking Number Mod 10	30	900	1	5735	Processing Unit Expansion D	20	800	1
7062	Self-Checking Number Mod 11	30	900	1	7081	Serial I/O Channel	159	7,790	5
7501	System/3 Attachment	45	2,205	11		MASS STORAGE			
7801	3735 Attachment	45	2,205	5		<u>Discs</u>			
7850	2772 Attachment	45	2,205	15	5444-001	Disk Storage Drive	164	8,550	47
	<u>Printers</u>				5444-002	Disk Storage Drive	270	10,280	47
5213-001	Printer (pin-feed platen)	160	6,200	48	5444-003	Disk Storage Drive	164	8,550	47
5213-002	Printer (vertical forms control)	200	8,000	65	6378	Second Disk Attachment	47	2,515	5
5213-003	Printer (vertical forms control)	250	8,200	75	5444-A1	Disk Storage Drive	200	8,450	65
3901	Printer Attachment (for 001)	70	3,430	19	5444-A2	Disk Storage Drive	300	10,075	65
3902	Printer Attachment (for 002)	70	3,430	19	5444-A3	Disk Storage Drive	200	8,450	65
3903	Printer Attachment (for 003)	70	3,430	19	4501	Higher Performance (1st disc attachment)	20	980	1
4450	Forms Stand Stacker	-	50	-	4502	Higher Performance (2nd disc attachment)	20	980	1
2222-001	Printer (unidirectional)	350	16,500	105	5422-001	Disk Enclosure	100	4,900	12
2222-002	Printer (bidirectional)	385	16,700	115	5440	Disk Cartridge (for all 5444 drives)	-	175	TM
7951	Printer Attachment (for 001)	70	3,430	19	5445-001	Disk Storage Drive	350	15,750	85
7952	Printer Attachment (for 002)	70	3,430	19	5445-002	Disk Storage Drive	335	15,075	80
	<u>Magnetic Character Readers</u>				3901	First 5445 Disk Attachment	500	20,000	33
1255-001	Magnetic Character Reader (500 doc/min; 6 stackers)	805	38,645	210	3902	Second 5445 Disk Attachment	15	600	1
1255-002	Magnetic Character Reader (750 doc/min; 6 stackers)	980	44,260	335	2316-001	Disk Pack	20	525	TM
1255-003	Magnetic Character Reader (750 doc/min; 12 stackers)	1,300	60,240	440		INPUT/OUTPUT			
1470	Balance List	68	3,260	6		<u>Punched Cards</u>			
3215	Dash Symbol Transmission	50 S	35	NC	1442-006	Card Read Punch (300 cpm reading; 80 cpm punching)	265	14,140	55
4380	Card Sorting (51-col)	15	720	NC	1442-007	Card Read Punch (400 cpm reading; 160 cpm punching)	385	15,255	65
4520	High Order Zero and Blank Selection	30	1,400	5	3950	5410 Coupling	30	1,475	1
6303	System/3 Adapter	121	5,820	4	4130	1442-006, 007 Attachment	190	9,310	15
7060	Self-Checking Number	49	2,330	3	129-001	Card Data Recorder (reading 80-col cards at 50 cpm and punching at 12-50 cpm; applies to all 129 models)	125	6,125	38
7850	2772 Adapter	44	2,095	3	129-002	Card Data Recorder	140	6,860	42
					129-003	Card Data Recorder	150	7,350	43

PRICES — SMALL BUSINESS COMPUTERS, I-M (U. S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
IBM SYSTEM/3 MODEL 10 (Contd.)					<u>Magnetic Character Reader</u>				
5486-001	Card Sorter	90	4,690	38	1255-001	Magnetic Character Reader (500 doc/min; 6 stackers)	805	38,645	210
5486-002	Card Sorter	121	5,370	58	1255-002	Magnetic Character Reader (750 doc/min; 6 stackers)	980	44,260	335
1225	Alphabetic Sorting	7	222	1	1255-003	Magnetic Character Reader (750 doc/min; 12 stackers)	1,300	60,240	440
2370	Auxiliary Card Counter	10	515	3	1470	Balance List	68	3,260	6
7245	Sort Suppress/Digit Select	10	515	1	3215	Dash Symbol Transmission	50 S	35	NC
5424-A1	Multi-Function Card Unit (250 cpm)	286	10,010	140	4380	51-Column Card Sorting	15	720	NC
5424-A2	Multi-Function Card Unit (500 cpm)	429	13,320	200	4520	High Order Zero and Blank Selection	30	1,400	5
4100	MFCU Attachment 250/60/60	84	4,450	14	6303	System/3 Adapter	121	5,820	4
4101	MFCU Attachment 500/120/120	16	900	2	7060	Self-Checking Number	49	2,330	3
<u>Magnetic Tapes</u>					7850	2772 Adapter	44	2,095	3
3410-001	Magnetic Tape Unit	185	7,700	45	<u>Optical Mark Readers</u>				
3410-002	Magnetic Tape Unit	245	10,300	50	3881-001	Optical Mark Reader	1,351	56,000	140
3410-003	Magnetic Tape Unit	305	12,800	55	1471	BCD Read	56	2,350	110
3411-001	Magnetic Tape Unit	405	17,000	70	3450	Document Counters	22	930	2
3411-002	Magnetic Tape Unit	515	21,600	75	3801	Expanded Storage	56	2,350	1
3411-003	Magnetic Tape Unit	625	26,300	80	6451	Serial Numbering	165	6,900	25
3211	Single Density (1,600 bpi; phase encoded)	55	2,500	8	<u>Keyboards</u>				
3221	Dual Density (800 or 1,600 bpi; NRZI; only for 002 and 003 models of 3410 and 3411)	80	3,600	27	5471-001	Printer-Keyboard	106	4,980	32
6550	Seven Track	80	3,600	13	4110	5471 Printer-Keyboard Attachment	53	2,965	5
7003	Attachment to System/3 (for 3411)	75	3,150	3	5475-001	Data Entry Keyboard	42	2,380	7
7951	3411 Magnetic Tape Attachment	160	4,800	10	4120	5475 Data Entry Keyboard Attachment	47	2,675	1
<u>Printers</u>					DATA COMMUNICATIONS				
5203-001	Printer (100 lpm; 96 positions)	243	11,230	67	2074	Binary Synchronous Communications Adapter	280	12,300	65
5203-002	Printer (200 lpm; 96 positions)	296	12,480	76	1315	Auto Call	42	2,075	1
5203-003	Printer (300 lpm; 96 positions)	435	17,400	127	3601	SIA Local Attachment	25	1,000	1
3475	Dual Feed Carriage	79	3,890	20	4703	Internal Clock	26	1,295	1
3480	Dual Feed Carriage Control	26	1,295	1	7477	Station Selection	21	1,035	1
3970	Printer Attachment (for 001)	58	3,100	10	7850	Text Transparency	21	1,035	1
3971	Printer Attachment (for 002)	58	3,100	10	2084	Binary Synchronous Communications Adapter (2nd)	280	12,300	65
3972	Printer Attachment (for 003)	95	4,525	13	1325	Auto Call	42	2,075	1
4730	Additional Interchangeable Chain Cartridge	79	3,890	20	3602	EIA Local Attachment	25	1,000	1
4740	Additional Interchangeable Chain Cartridge	110	2,910	33	4723	Internal Clock	26	1,295	1
5532	Additional Print Chain	—	975	—	7487	Station Selection	21	1,035	1
5558	Additional Print Positions (24)	53	1,590	2	7851	Text Transparency	21	1,035	1
5559	Additional Print Positions (12)	26	795	NC	IBM SYSTEM/3 MODEL 15				
5560	Additional Print Positions (36)	79	3,380	2	<u>CENTRAL PROCESSOR & WORKING STORAGE</u>				
8371	Type Subs (1st slug; chain)	15 S	5	—	5415	Processing Units			
8372	Type Subs (each additional; chain)	7 S	5	—	-A17	48K	1,510	63,000	210
8373	Type Subs (1st slug; train)	20 S	15	—	-A18	64K	1,610	67,000	215
8374	Type Subs (each additional; train)	15 S	15	—	-A19	96K	1,860	78,000	220
8639	Universal Character Set Attachment	10	300	1	-A20	128K	2,060	86,000	230
8642	Universal Character Set Control	15	477	1	<u>Processor Options</u>				
9950	Artwork Per Character	—	100	—	5501	Power Supply Expansion	50	2,250	1
9951	Matrix (per slug; 2 char)	—	150	—	5733	Processing Unit Expansion 1	20	800	1
9952	Set Up (for 2 char)	—	50	—	5734	Processing Unit Expansion 2	55	2,200	1
9953	Matrix (per slug; 3 char)	—	150	—	5735	Processing Unit Expansion 3	20	800	1
9954	Set Up (for 3 char)	—	50	—	7081	Serial I/O Channel	159	7,790	6
5421-001	Printer Control Unit for 1403	260	12,740	26	MASS STORAGE				
1403-002	Printer (60 lpm)	750	28,030	171	<u>Discs</u>				
1403-NI	Printer (1,100 lpm)	875	33,970	197	5444-A2	Disc Storage Drive	300	10,075	65
1376	Auxiliary Ribbon Feeding	73	2,540	16	5444-A3	Disc Storage Drive	200	8,450	65
1416	Interchangeable Train Cartridge (for NI)	97	2,910	TM	6378	Second 5444 Attachment	67	3,495	6
4140	Printer Attachment (for 002)	120	5,880	21	5445-001	Disc Storage Drive	350	15,750	85
4150	Printer Attachment (for 003)	175	6,380	21	3901	First 5445 Attachment	500	20,000	33
4740	Interchangeable Chain Cartridge Adapter	73	2,580	NC	3903	Second 5445 Attachment	75	3,000	1
5110	Multiple Character Set Feature (for 002)	10	380	2	5440	Disc Cartridge (for 5444-A2)	175	TM	
5111	Multiple Character Set Feature (for NI)	10	380	2	5422	Disc Enclosure	100	4,900	12
5381	Numerical Print	218	7,460	9					
5523	Preferred Character Set Feature	39	1,240	2					
5532	Additional Print Chain	975	975	NC					
6410	Selective Tape Listing (for NI)	184	6,680	10					
6411	Selective Tape Listing (for 002)	184	6,680	10					
6413	Selective Tape Listing Stacker	—	250	TM					
6420	Selective Tape Listing (for NI only)	272	9,890	23					
8371	Type Subs (first slug; chain)	15 S	5	—					
8372	Type Subs (each additional slug; chain)	7 S	5	—					
8640	Universal Character Set (for NI)	10	380	2					
8641	Universal Character Set (for 002)	10	380	2					
9950	Special Chain Artwork	—	100	—					
9951	Matrix (per slug)	—	150	—					
9952	Set Up (2-char slug)	—	50	—					

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
IBM SYSTEM/3 MODEL 15 (Contd.)					2020				
INPUT/OUTPUT					Submdl 3 Processing Unit Submodel 3				
					-B3	CPU (4K)	355	11,270	37
					-C3	CPU (8K)	450	14,190	42
					-BC3	CPU (12K)	605	19,080	48
					-D3	CPU (16K)	760	23,700	52
	<u>Punched Cards</u>				2020				
1442-006	Card Read Punch (300 cpm read; 80 cpm punch)	265	14,140	55	Submdl 4 Processing Unit Submodel 4				
1442-007	Card Read Punch (400 cpm read; 160 cpm punch)	385	15,255	65	-B4	CPU (4K)	395	12,560	40
3950	5410 Coupling	30	1,475	1	-C4	CPU (8K)	490	15,415	45
4130	1442-006, 007 Attachment	190	9,310	15	-BC4	CPU (12K)	645	20,235	51
					-D4	CPU (16K)	800	24,920	55
2501-A1	Card Reader (600 cpm)	195	11,010	35	2020				
-A2	Card Reader (1,000 cpm)	255	11,240	49	Submdl 5 Processing Unit Submodel 5				
3630	2501 Coupling	5	150	NC	-C5	CPU (8K)	875	44,230	90
8090	2501 Attachment	150	6,700	7	-BC5	CPU (12K)	1,125	56,260	100
					-D5	CPU (16K)	1,375	70,615	105
5424-A1	Multi-Function Card Unit (250/60/60 cpm)	286	10,010	140	-DC5	CPU (24K)	1,710	88,950	115
5424-A2	Multi-Function Card Unit (500/120/120 cpm)	429	13,320	200	-E5	CPU (32K)	2,050	104,565	130
4100	MFCU Attachment (for 5424-A1)	84	4,450	14	2020				
4101	MFCU Attachment (for 5424-A2)	16	900	2	Submdl 6 Processing Unit Submodel 6				
2560-A1	Multi-Function Card Machine	615	27,055	97	-C6	CPU (8K)	575	19,550	100
1575	Card Print (first 2 lines)	135	5,880	14	-BC6	CPU (12K)	800	29,600	110
1576	Card Print (second 2 lines)	135	5,880	14	-D6	CPU (16K)	1,000	40,000	115
1577	Card Print (third 2 lines)	135	5,880	14					
1580	Card Print Control	25	1,250	3	3901	1401/1440 Compatibility (submdl 5 only)	275	13,750	29
8100	2560 MFCM	150	6,300	16	MASS STORAGE				
	<u>Magnetic Tapes</u>				<u>Discs</u>				
3411-001	Magnetic Tape Unit & Control	405	17,000	70	2311-011	Disk Storage Drive	570	21,030	55
3411-002	Magnetic Tape Unit & Control	515	21,600	75	2311-012	Disk Storage Drive	350	18,390	35
3411-003	Magnetic Tape Unit & Control	625	26,300	80	1316	Disk Pack	15	360	TM
7951	3411 Magnetic Tape Attachment	160	4,800	10					
	<u>Printers</u>				7495	Storage Control (Submodel 2 or 4)	225	7,410	5
1403-002	Printer (600 lpm)	750	28,030	171	7496	Storage Control (Submodel 4)	172	5,540	5
1403-005	Printer (465 lpm)	580	26,800	123	7497	Storage Control (Submodel 5)	225	7,410	5
1403-N1	Printer (1,100 lpm)	875	33,970	197	7498	Storage Control (Submodel 6)	225	7,410	5
4140	Printer Attachment (1403-002)	120	5,150	21	INPUT/OUTPUT				
4135	Printer Attachment (1403-005)	110	4,700	21	<u>Punched Card</u>				
4150	Printer Attachment (1403-N1)	175	5,650	21	1442-005	Card Punch	255	12,365	52
5421	Printer Control Unit (for 1403)	260	12,740	26	3630	1130/1442 Coupling	5	225	NC
	DATA COMMUNICATIONS				4460	1442-005 Attachment	30	985	3
2074	Binary Synchronous Communications Adapter (1st)	280	12,300	65	2501-A1	Card Reader	195	11,010	35
1315	Auto Call	42	2,075	1	2501-A2	Card Reader	255	11,240	49
3601	SIA Local Attachment	25	1,000	1	3630	1130/2501 Coupling	5	150	NC
4703	Internal Clock	26	1,295	1	8090	2501 Attachment	20	670	2
7477	Station Selection	21	1,035	1	2520-A1	Card Read Punch	730	31,515	98
7850	Text Transparency	21	1,035	1	2520-A2	Card Punch	650	28,225	93
2084	Binary Synchronous Communications Adapter (2nd)	280	12,300	65	2520-A3	Card Punch	470	27,945	72
1325	Auto Call	42	2,075	1	8092	2520-A1 Attachment	50	1,640	6
3602	EIA Local Attachment	25	1,000	1	8095	2520-A2 or A3 Attachment	25	850	3
4723	Internal Clock	26	1,295	1	2560-A1	Multi-Function Card Machine	615	27,055	97
7487	Station Selection	21	1,035	1	2560-A2	Multi-Function Card Machine	480	19,885	97
7851	Text Transparency	21	1,035	1	1575	Card Print, First 2 Lines	135	5,880	14
4765	Local Communications Adapter	150	6,500	28	1576	Card Print, Second 2 Lines	135	5,880	14
3741-002	Data Station	194	7,250	50	1577	Card Print, Third 2 Lines	135	5,880	14
3271-002	Control Unit	180	7,200	12	1580	Card Print Control	25	815	2
3275-002	Display Station	145	6,500	13	8099	2560 Attachment	75	2,470	5
					8100	2560 Attachment	75	2,470	5
* * * * *									
	IBM 360/20				<u>Printers</u>				
	CENTRAL PROCESSOR & WORKING STORAGE				1403-002	Printer (600 lpm)	750	28,030	159
					1403-007	Printer (600 lpm)	630	26,960	124
					1403-N1	Printer (1,100 lpm)	875	33,970	183
					4442	1403-002 Attachment	225	7,410	23
					4447	1403-007 Attachment	200	7,245	23
					4448	1403-N1 Attachment	275	7,740	23
					1376	Auxiliary Ribbon Feeding	73	2,540	16
2020					4740	Interchangeable Chain Cartridge Adapter	73	2,580	NC
Submdl 1	Processing Unit Submodel 1				5110	Multiple Character Set Feature (for 002)	10	380	2
-B1	CPU (4K)	500	16,005	37	5111	Multiple Character Set Feature (for N1)	10	380	2
-C1	CPU (8K)	700	22,130	42	5381	Numerical Print	218	7,460	9
-BC1	CPU (12K)	950	30,035	48	1416	Interchangeable Train Cartridge (for N1)	97	2,910	TM
-D1	CPU (16K)	1,200	37,410	52	5523	Preferred Character Set Feature	39	1,240	2
					5532	Print Chain, Additional	975 S	975	NC
2020									
Submdl 2	Processing Unit Submodel 2								
-B2	CPU (4K)	575	18,375	40					
-C2	CPU (8K)	775	24,500	45					
-BC2	CPU (12K)	1,030	32,400	51					
-D2	CPU (16K)	1,275	39,780	55					

PRICES — SMALL BUSINESS COMPUTERS, I-M (U. S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
IBM 360/20 (Contd.)					1419-001	Magnetic Character Reader	2,380	107,185	241
5575	Printer Features Control	55	1,740	2	1445	Batch Numbering	130	6,060	10
6410	Select Tape List (for N1)	184	6,680	10	3215	Dash Symbol Transmission	50 S	35	NC
6411	Select Tape List (for 002)	184	6,680	10	3610	Electronic Accumulation and Sequence Check	251	9,455	19
6413	Selective Tape Listing Stacker	—	250	TM	3791	Endorser	394	17,800	32
6420	Select Tape List (for N1)	272	9,890	23	3792	Endorser Plate (no artwork)	—	55	—
8371	Type Subs, First Slug, Chain	15 S	5	—	3795	Endorser Only	261	11,735	21
8372	Type Subs, Chain, Each Additional Slug	7 S	5	—	3800	Expanded Capability	162	7,285	1
8637	Universal Character Set Adapter	15	505	4	4380	Card Sorter (51-col)	15	720	NC
8640	Universal Character Set (for N1)	10	380	2	4700	Isolation Control Unit	NC	NC	NC
8641	Universal Character Set (for 002)	10	380	2	5201	Multiple Column Control	52	2,180	2
9951	Service Charge — Matrix (per slug)	—	150	—	5739	5739 Program Control (for pocket lights 1-6)	27	960	1
9952	Service Charge — Set Up (2-chain slug)	—	50	—	5741	5741 Program Control (for pocket lights 7-12)	10	380	1
2203-A1	Printer (submdl 1, 2, 5, or 6)	510	18,390	72	7061	Self-Checking Number Mod 10	42	1,890	2
2203-A2	Printer (submdl 3 or 4)	390	14,020	72	7062	Self-Checking Number Mod 11	68	2,910	3
1901	Additional Character Set (13 char)	400 S	400	NC	7440	Split Field	21	1,190	1
1902	Additional Character Set (39 char)	450 S	450	NC	7720	S/360 Adapter — Single Address	104	5,140	7
1903	Additional Character Set (52 char)	475 S	475	NC	7730	S/360 Adapter — Dual Address	282	12,705	9
1904	Additional Character Set (63 char)	500 S	500	NC	DATA COMMUNICATIONS				
8082	2203 Attachment	55	1,815	5	1315	Automatic Calling	34	835	1
8083	2203 Attachment	55	1,815	5	2074	Binary Synchronous Communication Adapter	410	11,545	17
8084	2203 Attachment	55	1,815	5	4500	High Speed (19.2K bps)	49	1,190	1
8085	2203 Attachment	55	1,815	5	4501	High Speed (40.8K or 50K bps)	49	1,190	1
3475	Dual Feed Carriage	100	4,000	9	4100	Full Transparent Text Mode	20	490	1
3480	Dual Feed Carriage Control	10	350	2	4703	Internal Clock	25	615	1
5558	Print Positions (24 add'l)	45	1,980	4	7477	Station Selection	29	715	1
7815	Tape Channels (6 add'l)	10	340	1	3872-001	Modem (2,400 bps)	85	2,975	24
2152-001	Printer-Keyboard	131	5,430	61	3875-001	Modem (7,200 bps)	240	8,400	70
4450	Forms Stand Stacker	—	60	NC	4875-001	Modem (4,800 bps) point-to-point	—	4,460	20
8070	2152 Attachment	87	3,055	5	4875-003	Modem (4,800 bps) multipoint tributary	—	4,850	23
<u>Magnetic Tape</u>					Note				
2401-001	Magnetic Tape Unit	335	12,880	66	Disc drives, mag tape units, printers, and many features that connect to these devices may also be leased on either a 12- to 23-month plan, which decreases 1-year lease prices approximately 8%, or a 24-month plan, which decreases 1-year lease prices approximately 16%.				
2401-002	Magnetic Tape Unit	485	18,720	75	* * * * *				
2401-004	Magnetic Tape Unit	385	14,800	92	IBM SYSTEM/370 MODEL 115				
3471	Dual Density (800 to 1,600 bpi)	25	990	2	CENTRAL PROCESSOR & WORKING STORAGE				
5121	Mode Compatibility	10	380	NC	3115	Central Processing Unit (display operator console; dynamic address translation; commercial instruction set, including decimal instructions; byte-oriented operand; storage protection; time-of-day clock, interval timer, CPU-timer, and clock comparator; error checking and correction; program event recording; channel indirect data addressing; monitor call; direct attachment for the 3340 direct access storage facility; and core storage)			
5301	Native Tape Attachment (for 001 and 002)	440	22,000	170	-F	65,563 bytes	2,945	142,900	250
5302	Native Tape Attachment (for 004)	535	26,750	310	-FE	98,304 bytes	3,145	152,600	255
5519	Power Window	275	275	NC	-G	131,304 bytes	3,345	162,300	160
7125	7-Track Compatibility (for feature 5301)	50	2,500	22	-GE	163,840 bytes	3,545	172,200	265
7126	7-Track Compatibility (for feature 5302)	110	5,500	33	<u>Processor Options</u>				
7160	Simultaneous Read While Write	10	380	NC	3898	External Signals	100	4,850	1
2415-001	Magnetic Tape Unit and Control	750	29,390	108	3900	Floating Point	NC	NC	NC
2415-002	Magnetic Tape Unit and Control	1,205	47,030	194	4640	Integrated Communications Adapter	205	9,950	21
2415-003	Magnetic Tape Unit and Control	1,655	64,660	280	4641	Integrated Communications Adapter Extension	75	3,650	1
2415-004	Magnetic Tape Unit and Control	905	35,590	124	4650	Integrated 3203 Attachment (4653 req'd)	75	3,700	6
2415-005	Magnetic Tape Unit and Control	1,455	57,180	221	4653	Integrated 3203/5203 Prerequisite	80	3,800	7
2415-006	Magnetic Tape Unit and Control	2,005	78,770	318	4670	Integrated 2560 Attachment	140	6,800	10
3228	Data Conversion	45	1,730	1	4690	Integrated 5203 Mdl 3 Attachment (4653 req'd)	75	3,700	6
4701	Isolation Control Unit (for 001, 002, 003)	NC	NC	NC	4692	Integrated 5213 Mdl 1 Attachment	100	4,850	3
4703	Isolation Control Unit (for 004, 005, 006)	NC	NC	NC	4695	Integrated 5425 Attachment	140	6,800	16
5320	9-Track Compatibility	135	5,190	10	5248	Byte Multiplexer Channel	190	9,250	17
7125	7-Track Compatibility (for 001, 002, 003)	50	1,920	1	7520	S/360 Mdl 20 Compatibility	NC	NC	NC
7127	7-Track Compatibility (for 004, 005, 006)	95	3,640	4					
7135	7- and 9-Track Compatibility	155	5,950	13					
<u>Magnetic Character Readers</u>									
1255-001	Magnetic Character Reader (500 dpm; 6 stackers)	805	38,645	210					
1255-002	Magnetic Character Reader (750 dpm; 6 stackers)	980	44,260	335					
1255-003	Magnetic Character Reader (750 dpm; 12 stackers)	1,300	60,240	440					
6320	S/360 Mod 20 Adapter (reqrd)	150	7,200	18					
4520	High Order Zero and Blank Selection (mdl 3 only)	30	1,440	5					
7060	Self-checking Number/Improved Recognition	49	2,330	2					
3215	Dash Symbol Transmission	50 S	35	NC					
4380	Card Sorter (51-col)	15	720	NC					
1259-001	Magnetic Character Reader	1,065	48,015	250					
7081	Serial I/O Channel	100	3,490	7					

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
	IBM SYSTEM/370 MODEL 115 (Contd.)				6360	S/360/370 Adapter (req'd)	450	21,600	31
					1259	Magnetic Character Reader (max 1/system)	1,360	61,110	260
	MASS STORAGE				1419	Magnetic Character Reader	2,380	107,185	241
	<u>Discs</u>				7720	S/360 Adapter (single address; req'd)	104	5,140	6
					7730	S/360 Adapter (dual address; req'd)	282	12,705	8
3340-A2	2 Drives	999	40,000	74		<u>Optical Readers</u>			
-B1	1 Drive	558	22,000	40	1287	Optical Reader (max 8/system; document reading only)	3,400	136,000	1,160
-B2	2 Drives	705	28,000	64	3881	Optical Mark Reader (max 8/system)	1,351	56,000	140
	INPUT/OUTPUT				3886	Optical Character Reader (max 8/system)	2,315	91,000	475
	<u>I/O Attachments</u>					<u>Audio Response</u>			
3540	Diskette I/O Unit				7770	Audio Response Unit (up to 4 lines)	1,165	55,870	38
-B1	One drive	535	22,000	25	4668	I/O Line Frame (for more than 16 lines; max 1)	194	9,310	2
-B2	Two drives	805	33,000	35	4677	I/O Line Expander (4 more lines; max 11)	170	8,150	12
3411	Magnetic Tape Adapter (7361 req'd)	100	4,850	3	4679	I/O Line Panel (for each increment of 8 lines beyond first 8; max 5)	73	3,490	2
7361	S/370 Mdl 115/125 Attachment	100	4,200	4		<u>Displays</u>			
	<u>Printers</u>				1053-4	Printer (appropriate adapter req'd on 2848; max 1)	49	1,940	10
1443	Printer (240 lpm; 52-char set)	850	36,500	87	2250-1	Display Unit (for single display unit)	1,065	51,215	157
3203-1	Printer (600 lpm; 4650 req'd)	940	38,000	185	-2	Display Unit (max 4 per 2840)	1,550	31,025	177
-2	(1,200 lpm; 4650 req'd)	1,234	49,000	240	1002	Absolute Vectors and Control	390	15,520	11
5203	Printer (300 lpm; 4690 req'd)	435	17,400	127	1498	Buffer (4,096 bytes; req'd on 2250 mdl 1)	340	16,295	7
5213	Printer (4692 req'd)	160	6,200	48	1499	Buffer (8,192 bytes; req'd on 2250 mdl 1)	485	23,280	10
	<u>Punched Cards</u>				1880	Character Generator	365	17,460	15
1442-N1	Card Read/Punch (400 cpm read; 160 col sec punch)	510	25,460	81	2840	Display Control (controls and attachments for up to 2 2250 mdl 3s)	3,880	72,000	141
-N2	Card Punch (160 col/sec)	365	18,185	71	3352	Display Multiplexer (add'l attachments for up to 2 more 2250 mdl 3s)	390	8,000	13
2501-B1	Card Reader (600 cpm)	260	14,590	51	2848	Display Control			
-B2	Card Reader (1,000 cpm)	320	14,820	55	-1	Up to twenty-four 2260 mdl 2s (240 char/2260)	360	15,715	23
2520-B1	Card Read/Punch (500 cpm)	915	39,520	151	-2	Up to sixteen 2260 mdl 2s (480 char/2260)	390	16,480	23
-B2	Card Punch (500 cpm)	810	35,000	142	-3	Up to eight 2260 mdl 1s (960 char/2260)	420	17,975	24
-B3	Card Punch (300 cpm)	625	34,715	114	-21	Up to twenty-four 2260 mdl 2s (240 char/2260)	725	32,735	28
2596	Card Read/Punch	845	29,575	330	-22	Up to sixteen 2260 mdl 2s (480 char/2260)	775	34,920	28
2560-A1	Multi-functional Card Machine (500 cpm)	615	27,055	97		Display Adapter (1 req'd for each two 2260s)			
-A2	Multi-functional Card Machine (310 cpm)	480	19,885	97	3355	On Mdl 1 (3858 or 3859 req'd for more than 2)	40	1,505	2
5425-A1	Multi-functional Card Unit (250/60/60 cpm)	570	18,000	150	3356	On Mdl 2 (3358 or 3859 req'd for more than 1)	80	3,005	4
-A2	Multi-functional Card Unit (500/120/120 cpm)	740	22,000	295	3357	On Mdl 3 (3859 req'd for more than 1)	100	3,765	5
	<u>Paper Tape</u>				3368	On Mdl 21 (3868 req'd for more than 6)	58	2,620	2
1017-1	Paper Tape Reader (120 cps; reads strips of tape)	49	2,330	14	3369	On Mdl 22 (3868 req'd for more than 4)	116	5,240	3
-2	Paper Tape Reader (120 cps; reads strips or rolls)	73	3,565	17	3858	Expansion Unit			
1018	Paper Tape Punch (120 cps)	121*	5,395*	40	3859	On Mdl 1 or 2 (for add'l display adapters and/or a 1053 adapter-7927)	55	2,260	NC
2671	Paper Tape Reader (1,000 cps)	140*	6,305*	21	3858	On Mdl 1, 2, or 3 (for add'l display adapters; 3858 req'd on mdl 1 or 2)	45	1,835	NC
2822	Paper Tape Control (controls one 2671)	210*	9,410*	8	3859	On Mdl 21 or 22 (for add'l display adapters)	49	2,180	NC
2826	Paper Tape Control (for up to 2 1017s and/or 2 1018s)	275*	14,380*	35	7927	On Mdl 1 or 2 (3858 req'd)	40	1,505	3
5801	Punch Adapter - Line 1 (for first 1018)	97	4,945	9	7928	On Mdl 3	40	1,505	3
5802	Punch Adapter - Line 2 (for second 1018)	82	4,220	5	7938	On Mdl 21 or 22)	102	4,585	5
6101	Reader Adapter - Line 1 (for first 1017)	82	4,220	8	2260-1	Display Station (for use with 2848 mdl 3)	30	970	8
6102	Reader Adapter - Line 2 (for second 1017)	68	3,470	5	-2	Display Station (for use with 2848 mdl 1, 2, 21, or 22)	30	970	8
	<u>Magnetic Tapes</u>				3272	Control Unit (basic unit provides for attachment of up to 4 devices; one 3277 mdl 1 is req'd with a 3272 mdl 2)			
2495	Tape Cartridge Reader (900 cps)	340	18,670	155	-1	480 Char	190	7,500	11
3410	Magnetic Tape Unit (1 tape drive)				-2	1,920 Char	205	8,200	23
-1	20K bps at 1,600 bpi	185	7,700	45	3250	Device Adapter (each attaches up to 4 add'l devices; max 7)	55	1,075	1
-2	40K bps at 1,600 bpi	245	10,300	50					
-3	80K bps at 1,600 bpi	305	12,800	55					
3411	Magnetic Tape Unit and Control (single-channel control unit with 1 drive)								
-1	20K bps at 1,600 bpi	405	17,000	70					
-2	40K bps at 1,600 bpi	515	21,600	75					
-3	80K bps at 1,600 bpi	625	26,300	80					
3211	Single-Density Tape Unit	55	2,500	7					
3221	Dual-Density Tape Unit	80	3,600	27					
6550	7-Track Tape Unit	80	3,600	13					
	<u>Magnetic Character Readers</u>								
1255	Magnetic Character Reader								
-1	500 Documents/minute - 6 stackers	805	38,645	210					
-2	750 Documents/minute - 6 stackers	980	44,260	335					
-3	750 Documents/minute - 12 stackers	1,300	60,240	440					

PRICES — SMALL BUSINESS COMPUTERS, I-M (U. S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
INPUT/OUTPUT (Contd.)					NC No Charge	— Not Applicable	TM	Time and Material Basis	
					S Single Use Charge	NA Not Available			
3277-1	Display Station (480 char; for 3272 mdl 1 or 2)	75	3,400	7					
-2	Display Station (1,920 char; for 3272 mdl 2 only)	110	4,400	15					
3284-1	Printer (40 cps; 480 char; for 3272 mdl 1 or 2)	150	5,850	28					
-2	Printer (40 cps; 1,920 char; for 3272 mdl 2 only)	160	6,560	28					
3286-1	Printer (480 char; for 3272 mdl 1 or 2)	180	7,380	28					
-2	Printer (1,920 char; for 3272 mdl 2 only)	190	8,170	28					
DATA COMMUNICATIONS									
1201	Asynchronous Line Group	40	1,950	3					
1231	Asynchronous Line Medium Speed	40	1,950	2					
1241	Asynchronous Line Pair, Low Speed	55	2,650	3					
1291	Auto Call Adapter, Line Position A1	20	950	1					
1292	Line Position A2	20	950	1					
1295	Line Position S1	20	950	1					
1296	Line Position S2	20	950	1					
2701	Data Adapter Unit (attaches up to 4 lines or adapters)	200	9,130	15					
2702	Transmission Control (attaches up to 15 lines, max 600 bps; up to 32 lines, max 200 bps)	850	38,395	46					
2703	Transmission Control	1,450	65,485	76					
2715	Transmission Control Unit	1,550	77,600	185					
3704-A1+	Communication Controller (attaches up to 32 lines)	646	26,000	115					
3705-A1+	Communication Controller (attaches up to 352 lines, max 50K bps)	1,152	47,150	150					
4743	IBM Leased Line Adapter	14	490	2					
	IBM 1,200-bps Line Adapter								
4781	Nonswitched	15	525	2					
4782	Switched with Autoanswer	20	700	3					
4791	Switched with Autocall and Autoanswer	65	2,275	10					
4792	Line Adapter Base 2	25	1,200	2					
4793	Line Adapter Base 3	25	1,200	2					
7100	Synchronous Line Group	40	1,950	3					
7121	Synchronous Line High Speed	100	4,850	7					
	Synchronous Line Medium Speed with Clock								
7141	Line Position S1	55	2,650	3					
7142	Line Position S2	55	2,650	3					
7143	Line Position S3	55	2,650	3					
7144	Line Position S4	55	2,650	3					
	Synchronous Line Medium Speed								
7151	Line Position S1	45	2,200	3					
7152	Line Position S2	45	2,200	3					
7153	Line Position S3	45	2,200	3					
7154	Line Position S4	45	2,200	3					
7881	Telograph Line Pair	55	2,650	7					

Notes

* Manufactured in France. Freight charges from point of shipment in USA.

+ Model A1 prices are quoted. All other models are also compatible.

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LITTON ABS 1200 SERIES

CENTRAL PROCESSOR AND WORKING STORAGE

1241	Basic System (1801 16-32K processor; keyboard; paper tape storage; paper tape reader and punch; and printer)	NA	22,760	NA
1251	Basic System (same as 1241 except has 16K words of usable memory)	NA	26,900	NA
1281-1	Basic System (includes 1 magnetic ledger card chute)	NA	22,960	NA
1281-2	Basic System (includes 2 magnetic ledger card chutes)	NA	24,960	NA

MASS STORAGE

Disc

52	Drum Storage System (16K words)	NA	10,750	NA
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Notes

Two- to five-year leases available. Free installation; unlimited usage. Parts, labor, and 90-day preventive maintenance included in maintenance charges. Request price quotation for rental and maintenance prices.

PRICE DATA

Small Business Computers, N-Z (U.S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
	NCR CENTURY 50				615-100/				
	CENTRAL PROCESSOR & WORKING STORAGE				616-300	Processor (with 32K memory)	400	12,500	10
	Basic System				662-100	Paper Tape Reader (1,000 cps)	—	—	-15
615-50/616-200	Processor (with 16K memory)	1,575	71,500	275	626-101	Printer Control Unit (price included with printers)	—	—	—
682-100	Card Reader (300 cpm)				640-200	Printer (1,500 lpm; 132 cols), or	925	35,500	75
640-122	Printer (200 lpm)				640-210	Printer (1,500 lpm; 160 cols), or	1,025	39,750	75
655-151	Disc Unit (8.4 mb; low speed)				640-300	Printer (600 lpm; 132 cols)	675	25,450	50
	Alternate Devices (for basic system)				640-205	OCR Printer (750/1,500 lpm; 132 cols)	1,025	38,300	85
615-50/616-300	Processor (with 32K memory)	300	12,500	10	640-215	OCR Printer (750/1,500 lpm; 160 cols)	1,125	42,550	85
662-100	Paper Tape Reader (1,000 cps)	—	—	-15		Processor Options			
640-132	Printer (300 lpm)	150	6,000	15	6101	For Century 100 Basic System			
640-102	Printer (450 lpm)	350	12,000	30	6105	Input/Output Writer (for 615-100)	100	4,000	15
655-101	Disc Unit (8.4 mb; high speed)	150	5,000	35	6106	I/O Writer Selector Switch Assembly	5	200	1
	Processor Options				6107	Software Initiated Alarm	10	400	2
5621	Communications Package (6101 req'd)	425	19,500	75	6107	Remote Audible Alarm	20	800	1
5622	BASIC-1 Hardware Pkg (6101 req'd)	400	18,500	60	6108	Extra Loud Alarm	20	800	1
6051	One Common Truck	50	3,000	5		Century 101 Basic System	2,025	89,520	325
6101	Input/Output Writer	100	4,000	15	615-101 w/				
6106	Software Initiated Alarm	10	400	2	7001	Processor (w/16K byte memory)			
6107	Remote Audible Alarm	20	800	1	682-101	Card Reader			
6108	Extra Loud Alarm	20	800	1	649-300	Printer (300 lpm)			
	MASS STORAGE				656-102	Disc Unit (4.9 mb)			
	<u>Discs</u>				6561	Disc Unit Controller			
655-102	High Speed Disc (108 kb; 8.4M bytes)	625	28,750	110	6562	Fixed Disc (4.9 mb)			
655-152	Low Speed Disc (108 kb; 8.4M bytes)	550	26,500	75		Alternate Devices (for Century 101 Basic System)			
	INPUT/OUTPUT				615-101/				
	<u>Punched Card</u>				7002	Processor (w/24K byte memory)	175	7,875	10
686-111	Card Read/Punch (560/60-180 cpm; 6051 req'd)	400	20,500	115	615-101/	Processor (w/32K byte memory)	300	13,500	15
686-201	Card Reader (750 cpm; 6051 req'd)	300	14,750	75	7003	Processor (w/48K byte memory)	600	27,000	25
686-311	Card Punch (60-180 cpm; 6051 req'd)	300	14,750	75	615-101/	Processor (w/64K byte memory)	900	40,500	35
	<u>Paper Tape</u>				7005	Processor (w/64K byte memory)	900	40,500	35
660-101	Paper Tape Reader (1,500 cps; 6051 req'd)	300	14,750	35	662-100	Paper Tape Reader (1000 cps)	-0-	-0-	-15
665-101	Paper Tape Punch (200 cps; 6051 req'd)	375	18,000	55	640-102	Integrated Printer (450-900 lpm)	150	10,100	5
	<u>Magnetic Tape</u>				640-102/				
624-119	9-Channel Control Unit (40 kc)	300	14,000	20	626-101	Printer w/Controller (450-900 lpm)	300	17,350	5
624-179	7-/9-Channel Control Unit (10/28/40 kc; 200/556/800 bpi)	350	16,500	20	640-300	Integrated Printer (1,200 lpm)	575	23,800	30
633-117	7-Channel Control Unit (10/28/40 kc; 200/556/800 bpi)	350	17,000	65	640-300/				
633-119	9-Channel Unit (40 kc)	350	17,000	65	626-101	Printer w/Controller (1,200 lpm)	675	28,800	30
	<u>Sorter</u>				655-201/				
670-101	MICR Sorter (600 dpm; 6051 req'd)	990	45,000	150	625-101	Disc Unit & Controller (8.2 mb; 108 kb)	345	16,455	30
	DATA COMMUNICATIONS				656-102's	Additional Disc Unit w/Attachment (9.98 mb capacity)	225	9,195	47
622-201	735/736 Encoder Adapter	175	8,250	10	657-102/				
Notes:					625-201	Disc Unit & Controller (60 mb; 315 kb)	1,220	57,605	40
	Basic systems listed are minimum configurations that can be purchased. Device prices under the headings of Alternate Devices are amounts to be added to, or subtracted from, price of basic system.					Processor Options			
	*****				6001	For Century 101 Basic System			
	NCR CENTURY 100 and 101				6002	Multiply/Divide	100	4,500	10
	CENTRAL PROCESSOR & WORKING STORAGE				6003	Integrated Communications Multiplexor	175	7,875	40
615-100/616-200	Century 100 Basic System				6006	I/O Common Trunks 1 & 6	100	4,500	10
682-100	Processor (with 16K memory)	2,500	89,500	385	6007	640-102 Integrated Printer Controller	75	3,375	10
640-102	Card Reader (300 cpm)				6010	640-300 Integrated Printer Controller	125	5,625	10
640-102	Printer (450 — 900 lpm)				6101	Logic Command	50	2,350	—
655-101	Disc Unit (8.4 mb; high speed)				6102	Teletype I/O Writer w/Interface	100	4,000	15
	Alternate Devices (for Century 100 Basic System)				6106	Thermal I/O Writer w/Interface	150	6,250	15
					6107	Software Initiated Alarm	10	400	2
					6108	Remote Audible Alarm	20	800	1
					615-951	Extra Loud Alarm	20	800	1
					9511	Auxiliary Cabinet	25	800	—
						640 Integrated Printer Attachment	75	3,375	15
						MASS STORAGE			
						<u>Discs</u>			
					656-102	For Century 101 Basic System			
					6561	Disc Unit (4.98 mb)	310	13,020	60
					6562	Disc Unit Controller	150	6,750	25
					6563	Fixed Disc (4.98 mb)	95	4,275	15
						Dual Disc Attachment	10	450	2
						Additional Equipment (for Century 100 and 101)			
						MASS STORAGE			
						<u>Discs</u>			
					625-101	Disc Control Unit	300	14,000	15
					655-102	Disc Unit (as a sec unit on 615-100 processor)	625	28,750	110

PRICES — SMALL BUSINESS COMPUTERS, N-Z (U. S.)

Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$
MASS STORAGE (Contd.)					640-122/-	Printer (200 or 300 lpm, 132 col)	NA	NA	NA
655-201	Common Trunk Unit (625-101 reqd)	600	26,500	115	132	6/8 Lines Per Inch Selector	25	1,000	-0-
955-1	Disc Pack (for 655 Disc Units)	12	350	NA	6401	Printer (1,500 lpm, 132 col)	1,200	49,000	110
625-201	Single Density Disc Controller (for 657 disc units)	875	40,250	40	6402	640-200 Continuous Form Tab Set Handling Feature	10	300	2
625-202	Dual Density Disc Controller (for 657 disc units)	1,075	49,450	70	640-205	OCR Printer (750/1,500 lpm, 132 col)	1,300	51,800	120
657-101	Single Spindle Disc Unit (30/48 mb)	575	26,450	90	640-210	Printer (1,500 lpm, 160 col)	1,300	53,250	110
657-102	Dual Spindle disc unit (60/96 mb)				640-215	OCR Printer (750/1,500 lpm, 160 col)	1,400	56,050	120
	1st Unit	900	41,400	100	640-300	Printer (600 lpm, 132 col)	950	38,950	85
	2nd Unit	700	32,200	100	6401	6/8 Lines Per Inch Selector	25	1,000	-0-
	3rd or more Units	600	27,600	100	649-300	Printer (300 lpm, 64 char set)	575	24,150	80
6571	Add-On Drawer	325	14,950	10	6491	6/8 Lines Per Inch Selector	15	675	1
956-1	Disc Pack (for 656 disc units)	NA	175	NA	1001	Single Numeric, 64 char set (450/450 lpm)	-	1,500	-
957-1	Disc Pack (for 657 disc units)	12	425	NA	1011	Double Numeric, 52 char set (450/900 lpm)	-	1,500	-
CRAM Units					1081	Block Typeline for 1" char	-	3,000	-
623-201	CRAM Control Unit	300	14,000	20	1190	Shelf-Labeling Typeline	85	1,800	-
653-101	CRAM Unit (145 mb)	1,250	60,000	140	2001	Single Numeric, 64 char set (1,500/1,500 lpm)	-	1,500	-
	CRAM Deck	-	450	-	2011	Double Numeric, 52 char set (1,500/3,000 lpm)	-	1,500	-
INPUT/OUTPUT					2081	Financial Typeline	85	1,800	-
Punched Card					2181	Financial Typeline	85	1,800	-
680-201	Card Reader (1,200 cpm)	650	32,500	120	2101	Single Numeric, 64 char set (1,500/1,500 lpm)	-	1,500	-
686-102	Card Read/Punch (800/83-294 cpm)	500	24,000	115	2111	Double Numeric, 52 char set (1,500/3,000 lpm)	-	1,500	-
686-111	Card Read/Punch (560-60/180 cpm)	400	20,500	115	2161	OCR-A, Double Numeric, 64 char set (750/1,500 lpm)	-	1,500	-
686-201	Card Read (750 cpm)	300	14,750	75	2190	Shelf-Labeling Typeline	85	1,800	-
686-302	Card Punch (82-240 cpm)	300	14,750	115	2195	OCR-B, Double Numeric, 64 char set (750/1,500 lpm)	-	1,500	-
687-301/622-701	Card Punch and Controller (100 cpm)	325	15,500	95	3011	Double Numeric, 64 char set (1,200/1,200 lpm)	-	1,500	-
Paper Tape					3031	Upper/Lowercase, 52 char set (600/1,200 lpm)	-	1,500	-
660-101	Paper Tape Read (1,500 cps)	300	14,750	35	DATA COMMUNICATIONS				
665-101	Paper Tape Punch (200 cps)	375	18,000	55	621-101	Communications Multiplexor (15 lines)	300	15,000	40
Magnetic Tapes					690-101	621-101 Auxiliary Cabinet	50	2,500	-0-
624-111	80 kb Control Unit	450	21,000	20	621-102	Communications Multiplexor* (250 lines)	475	22,750	45
633-111	80 kb Single Unit (phase modulated, 9-channel)	400	19,500	60	6901	Transparency Feature	15	675	-0-
633-121	80 kb Dual Unit (phase modulated; 9-channel)	750	36,000	90	6902	Wide Band Feature	10	450	-0-
624-211	144 kb Control Unit	500	24,000	20	6921	End of Message Feature (621-102 only)	20	950	-0-
633-211	144 kb Single Unit (phase modulated; 9-channel)	500	24,000	60	690-201	621-102 Auxiliary Cabinet	250	12,500	5
624-311	240 kb Control Unit	550	25,500	20	692-100	Asynchronous Character Adapter	65	3,250	10
633-311	240 kb Single Unit (phase modulated; 9-channel)	550	25,500	60	692-401	Asynchronous Polling Adapter (1 line/cage)	100	5,000	10
624-119	9-Channel, 40 kc Control Unit	300	14,000	20	692-402	Asynchronous Polling Adapter (2 lines/cage)	140	7,000	15
633-119	9-Channel, 40 kc Unit (800 bpi)	350	17,000	65	692-403	Asynchronous Polling Adapter (3 lines/cage)	165	8,250	20
624-179	7-/9-channel, 10/28/40 kc Control Unit (200/556/800 bpi)	350	16,500	20	692-405	Terminal Adapter (1 line/cage)	100	4,800	15
633-117	7-channel, 10/28/40 kc Control Unit (200/556/800 bpi, respectively)	350	17,000	65	692-406	Terminal Adapter (2 lines/cage)	140	6,700	20
Optical Character Readers					693-200	735/736 Encoder Adapter	175	8,250	15
622-401	MICR Sorter Control Unit	200	15,100	10	693-300	General Purpose Synchronous Adapter	160	7,750	25
670-101	MICR Sorter (600 doc/min)	990	45,000	150	MISCELLANEOUS				
622-301	OCR Control Unit	150	7,000	10	Control Units				
420-1	Optical Character Reader	1,200	48,000	184	620-301	Common Trunk Switching Unit*	175	8,750	5
420-2	Optical Character Reader	1,700	68,000	265	620-302	Central Switching Controller (complete free standing unit)*	300	15,000	10
671-101	MICR Sorter (1,200 dpm, 18 Pockets)	2,350	117,500	530	6903	1 x 2 Switch Module (for -301 and -302)*	35	1,750	5
6711	Endorser Feature	300	12,000	45	6904	2 x 1 Switch Module (for -301 and -302)*	45	2,250	5
Displays					6905	2 x 2 Switch Module (for -301 and -302)*	65	3,250	5
795-100	Display Controller	190	6,650	18	622-201	For 736 Mag Tape Encoders	175	8,250	10
795-151	Memory (1024 char)	65	2,275	7	622-601	Processor Interconnector	300	14,750	30
795-152	Memory (2 x 512 char)	65	2,275	7	627-201	Emulator w/315 Feature	250	11,750	32
795-153	Memory (4 x 256 char)	65	2,275	7	627-202	Emulator w/1401 Feature	175	8,000	26
795-201	Cabinet (1 controller)	35	1,225	2	627-203	Emulator w/both 315 and 1401 Feature	400	18,500	57
795-202	Cabinet (up to 2 controllers)	35	1,225	2	* No longer in production.				
795-300	Display Screen	70	2,450	14	Notes:				
795-400	Keyboard (standard)	15	525	4	The Century 100 can also be leased for 3 years, at \$2,115/mo and 5 years, at \$1,995/mo installation charges included in lease prices.				
795-401	Keyboard (hard copy)	22	770	4					
795-402	Keyboard (A/M style)	30	1,050	4					
795-500	Split Screen	20	700	3					
795-521	Hard Copy Output	175	6,125	12					
795-640	Teleprinter	50	1,750	21					
Printers									
626-101	Printer Control Unit(1)	300	14,000	25					
640-102	Printer (450 lpm, 132 col)	575	27,500	60					

Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint \$*	Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint \$*
MISCELLANEOUS (Contd.)					ME-1	Disc Drive (30.7M bytes; sectored disc; 40,000 sectors; 760 bytes/sector; full sector buffer; auto detection and marking of defective sectors; CRC check/sector; decimal addressing; includes controller)	482	19,750	121
Notes: (Contd.)					MP-1	Disc Drive (60M bytes; sectored disc; 2314 type; 80,000 sectors; 768 bytes/sector; full sector buffer; auto detection and marking of defective sectors; CRC check/sector; decimal addressing; includes controller)	674	27,500	175
Basic systems listed are minimum configurations that can be purchased. Device prices under the headings of Alternate Devices are amounts to be added to, or subtracted from, price of basic system.									
Conversion-to-purchase option allows 50% of rental to be applied toward purchase for up to 24 months. For rental in nonmetropolitan areas, increase lease price by adding 20% of maintenance price; for purchased equipment increase the maintenance cost by 20%.									

PHILIPS 350 SERIES					INPUT/OUTPUT				
CENTRAL PROCESSOR & WORKING STORAGE					Console				
P-351	Central Processor (400 words)	200	NA	NA	AA-2	Programmers Control Console	35	1,440	10
P-352	Central Processor (1,200 words)	265-460	NA	NA	Typewriter				
P-354	Central Processor (1,200 words)	360-550	NA	NA	PA-1	Extra I/O Typewriter (heavy duty IBM Selectric 735; 15 cps; buffered)	96	3,950	30
P-356	Central Processor (1,200 words)	330-490	NA	NA	AB-1	10-Key Numeric Input Module (adding machine style keyboard; read-out tbe; 32-char buffer; two indicator flags; termination interrupt provided at end of message)	15	1,440	10
P-358	Central Processor (1,200 words)	480-600	NA	NA	Paper Tape				
P-359	Central Processor (1,200 words)	550-650	NA	NA	AD-1	Reader/Punch (50 cps; 5-, 6-, 7-, or 8-channel tape; 100 foot capacity)	57	2,350	20
INPUT/OUTPUT					Punched Card				
Punched Cards					AC-2	Reader (500 cpm; 80 col; photo-electric reader; translates extended Hollerith code to ASCII; reads col binary direct from card; controlled by Qantel Read and Set-Read instructions)	101	4,150	35
P-115	Card Reader (280 cpm; for P-352, P-354, P-356, P-358, P-359)	105	NA	NA	Printers				
P-110	Card Punch (37.5 cpm)	115	NA	NA	PD-1	Serial Printer (60-100 lpm; 132 PP; 132-char buffer; 63-char ASCII set; 1 original and four copies)	170	6,950	50
P-130	Auto Reader	125	NA	NA	PB-2	Line Printer (200 lpm; 132 PP; 132-char buffer; 64-char ASCII set; chain type printer)	305	12,500	275
Printer					PC-1	Line Printer (245 lpm-132 PP; 1,120 lpm-24 PP; 132-char buffer; 64-char ASCII set; prints up to 6-part multi-copy)	512	21,000	140
P-150	Line Printer	160	NA	NA	PE-1	Line Printer (700 lpm-132 PP; 1,800 lpm-68 PP; 132-char buffer; 64-char ASCII set; prints up to 6-part multi-copy)	817	33,500	185
Paper Tape					Magnetic Tape				
P-120	Paper Tape Punch (50 cps)	90	NA	NA	CJ-1	Magnetic Tape Drive Controller (20,000 bytes/sec; 800 bpi; handles up to 4 MJ-1 or MK-1 drives; all drives connected to CJ-1 controller must have same data densities and read-write speeds; controller board mounts in processor housing)	37	1,500	10
P-125	Paper Tape Reader (50 cps; or P-352, P-353, P-358, P-359)	90	NA	NA	CL-1	Magnetic Tape Drive Controller (40,000 bytes/sec; 1600 bpi; handles up to 4 ML-1 or MM-1 drives; all drives connected to CL-1 controller must have same densities and read-write speed; controller board mounts in processor housing)	49	2,000	12
P-351	Magnetic Stripe Ledger Card (included in price of P-358, P-359)	176	NA	NA	MF-1	600' Magnetic Tape Drive (9 channel, NRZI-IBM format; 800 bpi; read/write speed is 10,000 bytes/second; single desktop cabinet or multiple units in freestanding cabinet; 1 drive per controller with controller included in unit price)	121	4,950	30
Keyboard Input					MJ-1	600' Magnetic Tape Drive (9 channel, NRZI-IBM format; 800 bpi; read/write speed is 20,000 bytes/second; read-after-write capability)	121	4,950	32
Notes:									
Leases average 2.3% of purchase price. Maintenance fee under 12-month warranty. After first year, 7% of purchase price. Purchase prices range from \$8,395 to \$27,000. Average price of system is \$21,000. Request price quotations from manufacturer.									

QANTEL SYSTEM									
CENTRAL PROCESSOR & WORKING STORAGE									
QA-2	4K System (includes I/O typewriter and power supply mounted in desk, operates with up to 12 I/O controllers, each controller has either single device, multidevices or direct access to main memory capabilities)	300	12,315	65					
QB-2	8K System (basic system with expanded memory, can be field or factory installed)	353	14,465	75					
QC-1	16K System (basic system with expanded memory, can be field or factory installed, includes programmers control console)	483	19,805	105					
QF-1	24K System (basic system with expanded memory, can be field or factory installed, includes programmers control console)	580	23,755	125					
QD-1	32K System (basic system with expanded memory, can be field or factory installed, included programmers control console)	666	27,305	145					
MASS STORAGE									
Discs									
MD-1	Disc Drive (7.6M bytes; sectored disc; 20,000 sectors; 380 bytes/sector; full sector buffer; auto detection and marking of defective sectors; CRC check/sector; decimal addressing; includes controller)	351	14,400	80					

PRICES — SMALL BUSINESS COMPUTERS, N-Z (U.S.)

Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$**	Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$**
MASS STORAGE (Contd.)					Notes: (Contd.)				
MK-1	2400' Magnetic Tape Drive (9 channel, NRZI-IBM format; 800 bpi; read/write speed is 20,000 bytes/second; read-after-write capability; connects to CJ-1 controller)	194	7,950	50	** Maintenance prices are slightly higher outside regular service area, maintenance contract is mandatory with all leases.				
ML-1	600' Magnetic Tape Drive (9 channel; PE compatible format; 1,600 bpi, read/write speed is 40,000 bytes/second; read-after-write capability; connects to CL-1 controller)	140	5,750	34	*****				
MM-1	2400' Magnetic Tape Drive (9 channel; PE compatible format; 1,600 bpi; read/write speed is 40,000 bytes/second; read-after-write capability; connects to CL-1 controller)	218	8,950	60	20-101RJ	Card-Oriented Remote Job Entry System Terminal including Processor, 10K core, 2 Multi-Terminal I/O Channels, Communication Adapter, and SCA	205	10,660	NA
MFA-1	3-Tape Drive Cabinet (freestanding; mounts 3 MF-1, MJ-1, and ML-1 Drives)	—	250	—	20-101TP	Disc-Oriented Remote Terminal Processor, including Processor, 20K core, FAC, disc controller, 2 Multi-Terminal I/O Channels, Communications Adapter, and SCA	495	22,335	NA
Displays					20-104	Processing Unit (20K), including File Access Channel (FAC) Disc Controller 2 Multi-Terminal I/O Channels	720	24,075	NA
AF-1	Video Display Unit (12" CRT; 2048 x 8-bit mag core memory; 1998 char screen capacity; 74 char/line; 27 lines/display; programmable cursor; 64-char ASCII set; keyboard plus numeric keypad; configured with up to 6/system; includes controller)	121	4,950	30	20-106	Processing Unit (20K), including File Access Channel (FAC) Disc Controller 3 Multi-Terminal I/O Channels	765	25,380	NA
DATA COMMUNICATIONS					21	Processor (Expanded version of 20-104 and 20-106. Includes additional 10K core. Price shown to be added to 20-104 or 20-106)	190	7,500	NA
Model CC Series Communications Micro-Processor is a stored program micro-computer with a 2K by 8-bit IC memory. Direct access (cycle steal) channels provide programmed simultaneity and data exchange to processor main memory from the controller memory. No more than 3 of these controllers should be configured on any one processor.					10K Core Memory Unit	155	6,175	NA	
CCA-1	Buffered Synch/Asynch Controller (9,600 baud synch; 1,800 asynch; handles auto call unit; can interrupt system during unattended operation to auto answer; operates with any Bell serial-by-bit data set or sets with EIA interface; can communicate with systems using IBM bi-sync mode)	98	4,000	30	MASS STORAGE				
CCB-1	Communications Line Multiplexor (I/O extender including remote control unit, controller housing, and power supply mounted in desk or cabinet; handles up to 12 Qantel I/O controllers, other than model CC series controllers)	176	7,200	50		Disc Controller	95	3,000	NA
CCC-1	Display Concentrator (handles from 1 to 8 CRT's; includes display multiplexor)	96	3,950	30	40	Auxiliary Disc Controller	28	715	NA
CA-2	CA Series Unbuffered Synch/Asynch Communications Controller (operates half-duplex with any serial by bit data set with EIA I/O characteristics; transmission rates: synch, 4800 baud; asynch, 75 — 2400 baud; modes are switch selectable at time of installation; handles auto call unit and can interrupt system during unattended operation to auto answer)	49	2,000	20	42	Disc Drive	415	14,500	NA
CB-2	CB Series Buffered Asynch Communications Controller (half-duplex speed of 1,800 baud; simultaneity is provided by 156-byte buffer; data speeds are switch selectable at time of installation; operates with 103 or 202 serial data sets, or 402D parallel data set using 7 or 8 bit code, with 1 start bit and 1 or 2 stop bits, and byte only transfer; can handle auto call unit; can interrupt system during unattended operation to auto answer)	49	2,000	20	44	Disc Pack	—	400	NA
					44	Split Disc Drive	440	15,500	NA
						Disc Pack	1,000	35,000	NA
						Disc Drive			NA
						Disc Pack			NA
					INPUT/OUTPUT				
					Magnetic Tapes				
					50	Magnetic Tape Controller	95	2,970	NA
					45	Magnetic Tape Drive	390	12,000	NA
					Punched Cards				
					30	Card Reader	220	6,000	NA
					31	Card Reader			
						300 cpm	200	6,250	NA
						600 cpm	290	9,750	NA
						1000 cpm	315	10,750	NA
					35	Card Punch	320	9,000	NA
					Paper Tape				
					60	Paper Tape Reader	140	4,000	NA
					65	Paper Tape Punch	180	5,000	NA
					Printers				
					50	Line Printer (450 lpm)	585	18,000	NA
					52	Line Printer (100 lpm)	315	12,600	NA
					53	Line Printer (125 lpm)	410	17,500	NA
					54	Line Printer (200 lpm)	470	19,000	NA
					55	Line Printer (300 lpm)	550	22,000	NA
					56	Line Printer (400 lpm)	635	25,000	NA

					DATA COMMUNICATIONS				
					—	File Access Channel (FAC)	40	2,500	NA
					—	Multi-Terminal I/O Channel	48	1,305	NA
					70	Workstation	165	5,345	NA
					80	CRT Display	160	5,950	NA
					7102	Communications Terminal	140	4,750	NA
					100	Job Information Station	145	5,616	NA
					105	Attendance Terminal	70	2,592	NA
					—	Synch Communications Adapter (SCA) (for 20-106 only)	180	6,520	NA
					—	With Automatic Dialing Option	205	7,187	NA
					—	With Local Communications Option	260	9,435	NA
					—	Asynch Terminal Adapter (ATA)	60	1,700	NA
					—	Direct Connect Communicator	100	2,835	NA

Notes:
* Based on 36-month lease, 60-month full payout lease is available, may require up to a 10% security deposit.

Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$*	Purchase \$	Monthly Maint. \$
DATA COMMUNICATIONS (Contd.)					8414-94	Disc Storage (4 disc drives)	1,540	66,000	260
-	With Automatic Dialing Option	113	3,402	NA	8414-96	Disc Storage (6 disc drives)	2,160	99,000	390
-	Digital Clock	38	1,134	NA	8414-98	Disc Storage (8 disc drives)	2,680	132,000	520
2024	Modem (selectable rates of 1,000/1,200/2,000/ or 2,400 bps)	60	1,600	NA	8414-85	Disc Drive (for expansion)	410	16,500	65
					F1043-00	Dual Channel	85	3,700	15
					F1214-00	Disc Pack	20	440	-
Notes:					INPUT/OUTPUT				
For non-disc communications systems, delete price of FAC and disc controller. Lease rates include maintenance, Singer does not publish separate maintenance prices.					<u>Magnetic Tapes</u>				
*****					UNISERVO Tape Subsystems (for 9200II only)				
ULTIMACC COMPUTER SYSTEMS					0858-99	UNISERVO VIC Subsystem (9-track)	771	32,190	230
	Disc System Basic Configuration				0858-10	UNISERVO VIC Master (9-track)	420	17,350	123
	NOVA 1200 Processor (8-32K)	1,150*	56,900*		0858-14	UNISERVO VIC Slave (9-track)	252	10,470	74
	IOMEC 2000 Disc Storage System (5M char; max 4)	137	6,500	86	0858-98	UNISERVO VIC Subsystem (7-track)	771	32,190	230
	Printer (135 lpm)	145	6,900	55	0858-00	UNISERVO VIC Master (7-track)	420	17,350	123
	Printer (300 lpm)	NA	14,000	NA	0858-01	UNISERVO VIC Slave (7-track)	252	10,470	74
	Other Peripherals for Disc System				F0827-00	Data Conversion	55	2,130	5
	Video Display Terminal	82	3,900	27	F0828-00	7-Track Feature (for 0858-99)	55	2,130	5
	IBM-Compatible Magnetic Tape Drives (max 4)	232	1,100	60	F1021-00	7- to 9-Track Conversion (to 0858-00 and 0858-01)	NC	NC	NC
	Telephone Coupler or Asynch Modem	NA	NA	NA	F1021-99	7- to 9-Track Conversion (to 0858-99)	NC	NC	NC
	Tape System Basic Configuration				5017-99	UNISERVO 12 Control (9-track)	510	21,165	90
	NOVA 1200 Processor (4-32K)				0861-00	UNISERVO 12 Master (9-track)	482	20,015	107
	TRI-DATA 4169 Tape Cartridge				0861-01	UNISERVO 12 Slave (9-track)	283	11,745	74
	Serial Printer (30 cps)	975	42,500	175	0861-04	UNISERVO 12 Master (7-track)	306	12,699	107
					0861-05	UNISERVO 12 Slave (7-track)	252	10,440	74
* Minimum.					F0823-99	7-Track NRZI (allows 5017-99 to control 7-track units)	110	4,785	15
Notes:					F0826-00	9-Track NRZI	110	4,785	15
Installation and unlimited usage included in lease price. Lease is 5-year full payout. Conversion-to-purchase option available.					F0935-00	Dual Density	52	2,175	10
*****					F1028-95	7-Track Addition (to F0826-00)	80	3,480	10
	UNIVAC 9200 AND 9200II				F1028-96	9-Track Addition (to F0823-99)	80	3,480	10
					F1041-00	7- to 9-Track Conversion (for 0861-04)	47	1,960	NC
	CENTRAL PROCESSOR & WORKING STORAGE				F1042-00	7- to 9-Track Conversion (for 0861-05)	31	1,305	NC
3030-00	9200 Processor (with printer)	310	13,485	87	<u>Punched Cards</u>				
3030-94	9200II Processor (with printer and multiplexor channel)	364	15,834	95	F1487-00	Short Card - 51 Column	38	1,425	10
F0822-00	1001 control	42	1,690	5	F1487-01	Short Card - 66 Column	38	1,425	10
F0822-02	1001 control (9200II only)	90	3,870	10	F1488-00	Validity Check	15	720	-
F0869-98	Multiplexor I/O Channel (9200 only)	53	2,175	5	F1498-00	Alternate Stacker Fill	10	480	-
F0943-99	Channel Adapter 1004/1005	92	3,885	16	F1530-00	Dual Translate	21	960	5
F1104-99	Selector Channel (9200II only)	68	3,330	10	F1486-00	and-02 ASCII Conversion	-	100	-
7007-85	Storage (32K; 9200II only)	1,593	69,295	146	F1106-00	Mark Read - EBCDIC	173	7,920	37
7007-87	Storage (24K; 9200II only)	1,207	52,505	110	F1106-01	Mark Read - ASCII	173	7,920	37
7007-91	Storage (16K)	799	34,755	73	F1108-00	600 DPM Speed Upgrade	231	10,560	32
7007-92	Storage (12K)	673	29,275	55	F1149-00	Punch Card Read	57	2,640	10
7007-93	Storage (8K)	402	17,485	37	F1154-00	Validity Check	10	480	-
F0890-93	Storage Expansion (8K; 9200II only)	386	16,790	36	F1155-00	Univac II-14 Conversion	NA	725	-
F0890-94	Storage Expansion (16K; 9200II only)	794	34,540	73	F1156-00	USASCOCR Conversion	NA	725	-
F0890-95	Storage Expansion (8K; 9200II only)	408	17,750	37	F1163-00	Modulus 10 Check Digit	21	960	32
F0890-96	Storage Expansion (4K)	126	5,480	18	F1239-00	EBCDIC OCR Conversion	-	-	-
F0890-97	Storage Expansion (4K)	126	5,480	18	F1239-01	ASCII OCR Conversion	-	-	-
F0890-98	Storage Expansion (4K)	271	11,790	18	F1249-00	EBCDIC Mark Read Convert	NA	60	-
F0882-00	Multiply, Divide, Edit	79	3,380	5	F1249-01	ASCII Mark Read Convert	NA	285	-
	MASS STORAGE				F1557-00	Optical Card Reader -B	-	725	-
	<u>Discs</u>				2703	Optical Document Reader	918	42,000	187
F1023-00	Disc File Control (for 8410)	205	8,910	39	<u>Printers</u>				
F1023-01	Disc File Control (for 8410) If 1001 control or selector channel used	205	8,910	39	0768-00	Printer and Control (1,100 lpm; 9200II only)	981	40,675	337
8410-00	Dual Disc File Master	310	13,475	167	0768-02	Printer and Control (2,000 lpm; 9200II only)	1,123	46,545	379
8410-92	Dual Disc File Slave	310	13,475	140	0768-99	Printer and Control (1,600 lpm; 9200II only)	1,217	50,465	417
8410-02	Single Disc File Slave	189	8,220	89	F1071-00	1600/1200 lpm Rate (converts 0768-00 to 0768-99)	236	9,790	80
F1015-00	Buffer/FASTBAND Search	163	7,080	32	F0865-00	Variable Speed Printing	68	2,900	16
F1016-00	Disc Drive	121	5,255	50	F0866-00	120 Print Positions	116	5,070	16
F1102-00	Cartridge	12	240	-	F0868-01	132 Print Positions	179	7,730	22
5024-00	Disc File Control (for 8411) Subsystem for 9200II only)	460	20,010	85	F0868-00	Print Position Expansion	63	2,655	5
8411-00	Disc Drive	415	19,920	80	F0963-00	300 lpm Print Speed	53	2,175	-
F1043-00	Dual Channel	85	3,700	15	F0969-00	8 lpi Print Spacing	5	220	-
F1098-00	Record Overflow	10	435	-	F1130-00	Form Alignment	10	410	-
F1099-00	File Scan	36	1,525	-	F1522-00	Print Code Expansion	5	240	-
F1211-00	Disc Pack	15	300	-	8541-95	Console/Inquiry (with printer)	145	6,960	32
5024-02	8414 Control (subsystem for 9200II only)	550	26,400	90	DATA COMMUNICATIONS				
8414-92	Disc Storage (2 disc drives)	820	33,000	130	8575-00	Line Terminal Control-4	254	10,500	44
					F1000-00	Line Terminal Control-1	110	4,570	16
					F1002-00 CI	Telegraph	8	350	2
					F1002-03 CI	Private Line	13	565	2
					F1002-04 CI	Data Phone	13	565	2
					F1002-05 CI	Wideband	22	915	5
					F1002-08 CI	205B	13	565	2

PRICES — SMALL BUSINESS COMPUTERS, N-Z (U. S.)

Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$	Model Number	Description	Monthly Rental \$	Purchase \$	Monthly Maint. \$
DATA COMMUNICATIONS (Contd.)									
F1003-96	LT TWX	67	2,160	11					
F1003-97	LT Teleex	61	2,560	11					
F1003-98	LT Telegraph Checking	46	1,920	8					
F1003-99	LT Telegraph Non-Check	42	1,740	7					
F1004-98	LT Medium Speed Checking	59	2,470	10					
F1004-99	LT Medium Speed Non-Check	50	2,100	8					
F1005-96	LT Synch Checking								
	Odd LRC	70	2,895	13					
F1005-97	LT Remote Computer	61	2,555	10					
F1005-98	LT Synch Checking								
	Even LRC	57	2,375	10					
F1005-99	LT Synch Non-Check	50	2,100	8					
F1006-99	LT Parallel	38	1,600	6					
F1007-99	Dialing Adapter	49	2,060	8					
F1008-00	LRC (longitudinal redundancy check; for 8575-00)	42	1,735	7					
F1008-99	LRC (for F1000-00)	17	740	3					
F1010-99	ATA (Asynch Timing Assembly; 16 available speeds)	10	435	2					
F1011-00	STA 1200 (Synch Timing Assembly)	38	1,600	6					
F1011-04	STA 600	38	1,600	6					
F1011-05	STA 1800	38	1,600	6					
F1357-00	Line Terminal Control-IC Integral (adds to 8577-00)	131	6,000	26					
F1358-00	LT Non-Transparent	105	4,800	16					
F1358-01	LT Transparent	131	6,000	26					
F1359-00	High-Speed Buffer	26	1,200	5					
F1360-00	Polling (not software supported)	36	1,680	5					
F1361-00	Station Select	26	1,200	5					
F1363-00	Dialing Adapter	36	1,680	5					
F1395-00	Communication Interface	15	720	5					
F1395-01	Communication Interface	42	1,920	5					

**SMALL BUSINESS COMPUTERS
DEVICE REPORTS**

BASIC/FOUR

Basic/Four System



OVERVIEW

Basic/Four's series of small business computers is primarily marketed as an upgrade for users of electronic accounting machines. It bridges the wide gap between the simple, typewriter-oriented, interactive computers, which are preprogrammed with a handful of accounting-type programs, and the larger batch processing systems, which have compiler languages, extensive arrays of peripherals, and broad network capabilities. The Basic/Four systems are marketed in Europe by MAI.

Designed for multiple-user, interactive processing, Basic/Four comprises four models of a single, basic machine, field expandable so that the simplest configuration can be converted to the most powerful as the user's requirements grow.

The two simplest models of the series can use only a single terminal, but the other two models can support networks of terminals. In one model, up to eight terminals (each of which may be using a different program) can be serviced on a simultaneous basis by the central processor unit. Thus, although each terminal is in interactive mode, system throughput is far greater than that of an ordinary interactive processor because the CPU can be used to capacity by the combined demands of the several terminals.

The series is available in several combinations: on a turnkey basis, complete with software, operating system, and customized application programs; operating system and customized application programs only; and operating system alone, with the user's staff developing the application programs in the system's conversational programming language. A variety of support and

programmer-training services are also available from Basic/Four.

CONFIGURATION GUIDE

Basic/Four comprises four models: Models 300, 350, 400, and 500. All systems can be upgraded to the 500. A minimal-configuration Model 300 consists of a CPU with an 8K-byte memory, an accounting machine terminal (AMT), and a disc memory unit. The AMT has a split-platen, interactive printer with a standard keyboard plus numeric-key cluster. This unit can handle multiple, pin-feed and tractor-fed forms as well as front-feed ledger cards and can be used independently as a printout device. The CPU cabinet houses the disc memory unit, a dual-disc configuration with 2,100K bytes of storage to augment the 8K bytes of read/write memory.

The CPU includes 2560 bytes of read-only memory and 16K bytes of read/write memory reserved for the Business Basic Operating System Software (BOSS). It is a disc-oriented operating system that includes the interpreter for Business Basic, the conversational programming language, as well as the system's executive and monitoring software.

Model 300's memory is plug-in expandable to a maximum capacity of 48K bytes of read/write core and an additional 14,700K bytes of disc storage. The following peripherals are available: a 165 character-per-second (60 lines per minute) dot-matrix printer with a buffer for its full 132-character line; a buffered 120 and 200 line-per-minute line printer, with a 132-character line; magnetic tape transports that can read or write on either seven-track or nine-track tape; a communications controller to link a remote AMT to the CPU; and punched card readers for 80- or 96-column cards with speeds of up to 800 cards per minute. A paper tape reader (300 characters per second) and punch (75 characters per second) are also available.

Model 350 replaces the AMT with a video display terminal (VDT) and adds, as standard equipment, the 165 character-per-second dot-matrix printer. The video display terminal's CRT can display 1,998 characters in a 74-column by 27-row format and write up to 240 characters per second. The VDT has an alphanumeric keyboard and numeric keyset for data entry. The CRT's 12-inch screen can be used to display data for review and correction prior to entering it into the CPU, in addition to its use as an interactive communications device. Blank forms can be displayed, their outlines and section headings at

reduced intensity, so that the operator can fill in the blanks with information in the desired format. The Model 350's memory capacities and its peripherals are the same as those of the Model 300.

Model 400 adds to the Model 350 a multi-terminal processor, capable of accommodating up to four interactive terminals, either AMT and/or VDT. All of these terminals can be remotely located and linked to the CPU by telephone lines, and all can work concurrently on the same or different programs.

Model 500 has the same basic components as the Model 400. However, it can handle up to eight interactive terminals simultaneously. More than four and eight terminals, respectively, can be linked to the Model 400 and Model 500, but they cannot be serviced by the CPU at the same time. Model 500 has the same memory capacity as the other models. All models can be expanded in the field to the level of a 500 by adding the necessary components.

SOFTWARE

The Basic/Four series uses both a conversational programming language and an operating system, an unusually flexible combination for computers in this price range. Business Basic is Basic/Four's extended version of the widely known Basic language, developed at Dartmouth College to provide novice programmers with a powerful, yet easy-to-learn language. The additional features of Business Basic include: instructions for formatting input data and system printout in order to provide easily understood reports; instructions for management of disc data files, including password security arrangements to prevent unauthorized access to or alteration of stored data; and fixed-point (standard decimal) number representation and computation.

The Basic Operating System Software (BOSS) is available in two versions — one for the single-terminal systems of Models 300 and 350 and the other for the multiterminal systems of Models 400 and 500. BOSS assigns areas in core memory to the various users, implements the data file security features, manages the data files, and supports utility routines that include sorts and merges, data format conversion, file copying and listing, and file updates. BOSS also contains the Business Basic interpreter and exercises control over all I/O devices including the scheduling of command executions.

DESIGN FEATURES

The chief design feature of the Basic/Four series is the main-memory partitioning that its

operating system performs on a dynamic basis. A programmable operating system can offer greater flexibility than hardwired partitioning. The operating system can be altered to accommodate new utility routines for any additional peripheral devices. This feature permits multi-programming on a time-shared basis, without the complex program software normally associated with such an operation. Furthermore, since a terminal can call up any of the programs stored in the disc file library, a network can use more programs than there are terminals, with output data from each program buffered onto core or disc and printed out in turn.

Another major feature of this series is the compatible upgrade ability of each model to the level of the Model 500, with its substantial networking capabilities. A user can initially acquire the smallest configuration that meets his needs. As his requirements grow, the system can be modularly expanded to keep pace. This approach optimizes price/performance.

PERFORMANCE

Basic/Four is well matched to the needs of small businesses that are planning an upgrade from an electronic accounting machine installation because of an increased volume of business. The series' performance is far superior even in its single-terminal configurations to that of a punched card system, an alternate type of upgrade.

Multiterminal configurations in the series can support a far higher volume of business activity. While each terminal can function as an independent I/O device for order entry, invoice preparation, inventory monitoring, and so on, data entered once is always available to any authorized access for program execution. This feature eliminates multiple handling of files and the subsequent possibilities for error.

Basic/Four offers the standard accounting-type applications such as invoicing and payroll, all of which are available in customized form. It also provides easily programmed means of report generation which is useful to the small business whose operations are outgrowing simple management techniques.

MAINTENANCE

Maintenance for the Basic/Four series is available through Sorbus, Inc., a broad based service company that has offices in over 100 cities across the country. Sorbus, like Basic/Four, is a subsidiary of Management Assistance Inc. Service is provided, by contract, either

during regular business hours or, at higher rates, on a 24-hour basis.

HISTORY

Basic/Four Corporation began marketing the system in June 1971 in Southern California. Genesis One Computer Corporation, another MAI subsidiary which markets a broad range of data processing products, introduced the Basic/Four system in the New York and Chicago areas in November 1971 and will gradually expand into other key areas in the United States. MAI International Corporation is marketing the system in Canada, Latin America, and Europe.

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	8
Capacity (words)	8-65K
Cycle Time (μ sec)	1.1
Working Storage	Core
AUX STORAGE	Disc; magnetic tape
DATA OUTPUT	
Line Printer (lpm)	120; 200
Serial Printer	Yes
Card (cpm)	—
Paper Tape (cps)	75
DATA INPUT	
Keyboard	Standard
Card (cpm)	400; 800
Paper Tape (cps)	300
SOFTWARE	
Assembler	No
Operating System	Yes
Compiler	Basic

BURROUGHS

L Series



SUMMARY

Burroughs L Series comprises a family of computers intended for accounting applications. Individual members vary in capabilities, but higher-performance members can be used for data analysis and report generation. The design emphasis is on interactive processing and simple control by novice users responding to the step-by-step guidance of indicator lights on the console. The series includes models capable of operating as terminals in a data processing network as well as models intended exclusively for stand-alone operation.

The family is distinguished from other small business computers by the nature of its working storage; L Series members utilize magnetic disc rather than core or semiconductor. Interestingly, however, only the most powerful member, the L 7000, has the capability for disc storage of on-line master files. The L 7000 is also unique in the series in that its working storage incorporates a scratchpad memory made from integrated circuits.

All L Series models support a Cobol compiler, a powerful tool for programming business applications.

CONFIGURATION GUIDE

Burroughs L Series is composed of the following members: L 2000, L 3000, L 4000, L 5000, and L 7000.

L 2000 features a standard typewriter keyboard, a numeric keyset, a set of program select keys, indicator lamps, and service keys. It includes an integral serial printer with a rear-

feed forms handler that can simultaneously handle up to two cut or continuous forms. In addition, L 2000 can support readers and punches for handling cards, paper tape, and edge-punched cards.

L 3000 differs from L 2000 primarily in its use of a front-feed forms handler. One version, the L 3000 Window Accounting Computer, has a tall, freestanding "pillar" shape, which makes it suitable for use at a teller's window.

L 4000 is also designed for front-fed forms but it differs from the L 2000 in its much larger platen, which provides a 255-character print line. In addition, its keyboard has space for 24 program select keys rather than for 16 as on the L 2000. The L 5000 resembles the L 4000, varying primarily in the 5000's ability to accept data input from magnetic record cards. Used in conjunction with a magnetic record reader that can read forms 11 inches long and from 6 to 14-1/2 inches wide, the L 5000 can process and analyze magnetic unit records to generate management reports.

The L 7000 is the most powerful of the L Series. It incorporates 2,560 words (16-bit) of magnetic disc main memory, which is field expandable to a maximum 8,704 words by the addition of three 2,048-word modules. Scratchpad memory is also available in 32-word increments, from 32 to 256 words capacity.

L 7000 Series can accommodate either single or dual 80-column punched card or punched paper tape/edge-punched card peripherals (two input devices, two output devices), in various combinations. A card/tape subsystem controller which contains input/output buffers controls the input/output devices. Like the L 5000, the L 7000 can accept data input from magnetic record cards. L 7000, however, can support a single-track record (interchangeable with the L 5000) and add a dual-track capability.

SOFTWARE

The L Series is unusual in terms of programming flexibility, because it remains the only one that permits Cobol programming for small operator-attended systems. Such Cobol programs must be compiled on the larger Burroughs B 3500 computer. However, if the L Series system has data communications ability, the program can be transmitted to a remote B 3500 for compilation.

This series can be programmed in assembler language. The programs are assembled either on the L Series machines or remotely on a B 3500 if desired. The company provides, at no

BURROUGHS L SERIES

extra cost, preprogrammed routines to assist in program debugging, as well as several utility routines.

Burroughs offers a wide range of standard application packages including: accounts payable, general ledger and financial statements, payroll accounting with reports, public utility billing, billing and account updating, cash receipts and posting, general ledger and month-end reports, payroll accounting, accounts receivable, age analysis, and general billing. In addition, Burroughs will either modify these standard packages to meet the user's specialized needs or write appropriate customized programs.

DESIGN FEATURES

The L Series is unique in its use of magnetic disc for main memory. However, except for the L 7000, no provision is made for storing auxiliary files on magnetic disc. The L 5000's ability to use a file of magnetic record cards offers some compensation for this shortcoming.

Models L 2000 to 5000 use so-called firmware microprograms stored permanently in the disc memory to perform such functions as arithmetic and printer control. While storing firmware on the disc is more economical than processor residency, access times are usually slower. For the L 7000, special semiconductor memory is incorporated in the processor console to store firmware. This enables faster processing for the firmware function.

L Series also provides versatile printed output via an interchangeable ball-type printing head, available in a variety of fonts.

PERFORMANCE

The fact that the L Series of computers can be programmed in Cobol gives it a versatility that exceeds the basic design as a series of sophisticated electronic accounting machines with the ability to be configured into a network. Both L 5000 and 7000, with their magnetic memory card capability and ability to generate management reports, have some of the flexibility of the larger small business computers. The L Series upper performance range is also significantly enhanced by the L 7000's magnetic disc storage capability.

Forty-eight standard application packages are available, all written in Cobol, and covering every ordinary accounting application, as well as sales analysis, daily operating control reports, cash flow forecasts, stock status reports, and others.

MAINTENANCE

L Series maintenance is performed by Burroughs service personnel available on-call during normal business hours and operating from over 200 branch locations throughout the country, in addition to a large number of fully stocked residence posts. First-year maintenance is covered by a warranty. A separate contract covers subsequent service.

HISTORY

Burroughs Corporation, founded in 1905, is one of the two largest manufacturers of electronic accounting machines, as well as one of the largest computer manufacturers. The company employs over 52,000 people, grosses approximately \$900 million a year, and maintains a worldwide marketing force.

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	64; 16
Capacity (words)	1,024-8,704
Cycle Time (μ sec)	5
Working Storage	Magnetic disc
AUX STORAGE	L 5000 and 7000, magnetic cards; L 7000 only, magnetic disc
DATA OUTPUT	
Line Printer (lpm)	—
Serial Printer	Yes
Card (cpm)	19
Paper Tape (cps)	40
DATA INPUT	
Keyboard	Standard
Card (cpm)	100; 200
Paper Tape (cps)	40
SOFTWARE	
Assembler	Yes
Operating System	Yes
Compiler	Cobol

BURROUGHS

B 700 Series

SUMMARY

It's not certain that a "gap" really existed between the Burroughs Series L 8000 and the Burroughs B 1700 Series, but Burroughs has conveniently filled it by the introduction of the B 700 Series, the smallest of the Burroughs "700" family of computers. The B 700 Series is truly a small business machine. It offers hardware, an operating system, a license to programming products, training, and selected maintenance. Programs to be run are called by very simple commands. Data conversion, from card to disc, or from tape cartridge to disc, is simple and fast.

The B 700 system is aimed at first-installation users and is totally designed to be run with the Burroughs Business Management System (BMS). BMS is a comprehensive set of business programs developed for and being used with the Series L 8000 and the B 1700 Series computer systems, and now the 700 series. BMS is priced separately from the hardware and operating system software. According to users, it is sufficiently flexible to contain the needs of any business operation, world-wide.

It is the BMS, in fact, that separates the B 700 from a high-powered programmable accounting machine. Business reports of almost every usable genre can be produced easily, if not quickly.

Clearly, the Series L 8000, B 700, and B 1700 overlap. All use the Business Management System and all have Cobol. The larger two have RPG. The B 1700 and L 8000 can handle communications, the B 700 currently cannot (hints are being made about the B 700, however). The L 8000 cannot handle disc or full-sized magnetic tape reels. The B 700 and B 1700 both have operating systems. The B 1700 currently can handle IBM System/3 RPG, the B 700 cannot (more hints). Prices and core capacity overlap between the L 8000 and the B 700, and between the B 700 and the B 1700.

It appears that the deciding factor in which system to purchase should be the amount of data and the degree of general purpose flexibility desired. The B 1700 is technologically and operationally superior; at the low end it completely encompasses the B 700 for a slightly higher price. At the high end it overlaps the medium general purpose B 2700.

However, for a pure and simple business system, flexible within the constraints of small business requirements, and little else, the

B 700 is a good system if not too much data needs to be readily accessible at any one time.

One of the better features of data entry is the Audit Entry capability. The operator/data-enterer is informed by a beep whenever illogical or invalid data is entered in a specific field. The console used for entering data is the same pleasantly pastel color-coded terminal used for the L 8000. The Audit Entry Terminal (AE 300) is available whenever input needs go beyond a single data enterer, or whenever data is to be encoded at a different location and transferred for entry to the machine. The AE 300 enters data onto a magnetic tape cassette, compatible with the L 8000. Information from the tape cassette is read by the B 700 processor and placed on disc.

Data and programs to be executed are stored on disc. This is different from the L 8000, for which programs are stored as object programs on tape cassettes, and require previous compilation on a B 3500, and data is stored on magnetic records. Disc-resident programs are the norm for the B 1700 Series, and the data can be stored on disc or tape. And of course, the B 700 offers the ever-present 80- or 96-column punched card.

Security procedures were not mentioned at the B 700's announcement, although the organization of data stored on disc for the B 700 series is key-oriented. Apparently, access to the machine and knowledge of report programs' names yield access to the data.

Another similarity with the B 1700 Series is that the B 700 series has an operating system, albeit a naive one. The operating system can assign resources, handle the checkpoint/restarting of the program running (Burroughs calls this facility "interrupt/resume"), and handle the invocation of general programs, sort, utilities, and the Cobol and RPG compilers.

Physically, the B 700 system is small, both in occupied floor space and number of units, and is quiet. It is also low to the ground; access to the disc cartridges, the printer, the terminal, and the tape storage area is best performed by continual and uncomfortable stooping.

COMPETITIVE POSITION

In addition to competing with other Burroughs products, the B 700 competes with the HIS 2020, the Univac 9200, the IBM System/3 Model 10, the Singer System Ten, and the NCR Century 50.

The HIS 2020 has a wider range of peripherals and available languages, and already offers communications capabilities. It also has a slightly more sophisticated operating system which, although not offering a checkpoint/restart, can handle two programs at one time by alternating I/O and CPU time. Both the B 700 and the HIS 2020 are disc-oriented. Both offer a wide range of applications programs for businesses, banks, wholesalers, etc.

The B 700 however is technologically more innovative than is the HIS 2020 and as a result operates at significantly faster speeds. The operating system on the B 700 is microprogrammed, as are all I/O instructions and the instructions for the Cobol interpreter, the sort program, and the utilities, that is, the B 700 is a mini-computer disguised as a small business machine. The HIS 2020 is a conventional smaller version of a larger general-purpose machine.

Both the HIS 2020 and the B 700 are upward compatible with their respective general-purpose machines at the source code level.

Users who want a larger choice of business and scientific applications software than is offered by the B 700, IBM System 360/370 compatibility, but not IBM prices, can opt for the Univac 9200. The Univac 9200 is completely upward compatible with the rest of the Univac 9000 series.

The nearest IBM competitor to the B 700 is the System/3 Model 10. The system is more flexible, offers a wider variety of programming support and of peripherals, and has a more sophisticated operating system. It is also more expensive. And it is completely incompatible with the larger general purpose computers in the IBM product line.

In the discussion of relatively isolated performers, i.e., machines that are not upward compatible with anything in particular, the Singer System Ten is a noteworthy competitor. Its strongest distinguishing factor when compared with the B 700 is its wide range of special purpose peripherals, including employee badge readers and cash-register-type terminals with merchandise tag readers. It also supports a CRT display.

The System Ten doesn't have an operating system, but it does have a sophisticated memory segmentation and I/O channel sharing that allows multiprogramming of up to 20 programs at one time.

The NCR Century 50 could be called the "plain vanilla" competitor of the B 700. It offers about the same functions, to approximately the same user base, for about the same price. However, its total core capacity is less. And it is not intended for any kind of conversational user-machine interaction. Its typewriter keyboard is an optional feature that serves primarily for communication with the CPU.

CONFIGURATION GUIDE

Two central processors are available for the B 700 series; the B 705 and B 711. Both have 1 microsecond cycle times, although processor speed for the B 705 is half as fast as processor speed for the B 711. The B 705 has a 32K byte basic memory which is field expandable to 40K. The B 711 has a 32K byte basic memory, field expandable in two 8K byte increments to 48K bytes. There is no technological reason why either of the processors could not be further expanded.

The processor logic, memory, peripheral controls, and power supplies are all included in one unit. Two buffered I/O controls, the minimum per processor, may be expanded to eight I/O controls.

Regardless of functional orientation, every basic configuration includes 32K bytes of memory, a 26-inch console, and a disc cartridge drive with 4.6 megabytes of storage. Every basic configuration can accommodate either of the two available processor speeds.

Tailoring of the basic configuration for audit entry includes addition of a 90-line-per-minute printer, a magnetic tape cassette drive, and an AE 300 audit entry terminal equipped with a magnetic tape cassette.

Tailoring of the basic configuration for a card system includes addition of a 90-line-per-minute printer, a 96-column card reader/punch/printer/data recorder, and an off-line 96-column card data recorder for data preparation.

Equipment announced as available, and a general comparison with the L 8000 and the B 1712/1714, appears in Table 1.

COMPATIBILITY

At the source code level, the B 700 Cobol and RPG programs are compatible with the B 1700 and therefore with the rest of Burroughs' medium systems (the B 2700, B 3700, B 4700, etc.).

Object code is in no way compatible. Data should be compatible. Cobol programs written for tape cassettes and with minimal I/O from the L 8000 will run on the B 700 with little or no modification.

The Cobol and RPG are not compatible with other manufacturer's versions of the same languages.

Peripheral compatibility appears in Table 1.

SOFTWARE

The most noteworthy feature of the software is the Burroughs Management System, which is indeed the set of applications programs of the same name that exists for the L 8000 and the B 1700.

The BMS is actually a collection of over 350 modules, each of which performs a single,

common business function. The modules are collected into different groups to perform the required functions of the user. The same modules are used in whatever functional group requires them.

For example, a hospital accounting routine payroll subsystem may require deductions of various natures. Even though the function and performance results of the entire package may differ from the results of a wholesaler's payroll subsystem, the chances are that exactly the same BMS module is being used in both packages to perform the desired payroll deductions. To the user, this modularity means desirable flexibility, comprehensiveness, and ease of use.

The BMS is heavily report oriented. Its data base is key-oriented, which makes production of reports much simpler. Key-oriented data bases lend themselves to cross-referencing.

Table 1. Available B 700 Peripheral Devices

B 700 Characteristic or Device	Compatible with L 800	Compatible with 1712/1714
B 9343 Console	No	No
AE 300 Audit Entry Computer	No	No
Disc Cartridge		
A 9480 (4.6 megabyte)	No	Yes
A 9481 (9.2 megabytes)	No	Yes
Magnetic Tape Cassette		
A 9490-25 (240,000 char, 800 bpi, 10 inches per second)	Yes	No
A 9491-2 (9-channel, 800 bpi, NRZI, 10 kb)	No	Yes
Line Printers		
A 9249-1 (90 lpm, 132 char. print line)	Yes	Yes
A 9249-2 (180 lpm, 132 char. print line)	No	Yes
A 988 (164 lpm, 120 char. print line)	No	No
A 9247-2 (400 lpm, 120 char. print line)	No	No
Card Reader		
A 9114-1 (80-col, 200 cpm)	Yes	No
A 9119-1 (96-col, 300 cpm)	No	Yes
Card Reader/Punch/Data Recorder		
A 9419-2 or -6 (96-col, 300/60 cpm)	No	Yes
Paper Tape Reader		
A 9122	No	No
Paper Tape Perforator		
A 9222-1	No	No

Registers, reports, journals, statements, and inventories of many descriptions are available.

Other software functions available are a sort program, and various data conversion utilities.

The B 700 operates under the control of the System Control Program (SCP) which is primarily a serial batch processor. The SCP handles interrupts (I/O and operator), I/O transfer (including parallel I/O), and checkpoint/restart (which Burroughs calls "interrupt/resume"). The checkpoint/restart facility means that an executing program (including a utility, or sort) can be temporarily suspended. Another program can then be invoked and executed. The first program can then be resumed, without omission or duplication of any function.

The SCP is disc-oriented. Programs are read to disc before being executed. This allows for much faster processing than in the L 8000, for example.

TECHNOLOGY

Burroughs has a marketing habit — annoying to people who prefer technical accuracy — of stressing design features that are sometimes inaccurately named. For the MCP it was "virtual memory", for the B 1700 it was "bit addressability". For the B 700 the design feature inaccurately named is "Dynamic Interpreter Configuration".

Classically, an interpreter is a fixed set of routines designed to provide immediate execution of a series of programming language instructions, as each instruction is encountered.

Burroughs when it refers to an interpreter, means an organized group of micro-instructions used to control the processor functions. Immediate execution of sequential instructions does not enter into the picture at all. Also, Burroughs' interpreter refers not just to the programming language "compilers", but also to the various sort and utilities routines.

What Burroughs means by "dynamic interpreter configuration" is the following. Memory on the B 700 is divided into a shared memory (magnetic core) and nanomemory (bipolar ROM). The shared memory is used for all applications programs, utilities, sort, and the microcoded operating system. The nanomemory holds the microcode for every basic function that the machine is capable of performing. The functions in the nanomemory are language-independent.

They are a group of 256 carefully chosen instruction primitives designed to represent a composite of the basic desirable functions of Cobol, RPG, sort, various utilities, and the operating system, including I/O.

When each application program is compiled, a list is made of the micro-instructions it will use, and the proper execution sequence for the instructions. These lists are read onto disc. When the program is called into memory, micro-memory collapses to include only those micro-instructions needed for execution; the remainder of memory is therefore expanded and can be used for the processing of the application.

There is overhead in I/O transfer from memory to disc; but generally this overhead should be offset by the increased available core.

Again, as it did with the B 1700's variable word length, Burroughs has chosen not to promote what seems to be the most exciting technological aspect of the B 700 — that is, the modular treatment of the language-independent primitive instructions of the machine.

The difference between this concept and, say, the way IBM operates, is that IBM designs its basic machines around the functions represented by the Assembler language.

Burroughs in the B 700 has designed basic functions irrespective of any one particular language.

What this means for the B 700 is that any application program can have access to whatever micro-instructions are best suited to the tasks it is performing. It does not have to suffer through a series of micro-instructions that are makeshift substitutes for its preferred functions. This means that processing time and core resources are being much more effectively used.

Burroughs engineers probably learned this from their application program designers. The Business Management System, for example, is composed exactly the same way: it is a clearly defined group of basic, company-independent functions, able to be combined in a wide variety of ways to perform almost every conceivable business function (hospitals, wholesalers, banks, etc.).

The use of microprocessors will very likely give the B 700 a processing edge with respect to its competitors.

MAINTENANCE AND TRAINING

Maintenance test routines exist that will convert the system to a diagnostic tester. Micro-coded diagnostics routines use test cards and a dictionary to isolate memory failures.

Maintenance of hardware, operating system software, and program products is provided if

the user buys the entire package of hardware, operating system, licensing of program products, and the training of personnel. No mention was made of maintenance agreements available if the entire package is not purchased.



BURROUGHS

B 1700 Report Update

OVERVIEW

In July, 1973, Burroughs Corporation announced the latest and largest processor in its 1700 line of business-oriented general purpose computers. Target areas for its use are industries such as banking, wholesaling, distributing, manufacturing, hospitals, government, and education.

The announcement of the B 1728 is significant because it extends what was originally a line of small business machines into the small-to-medium area. In fact, the 1728 overlaps the capabilities of Burroughs current entry into the Medium Systems area, specifically, the "700" series B 2700/3700 computers.

The B 1728 has all of the characteristics and capabilities of the formerly announced members of the 1700 line: the B 1712 and 1714 (the so-called "1710" systems) and the 1726. (The 1726 and 1728 together are called the "1720" systems.) These features include compatibility with Burroughs' B 300/B 500 (achieved through emulation or straight compatibility, depending on model), and emulation capabilities for IBM's 1401/1440/1460. Other characteristics shared by the new arrival with the series are its orientation towards communications (a multiline controller was announced), and its ability to use the peripherals and subsystems available on the 1712, 1714, and 1726. It also shares a market thrust towards small or new businesses as well as large firms that require satellite data processing computers.

COMPARISON WITH OTHER BURROUGHS PRODUCTS

The B 1728 is similar to the 1726 in that both have the same control memory/main memory stratifications and speeds, although the 1728 control memory can be expanded from 6,144 bytes to 8,192 bytes, double that of the 4K maximum available on the 1726.

They have similar I/O channel schemes, and all of the peripherals that can be attached to the 1726 can also be attached to the 1728.

Both use the MCP-II multiprogramming operating system, and the same programming languages: Cobol, Fortran, RPG, Basic, NDL (Network Definition Language), and UPL (User Programming Language). Also, both can use the same applications software, including the Burroughs-authored business management system software.

Both the 1726 and the 1728 can use the multiline controller announced simultaneously with the 1728. Use of this controller provides a maximum of 8 lines on the 1726 and 16 lines on the 1728. The controller uses direct memory access and transmits data at 9,600 bits per second. It is very similar to the Data Communications Processor in use with the Burroughs Medium Systems.

The B 1728 differs from the B 1726 in that the main memory capacity of the B 1728 is larger: 64K bytes expandable in 16K increments to 262K bytes.

Another difference between the B 1728 and B 1726 is that a head-per-track systems disc memory with integrated controller is included in the basic price of the 1728; it is available at separate cost on the 1726. The disc is a modified version of the head-per-track discs available with the Medium Systems processors: it has the same access time (20 milliseconds); its capacity is slightly lower (8.1 million bytes) because of modifications necessary to adapt the disc to the 1728. Disc expansion is the same as that available for the Medium Systems — up to 5 units can be attached for a total of 40.5 million bytes for the 1728. The disc is used to store systems programs and, additionally, user programs and data.

Also announced were phase-encoded, 1,600 bpi tape drives for use on the 1726 and the 1728. Transfer speeds for the 3 drives announced are 40, 80, and 120 kilobytes per second, respectively.

Other devices that have been announced for the 1728 seem to be modified versions of devices available on the Medium Systems; these include an 80-column card reader with a reading speed of 800 cards per minute, and an 80-column card punch with a punching speed of 300 cards per minute; paper tape equipment with respective read/punch speeds of 1,000 and 100 characters per second; and a chain printer with a 48-character set and a speed of 400 lines per minute. High-speed devices that also seem to be modified Medium Systems devices are the 9-channel magnetic tape unit with a 96-kilobyte transfer rate and a 7-channel tape unit with a 72-kilobyte transfer speed.

Because a pattern of adapting Medium Systems peripherals to the "1700" line is developing, a relevant question is, what does the emergent "1700" line have over the existent "700" line?

For one thing, the "1700" series uses the more modern stratified approach to memory technology. Control memory is bipolar semiconductor and operates at 167 nanoseconds (2 bytes). Main memory, also integrated circuit memory, cycles at 667 nanoseconds (3 bytes). This layered approach yields faster execution times than the core technology of the "700" series.

Secondly, the "1700" series can be configured at lower monthly rentals than their "700" series counterparts.

Thirdly, the operating system of the "1700" series computers is more sophisticated than that of the "700" series Medium Systems. The MCP-II uses a pure paging scheme (similar to that used on the multiprocessing 6700/7700 machines) and dynamically reconfigures microcode instructions. These features give it a performance edge over the "700" series MCP-V, which uses a segmentation form of virtual addressing and a fixed microcode instruction set.

Competitive Position

The first obvious target for comparison is Burroughs' own Medium Systems processors, the B 2700/3700. The B 1728 has several distinct advantages. Analysis of monthly rental costs for comparable configurations of the B 1728 and B 2700/3700 indicate that the B 1728 is less expensive. The maximum memory capacity of the B 1728 outstrips that of the smaller B 2700 configurations, and maximum memory of the B 3700 is only 38 kilobytes greater than that of the B 1728.

Other factors in favor of the B 1728 are its more modern technology already discussed, and the somewhat more sophisticated MCP-II.

The major advantage of the B 2700/3700 series over the B 1728 is the significantly greater on-line storage capacity, but future announcements may alter this.

Other more modern competition includes the IBM System/370 Model 125. The B 1728 was scheduled for first delivery September, 1973. Comparisons therefore can only be speculative, pending actual throughput analyses.

The B 1728 is good for applications that need large amounts of on-line storage; it has in excess of a half-billion bytes of on-line storage. How-

ever, the S/370 Model 125 dual-density 3330 Model 11 drives give it an 800 million-byte capacity. Model 1 packs give a 400-million byte capacity, which is less than that offered on the 1728.

The 1728 is also good for applications that are oriented toward communications; the single line controller of the earlier 1700 systems is available, plus the multiline controller, as announced (an independent processor), can connect up to 16 lines. The IBM System/370 Model 125 can support 6 synchronous lines or 16 start-stop lines with one optional adapter or double that with a second optional adapter. IBM offers a Network Control Program that eases the user's network definitions, but Burroughs Network Definition Language offers more flexibility and it is easier to use.

As far as operating systems go, the MCP as defined in the main 1700 report is better than any of the competing operating systems for increased throughput without unnecessary overhead.

Both operating systems require some user sophistication. IBM's DOS/VS is not for the novice, since throughput on a virtual memory machine as implemented by DOS/VS, where core is a strict limitation, requires considerable planning to avoid "thrashing". Job mix and balancing functions must be performed by the user with DOS/VS. MCP-II, on the other hand, performs these functions and allocates system resources. The 1728 is a good system. The only truly negative feature that we have found lies not in the 1728 hardware, but in the business management system software available for applications. Users of this system, which is available on other Burroughs machines, have complained that its extreme modularity makes it slow and unnecessarily redundant.

CONFIGURATION GUIDE

The B 1728-1 Basic System includes a central processor; 6,111 bytes of control memory (167 nanoseconds for 2 bytes); 65,536 bytes of main memory (667 nanoseconds for 3 bytes); an I/O subsystem with 14 I/O positions; a console printer and control; a head-per-track disc file control (partly integrated); and a head-per-track systems disc. The latter comprises one disc file electronics unit and one disc file storage unit (capacity: 8.1 million bytes, average access time: 20 milliseconds).

The basic system is modular and can be expanded as follows:

- Main memory (LSI) from 65,536 bytes to a maximum of 262,144 bytes, in 16K-byte increments.
- IC control memory from the standard 6,144 bytes to 8,192 bytes.
- Head-per-track disc from the standard 8.1 million bytes to 40.5 million bytes in 8.1 million-byte increments.
- Removeable disc subsystems up to a maximum of 525 million bytes.

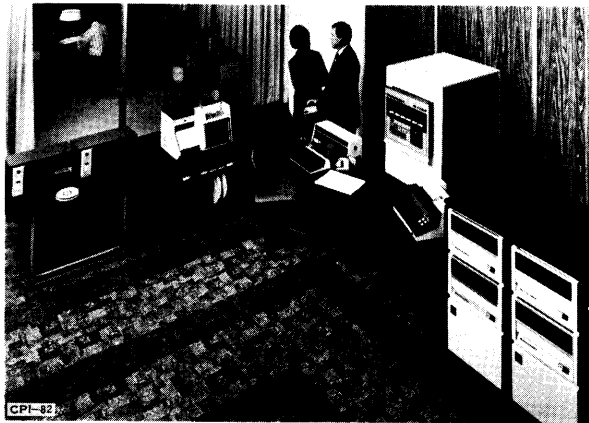
Addition of a second electronics unit as available on the "700" series disc system, but not yet

announced for the 1728, would allow a 1 x 2 exchange and the addition of another 40.5 million bytes of on-line storage. Additionally, a disc pack memory controller connects the modular disc pack memory subsystem. Transfer rate is 625,000 bytes per second. The maximum disc capacity is 525 million bytes.

The I/O subsystems offer buffered controls for the following devices: 96- and 80-column card equipment, line printers, the head-per-track memory, disc cartridge memory, magnetic tape, paper tape, MICR reader/sorters, and the data communications single line control. Buffered controls speed up I/O transfer considerably, which is important in systems with I/O bound applications, such as business systems invariably use.

BURROUGHS

B 1700 Systems



OVERVIEW

Burroughs B 1700 computers are small-scale general business systems aimed at both small and/or new businesses as well as large firms that need satellite data processing installations. They provide efficient competition for the IBM System/3, Honeywell Models 2020 and 2030, NCR 50, and Univac 9200.

The 3 models currently in the B 1700 series — B 1712, B 1714, and B 1726 — vary essentially in processor cycle rate, size range of main memory, and available peripherals. The B 1726 also has a control memory that operates at 4 times its main memory operating rate of 666 nanoseconds per 24 bits.

Peripheral equipment available includes 80- and 96-column card readers and punches, 96-column card sorters, and multifunction units, disc units, line printers, magnetic tape units, a data communications interface, and a console printer. Also available is a new series of MICR document reader-sorters, which are of special interest for banking applications. All devices are buffered; up to 8 individual I/O controls are available on any of the 3 systems.

Two versions of the Master Control Program (MCP) operating system have been announced for the 1700 series: MCP I and MCP II. MCP I is a serial programming system which is not released to date. MCP II provides a multiprogramming environment. Both MCPs are responsible for dynamic control of memory and resource assignment, I/O operations, operator communications, library management, logging, and other functions. The commands for the MCP, entered via the console or via control cards, are simple to use and understand.

Burroughs supplies a comprehensive library of business management software (BMS) for customers who do not have or cannot afford to develop their own software. The BMS package is functionally general enough so that it can be tailored to almost any user environment. This generality, however, has resulted in some user complaints in relation to slow processing.

The programming languages available are Cobol, Basic, Fortran, and RPG. The language compilers in each case generate "s-code," Burroughs' version of machine language. The s-code is then executed by interpreters for each language. RPG is handled somewhat differently; the RPG compiler generates Cobol s-code, which is then executed by the Cobol interpreter.

A design feature, strongly emphasized by Burroughs, is "bit addressability." Burroughs claims that this is the ability of the B 1700 processors to address an individual bit in memory. It is true that the 1700 microinstructions are capable of direct bit manipulation and that memory fetch addresses are at the bit level. However, the B 1700 memory is physically divided into 8-bit words. The CPU addresses main memory physically on byte boundaries so that parity bits can be checked and created. What the microinstructions can do that is noteworthy is access memory in either positive or negative increments respective to a referenced bit, for a specified number of words of variable length.

The variable instruction, operand, and word lengths are the design features that Burroughs should really be emphasizing. At the s-code level, the Burroughs word (or "unit") can be defined as 1 to 65,535 bits (8,191 characters). This flexibility allows improved utilization of available space and faster execution. In regard to space savings, Burroughs is making a claim of a 20 to 40% reduction in the amount of memory needed to execute programs. Users of variable word length machines from other manufacturers have reported space savings of as much as 70%. Burroughs' 40% is probably a conservative estimate.

Configuration Guide

Tables 1 and 2 show the variations in processor speed, memory size, and supported peripherals of the three B 1700 series models. It also contains configuration information. A minimum entry configuration for the B 1700 series could include a B 1714 with 16,384 bytes of memory, an A 9350 console printer, an A 9419-2 96-column reader-punch (300/60 card per minute), an A 9245-16 32-column line printer, and an A

BURROUGHS B 1700 SYSTEMS

Table 1. Burroughs B 1700: Series Comparison and Configuration Information

Characteristic or Device	B 1712	B 1714	B 1726	Comments
Processor Speed (msec)	0.5	0.25	0.125	
Memory Size (bytes)	16-40K	16-65K	24-98K	
Increment Sizes	8K	8K	8K to 65K; 16K to 98K	On the 1726, main memory increments replace the basic configuration memory. MOS/LSI semiconductor.
Control Memory	—	—	x	2K or 4K available for 1726.
9340 Console Printer & Control	x	x	x	Required.
I/O Channels (max without I/O expansion feature)	5	5	8	On the 1726, there are 5 types of I/O subsystem connections. 1 each std.
I/O Channels (max with I/O expansion feature)	8	8	8	Max 2 expansion features on 1726; adds 1 each of 3 types of subsystem connections.
HIGH-SPEED PERIPHERALS				
Direct Access Devices				
				At least 1 dual drive required. Max 2 for 1714, unless MICR reader/sorter is used, then max 1. Need I/O expansion feature when 2 disc subsystems or when 1 disc and 1 MICR are used.
9480 Single Disc Cartridge Drive (2.3 or 4.6 mb; 90 msec)	x	x	x	Data in cartridges is recorded in 180-byte segments; avg head positioning is 60 msec; rotational delay 20 msec; transfer rate is 193 kb/sec.
9481 Dual Disc Cartridge Drive (4.6 or 9.2 mb; 90 msec)	x	x	x	
9486-2 Dual Disc Pack Drive (95.5 mb; 42.5 msec)	—	—	x	Max 1/control.
9371 Head-per-Track Memory Bank (7 or 14 mb; up to 5 units; 20 and 40 msec, respectively.)	—	—	x	Max 1/control.
Magnetic Tape				
				Max 1 control/processor.
9491-2 9-Channel Magnetic Tape Unit (10 kb; NRZ; 800 bpi)	x	x	x	Max 4/control.
9381-12/13/14 9-Channel Magnetic Tape Cluster (18 kb; 2/3/4 stations)	—	x	x	
9381-22/23/24 9-Channel Magnetic Tape Cluster (36 kb; 2/3/4 stations)	—	x	x	
9390-3 7-Channel Magnetic Tape Unit (18/50 kb; NRZ; 200 or 556 bpi)	—	—	x	

9480-2 dual disc cartridge file (4.6 million bytes). Every system must include a console printer and a disc subsystem.

Expansion within the series, except for the 1726, is eased by add-on memory modules and compatibility of peripherals. On the 1726, the basic configuration memory is replaced during upgrading. Also, the 1726 will not handle the slow-speed printers of the 1712 and 1714.

Expansion to larger computers in the Burroughs 700 series (the B 2700, B 3700, and B 4700) is eased by the fact that the larger computers are designed to run in a similar multiprogramming environment. They also accept without modification the higher-level languages, especially Fortran and Cobol, that can be run on the B 1700s.

Upgrading from Burroughs commercial mini-computers and the B 500 systems is eased by

Table 2. Burroughs B 1700: Configuration Information

Characteristic or Device	B 1712	B 1714	B 1726	Comments
Card Equipment				Max 2 controls/processor. Max 3 readers on 1726.
9115 80-Col Card Reader (300 cpm)	x	x	x	
9116 80-Col Card Reader (600 cpm)	—	x	x	
9111/2 80-Col Card Readers (800, 1,400 cpm)	—	—	x	
9210 80-Col Card Punch (100 cpm)	x	x	x	
9119-1 96-Col Card Reader (300 cpm)	x	x	x	Max four 96-col readers, or if MICR used, probably 3.
9319-2 96-Col Card Reader-Punch (300/60 cpm)	x	x	x	
9319-4 96-Col Reader-Punch (500/120 cpm)	—	x	x	
9419-2 96-Col Reader-Punch Data Recorder	x	x	x	
9419-6 96-Col Multifunction Card Unit (includes sorter)	x	x	x	
Line Printers				Max 1 control/processor.
132-Col Line Printers (90-300 lpm)	x	x	—	
132-Col Line Printer (400 lpm)	—	x	—	
132-Col Line Printers (475-750 lpm)	—	x	x	
132-Col Line Printer (1,040 lpm)	—	—	x	
Reader-Sorters				Max 1 control/processor. If used, requires I/O expansion feature. If used, only 1 disc subsystem can be used on 1714.
MICR Reader-Sorters (600 cpm; 8 or 12 pockets)	—	x	x	
MICR Reader-Sorters (900 cpm; 8 or 12 pockets)	—	x	x	
MICR Reader-Sorter (1,000 cpm; 13 pockets)	—	—	x	
MICR Reader-Sorter (1,625 cpm; 4-16 pockets)	—	—	x	
Data Communications Single Line Control	—	x	x	Max 2 controls/processor, controls need line adapters.

their high-level language programs that will run on the B 1700 and make full use of the B 1700 configurations. B 300 programs can run under an emulator.

Performance and Competitive Position

B 1700 is well suited for the typical scope of small business data processing needs. The provision of customer-oriented software packages, and the high-level language compatibility with the 700 series computers make the B 1700 an excellent entry system for a small business or for a large firm that requires satellite data pro-

cessing installations. The interfaces possible between computers in the 700 series in a communications environment, and the compatibility of other peripherals establish the B 1700 as a growth system. The multiprogramming facilities, albeit limited, are an encouraging step in a small system.

Burroughs is marketing the B 1700 series as implicit competition for the IBM System/3. Similar to System/3, Burroughs offers both 80- and 96-column card peripherals and data preparation equipment. Both systems offer Basic, RPG, Fortran, and Cobol. IBM also offers Assembler

and a desk calculator. Burroughs, however, is aiming at the Cobol market; this is indicated by the facts that RPG is interpreted by the Cobol interpreter for the B 1700, and that Burroughs offers COFIRS (Cobol from IBM RPG Specifications), which is designated to automatically convert IBM's RPG to Burroughs' Cobol.

Multiprogramming can be done in both series. Burroughs' operating environment is suitable for multiprogramming because of the larger available core capacity and better space allocation. On the System/3 Model 10, IBM realistically offers 2 levels of multiprogramming as an option. Both systems apply variations on the theme of virtual memory. The System/3 Model 6 employs disc storage, and swapping to handle Basic programs that would not normally fit into main storage. The B 1700 MCP II uses a paging technique of programmer-defined or compiler-defined segments to accomplish a similar end.

System/3 offers time sharing; B 1700 does not, although release of an interactive Basic compiler is planned. Both systems have communications capabilities. The configuration of Burroughs' communications system should be greatly facilitated by the use of the Network Definition Language (NDL), a high-level language originally designed for the medium systems in the 700 series.

A major difference, from the users' point of view, is that source code on the B 1700 is upward compatible with the rest of the 700 series. This is not the case with System/3 code or data files.

History

Burroughs, founded in 1905, is one of the 2 largest manufacturers of electronic accounting machines, as well as one of the largest computer manufacturers. The company employs over 52,000 people, grosses approximately \$900 million a year, and maintains a worldwide marketing force.

The B 1700 is currently the second smallest system in the 700 series of computers. The Burroughs chain now extends from the L Series terminal computers introduced in 1968 through the B 700 and B 1700 small business computers to the B 2700, 3700, 4700, 5700, 6700, and 7700 medium- and large-scale computers. All are programmable in Cobol; most of the computers operate in multiprogramming mode and share many of the same peripherals. This enables expansion within a computer line that ranges from the very small to the very large.

MAINFRAME

All systems in the B 1700 series use large-scale integrated (LSI) circuit main memory. This small-size, high-density circuitry is faster, more reliable, and more easily maintained than conventional magnetic core. Main memory operates with a 666-nanosecond cycle time; control memory (B 1726) cycles in 167 nanoseconds. These speeds are significantly faster than the speeds of most competitive systems.

Bit Addressability

For the B 1700 Burroughs is advertising "bit addressability," a concept that has been existent at least since IBM's ill-fated STRETCH. Burroughs claims that this is the ability of the B 1700 processors to address an individual bit in memory. Microinstructions' memory fetch addresses are at the bit level. However, the CPU addresses main memory physically only on byte boundaries in order to check and create parity bits for the 8-bit words (into which the memory is physically divided). The difference with Burroughs' access of main memory is that it can be done either in negative or positive increments respective to the desired bit; the data can be rotated to isolate the appropriate starting bit during the memory fetch.

Normally, bit manipulation at this level isn't noteworthy. However, Burroughs has thoughtfully provided a varying word length which optimally means that storage can be allocated in bits. The interpreters can directly invoke calls to microinstructions that operate on bits. More importantly, this avoids the crime of wasted storage classically committed by higher-level languages that require byte boundaries for values that could be represented in less than a byte. This manipulation of individual bits — generally a systems programmer's concept — is an interesting development from a manufacturer whose machines are oriented toward the higher-level languages.

One result is that bit addressability gives the ease of higher-level language coding, plus some of the storage utilization of a systems language, namely, Assembler — an almost ideal blend. Add to this, the microcoded interpreters, which allow dynamic reconfiguration of the hardwired microinstructions on the basis of a series of software microinstructions tailored to the appropriate higher-level language, and the B 1700 becomes a technological blend of minicomputer sophistication and general-purpose computer flexibility.

A logical extension of this sophistication is that the 1700 systems are well suited to be "universal emulators." Technologically, the 1700 systems are so flexible at the microcode level that they could emulate any machine.

PERIPHERALS

Tables 1 and 2 contain peripheral device characteristics and configuration information for the three B 1700 series models.

Slow-Speed Peripherals

The operator's console features a built-in magnetic cassette unit intended for the initial entry of systems software and, when needed, the entry of diagnostic software.

The card reader controls will allow a dynamically determinable card size; for example, the readers will handle only 36 columns of a card instead of the full 80 or 96.

A new series of MICR document reader-sorters provide 8 to 12 distribution pockets and sorting speeds of 600 or 900 documents per minute, or 4 to 16 pockets at 1,000 or 1,625 documents per minute.

High-Speed Peripherals

Disc storage is available in 3 different forms; their respective capacities and access times appear in Table 1. Suitability for on-line random access is relative to access time, with the cartridge disc file least suited and the head-per-track disc best suited. The latter is available only on the B 1726.

Magnetic tape equipment is a subset of the equipment that is offered for the larger 700 series computers. Both slow-speed tape units and slow-speed tape clusters are available for B 1700.

Data Communications

For data communications, the B 1700 can interface with other models in the series and with larger Burroughs 700 systems, either as a "host" or a remote batch collection terminal system. The data communications single-line control option can handle up to 2 lines on the B 1714 and 3 lines on the B 1726. Synchronous or asynchronous lines, that operate at a maximum of 9,600 bits per second, can be controlled. The 1700 is best suited for remote terminal processing for a larger central computer. Presently the option is capable of operation with all Burroughs data

communications terminals (namely, the TC, RT, and TU series). Burroughs states that the option later will be expanded to include standard synchronous and asynchronous communications conventions of other manufacturers' terminals.

SOFTWARE

Burroughs "soft" machines offer a sophisticated operating system and a very flexible set of applications packages.

Operating System

Two versions of the Master Control Program operating system have been announced for the B 1700: MCP I and MCP II. The installed base is operating under MCP II, since MCP I is not available yet. MCP I is planned as an entry-level (minimum 16K main memory) batch serial operating system that handles all I/O scheduling, dynamic control of memory and resource assignments (including the addition of memory and peripherals), disc program library management, operator and system communication (via console or control cards), job status and logging, program compilation and loading, file management, and utilities. MCP I is expected to need a minimum of 4K for resident requirements.

MCP II, currently available, does all of the functions of MCP I, plus the system handles communications controllers, MICR reader-sorters, and scheduling and loading of programs in a multiprogramming environment. It also provides spooling in the form of pseudo readers and disc backup for printers. The MCP II requires at least 8K bytes of main storage.

The MCP is a paging operating system; page sizes are controlled either by the MCP or by the programmer (the Cobol SEGMENT-LIMIT clause, for example). Paging is facilitated by code (not data) that is entirely reentrant; therefore, there is no need to write back to disc. Data, however, is always written to disc if space is required. Associated with the programs in core is a run status nucleus, tables/stacks, and a segment dictionary, which at any time indicates the pages resident in main storage. If space is needed, it is allocated dynamically in the following page order: available memory, not in use code, in use code, not in use data, and in use data. This is the optimum order with respect to minimized disc access.

Interrupts in the 1700 are soft interrupts; for example, there is a timer bit set every 100 milliseconds, and software must test the bit in order to realize a "timer" interrupt.

The 1700 interpreters reside in 4K or less of core and can be overlaid. On the 1712 and 1714, the MCP resides in whatever core is available. On the 1726, the interpreters reside in control memory, which is either 2K or 4K.

The MCP's paging technique will allow it to run faster as more core is made available. Therefore, we feel that in the 98K bytes (max) available for the 1726, 3 programs are a reasonable multiprogramming mix. Burroughs claims that the 1710 systems also can multiprogram effectively.

We were sceptical about the ability of the 1710 systems (1712, 1714) to multiprogram effectively. A meeting with Burroughs was arranged to discuss the machines and watch a 1714 with 48K, running MCP II. We had 3 Burroughs-authored demonstration programs, subsets of BMS programs, that performed the following: card input; inventory totaling and printing; and file updating. The programs could be further characterized as heavy card input, light processing, light printing; light input, light processing, heavy printing; and light input, heavy processing, light printing. Each of the 3 programs was run serially; the timings were recorded. The programs were then multiprogrammed.

Their order of entry into the system was 2, 3, 1. In this order, the programs ran in 69% of the time required by the serial execution. We then requested that the programs be run in the order 1, 3, 2. In this order, the programs ran in 93% of the time required by serial execution. The pseudo-reader of MCP II was not used in either multiprogramming example. We feel that if this option had been used, more favorable timings would have resulted. Disc backup for the printers, however, was used.

Clearly, for the 1714 to multiprogram effectively, the order of job submission can be critical. This in itself requires knowledge of the job types in terms of resource utilization.

Applications Software

Burroughs offers a comprehensive library of business management software in wholesaling, distribution, and manufacturing, including reports; invoicing, accounts receivable, and inventory control; accounts payable; payroll; and general ledger. Other management systems exist for contractors, credit unions, automobile dealers, utilities, and government.

The firm also offers bank management software in proof and transit; demand deposit ac-

counting; savings accounting; installment loan accounting; and general ledger accounting.

Hospital management software includes reports; patient accounting; medical records; payroll and personnel reporting; and general and responsibility accounting.

All of Burroughs' software is modular in design, which allows modification of packages to suit individual users' needs. This generality of design has aroused some user complaints of lengthy execution times.

Programming Languages

Users intending to write their own software can do so in Basic, Cobol, Fortran, or RPG.

Basic is batch only. Cobol is an extended ANS Cobol. Fortran is also an extended ANS. Cobol programs can run on a 16K entry level system. RPG is handled as if it were Cobol, below the compiler level.

The "variable micrologic" of the B 1700 series computers allows dynamic respecification of the micrologic to fit the particular parameters and requirements of a specific language. For example, Cobol and Fortran vary in their needs for transfers of large data areas. The Cobol compiler might invoke a specially designed move instruction that is not subject to the traditional limit of 256 characters; whereas, the Fortran compiler could still use the traditional instruction. The sequence of (software) microinstructions is changed by the specific interpreter called by the control program.

The minimum number of interpreters per purchased machine is 2: one for SDL (Systems Definition Language, Burroughs' high-level language version of Assembler), and 1 for the language that the users' applications programs employ (Cobol/RPG or Fortran).

Burroughs also offers COFIRS for users of IBM's RPG who may wish to convert their programs to Burroughs' Cobol. Input to COFIRS is an RPG source deck. Output is Burroughs' Cobol.

Users who plan on a communications environment will have their configuration definition (for Burroughs-supported terminals) eased by the use of the Network Definition Language (NDL). Parameter statements to the NDL compiler create instructions and tables for handling the Burroughs-supported terminals. NDL also handles

respecification of the communications network as terminals are added or deleted.

MAINTENANCE

Maintenance for the B 1700 series is performed by Burroughs service personnel available on-call during mutually agreeable business hours and operating from over 200 branch locations

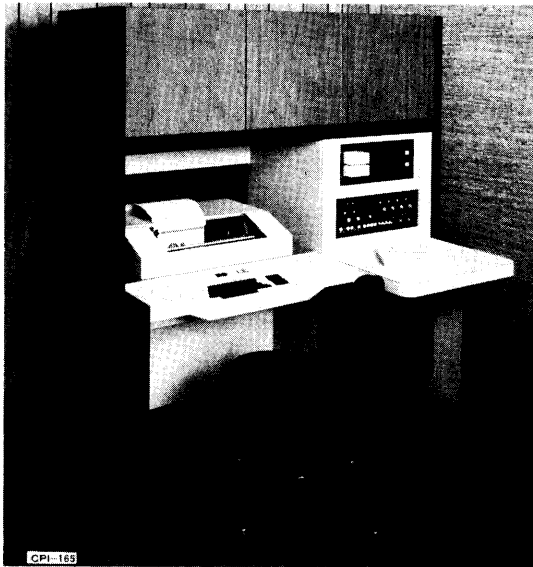
throughout the country. First-year maintenance is included in the lease or provided by a separate contract.

HEADQUARTERS

Burroughs Corporation
6071 Second Avenue
Detroit, MI 48202

CASCADE DATA

Concept II Series



OVERVIEW

Cascade Data's Concept II Series is a customer-tailored system for the new data processing user. While the Concept II is designed for operation by clerks and secretaries, it can also be used in more complex data processing applications. Both interactive and batch processing models are available. Concept II Series is specifically aimed at business applications for companies with annual sales in the range of \$1 to \$10 million.

Concept II comes in 10 basic models that can be configured by the vendor to fit the specific needs of a company. A full complement of peripheral devices can be field installed on most of these models.

The Concept II Series is either magnetic tape or magnetic disc oriented, but magnetic tape capability can be retained with a disc-oriented system. Both tape and disc operating systems are available.

Cascade Data is a wholly owned subsidiary of APECO. As a matter of policy, Cascade will bring up the user's actual application programs and demonstrate on the user's data, for acceptance, before requiring any contractual agreement to purchase or lease.

CONFIGURATION GUIDE

Ten basic models are available (Table 1):

- 3010 — direct-entry, interactive data processing system.
- 3510 — batch processing version of the 3010.

- 3011 — direct-entry, interactive magnetic tape system with a higher-speed printer replacing the console printer used in 3010.
- 3511 — batch processing version of the 3011 with a 16K CPU.
- 3512 — a 3510 with an additional matrix printer.
- 3513 — replaces the matrix printer on the 3512 with a 200 line-per-minute line printer.
- 4011 — direct-entry interactive system with a 16K CPU, 5-million-byte disc drive, and a matrix printer for output.
- 4511 — batch processing version of the 4011.
- 4512 — a 4511 with a console printer in addition to the matrix printer.
- 4513 — replaces 4512 matrix with a 200 line-per-minute line printer.

The CPU has a basic 8K core storage memory for the interactive tape systems and a 16K core storage memory for interactive disc and all batch processing systems. Most models can expand core storage memory to 65K. The CPU responds to 65 different hardware instructions. All models include a standard typewriter keyboard with a 10-key, adding-machine-type, numeric subset. A keypunch-style, 10-key keyboard is also available for the user who is data processing oriented. All models are field expandable to provide upgrade capability from the simplest configuration to the most powerful. Table 2 lists the Concept II specifications.

Peripherals for the Concept II Series include the following.

- Visual Display CRTs: TV/Xaminer (TVX) is a self-contained visual display unit and keyboard device for data entry or inquiry applications; it accommodates up to 16 stations. TVX is available in two models — 640 or 1,280 characters. Both have a full 96-character set, which includes all upper- and lowercase letters, and a data protect mode, which insures input accuracy.
- High-Speed Line Printer: A 600 line-per-minute line printer is available for most models.
- Magnetic Disc Drive: Duo-Disk 412 (an integral component of Models 4011, 4511,

CASCADE DATA — CONCEPT II SERIES

Table 1. Cascade Concept II Series: Basic Models

Features	Model									
	3010	3011	3510	3511	3512	3513	4011	4511	4512	4513
Main Storage (kb)										
Min	8	8	8	8	8	8	16	16	16	16
Max	8	8	16	16	32	32	65	65	65	65
Console Keyboard	x	x	x	x	x	x	x	x	x	x
4005 Mag Tape System	x	x	x	x	x	x	—	—	—	—
601 Console Printer (30 cps)	x	—	x	—	x	x	—	—	x	x
601 Matrix Printer (165 cps)	—	x	—	x	x	x	x	x	x	—
650 Card Reader (300 cpm)	—	—	x	x	x	x	—	x	x	x
620 Line Printer (200 lpm)	—	—	—	—	—	x	—	—	—	x
412 Disc System (5 mb)	—	—	—	—	—	—	x	x	x	x

Table 2. Cascade Concept II Series: Specifications

CENT PROCESSOR	
Word Size (bits)	8; 16
Capacity (words)	8K-64K; 4K-32K
Cycle Time (μsec)	0.900
Working Storage	Core
AUX STORAGE	Disc; mag tape
DATA OUTPUT	
Line Printer (lpm)	90; 200; 600
Serial Printer	Yes
Card (cpm)	—
Paper Tape (cps)	60
DATA INPUT	
Keyboard	Standard
Card (cpm)	300
Paper Tape (cps)	300
SOFTWARE	
Assembler	Yes
Operating System	Yes
Compiler	RPG

4512, and 4513) is a dual-disc configuration with 5 million bytes of on-line storage. Up to four drives can be added to single controller, providing 20 million bytes of on-line storage.

- **Card and Tape Readers:** Besides the 300 card-per-minute Data Speed 650 card reader, the Optiscan 660 optical card reader (also 300 cards per minute) is offered. The Optiscan 660 reads pencil-marked cards. A paper tape reader (300 characters per second) and punch (75 characters per second) are available.

- **Magnetic Tape Storage:** A four-drive cartridge tape unit is an integral component of Models 3010, 3011, 3510, 3511, 3512, and 3513. Communicator 421, a nine-channel magnetic tape unit, is available on most systems. This unit comes with 10-1/2 inch reel size and 800 or 1,600 bit-per-inch packing density.

SOFTWARE

Concept II Series software includes translators and compilers for programming languages, support software, and application programs.

Programming language support includes Cascade Basic Assembler Language (BAL) and Report Program Generator (RPG). These languages are compatible with those offered by other major computer manufacturers and are supported by a library of preprogrammed sub-routines that simplify computer programming and operating. The code generated by the language system is processed by an allocator, which optimizes the final computer program.

Support software includes a resident supervisor that requires 2K memory. The supervisor serves as a focal point for control of the operating hardware. A library of utility programs handles routine data processing. The support software is available under two operating systems: TESS (Tape Environment Supervisory System) and DESS (Disk Environment Supervisory System). When operating under TESS, all software resides on magnetic tape; under DESS all software resides on magnetic disc.

Application programs are the user programs that are modified and customized to a user's

specific needs. An extensive library of applications packages is available and includes: order entry, billing, inventory control, sales and gross profit analysis, accounts receivable, accounts payable, payroll labor distribution, job costing, general ledger, and financial statement preparation. Special industry packages are available for accounting firms, auto dealers, fuel oil distributors, tire dealers, contractors, printers, hospitals, and nursing homes. There is also a material requirements and production control system for manufacturers, which includes multilevel bill of materials and parts explosion.

DESIGN FEATURES

The main design features of the Concept II Series are ease of operation, upgrade compatibility throughout the product line, and a large maximum on-line auxiliary storage capacity. Plug-in modules simplify maintenance because any device in the system can be entirely and quickly replaced on-site.

PERFORMANCE

Concept II Series performance is geared for acceptance by nondata processing oriented businesses. Cascade is emphasizing the first-time processing user by providing customer-

tailored software, the ability of the customer to actually see what he is getting before contract signing, and complete installation procedures.

Another important aspect of this series' performance is Cascade's rapid startup with previously untrained personnel as operators. Reportedly, clerks, secretaries, and bookkeepers become efficient operators after only several hours of training.

MAINTENANCE

Maintenance for the Concept II Series is available through all Cascade Data offices and a growing number of APECO offices throughout the country. Service is available on a 24-hour basis.

HISTORY

Cascade Data was founded in June 1969 exclusively to manufacture and distribute small business computers. During 1972, Cascade became a wholly owned subsidiary of APECO and presently maintains 48 sales offices throughout the country. The first Cascade system was delivered in January 1970; and during early 1972, the firm's one hundredth system was installed.

DEC

Datasystem Series 300

OVERVIEW

DEC Datasystem (DDS) 300 Series of computers are small business computers aimed at the "highly self-sufficient" end user capable of doing the applications software in-house. DEC supplies the systems software: easy-to-use high-level languages and commercial operating system. The Commercial Operating System (COS) 300 includes a DIBOL (Digital Business Oriented Language) compiler as well as system monitor, device handlers, system generation, maintenance programs, and a data entry package. It is designed for small business accounting operations, plus related applications such as inventory control, monitoring of sales and salesmen's activities, and management reports.

The DDS 300 Series is based on the 12-bit word PDP-8/E minicomputer. The DDS 320 is an all DECTape system with 4 DECTape drives. DDS 330 replaces 2 of the DECTape drives with disc storage, and DDS 340 is an all-disc system with no DECTapes. DECTape is not industry standard tape but is a 10-track block addressable tape that DEC developed several years ago for low-cost mass storage for its minicomputer systems. DECTape is very reliable and inexpensive and DEC has generally used it in the same way as disc storage.

DEC introduced the PDP-8 computer line in 1965, a time when the prevalent trend was toward big, complex, expensive computers. The PDP-8 family went counter to this trend with a short 12-bit word, modular small memory of 4K to 32K words, simple instruction set, flexible I/O structure, and an \$18,000 price tag. The system lent itself to many scientific and control applications that did not need a powerful computer, so the PDP-8 sold briskly. Its acceptance proved that a large market exists for minicomputers; over 17,000 PDP-8 computers have been installed.

Despite the proliferation of different minicomputers on the market, the PDP-8 family remains a significant system in the entire minicomputer field. It is a dynamic system. DEC keeps it competitive by introducing new PDP-8 models that reflect current technology; DEC continues to add extensive system and applications software, and DEC interfaces almost all of its broad range of peripheral devices to it. The PDP-8 also remains popular because of the amount of software users have developed for the system.

Competitive Position

The DDS 300 Series and the DDS 500 Series, announced at the same time as the 300, are the first systems DEC has marketed specifically to

the commercially oriented end user. DEC has usually marketed its small computers as general-purpose systems for real-time, scientific, or time-sharing applications. Commercial processing has generally been done to use processor time left over from the primary application. Most commercial software was developed by users although DIBOL has been available for the PDP-8 for several years.

The DIBOL offered for the DDS-300, however, is a vast improvement over the older DIBOL. DEC also offers Fortran IV, Focal, and Basic-Plus for the PDP-8/E. In addition to its own software support groups, DEC supports DECUS (Digital Equipment Users Society), which maintains a library of programs contributed by users and available to all members. A special interest group has been formed for business users.

DEC was a pioneer in the small computer business and became a major computer manufacturer by catering to small computer users. DEC early recognized the need for mass storage devices, high-level languages, and operating systems for small computer systems. DECTape allowed small systems to be automatic long before discs were inexpensive enough to be used as mass storage devices for them. Focal gave users of small systems with 4K words of memory a high-level language that was easy to use. The OS-8 operating system provides features that make the PDP-8 a more versatile system than many much larger systems.

All these things have little bearing on the DDS 300 as a commercial processing system except to point out that DEC has been a real leader in developing small computer systems.

DEC recognizes that marketing small business systems is quite different from marketing general-purpose minicomputers. For one thing, small commercial users expect more help in getting their system installed and running. DEC has set up a new commercial marketing group to handle only the DDS 300 and 500 systems. Secondly, small commercial users want to lease their equipment rather than buy it outright and DEC offers leasing arrangements for its DDS systems.

Because the DDS 300 is not compatible with any other computer system, expansion capability is limited to a DDS 340 system with 32K words of memory. Typically, expansion requirements are satisfied with 2 additional disc drives, a faster line printer, and data entry terminals.

One user of the DDS 300 is a Chicago realty company that operates 4,000 apartment buildings. It has been building its system since February

1970, two years before DEC announced the DDS 300 in December 1972. The realty company purchased a PDP-8/I with 8K words of memory, 4 tape units, and 1,100 line-per-minute printer, and a DECwriter terminal, and began using it with a preliminary version of DIBOL. The user replaced the system software with COS 300 as soon as it was available; the conversion took about 2 weeks. The company uses the system to do its own payroll and billing, and in addition, the bookkeeping for a small investment company and 2 insurance businesses. The DEC system was chosen in 1969, after evaluating many other small computer manufacturers, partly because the realty company felt it could rely on DEC for hardware maintenance and for support as it developed its software. The company now has about 200 programs and is extremely enthusiastic about the installation; it has been particularly pleased with the maintenance DEC has provided.

CONFIGURATION

The DDS 300 Series consists of 3 models that are based on the PDP-8/E minicomputer with 8K words of memory.

Model 320 also includes 2 TD8-EM Dual DEC-tape units totaling 4 drives, a VT05 CRT terminal, 1 LS8EA Line Printer, and the COS 300 operating system with DIBOL compiler.

Model 330 replaces 1 of the Dual DECTape units with the RK05-AA Cartridge Disc Drive. Model 340 replaces the other DECTape unit with a second RK05-AA to make an all-disc system. The PDP-8/E CPU includes a chassis, power supply, Omnibus[®] with 20 slots, an asynchronous line unit for the console, and a hardware bootstrap loader. The optional OMNIBUS expander provides 20 more slots for connecting additional memory and peripherals to a system. Memory can be expanded to 32K words in modules of 4K words. Peripherals, such as a card reader, high-speed printer, and paper tape reader/punch, can be added to a system.

The Omnibus, a back-plane, etched circuit board, is an internal bus that provides 20 quad slots to connect all circuit modules to the PDP-8/E. A 4K-word memory module requires 3 slots and peripheral device controllers require 1 or more slots depending on the peripheral. The Omnibus can be extended by a KA8-E external interface for positive I/O devices. A DW08A bus converter is required to interface older PDP-8 family (PDP-8/I, L, and S) peripherals to the PDP-8/E. Older PDP-8 peripherals re-

quire a negative bus and the Omnibus is positive. High-speed peripheral devices such as discs require the KD8-E data break interface to control the transfer of data directly between the devices and PDP-8/E memory.

The Omnibus can be expanded to 76 quad slots through the addition of BA8-AA and BA8-BA system expander boxes.

MAINFRAME

The COS 300 Operating System has a foreground/background multiprogramming capability for the DDS 330 and DDS 340 systems. It can process 3 data entry jobs in the foreground concurrently with 1 background job. Currently, software for the DDS 320 does not permit multiprogramming.

No multiprocessing software is available for any of the DDS 300 systems.

Central Processor

The PDP-8/E computer is a single-address, parallel binary processor that uses a 12-bit word. Two general-purpose registers are provided — an accumulator and an MQ register. All arithmetic operations are performed in two's complement form. Of the arithmetic operations, only singleword, fixed-point add is hardware implemented in the basic system. Hardware multiply and divide and a floating-point processor are available as options to the Basic, Focal, and Fortran IV systems. DIBOL achieves 15-place accuracy without any hardware arithmetic options. All other arithmetic operations can be performed through DEC-supplied subroutines.

The FPP-12P Floating-Point Processor operates as an I/O device asynchronously with and parallel to the central processor. It requires the KA8-E external interface for positive I/O devices.

The KM8-E Memory Expansion and Timeshare option establishes 2 processor modes, user and executive. Executive mode programs can execute any instruction. User mode programs cannot execute halt, I/O, or load console switches instructions.

Central Processor characteristics are listed in Table 1.

Data Structure. The basic unit of data is the 12-bit word, which can hold two 6-bit characters. Table 2 lists the data formats used.

[®] Registered trademark of Digital Equipment Corporation.

Table 1. DEC Datasystem 300:
Processor Characteristics

Characteristic	DDC 300
Processor	PDP-8/E
No. of Internal Registers	2 (ACC & MQ)
Addressing	
Direct (no. of words)	256
Indirect	4,096 ⁽¹⁾
Indexed	NA
Instruction Set	
Number (std, opt)	56, 16
Dec Arithmetic	Subroutine
Floating-Point Arithmetic	Opt
Priority Interrupt	
Line	1
Levels	Software
Main Storage	
Type	Core
Basic Addressable Unit	Word
Cycle Time (μ sec)	1.2
Min Capacity (words)	8,192
Max Capacity (words)	32,768
Increment Size (words)	4,096
Memory Parity	Opt ⁽²⁾
Memory Protect	Yes
ROM	Opt
Use	Programs and constants
I/O Channels	
Programmed I/O	Std
DMA	1- and 3-cycle data break

Notes:

- (1) Per user program.
 (2) Each program confined to 4K-word field; memory extension option establishes user and executive modes.

Table 2. DEC Datasystems 300:*
Data Structures

Data Name	Representation
Word	12 bits
Character	6 bits of 2/word
Decimal Operand	No
Binary Operand	
Single Precision	12 bits
Double Precision	24 bits
Floating-Point	
Operand	3 words (exponent) 11 bits + sign; fraction 23 bits + sign

*DIBOL provides 15-place accuracy, a function of the COS 300 operating system.

Instruction Set. The instruction repertoire is divided into 3 basic categories: memory reference instructions, 3 groups of operate instructions, and separate instruction sets for each option and I/O device. There are no direct compare instructions, but comparisons can be performed through a combination of logical operations and skip-on-condition instructions. There are 6 memory reference instructions, and these constitute the main power of the instruction repertoire. The 3 groups of operate instructions perform shift, clear, rotate, skip, and inter-register operations.

The only arithmetic instructions in the basic set are add, complement, and increment. The extended arithmetic element (EAE) option provides multiply, divide, and double precision add, complement, and increment. The floating-point processor provides 34 instructions for floating-point add, subtract, multiply, and divide. Table 3 gives typical instruction execution times.

Addressing. For addressing purposes, memory is divided into 4,096-word fields and each field is subdivided into 128-word pages. The format for memory referencing instructions includes a 3-bit operation code, an indirect addressing bit, a "page" selector bit, and an 8-bit address. The page selector bit selects either the current page (the one containing the instruction) or the zero page (the first page in the field containing the instruction). The address selects the core location within the selected page.

PDP-8 has no index registers but does have a specialized form of indirect addressing called auto-indexing for which 8 memory locations in each field are reserved. When any of these locations is directly addressed, it is treated as a normal access; when addressed indirectly, the contents of the location are incremented by one and the resulting quantity is used for the effective operand address. This auto-indexing technique satisfies the major indexing chore of loop control.

To address memory beyond 4,096 words, the PDP-8/E requires the KM8-E Memory Expansion option. KM8-E provides a 3-bit data field (DF) register, a 3-bit instruction field (IF) register, and instructions to control and use the registers. The contents of DF select the memory field when an indirect address is specified. The contents of IF select the field when an instruction is fetched or when a direct memory address is specified.

Interrupt Control. There is 1 common interrupt line and only 1 interrupt level for all interrupts, regardless of their origins. Each interrupt

Table 3. DEC Datasystem 300: Typical Instruction Execution Times

Instruction Type	Number of Instructions	Execution Time (μ sec)
Memory Reference	5	2.6
Unconditional Jump	1	1.2
Literal Loads	16	1.2
Register Operate (complement, shift rotate, increment)	11	1.2
Skip, Halt, OR, or load A with switch register, clear A	21	1.2
Register to Register (MQ and A)	8	1.2
Control (interrupt on/off, test interrupt on/off, get/restore flags, etc.)	8	1.2
Extended Arithmetic Option*	16	—
Multiply	1	7.4
Divide	1	7.7
Normalize	1	1.2 + 0.3N
Shift	3	2.6 + 0.3N
Double Precision	5	1.8 to 5.2
Memory Extension Option	10	1.2
Floating Point	18	—
Add	—	—
Subtract	—	—
Multiply	—	—
Divide	—	—

*These hardware options are not used by COS 300 software. DIBOL statements perform addition, subtraction, multiplication, and division with 15-place precision.

must be identified by subroutine. The interrupt facility provides for storing current processor status and transfers control to an interrupt servicing routine. The number of interrupting sources that can connect to the interrupt line is limited only by the ability of the program to handle them. An interrupt servicing subroutine can be interrupted if the interrupt inhibit is turned off by instruction. This feature permits the programming of a software priority interrupt system.

Main Memory

Main memory consists of core modules available in 4,096-word increments. Each word is 12 bits long. A memory parity bit is optional. Modules can be added for a maximum memory of 32,768 words. Cycle time is 1.2 microseconds per word. Each 4K memory module requires 3 quad slots on the Omnibus.

Read/write core memory with a write protect feature is available in a 256-word increment. It requires 2 Omnibus quad slots; it can be used to protect the monitor, to store frequently used monitors, or to test out programs before they are committed to read-only memory.

Read-only memory (ROM) modules are available in 256-word and 1K-word increments. Any number of ROM modules can be incorporated in a system limited only by the addressing capability of the processor and the amount of read-write core memory. ROM is used to store constants or to protect a user monitor program in a time-sharing environment.

Transfer rate in core memory is 156,250 words per second within a page and 113,636 within a field.

Input/Output Control

Devices connected directly to the Omnibus transfer data one word at a time under program control between the accumulator and the peripheral device. Devices connected to the KA8-E external interface can transfer data 1 word at a time under program control or can transfer blocks of data directly to or from core memory under control of the KD8-E data break interface. Only 1 device can connect to a KD8-E unit, but up to 12 KD8-E units can connect to a PDP-8/E system.

A KD8-E unit operates as a 1-cycle transfer control register or a 3-cycle data break facility, depending on whether the interfaced peripheral device has word count and current address registers. If the device controller has transfer control registers, the device uses 1 memory cycle for each word transferred. If the device controller does not have control registers, core locations are used to store the word count and current address, and 2 memory cycles are used to access them before the data word is transferred. Thus, these devices use the 3-cycle data break facility and require 3 memory cycles for each word transferred.

Maximum I/O transfer rate is 833,333 words per second using the single cycle data break facility and 277,778 words per second using the 3-cycle data break facility. Maximum transfer rate, using programmed I/O transfers, is a function of the number of devices connected to the interrupt line and the length of the servicing routines.

Console

The operator's console is a VT05 alphanumeric keyboard display terminal that includes the keyboard, cathode ray tube (CRT), refresh memory, and interface. It is portable and weighs 55 pounds. The CRT screen displays a total of 1,440 characters in 20 lines of 72 characters per line. A keyboard controller cursor is operated under program control, to allow interactive data entry.

The characters on the CRT screen are refreshed 50 or 60 times per second, synchronized to the power line frequency. Characters are generated using a 5 x 7 dot matrix. The keyboard is the familiar typewriter keyboard. A 10-key numeric pad insert is added for entering all numeric fields. The keyboard has the following control keys and switches:

- Power on/off switch.
- Remote/local switch — in local mode data can be typed without entering it into the computer.
- Contrast and brightness controls — used to adjust display clarity and brightness.
- Vertical and horizontal sync controls — used to adjust picture on the CRT.
- CR key returns cursor to the left margin of screen.
- LF key moves cursor down 1 line in the same position in line.

- Rubout key works in remote mode in conjunction with monitor/editor to erase characters.
- Tab key moves cursor to the right to the next tab stop.
- Alt key has no effect on display but provides an alternate escape character for use in a user program — replaces carriage return or line feed.
- Ctrl key used in conjunction with character keys to perform special control functions.
- Shift lock enables shift function when in the down position.
- Space produces a blank and moves cursor 1 position to the right.

PERIPHERALS

Peripherals offered for the Datasystem 300 Series include discs, block-addressable DECTape, a serial printer, a card reader, a paper tape reader-punch, a CRT terminal, high-speed line printer, and a hard-copy terminal. Table 4 lists the specifications for these devices.

There are a large number of PDP-8/E peripherals not designated as peripherals for the Datasystem. If a user wants to convert his purchased PDP-8/E to a Datasystem or has special requirements for his application, DEC will try to accommodate him.

DATA COMMUNICATIONS

DEC provides optional asynchronous communication at up to 9,600 baud on all 300 Series processors. This option enables the Datasystem to communicate with another Datasystem or with an IBM System 360 or 370. The 300 Series does not have the extensive communication software required to use it as a communication processor or "front-end".

SOFTWARE

COS 300 includes the following programs:

- SYSGEN — configures system I/O handlers, assigns logical devices to physical I/O units, and prints table of device assignments.
- Editor — consists of a basic source language editor for input from source console

Table 4. DEC Datasystem 300: Peripherals

Peripheral Device	Performance Characteristics	Comments
MASS STORAGE		
RK05-AA Removable Cartridge Drive	Capacity 1.6M words; positioning time 12 to 85 msec; avg latency 20 msec; transfer rate 250K words/sec; 2 surfaces; 200 tracks/surface; 16 sectors/track; 256 words/sector.	Uses cartridge similar to IBM 2315; requires RK8E controller for up to 4 drives for over 13M bytes of on-line storage.
TD8-EM Dual DECtape Drive	Two drives; capacity 188,672 words; transfer rate 8,325 words/sec; block size 128 words.	10-track tape; controller for up to 4 drives; control connects to Omnibus.
CONVENTIONAL I/O		
CRF-8 Card Reader	Reads 300 cpm; input and output hoppers hold 550 cards.	80-col cards; tabletop unit.
PC8-E Paper Tape Reader/Punch	Reading speed 300 char/sec; punching rate 50 char/sec.	Separate interrupt for reader and punch.
LS8-EA Serial Printer	Prints 165 char/sec; 132 cols/line; 64-char set.	Slew speed 4 in/sec; line advance time 45 msec; carriage return time 200 msec.
LE8-JA Line Printer	Prints 356 lpm for 80-col lines and 245 lpm for 132-col lines; 64-char set.	Prints on multiple forms of up to 6 parts; slew speed 13 in/sec; line advance time 20 msec.
TERMINAL		
VT05 Alphanumeric Keyboard Display	Display of 20 lines, 72 char/line; keyboard conventional typewriter plus control keys; normal transmission speed 240 char/sec.	Optional switch selectable speeds of 10, 15, 30, 60, and 120 char/sec; numeric key pad.
LA30 DECwriter	Speed 30 char/sec; 250 msec for carriage return; 64-char print set; 97- or 128-char keyboard; 80 char/line.	Prints 1 original and 1 copy; uses 5 x 7 dot matrix.

- keyboard, cards, or paper tape; and outputs file to line printer, paper tape, or console display.
 - COMPiler — compiles source programs written in DIBOL.
 - PIP (Peripheral File Interchange Program) — transfers files from 1 peripheral device to another and provides system file maintenance.
 - BUILD (a key-word data entry package) — consists of a program to create data files.
 - SORT/Merge — sorts data files in ascending or descending order; can also merge files.
 - UPDATE — provides facilities to maintain a master file, change, delete, or insert records, and print all changes.
 - Conversion programs — converts PDP-8/E data files that run under OS-8 to the COS 300 environment.
 - Monitor — provides master control via 2 segments: 1 core resident and the other system device resident through a monitor command language; contains I/O handlers, program loaders, editors, file directories, and operation message.
- The Foreground Data Entry Option is an extension of COS 300 for the DDS 330 and 340. It allows an operated/initiated data entry or data

inquiry program to operate concurrently with a background job stream. The background or system console can execute any system utility or application program. Up to 3 data entry terminals can operate concurrently in the foreground. The terminals can be transcribing source data and creating a disc transaction file while interrogating and editing existing files.

The foreground entry package includes a format description program that allows the user to define data entry formats using a format descriptor language for display on the CRT. It permits interactive data validation; errors cause an audio signal and an error message to be displayed on the bottom 2 lines of the CRT screen. It provides cumulative hash totals for up to 10 fields, automatic duplication of identical information, initial value definition, and free-form data entry with automatic right justification of numeric fields. The operator can use either the keyboard or the numeric keypad for numeric fields.

The format descriptor language provides facilities to define the fields displayed on the screen, display coordinates, editing checks to be performed on the input fields, and field descriptions to be displayed.

The data entry option requires 4K words of memory in addition to the COS 300 minimum configuration for 1 terminal and 8K words for 2 or 3 terminals.

Assemblers and Compilers

The standard language compiler for COS 300 is the integral DIBOL compiler. DIBOL is a high-level language much like COBOL, Level 1. DIBOL offers 15-place accuracy, device independent data files, multi-volume data files, interactive program debugging, program chaining or overlaying, line printer overlap, and internal subroutines. Typical compilation time is under 10 seconds. DIBOL uses simple English-like statements for the following categories:

- Compiler — tells the compiler the kind of statements to follow.
- Data Specification — describes type, size, and location of data elements.
- Device Control — opens and closes data files used by the application program.
- Data Manipulation — controls calculations and movement of data within memory.
- Control — sequences the execution of statements with a program.

- Input/Output — moves data within memory and between memory and peripheral devices.
- Debug — traces program execution.

Fortran IV, frequently used for scientific and mathematical applications, and Basic-Plus, an expansion of the Dartmouth time-sharing Basic language, are also optionally available on the 300.

Utilities

The SORT/Merge routine in COS 300 is a particularly powerful part of the software. It requires a system with at least 8K words of core and a minimum of 3 DECTape units or an equivalent disc. The user can specify up to 8 subfields in the sort key, and unlike many other sorting routines, the size of the key does not affect sort timing. An 80 column card sort on 20,000-card image records takes 23 minutes on a DDS 340. SORT also has a merge file capability.

The system's editor is interactive, allowing a number of types of input. The SYSGEN routine allows the user to reconfigure or modify the current system using simple English-like statements. COS 300 also has a Peripheral Interchange Program (PIP) to transfer files from one device to another. The BUILD routine allows the user to create data files from a data entry terminal. An UPDATE routine provides facilities to maintain master files. Conversion programs allow the user of PDP-8/E OS-8 data files in the COS 300 environments. A Monitor controls all program operations.

Service is provided by DEC through its network of sales and service offices in more than 48 cities in the United States and 50 cities in Europe, Canada, Central and South America, Australia, India, and Japan. Maintenance is included in the lease; it can be obtained for purchased systems on a per-call basis or through a variety of service contracts. Field offices also have software specialists to provide users with a fast response to software problems.

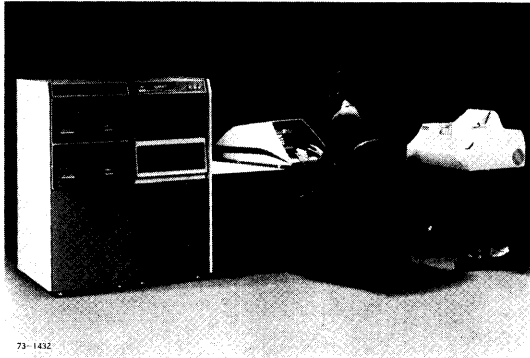
Training in 300 system software is provided by DEC usually in either Maynard, Massachusetts, or Sunnyvale, California. The training courses, which last from 2 to 3 weeks, are free of charge to users of purchased systems.

HEADQUARTERS

Digital Equipment Corporation
DEC Datasystem 300
146 Main Street, Building PK3-1
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DIGITAL EQUIPMENT (DEC)

Datasystems 500 Series



OVERVIEW

The Digital Equipment (DEC) 500 Series Datasystems are small business computers aimed at the "highly self-sufficient" end user capable of doing the applications software in-house. In contrast to offering a turn-key system with completely customized applications software, DEC supplies the systems software for the series, and offers easy-to-use high-level languages, assistance in software design, and a lower price. There are 3 choices of operating systems, the disc-based COS 500 (a batch processing system that utilizes Macro assembler, RPG II, and Fortran IV), the time-sharing CTS 500 (a general purpose, interactive multi-use timesharing system that supports up to 16 users) and the management-oriented CDMS (a multi-terminal data base management system that provides a hierarchical structure of the data base).

All models of the series use the PDP-11/40, 45, and 50 processors, DEC's most technically advanced members of the 16-bit PDP-11 line. In fact, the Datasystems are functionally identical to certain configurations of the PDP-11 that have already been supplied to minicomputer users in the past. What has been added is busi-

ness-type packaging, leasing arrangements, commercially oriented operating systems, and the kind of service and support needed for end users with business applications.

Datasystems/PDP-11s have an average main memory cycle time of 900 nsec, and range in memory size from 16K to 248K bytes. Available options include ROM and semiconductor read/write memories, hardware multiply/divide and a floating point processor, memory management options that permit virtual addressing, discs, tapes, printers, card and paper tape equipment, and terminals of several kinds. DEC does not have a magnetic stripe ledger card reader or a printing terminal with the double platen found on some small business computers that are more like programmable accounting machines.

This report is confined to details of DEC's commercial marketing of the PDP-11 minicomputer (i. e., Datasystem 500) and presents only a broad outline of the system's architecture. Tables 1, 2, and 3 present a few specifications on PDP-11 processor characteristics, main storage characteristics, and data structure. All DDS systems support the COS 500 operating system. The DDS 530 upward can also support the commercial Timesharing System, CTS 500. Current emphasis is on CTS 500, but DEC states DDS 530 upward can also support CDMS (Commercial Data Management System). Configuration possibilities are endless; DEC has identified standard configurations: 520, 530, 540, 550 and 560 Systems.

The basic DDS 520 configuration used with COS 500 consists of an 11/40 processor with 32K bytes of memory, 2 RKO5-AA disc drives totaling 4.8 million bytes capacity, a CR11 card reader, an LS11-A printer, and a VTO5 CRT console terminal. Included with the processor is a real-time clock, a mounting cabinet, power

Table 1. DEC PDP-11 Central Processor Characteristics

Model	No. of Registers	Addressing			No. of Instructions (Std; Opt)	Arithmetic		Interrupts	
		Direct	Indirect	Indexed		Decimal	Floating Point	Lines	Levels
11/40	9	No	1 level	Yes	70; 10	No	Hardware option	4	Multilevel
11/45	16	No	1 level	Yes	83; 50	No	Hardware option	8	20 (7 software levels)
11/50	16	No	1 level	Yes	83; 50	No	Hardware option	8	20 (7 software levels)

(1) A specialized form of indirect addressing called "auto-indexing."

Table 2. DEC PDP-11 Main Storage Characteristics

Model	Cycle Time, msec	Parity	Addressable Units	Bytes per Access	Capacity (bytes)			Memory Protection
					Min	Max	Increments	
11/40	0.90	No	Byte, word	1 or 2	8K	248K	16K, 32K	Option
11/45	0.90 (1)	Opt on MOS only	Byte, word	1 or 2	32K	496K	4K, 8K, 16K, 32K	Option
11/50	0.45 (2)	Opt	Byte, word	1 or 2	8K	64K	8K	Option

(1) Time listed is for core. MOS (0.45 msec) and bipolar (0.30 msec) memory also available.

(2) MOS memory only on the 11/50.

Table 3. Datasystem Data Structures

Series	500
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DATA FORMAT

Bits per Word 16
 Bits per Byte 8

Operand Lengths, bits 16; 32; 48

ARITHMETIC

Operands
 Decimal No
 Binary 8, 16 bits

Floating Point
 Exponent, bits 8
 Fraction, bits 23 or 55 + sign

supplies, bootstrap loader, and an interface for the VT05. Up to 56K bytes of memory can be added to the basic configuration; more disks (including RPO3-AS drives with 40M bytes capacity each), magnetic tape drives (including the TU10 IBM-compatible 7- and 9-track models as well as DECTape) LP11-JA high speed line printers, PC11 paper tape reader/punches, and LA30 or LT33 hard copy terminals can also be added.

DDS 530 includes a PDP-11/40 with 32K bytes of memory expandable to 56K bytes. It can support up to 8 disc, 8 tape storage units, and 4 on-line terminals.

Model 540 memory is expandable to 248K bytes, the 11/40 has extended arithmetic features and memory protection. Floating point arithmetic is optional. It can handle 16 disc, 8 tape units, and up to 16 on-line terminals.

The Model 550 is based on the PDP-11/45. Memory is expandable to 248K bytes and floating point arithmetic is optional. Model 550 supports an extended version of CTS 500.

Model 560 has all the features of the 550 plus 32K bytes of MOS solid state memory with a 450-nanosecond cycle time.

COMPATIBILITY

PDP-11 computers used in Datasystems are upward compatible from the 11/40 through the 11/45 and 11/50. All can use the same peripheral devices and core memory modules, as well as the same instruction and data formats. All use the same basic instruction set; the 11/40 and the 11/45 use supersets of the basic instruction set used on earlier models.

PDP-11 is only compatible with other manufacturer's computer systems through magnetic tape or data communications.

Competitive Position

The Datasystem 500 is based on the DEC PDP-11, a major minicomputer system from the leading minicomputer manufacturer — it is the system with which all other minicomputers in the marketplace are compared.

DEC announced a series 300 Datasystems, based on the PDP-8E, at the same time as the 500 series was released. The 300 and 500 series are related to each other somewhat like the 2 models of IBM's System/3. The 300, like the System/3 Model 6, is a smaller, slower system with more processing limitations than its companion model. The 500 series, on the other hand, like System/3 Model 10, is faster, can be expanded to sizes competitive with much larger general-purpose systems, handles a number of high-level languages, can do multiprogramming, and can be configured to meet a variety of different needs.

Although the 300 and 500 series are related to each other like the 2 IBM models, they do not compete equally well with IBM. The 300 series is neither as fast nor as versatile as the IBM System/3 Model 6. Also, the 300 Series uses DIBOL, a Cobol-like language that is not compatible with the 500 series. IBM RPG applications can be upgraded from the Model 6 to the compatible System/3 Model 10. The Datasystem 300 Series, however, does offer a significant price and growth advantage over the System/3 Model 6.

The DEC 500 Datasystems, on the other hand, can compete directly with the IBM System/3 Model 10. Comparable configurations are available at the lower end of the line, and the maximum memory size of 256K bytes on the PDP-11 is considerably more than the 40K maximum of the Model 10. The upper end of the 500 line competes with IBM System 370 Models 115 and 125. Other competitors are the Burroughs B1700, which has a similar range of configurations, and the NCR Century 100 series.

The Datasystem 500 computer is also faster than the System/3 Model 10, with a main memory cycle time of 0.90 microsecond as compared to the 1.52 microseconds on the System 3. Model 560 is even faster with its 32K bytes of 450-nanosecond MOS memory. It also has a dual bus structure that allows more parallelism, thus the 560 processing speed can be over twice as fast as the Model 550.

DEC system software allows time-sharing, as well as batch processing, on a wide variety of configurations. DEC feels that the Datasystem 500 in its multitasking timesharing version (CTS-500) has no real competitor. The wide range of the series allows for a long growth cycle that should be one of its most attractive features to potential users.

IBM offers application programming systems that can be tailored to the user's requirements and a special Application Customizer Service to minimize the in-house programming needed, whereas DEC, in catering to the more sophisticated small-business user, does not provide these services. In addition to their own software support group, however, DEC supports a voluntary, non-profit users group called DECUS (Digital Equipment Computer Users Society), which maintains a program library of programs contributed by users and available to all members. Special interest groups like the Business Users have sample application write-ups that are of interest to DEC Datasystem users.

MAINFRAME

The PDP-11 line has 3 characteristics that distinguish it from other computers in its class: the UNIBUS, multiple general-purpose registers, and the manner of handling I/O operations.

All PDP-11 models except the PDP-11/45 are organized around a single, fast UNIBUS that connects all system components. The processor, memory, and peripheral devices operate as UNIBUS subsystems; the processor allocates UNIBUS time to system components, which communicate with each other in a master-slave relationship.

The distances between devices and the speeds of the connected devices are immaterial because of the master-slave communications technique. This means, for example, that memory modules with different speeds can be connected to a system. A single UNIBUS inherently limits system speed to that of the UNIBUS because units in the system must time-share it. PDP-11/45 overcomes this limitation because it is a dual-bus system.

The 11/40 processor optionally has 2 possible processor modes and a floating point option, in addition to all the features of the PDP-11 line. The memory management option allows addressing 248K bytes of core and provides for programmed memory protection.

The PDP-11/45 is a major upward expansion of the PDP-11 line and offers many features unavailable for the other models, including semiconductor bipolar, or MOS, memory and 3 processing modes. It is designed for applications requiring large memories, fast computation speeds or multiprocessor configurations.

PDP-11/45 memory segmentation option is functionally similar to the 11/40 memory management option, but differs because of the larger number of registers and processing modes on the 11/45. Memory segmentation (memory management) provides virtual addressing for memories larger than 64K bytes and is a means of providing memory protection for multiprogramming environments.

The PDP-11/50 uses the same processor as the 11/45. The only difference between them is that MOS semiconductor memory is the standard main memory on the 11/50, but it is optional on the 11/45.

SOFTWARE

The 3 basic operating systems for the Data-systems have parallels in the PDP-11. COS 500, (with its Macro Assembler, Fortran IV, and RPG II) is the same as DOS, except the RPG facility is available only to the Datasystem series users. CTS 500 corresponds to RSTS on the PDP-11, and CDMS corresponds to MUMPS-11.

COS 500 is a disc-based operating system, which is basically keyboard oriented, for the preparation and execution of programs. It provides the user with access to system programs, performs I/O transfers, and manages secondary storage in response to control commands from the console or the user's program. The user can generate, edit, assemble or compile, debug, load, save, call, and run programs under COS 500 control. As the basic operating system for the series, it is modular and open-ended, allowing the user to add programs needed for a particular application.

CTS 500 provides time-sharing facilities for up to 16 terminal users. It consists of the basic features of DOS, a monitor, and the Basic Plus Language Interpreter and Run Time System. CTS 500 requires 40K bytes of memory, 512K words of fixed head disc storage, 2 DECTapes, a real-time clock, and user terminal interfaces.

CDMS 500 is a compact time-sharing system designed for use primarily as a data management system. It was originally developed for the PDP-15 by the Laboratory of Computer Sciences, the Department of Medicine, Massachusetts General Hospital, and the Harvard Medical School. The development effort was supported by grants from the National Institute of Health and the National Center for Health Service Research and Development. The CDMS 500 time-sharing monitor contains facilities to support the DECdisk, the RP02 Disk Pack, DECTapes, paper tape reader/punch, and a set of terminal scanners used to interface remote devices such as Teletypes, buffered display scopes, line printers, and

so forth. Core memory, exclusive of space required by the monitor and the interpreter, is divided into partitions; each partition contains an application program and its local data. All active users are assigned partitions of core memory. Activating a program requires finding an available partition and loading it with a program from the disc; as long as the program is active, it remains in core. The monitor also automatically overlays external program segments when required by an active program.

Proper linkages are set up to return automatically to the program when execution of the segment terminates. Typically, 20 to 30 users can be simultaneously active; as many interactive terminals as required can interface to the system.

RPG II, an easy-to-learn business-oriented language particularly useful for generation of clear reports, is available only to Datasystem 500 users, not to users of the PDP-11. The Basic Plus used with CTS is DEC's own superset of the Dartmouth Basic Language.

MAINTENANCE

Service is provided by DEC through its network of sales and service offices in more than 48 cities in the United States and 50 cities in Europe, Canada, Central and South America, Australia, India, and Japan. Maintenance is included in the lease; it can be obtained for purchased systems on a per-call basis or through a variety of service contracts. Field offices also have software specialists to provide users with a fast response to software problems.

Training in 300 or 500 system software is provided by DEC usually in either Maynard, Massachusetts, or Sunnyvale, California. The training courses, which last from 2 to 3 weeks, are provided free of charge for users of purchased systems.

HEADQUARTERS

Digital Equipment
Maynard, MA 01754

ELDORADO ELECTRODATA

Model 140

OVERVIEW

The Eldorado Model 140 is a small business computer system designed for interactive use by novice computer users. It is a desk-console, typewriter-oriented system, programmable in ESP (Eldorado String Processor), a powerful conversational language. ESP resembles Basic and Fortran II languages, but can be used only on the Eldorado computer. The system incorporates Eldorado's ee 200 processor, which is also used in Eldorado's Model 125 batch processing data terminals.

Model 140 is available with a variety of application software including: accounting-type programs such as payroll, general ledger, invoicing, and accounts receivable; operational programs such as job cost accounting, labor cost analysis, sales analysis, inventory analysis and control, and maintenance scheduling, routing, and billing.

Financial programs include a software package specifically designed for CPAs, enabling them to rapidly prepare a variety of financial statements for their clients. A cost accounting package has been developed for attorneys which bills clients according to the time spent in case preparation and courtroom appearances.

A variety of peripheral equipment provides flexible means of data input and output. Magnetic cassette capability is available for high-volume data and program storage. A random access storage medium facility is furnished by disc drives. The system can communicate with either its sister series of remote data terminals or with other computers — including Burroughs, Control Data, IBM, and Univac machines — through use of an assortment of emulation software. In order to communicate with other computers, Model 140 converts its data into a compatible format.

CONFIGURATION GUIDE

The basic configuration of a Model 140 consists of a desk console housing the ee 200 processor with an 8K-byte core memory and a magnetic cassette drive capable of simultaneously handling three separate cassettes. The heavy-duty, interactive IBM Selectric typewriter on the desktop has a tractor for continuous forms and the option of multiple fonts.

This configuration can be expanded by extending main memory, in 4K-byte plug-in increments, up to a total of 61K bytes. Auxiliary disc and/or magnetic tape storage, any one of

three IBM-compatible tape drives, and peripheral equipment can also augment the basic system.

The addition of a disc controller permits the system to handle up to four disc drives, each of which provides 5,000K bytes of on-line storage.

Peripheral equipment includes the following: a card reader operating at 300 cards per minute; an auxiliary numeric keyset; two buffered, 132-column line printers, with respective operating rates of 135 and 600 lines per minute; a 75 character-per-second paper tape punch; a 300 character-per-second paper tape reader; and synchronous or asynchronous communications controllers. Twelve, or optionally 27, of the preceding devices, in any combination, can be added to the basic configuration, with each memory module considered as one device.

SOFTWARE

The Eldorado DISKOS disc operating system is a comprehensive software package claimed to combine sophisticated system performance with operating simplicity.

Eldorado's application software can be modified to meet the special needs of users. A customer programming service is also available. Programs are normally resident in the system's tape cassettes or disc files. They are stored in machine language form, following a two-step procedure using Eldorado's compiler and assembler tapes.

An assortment of system software that, in its combined functions, resembles an operating system comes with each installation. It includes routines for: loading programs from cassette into main memory and initiating their execution; file-to-file copying; program library construction; file search and listing; and file editing, including data deletion and modification. Sort/merge programs are also available.

Eldorado provides an executive system to permit operator control of program execution through the typewriter keyboard. This feature allows the operator to: print out and modify the contents of a memory cell or an operational register; print the contents of a memory area; load programs; write from memory onto cassettes; and assist in program debugging.

DESIGN FEATURES

Eldorado's ee 200 processor incorporates a variety of unusual features. It uses a common

bus to access both its memory and peripheral devices. This permits the peripherals to access each other or the system's memory directly, with minimal CPU intervention.

The system employs an asynchronous memory interface that permits ready intermixing of different types of memory. Various mixes of Eldorado's semiconductor, core, and read-only memories are made practical by this arrangement; however, the total cannot exceed 61K bytes.

The ee 200 has an exceptionally large instruction set for a minicomputer. Sixty-nine basic instructions can be modified into several hundred special instructions, providing unusual programming flexibility. The computer's addressing flexibility adds to the customary direct addressing the capability of indirect, relative, and indexed addressing. The ee 200 also features an extensive interrupt capability, with 15 levels of preassigned priorities to insure that the I/O devices performing the most important tasks have earliest access to the CPU. Such a hardware priority system eliminates the necessity of polling each device via software routines and results in more efficient system throughput. Several devices can share an interrupt level, in which case each device on the same level is serviced on a first-come, first-served basis.

Finally, the system's compactness and modularity facilitate expansion and repair. Three circuit boards comprise the complete CPU and power supply. Additionally, I/O device controllers and memory modules are plug-in cards.

PERFORMANCE

Model 140 offers a good assortment of application programs and a mix of peripheral equipment that can afford the novice user considerable room for system expansion. Although the minimal system is primarily oriented toward interactive use, expanded configurations have a batch processing capability that has already been used by at least one service bureau.

The availability of operational programs, in addition to those purely for accounting, is another important feature. Several small manufacturers have installed this system largely because of the job costing and inventory analysis it provides.

Model 140's CPA software package addresses a relatively new, but extremely profitable market — the very small businessman who has an

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	16
Capacity (words)	4-32K
Cycle Time (μ sec)	1.2
Working Storage	Core
AUX STORAGE	Disc; magnetic tape; tape cassette
DATA OUTPUT	
Line Printer (lpm)	135;600
Serial Printer	Yes
Card (cpm)	—
Paper Tape (cps)	75
DATA INPUT	
Keyboard	Standard
Card (cpm)	300
Paper Tape (cps)	300
SOFTWARE	
Assembler	Yes
Operating System	Keyboard executive
Compiler	Eldorado String Processor (ESP)

outside accountant prepare his financial statements on a monthly basis. This automated system of statement preparation permits a CPA to at least quadruple the number of his accounts, while providing more timely and accurate service.

MAINTENANCE

Maintenance for Model 140 is provided through Eldorado's sales and service agencies. There are 16 prime offices and four subagencies in major cities in the United States and Canada. Service is initially provided under a 90-day warranty. A separate contract covers subsequent maintenance.

On-call service is available either during regular business hours or, at higher rates, on a round-the-clock basis. Preventive maintenance is scheduled during regular business hours.

HISTORY

Eldorado Electrodata has grown out of a digital instrumentation company founded in 1960. After developing its ee 200 computer, Eldorado incorporated the model in a line of remote batch terminals, introduced in 1969. Eldorado released Model 140 in mid-1970.

HIS

Series 2000 Models 2020 and 2030

OVERVIEW

The Honeywell Model 2020 and Model 2030 are the smallest and second smallest computers, respectively, in Honeywell's Series 2000, a range of medium-scale general-purpose computers designed as successive enhancement of the firm's highly successful Series 200. These 2 newly announced models at the low end of the line strengthen Honeywell's position as the only major manufacturer offering a range of medium-scale computers that is fully upward compatible with its small business computers. All members of the series are disc-file-oriented multiprogramming processors. Six of the processors — 2020, 2030, 2040, 2050, 2060, and 2070 — are single-processor; the dual-processor 2088 completes the series.

Models 2020 and 2030 are being marketed as growth path machines for current users of small-scale Honeywell Series 200 computers, and Honeywell Series 50 Model 58. Honeywell's new processors compete with such computers as the IBM System/3, Burroughs 1700, NCR 50, and Univac 9200. Customer deliveries have already begun. This advance report examines the preliminary factual data on the Models 2020 and 2030.

Both new systems can accommodate most Series 200/2000 peripherals. In addition, both can process programs in RPG, Assembly, Cobol, and Fortran; and both offer a wide range of multi-industry application packages, including an array of communications-oriented products and services.

The Models 2020 and 2030 operate under the Mod 1 Mass Storage Resident (MSR) operating system originally introduced in 1966 for the Series 200. Model 2030 has the additional capability of operating under OS/2000, a multiprogramming operating system announced in 1972 for use by the rest of the Series 200/2000 processors.

Processor Design

The control memory is magnetic core storage. Main memory on the 2020 can be increased in 6 variable increments from 24,576 characters to a maximum of 65,536 characters. Main memory on the 2030 can be increased in 5 variable increments from 40,960 characters to a maximum of 98,304 characters.

The basic character is 6 bits but an 8-bit code handler exists in both processors. Instruction sets are business oriented, although a scientific unit is available for the 2030. Instruction format is variable-length, 2-address, working on variable-length data fields.

The arithmetic unit performs comparisons, binary and decimal addition/subtraction, and decimal multiplication/division (on processors 40K and up). Cycle time for the 2020 is 2.75 microseconds, although an option (required to use the 275 disc) provides a 2.5-microsecond cycle. Cycle time for the 2030 is 2.0 microseconds.

Three read/write channels are standard on the 2020 (a fourth is available) and 6 for the 2030, allowing up to 4 and 6 peripheral devices, respectively, to operate simultaneously. Sixteen peripheral address assignments are available on both systems; 2 addresses must be used for peripherals capable of both reading and writing. An integrated control is included for slow-speed peripherals and selected disc packs.

CONFIGURATION GUIDE

A minimal Honeywell Model 2020 installation consists of a central processor with 24,576 characters, a card reader/punch, a 450 line-per-minute printer, and a 2-spindle disc subsystem with a capacity of 9.2 million characters.

A minimal Honeywell 2030 installation consists of a central processor with 40,960 characters, a card reader/punch, a console, a 650 line-per-minute printer, and a 2-spindle disc subsystem with a capacity of 18.4 million characters.

In keeping with its policy of diverse peripheral options, Honeywell also announced a tape subsystem for the disc-oriented Models 2020 and 2030. The 204B tape subsystem includes 3 tape drives and a controller, with a fourth tape drive optional. Three transfer rates are available (10,000/20,000/30,000 characters per second); packing density is 556 bits per inch (200 optional).

Table 1 gives specifications for the 2020 and 2030.

SOFTWARE

The operating system for both the Model 2020 and the Model 2030 is the Honeywell Mod 1 MSR, a multiprogramming disc-oriented operating system in existence since 1966. The Mod 1 MSR has a supervisor driven by a primitive priority interrupt system that allows 2 programs to alternate between CPU and peripheral I/O operations as necessary.

Also available for the Model 2030 is the Honeywell OS/2000, a multiprogramming operating system allowing up to 5 priorities and a theoretical limit of 15 core regions. The actual limits are 10 core regions for jobs, and 5 for data transcription routines.

HIS SERIES 2000 MODELS 2020 AND 2030

Both machines can process programs in RPG, Cobol, Fortran, and Assembler. They also offer a very wide range of application software, including a number of packages oriented towards

the needs of market areas like manufacturing, banking, and hospitals. Both models also have an array of communications-oriented products and services.

Table 1. HIS 2020 and 2030: Specifications

CENT PROCESSOR	2020	2030
Word Size (bits)	6	6
Capacity (words)	24K-64K	40K-98K
Cycle Time (μ sec)	2.75; 2.5	2.0
Working Storage	Core	Core
AUX STORAGE	Disc; mag tape	Disc; mag tape
DATA OUTPUT		
Line Printer (lpm)	300; 650	300; 650
Serial Printer	Yes	Yes
Card (cpm)	100-400	100-400
DATA INPUT		
Card (cpm)	400; 600; 1,050	400; 600; 1,050
SOFTWARE		
Assembler	Yes	Yes
Operating System	Yes	Yes
Compiler	Cobol; RPG; Fortran	Cobol; RPG; Fortran

IBM CORPORATION

System/3 Model 6



IBM System/3 Model 6 with Ledger Card Device



IBM System/3 Model 6 Problem Solving System

OVERVIEW

IBM's System/3 extends EDP to small businesses. It is an extremely flexible system, meeting the varied requirements of different industries and individual companies in the small computer market. The System/3 family has two models: Model 6 and Model 10. Both models have many features in common but are distinctly different systems, too. An examination of throughput, which is a measure of the speed with which computer will input, process, and output a transaction underscores the major differences between Models 6 and 10.

Model 6 is basically a low-throughput operator-oriented system, attributable largely to heavy reliance upon man-machine communications. Model 10's throughput capability is greater. The characteristics of I/O devices in Model 10 configurations are output oriented in both the card and disc systems. For example, the Model 6 system printer is a serial unit that prints one character at a time at a maximum rate of 85 characters per second; it can output approximately twenty 132-character lines per minute. Model 10, on the other hand, uses line printers. The 5213 printer is capable of 100, 200, or 300 lines per minute; this can be increased to 600 or 1,100 lines per minute by using a 1403.

Model 6 and 10 architecture is identical in the areas of central processing unit (CPU), I/O structure, interrupt system, and communications. In certain instances the software and some devices for the two systems are the same, but it is also in these areas that the two models are distinguishable (Table 1). The software and I/O

devices reflect procedural methods and system use and, from the applications viewpoint, underline the two systems' differences.

System/3 Model 6

System/3 Model 6 is a small, general-purpose, commercial data processing and interactive problem-solving system. Smaller and cheaper than System/3 Model 10, it is aimed at the segment of the small business computer market that currently uses mixed data processing methods. Model 6 appeals to users with environments characterized by diverse applications now handled by manual methods, assisted by small calculators, bookkeeping machines, accounting machines, or ledger card machines. In this setting, large data files and high-speed throughput aren't required. Rather, the prime criteria of the basic system design is to perform the wide range of tasks more effectively than by present methods.

Model 6 is also intended for small businesses who subscribe to a time sharing or service bureau system. Besides being a flexible system that can be configured to fulfill the diverse commercial requirements of small business, Model 6 can also serve a user who requires financial (bonds and lease analysis, rate of return) accounting, scientific, or interactive processing; data input; and engineering and mathematical problem solution.

A minimum Model 6 configuration consists of a central processor (the operator console-keyboard is part of the Model 6 CPU), a disc storage system (2.45 million bytes), and a serial printer.

It is field expandable to include two disc drives with four times minimum system capacity (9.82 million bytes), data recorder (for on-line card I/O), either ledger card processing capability or a CRT display station (the latter for interactive

use), MICR input processing, and a communications facility.

Model 6 language facilities include a Basic compiler for interactive problem solving, RPG II

Table 1. IBM System/3 Models 6 and 10: Distinctions

Point of Comparison	Model 6	Model 10
System	Disc oriented only; emphasis on operator interaction	Card or disc oriented; emphasis on batch processing
Central Processor	16K max; no multiprogramming	48K max; multiprogramming to 2 levels opt
I/O Devices		
Dis Storage	Slow cartridge unit only; 1 unit required	Slow cartridge unit; speeded-up version and disc pack fast file unit available; none required
Magnetic Tape	None available	20, 40, and 80 kb/sec units available
Card Units	Slow on-line data recorders available in 80- or 96-col models; units can be used off-line	Fast multifunction printing card read punches available in 80- and 96-col models; units are on-line
Printers	Serial units for slow output; 1 type can post magnetic stripe ledger cards	Line printers for fast output; 100, 200, 300, 600, and 1,100
Console	Interactive console keyboard with function switches std; unit can function as calculator	Console I/O opt; printer-keyboard and data entry keyboard available; latter + card unit permit use of system as data recorder
Display	CRT display unit available for use as console or output device	No display unit available
Optical Mark Read Input	None	OMR available
Communications	Single line opt	1 or 2 lines available
Software		
Languages	RPG II; Basic	RPG II; Fortran; Cobol; Assembler
Application Programs	Few available	Many available

for generating report programs, and Fortran IV for batch processing of mathematical-oriented problems. The Model 6 capitalizes on the strength of the Basic language (easy-to-learn, conversational problem solving) to simplify the transition to computer data processing for new EDP users. A function of Basic is Desk Calculator (DCALC), which enables the user to convert the system into a large, highly sophisticated, electronic desk calculator.

RPG II facilitates programming commercial applications for Model 6. Applications such as accounts receivable, billing, inventory control, payroll, and sales analysis are organized on disc files where they are readily accessed by inquiry programs. RPG II is a relatively easy-to-learn programming language that expands the capabilities of the inexperienced programmer.

Fortran, the widely accepted language specifically oriented to the solution of mathematical problems, enhances the Model 6 programming capabilities.

Table 2 summarizes System/3 Model 6 specifications.

CONFIGURATION GUIDE

System/3 Model 6 can be assembled in various configurations to meet different user needs. Three CPU core storage sizes are available: 8,192 bytes (Model B2); 12,288 bytes (Model B3); and 16,384 bytes (Model B4). Core storage cycles take 1.2 microseconds per byte.

Auxiliary storage (5444 Model 1, 2, 3) is available in four combinations of the dual disc drive system. The on-line storage capacities of the four combinations are 2.45, 4.90, 7.35, and 9.80 million bytes. A removable disc cartridge on the 5444 drive provides virtually unlimited off-line file storage. Model 6 configurations require at least one disc drive.

Serial printers feature a dot matrix print head that moves at a constant velocity back and forth across the paper.

- Serial Printer (5213) — prints 132-column lines at 85 characters per second (all models). Model 1 is a single-line advance, pin-feed, unidirectional printer; Model 2 adds vertical forms control; Model 3 has both forms control and bidirectional printing. A print enhancement feature increases printing speed to 118 characters a second.
- Printer (2222) — the system printer or a ledger card device. As a printer, it produces 220-column lines at 85 characters

Table 2. IBM System/3 Model 6: Specification Summary

CENT PROCESSOR	
Word Size (bits)	8 + parity
Capacity (words)	8-16K (K = 1,024)
Cycle Time (μ sec)	1.52
Working Storage	Core
AUX STORAGE	Disc
DATA OUTPUT	
Line Printer (lpm)	None
Serial Printer	Yes; 85 cps
Card (cpm)	22 (96-col)
Paper Tape (cps)	—
DATA INPUT	
Keyboard	Standard
Card (cpm)	22 (96-col)
Paper Tape (cps)	—
SOFTWARE	
Assembler	No
Operating System	System Control Program
Compiler	Basic; RPG II

per second. Model 1 is a unidirectional printer; Model 2 is bidirectional. The 2222 allows posting of ledger cards, which can vary in size from 6 x 8 inches to 11 x 14 inches.

- Display Station (2265) — rapid, silent, TV-type display, used for man-machine communication. It is especially useful in interactive Basic application systems, and can display up to 15 lines of 64 characters each. IBM programming systems require a Model 6 with at least 12,288 bytes of core storage to support this device. The 2265 and 2222 cannot be used together on one system.
- Binary Synchronous Communications Adapter (feature 2074) — permits Model 6 to function as a terminal processor communicating over leased, switched, or private communications lines. It attaches one transmission line. In conjunction with the System/3 Model 6 RPG II Telecommunications program, a Model 6 with feature 2074 can communicate in a binary synchronous mode with another System/3, System/360, System/370, a 2770 Data Communications System, or a 2780 Data Transmission Terminal. With the foregoing, the Model 6 can communicate only on a point-to-point basis at 600; 1,200; 2,000; 2,400; 4,800; 7,200; 19,200; 40,800; or 50,000 bits per second.

Model 6 can be a tributary station (capable of responding to call, but not calling) to System/360 Models 25 and larger and System/370 in a multipoint network. In this mode it operates at speeds between 1,200 and 7,200 bits per second. Model 6 binary synchronous communications are in half-duplex mode.

- Magnetic Character Reader (1255 Model 1, 2, or 3) — can be attached to a disc-oriented System/3 with 12K bytes of memory to input data for on- or off-line operations. Model 1 reads 500 documents per minute; Models 2 and 3 read 750 per minute. Models 1 and 2 have six sorting pockets; Model 3 has 12. All models read characters printed in the American Banker's Association E13-B font. The 1255 can also be used with System/360 and 370 or an IBM 2770 Data Communications System.

Model 6 is basically a disc system. It can also provide limited card facilities by using the 5496 or 129 Data Recorder.

- Data Recorder (5496) — a key entry unit normally used off-line for batch recording of data and preparation of System/3 programs on 96-column cards. With the appropriate attachment, the 5496 can be used on-line for card I/O. It reads or punches and prints on 96-column cards at up to 22 cards per minute. Recently, IBM introduced a 5496 attachment for System/360 and 370, to allow System/3 card data input to those systems. This was reciprocated in announcing attachability of the 129 Data Recorder to Model 6.
- Data Recorder (129) — an 80-column card data recorder, which, can be used on-line with Model 6 to read up to 50 cards per minute. It can punch, or punch with printing, 80-column cards at rates from 12 to 50 cards per minute and thus can be used to prepare cards for System/360 or 370. Off-line, it functions as a conventional card data recorder.

Configuring an IBM system involves paying particular attention to a variety of requirements, prerequisites, and limitations specified by the manufacturer. For example, use of the RPG II Telecommunications feature requires a 12,288-byte system. Attaching the binary synchronous communications (BSC) adapter or the 1255 MICR unit requires the processing unit expansion feature on the Model 6. Frequently, an adapter is required to attach a unit to the system, as well as

an adapter on the unit; this is true of the data recorders and MICR unit.

A feature can have subfeatures available; these are usually standard in nature. For example, auto call, internal clock, station selection, and test transparency are available once the BSC adapter is installed. In a similar fashion, attachable devices can have optional features available (listed in the accompanying price data report). Their uses are quite easy to understand, so that users are unlikely to become confused by the abundance of items.

In addition, a number of features — called "specify items" by IBM — are required in all situations. These, however, are always no-charge, are ordered by IBM sales personnel, and are installed gratis. They correctly identify such specifications as the transmission speed to be used by a communications adapter or the color of the system's panels. For simplicity, they do not appear in the price data list.

SOFTWARE

Three high-level languages are available to Model 6 users: RPG II, Basic, and Fortran IV. RPG II and Basic were the original programming languages offered. Fortran IV, the most widely used language for solving problems that can be stated in terms of formulas or arithmetic procedures, has enhanced Model 6's appeal.

Report Program Generator II (RPG II) is a language designed for the creation of reports based on source data contained in peripheral storage files. Basic is an easily learned conversational language that also has powerful Fortran-like capabilities for numerical problem solution.

System Control Programming

With the exception of Basic, SCP handles control of the Model 6 system environment. SCP supplies the functions necessary for commercially oriented Model 6 applications. It is available with the hardware at no charge. Programs within SCP include the following:

- Disc System Management — generates and maintains a disc-resident system for creating and executing programs. It permits selective loading of programs from disc; program execution under control of Operation Control Language (OCL) a limited set of statements that allows the user to communicate with SCP; I/O control; and rollin/rollout operations. Rollin/rollout

lets the system suspend a program during its execution, place it on disc, and bring in an inquiry program to be executed. Upon completion of the latter, the original program is restarted from the point of interruption.

- Copy-Dump — copies disc files onto another disc or prints them on the printer. Portions of the original file can be deleted and certain limits can be set for printing.
- Library Maintenance — enables the user to create, maintain, and service the source and object program libraries.
- Utility (disc) — permits the user to prepare and maintain disc files, including initialization, alternate track assignment and re-building, file and volume display, and file delete.
- Overlay Linkage Editor — creates loadable programs from multiple relocatable modules.

Program Products

Program products available at a monthly charge include the following:

- Conversational Utility — contains three separate programs that operate under SCP: Keyboard Data Entry (dedicates the system to keying data directly onto a disc); Keyboard Source Entry (allows a user to key RPG II source statements directly into the source library on disc); and Data Interchange Utility (facilitates conversion between RPG and Basic disc files).
- Disc Sort — sorts any file, which is organized in a way that is supported by Model 6 RPG II, in either ascending or descending sequence. The program provides six means of recognizing a record; control fields can be in different locations in records within the file.
- Utility for 1255 Magnetic Character Reader — support systems that include a 1255; permits data read from MICR encoded documents to be placed on disc, tape, or printer output files.

Report Program Generator II (RPG II). RPG II is a programming language oriented towards automatically generating reports. Programming is output oriented, because the primary concern is delivery of clear reports based on the file or input data. RPG II uses preprinted specification

sheets that permit the programmer to specify the form of the input data; the operation to be performed on the data; and the output format, including line layout, page and paragraph headings, and page numbering. It simplifies the programming task and enhances the novice's programming capability.

RPG II provides for the creation and execution of Model 6 programs and is compatible with Model 10 RPG II. It also supports ledger card units, display station, and keyboard console — devices that are available for Model 6 but not for Model 10.

Two additional features are available for RPG II:

- RPG Telecommunications feature — enables the system to transmit and receive synchronous data over communications lines.
- RPG II Auto Report feature — simplifies programming in RPG II by reducing much of the preparation and coding normally required to prepare users' applications programs.

Basic. The Basic language is a stand-alone, (not operating under system control program), interactive programming system, which uses a virtual memory concept to permit compilation and execution of programs that do not fit into available core storage. An optional feature of Basic, DCALC, provides macros for such mathematical functions as addition, subtraction, multiplication, division, roots, and reciprocals; it thus can be used just like a calculator. Users who are unfamiliar with programming languages can use DCALC with ease.

Basic includes a set of programs for system generation and disc pack use. The system disc stores system programs and user data files and provides for continuous execution of stacked jobs without requiring operator intervention.

Stat/Basic. A comprehensive, interactive application program — Stat/Basic — uses statistical techniques for analysis of numerical data. It consists of 40 procedures designed to aid the statistician, engineer, researcher, or business analyst by supplying him with the most commonly used statistical methods. Stat/Basic is used in association with an IBM System/360 system.

DESIGN FEATURES

Model 6 embodies a number of features that contribute to its interactive use by relatively untrained personnel. It also appeals to the

first-time user by offering complete system control in operator-oriented data processing applications. The Model 6 interactive Basic language, which features desk calculator mode, offers personalized computing to the user. A limited batch processing capability for card applications is provided by optional 80- or 96-column card I/O devices. Model 6 allows the novice to get started in data processing; if the user applications outgrow Model 6, the RPG applications can be easily upgraded to the compatible System 3 Model 10.

Being a versatile small computer, Model 6 can handle the requirements of a small business computer, a computer terminal, a ledger card computer, and a problem-solving computer.

PERFORMANCE

Model 6 competes with time sharing terminals and service bureaus in serving small businesses that need computation for varied applications and do not require high throughput.

The Model 6 Basic compiler language offers the user a capability for engineering and scientific calculation, in addition to such simple computations as interest and amortization schedules. Basic, like RPG II, permits the programming of output format to provide well-organized reports. It can be used by anyone from the beginner to the programmer. Basic programs of up to 990 statements can be processed. RPG II can be used for analysis of bonds, securities, portfolios, leases, potential acquisitions and mergers, sales, cash flow, and performance of advertising media. It is also well adapted to cost estimation, job scheduling, project control, and pricing analysis.

MAINTENANCE

System/3 maintenance is available through the more than 50 Basic System Centers that IBM operates across the country. Other IBM services include comprehensive customer training courses and system engineering assistance; these, unlike maintenance under a rental contract, are separately priced.

The education courses provide sound knowledge of basic System/3 concepts, application design, disc system design, and programming fundamentals. System engineers are ready to operate a turnkey system for the user who doesn't want to acquire a programming staff or who doesn't want to assign System/3 programming tasks to his current programming group. The IBM system engineers furnish user support ranging from simple aid to design of entire application systems.

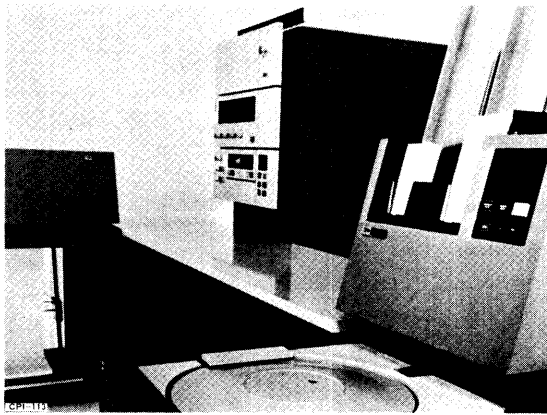
HISTORY

System/3 is IBM's highly successful entry into the market represented by smaller businesses with limited or no computer experience. Since its inception, IBM has continually expanded System/3's capabilities by adding new peripherals as well as more models to the product line. Model 10 was announced June 30, 1969; Model 6 on October 20, 1970.

At IBM's April 1972 stockholder's meeting, it was revealed that, since January 1970, the firm had shipped more than 100,000 System/3s. In the words of the company's president, System/3 ". . . is rapidly becoming the most popular single system that IBM has ever produced."

IBM CORPORATION

System/3 Model 10



IBM System/3 Model 10-disk

OVERVIEW

IBM's System/3 extends EDP to small businesses. It is an extremely flexible system, meeting the varied requirements of different industries and individual companies in the small computer market. The System/3 family has two models: Model 6 and Model 10. Both models have many features in common but are distinctly different systems, too. An examination of throughput, which is a measure of the speed with which a computer will input, process, and output a transaction, underscores the major differences between Models 6 and 10. Model 6 is basically a low-throughput operator-oriented system, attributable largely to heavy reliance upon man-machine communications. Model 10's throughput capability is greater.

The characteristics of I/O devices in Model 10 configurations are output oriented in both the card and disc systems. For example, the Model 6 system printer is a serial unit that prints one character at a time at a maximum rate of 85 characters per second; it can output approximately twenty 132-character lines per minute. Model 10, on the other hand, uses line printers. The 5213 printer is capable of 100, 200, or 300 lines per minute; this can be increased to 600 or 1,100 lines per minute by using a 1403 printer.

Model 6 and 10 architecture is identical in the areas of central processing unit (CPU), I/O structure, interrupt system, and communications. In certain instances the software and some devices for the two systems are the same, but it is also in these areas that the two models are distinguishable (Table 1). The software and I/O devices reflect procedural methods and system use and, from the applications viewpoint, underline the two systems' differences.

System/3 Model 10

Model 10's appeal is to novice computer users, primarily businessmen with straightforward commercial data processing requirements. It's a low-cost, versatile data processing system that integrates the capabilities of punched card equipment into a compact electronic processing system. The versatility of the system is demonstrated by its ability to support a turnkey operation for novice computer users or a complex operation required by the procedural systems of the moderately experienced user.

Model 10 is available as either a card or disc system. Each encompasses different data file storage media and data management techniques. In either type, six processor models (memory storage size from 8K to 49K) are offered to accommodate a wide range of user applications. The availability of the larger memory sizes provides growth capability for the small user who will need to upgrade later due to an expansion of business. A plausible sequence of events for some beginning users could be conversion from accounting cards to card System/3 and later conversion to disc System/3.

All Model 10 systems (card and disc) can support a magnetic tape subsystem, utilizing industry-compatible tape equipment, to furnish auxiliary storage. The disc-oriented systems can support up to four disc drives, providing up to 50.8 million bytes of on-line storage and virtually unlimited off-line storage.

Model 10 was designed to use the Multi-Function Card Unit (MFCU) as the system card I/O device. This card unit characterizes the design of System/3. The MFCU handles the entire gamut of punched card functions for a system: It reads, punches, interprets, sorts, and collates cards. Historically these operations required an assembly of separate machines, yet the MFCU dispenses to the user services formerly obtained from several other unit record devices while containing less hardware and occupying less space.

The Model 10 card-oriented systems appeal to present users of electromechanical punched card systems for several reasons. Because the function of the basic medium, punched cards, remains the same and is understood by the user's current personnel, conversion from older card systems to the Model 10 is simplified. Although the basic medium remains the same, its form (a 96-column card contains 20% more characters but is only about one-third the size of the common 80-column card) and handling are streamlined by the Model 10 information system.

Table 1. IBM System/3 Models 6 and 10: Distinctions

Point of Comparison	Model 6	Model 10
System	Disc oriented only; emphasis on operator interaction	Card or disc oriented; emphasis on batch processing
Central Processor	16K max; no multiprogramming	48K max; multiprogramming to 2 levels opt
I/O Devices		
Disc Storage	Slow cartridge unit only; 1 unit required	Slow cartridge unit; speeded-up version and disc pack fast file unit available; none required
Magnetic Tape	None available	20, 40, and 80 kb/sec units available
Card Units	Slow on-line data recorders available in 80- or 96-col models; units can be used off-line	Fast multifunction printing card read punches available in 80- and 96-col models; units are on-line
Printers	Serial units for slow output; 1 type can post magnetic stripe ledger cards	Line printers for fast output; 100, 200, 300, 600, and 1,100 lpm
Console	Interactive console keyboard with function switches std; unit can function as calculator	Console I/O optional; printer-keyboard and data entry keyboard available; latter card unit permits use of system as data recorder
Display	CRT display unit available for use as console or output device	No display unit available
Optical Mark Read Input	None	OMR available
Communications	Single line opt	1 or 2 lines available
Software		
Languages	RPG II; Basic	RPG II; Fortran; Cobol; Assembler
Application Programs	Few available	Many available

Model 10 language facilities include RPG II, Cobol's powerful business language capabilities, and the scientific problem-solving facilities of Fortran. Model 10 also has an assembler.

A Model 10 can be linked to IBM's System/360 and System/370 computers as a remote tributary station on a multipoint communications line. This feature makes Model 10 especially useful as an intelligent terminal offering additional batch processing capabilities.

The disc-oriented System/3 Model 10 with 12K bytes or larger memory can use the Dual Programming feature. With the feature installed, two separate programs can share the system,

permitting more effective use of the surprisingly high internal speed (in view of the low cost) central processor, and meaningful use of dual-feed carriage printers. Programs switch when a special instruction (treated as no operation in other System/3 systems) is encountered or when one program halts processing to wait for completion of an I/O operation.

See Table 2 for summarized System/3 Model 10 specifications.

CONFIGURATION GUIDE

A wide range of configurations is available for Model 10, starting with the central processor unit

Table 2. IBM System/3 Model 10: Specification Summary

CENT PROCESSOR	
Word Size (bits)	8 + parity
Capacity (words)	8-48K (K=1,024)
Cycle Time (μ sec)	1.52
Working Storage	Core
AUX STORAGE	Disc; mag tape
DATA OUTPUT	
Line Printer (lpm)	100; 200; 200; 600; 1, 100
Serial Printer	No
Card (cpm)	60; 120 (96-col)
Paper Tape (cps)	None
DATA INPUT	
Keyboard	Opt
Card (cpm)	250; 500 (96-col)
Paper Tape (cps)	None
SOFTWARE	
Assembler	Yes
Operating System	System Control Program
Compiler	Cobol; RPG II; Fortran IV

(CPU). A total of 12 CPU versions are available, six memory sizes for card-oriented systems and six for disc-oriented systems. The basic difference among the models in each category is core memory capacity, ranging from 8K to 49K bytes. Each CPU provides arithmetic functions and control for its core memory, as well as a single I/O interface to communicate with multiple I/O devices in a cycle-stealing or programmed I/O mode, depending upon the attached devices' characteristics. IBM programming systems, however, support neither 8K disc systems nor 48K card systems.

Minimum configuration for a card system consists of a 5424 MFCU or 1442 Card Read Punch, and a 5203 or 1403 Printer. In addition to these units the minimum disc-oriented configuration requires at least one 5444 Disk Drive.

Basic auxiliary storage (5444 Model 1, 2, or 3) is available in four combinations. In addition, the speeded-up versions of the basic disc units (5444 Model A1, A2, or A3) can be used, but the basic and faster models cannot be intermixed. For additional disc file capacity, up to two high-capacity, high-performance (5445) units can be attached. These use IBM 2316 disc packs, the disc pack used in 2314 discs on the System/360. The 5445 drives, however, can be connected only to systems having a 5444 disc because the System Control Programming operating system must reside on a 5444.

Permitted Model 10 disc configurations are as follows: one 5444 Model 1 (or A1), one 5444 Model 2 (or A2), one 5444 Model 2 (or A2), and one 5444 Model 3 (or A3); or two 5444 Model 2s (or A2s). A 5445 Model 1 or a 5445 Model 2 can be added to any 5444 disc configuration.

Each 5444 disc uses a 5440 Disk Cartridge, a single removable disc unit. A 5444 can also include a fixed disc, equivalent to the 5440, mounted on its drive spindle (depending on the model). Models 1 and 2 (or A1 and A2) have one fixed and one removable disc. The difference between Models 1 and 2 is the number of tracks per disc: Model 1 (or A1) uses 100 tracks per disc surface, with an average access time of 153 per 86 milliseconds; Model 2 (or A2) uses 200 tracks per disc surface, with average access time 269 or 126 milliseconds. Model 1 (or A1) capacity is 2.45 million bytes; Model 2 (or A2) capacity is 4.90 million bytes. The remaining model, Model 3 (or A3), uses a single 5440 and has no secondary fixed disc. It uses 200 tracks on the disc surface and has a storage capacity of 2.45 million bytes; average access time is 269 or 126 milliseconds.

If the Model 10 has an MFCU, the 5444 discs are housed in drawers within that unit. If the system card unit is a 1442, a 5422 Disc Enclosure must be used to house the disc units. The A-series of the 5444s requires attachment features on the CPU, as do the 5445 large file discs. Depending on the disc configuration, the use of other devices and/or features, a number of processing unit expansion features can be required. Most I/O units require the appropriate attachment feature on the CPU.

The Magnetic Tape and Control Unit (3411) and Magnetic Tape Units (3410) permit magnetic tapes that are completely compatible with IBM 2400- or 3400-type magnetic tape units used in System/360 and 370, to be used as another auxiliary storage medium. The 3411, available in three nine-track models, can attach up to three 3410 drives. Models 1, 2, and 3 operate in a phase-encoded mode and transfer data at 20, 40, or 80K bytes per second, respectively; the Models 2 and 3 can be equipped to record at 800 bit-per-inch NRZI but transfer data at half their phase-encoded speeds.

Line printers (5203 Model 1, 2, or 3) produce 96-, 120-, or 136-column lines at respective rates of 100, 200, or 300 lines per minute. Models 1 and 2 are chain printers, and Model 3 is a train printer. Dual-feed carriages, which permit concurrent printing of separate forms on the

printer, are optional. The feature requires a matching control adapter on the CPU.

The 1403 Line Printers (Model 2 or N1) are also available. They print 132-column lines at speeds of 600 (Model 2) or 1,100 (Model N1) lines per minute. Model N1 uses the 1416 Interchangeable Print Train Cartridge. A 5421 Printer Control Unit is required for 1403 use.

MFCUs (5424) perform a full range of card functions (reading, punching, printing, interpreting, sorting, and collating). Using 96-column cards, MFCU Model A1 reads at 250 cards per minute and punches and prints at 60 cards per minute. Model A2 operates at double these rates.

Card Read Punches (1442 Models 6 and 7) are available for 80-column card I/O. Model 6 reads 300 cards per minute and punches 80 columns per second; Model 7 reads 400 cards per minute and punches 160 columns per second.

The Printer-Keyboard (5471) is a combination inquiry device and auxiliary printer, it keys operator input directly into core storage. When printing, it operates under program control at a speed of 15.5 characters per second. IBM programming systems require a disc-oriented System/3 Model 10 with 12K bytes of memory for 5471 support.

Binary Synchronous Communications Adapter (BSCA 2074 and 2084) features are single-channel communications adapters that permit System/3 Model 10 to function as a point-to-point or multi-point processor terminal. BSCA 2074 supports various data rates between 600 and 50,000 bits per second and allows half-duplex or full-duplex operation over leased, switched, or private communications lines. Communications can be between System/3 and another System/3 or between a System/3 and various System/360 or 370 units with the correct attachments. Feature 2084 permits Model 10 to add a second data transmission line.

A Magnetic Character Reader (1255 Model 1, 2, or 3) can be attached to a disc-oriented System/3 with 12K bytes of memory to input data for on- or off-line operations. Model 1 reads 500 documents per minute; Models 2 and 3 read 750 per minute. Models 1 and 2 have six sorting pockets; Model 3 has 12. All models read characters printed in the American Banker's Association E13-B font. The 1255 can also be used with System/360 and 370 or an IBM 2770 Data Communications System.

The Data Entry Keyboard (5475) is a unit similar to the keyboard of the data recorder. It pro-

vides dedicated system on-line data recording and verifying using the MFCU and a system program.

The 3881 Model 1 Optical Mark Reader, a new unit from IBM, was announced for on-line use with Model 10 disc systems at the end of July 1972.

An off-line key entry unit, the Data Recorder (5496), can be used for batch recording and verifying data and programs on 96-column cards. It can be attached to a 2770 Data Communications System for transmission and punching of cards.

The off-line 5486 Card Sorter is a compact tabletop unit for sorting cards into numeric, alphabetic, and alphanumeric sequence. Two models are available, sorting 1,000 and 1,500 cards per minute.

Configuring an IBM system involves paying particular attention to a variety of requirements, prerequisites, and limitations specified by the manufacturer. For example, use of RPG II Telecommunications feature requires a 12,288-byte system. Attaching the binary synchronous communications (BSC) adapter or the 1255 MICR unit requires the processing unit expansion feature on the Model 6. Frequently, an adapter is required to attach a unit to the system, as well as an adapter for the system on the unit; this is true of the data recorders and MICR unit.

A feature can have subfeatures available; these are usually standard in nature. For example, auto call, internal clock, station selection, and text transparency are available once the BSC adapter is installed. In a fashion, attachable devices can have optional features available (listed in the accompanying price data report). Their uses are quite easy to understand, so that users are unlikely to become confused by the abundance of items.

In addition, a number of features — called "specify items" by IBM — are required in all situations. These, however, are always no-charge, are ordered by IBM sales personnel, and are installed gratis. They correctly identify such items as the transmission speed to be used by a communications adapter or the color of the system's panels. For simplicity, they do not appear in the price data list.

SOFTWARE

Report Program Generator II (RPG II) is the main programming language of the Model 10 systems (disc and card). It is a high-level language especially designed for the creation of clear reports based on input data contained in peripheral

storage files. Besides RPG II, Model 10 disc-oriented systems support the Fortran IV and Cobol compiler languages. Fortran IV handles scientific, engineering, and mathematical problems; Cobol is an effective business-oriented language that has been in wide use for more than a decade. Basic Assembler, a machine-oriented language, is available for programming applications on disc systems. Readers should not confuse this last-mentioned language with Model 6 Basic, a high-level compiler language unavailable for Model 10.

System Control Programming

To simplify the user's programming tasks, System Control Programming (SCP) programs are supplied with the Model 10 hardware. All programs, except some produced by the Assembler, operate under SCP. Because SCP performs the control functions for the computer installation, its components differ somewhat for card and disc systems.

Card SCP includes the following programs.

- Program maintenance — incorporates programming changes in the card programming system decks. The program maintains card system software.
 - System initialization — enters user data and user switches into the communications area at the beginning of each day.
 - Remote job entry (RJE) workstation support — permits a Model 10 equipped with a BSCA and EBCDIC (Extended Binary Coded Decimal Interchange Code) text transparency to submit OS/360 jobs over communications facilities. The system must be a System/360 Model H40 (262,144 bytes) or larger or a System/370.
 - Device counter logout — serves as an aid in problem determination by recovering the contents of counters accumulated in the previous communications program.
 - Magnetic tape counter logout — recovers the contents of the magnetic tape error counters immediately following the execution of any program that updates these counters.
 - Magnetic tape initialization utility — allows the creation and deletion of standard tape volume labels, checks for unexpired labels, and displays volume and data file labels.
- Disc SCP includes the following programs.
- Disc System Management (DSM) — generates and maintains the disc-resident system, which facilitates compilation, generation, and execution of programs.
 - Disc system library maintenance — analogous to the card system's program maintenance in that it maintains and services the system disc and libraries.
 - Disc copy/dump — an easy-to-use method of file creation that can provide file backup or produce hard copies of disc data files.
 - RJE workstation support — functionally identical to the card version, with the added feature of support for discs as I/O devices.
 - Overlay linkage editor and checkpoint/restart feature — linkage editor creates loadable programs from multiple relocatable modules. Overlays can be created automatically or as designated by the user. Checkpoint allows the user to write checkpoint records. Restart allows the programmer to resume from the last checkpoint rather than from the beginning of the program in case of machine or operator failure.
 - Magnetic tape support feature — provides support for the use of magnetic tape as a data storage device. Tape initialization support is functionally the same as the card version magnetic tape initialization utility program.
 - BSCA multiline/multipoint feature — provides communications support when used with System/3 Macro feature. Program counters, used to gather performance information, are maintained on disc file.
 - Macro feature — provides data management and I/O support to the assembler language user for control of I/O services.
 - Disc utility — includes five programs that allow the user to prepare and maintain his discs, including initialization, alternate track assignment, alternate track rebuild, file and volume display, and file delete.
 - IBM 5445 Disc Storage Drive feature — offers the users of 5445 disc units the same services as the disc utility program already

mentioned. In addition, a disc copy/dump program is included.

Program Products

Program products, including the language processors, are available at a monthly fee. These products allow the user to submit his applications to the system. Program products for card-oriented systems include the following:

- Card RPG II — the basic programming language used to produce object programs for a wide range of commercial data processing jobs. RPG II is compatible with IBM System/360 RPG, but it has extended features over System/360 RPG and provides greater capabilities.
- Reproduce/Interpret — console-entered card function options allow reproduce, interpret, reproduce and interpret, reproduce with reformatting, and reproduce and interpret with reformatting.
- 96-Column Card List — cards listed on the printer without reformatting; printer lines are single, double, or triple spaced, and the cards are counted; list can be suppressed if only a card count is desired.
- Sort/Collate (5424 MFCU) — a well-rounded sort/collate program that can sort, merge, match, select, or sequence cards.
- Data Recording — dedicates the system with a 5475 data entry keyboard to use as on-line data recorder.
- Data Verifying — like the data recording program, permits the system to be used as a data verifier.
- 80-96 Conversion — applies to systems with a 1442 card read punch and a 5424 MFCU; converts 80-column card decks to 96-column System/3 decks.
- Card RPG II Telecommunications feature — provides the capability to transmit and receive synchronous data over communications lines.
- Card RPG II Braille feature — supplies an option to list compilations and object programs in braille.

The disc version program products include:

- Disc RPG II — has same functions as card RPG II, but it also supports three types of file organization: sequential, indexed, and direct.
- Disc RPG II Telecommunications feature — functionally identical to card RPG II telecommunications feature.
- Disc Sort — facilitates sorting of any file organization (sequential, indexed, direct) in either ascending or descending sequence. The program provides six means of recognizing records.
- Disc RPG II 5445 Disk Storage Drive feature — processes data files for systems, utilizing 5445 Disk Drives.
- Disc Sort 5445 Disk Storage feature — extends the disc sort program to systems configured with 5445 Disk Drives.
- RPG II Auto Report feature — simplifies programming in RPG II by reducing much of the preparation and coding normally required in producing a user application program.
- Disc Resident Card Utilities — provides disc users with the same services offered by the card system programs (reproduce, interpret, 96-column list, MFCU sort/collate, data recording, data verifying, 80- to 96-column conversion).
- Utility for 1255 Magnetic Character Reader — supports systems that include a 1255; permits data read from MICR-encoded documents to be placed on disc, tape, or printer output files.
- Basic Assembler — a symbolic programming language, machine-oriented for System/3; used to produce object programs. Some run under SCP, others are stand-alone programs.
- System/3 Subset ANS Cobol — furnishes the user with the most widely accepted and used standard higher-level programming language. Cobol, originally designed for business applications, is available to Model 10 programmers.
- System/3 Disc Fortran IV — provides a high-level programming language for the

solution of scientific and mathematical problems.

Application Programming Systems

There are eight application programming systems that are completely operational; the customer supplies information and parameters, and the systems are tailored to his needs. The required level of user programming effort depends on the specific application; it varies from none to forms design to writing RPG source programs. Customer responsibilities are delineated for each system.

The following applications programming systems are available.

- Apparel Business Control — provides the apparel industry with an easily installed order processing system that performs order editing, order writing, booking reporting, fabric requirements reporting, finished goods requirements reporting, stock allocation, and invoicing.
- Hospital Patient Billing — contains 15 programs to be used with card system utilities to provide patient billing processing and management information.
- Property and Liability Agency Accounting — designed for property and liability insurance agents or brokers to handle their accounting requirements.
- Utility Billing — manages the utility billing for local governments and small utility companies. Potential customers for this system are utilities that supply water, gas, and/or electric services to 25,000 to 250,000 homes.
- Law Enforcement — furnishes local police departments with a variety of information processing capabilities. Six subsystems provide offense reporting, arrest reporting, accident reporting, radio dispatch analysis, field interview reporting, and police personnel reporting.
- Unit Inventory Techniques — furnishes the retailer with reports on merchandising activity and inventory status. Nine program elements make up a comprehensive inventory control system for retailers.
- Bill of Material Processor — allows the user to load, maintain, and organize four files: item master, product structure, work center master, and standard routing.

Information can be retrieved from these files to generate reports on the requirements for any of the materials that go into the end product.

- Optimum Blending — uses linear programming directed to applications in the agriculture and food processing industries. The blend function obtains an optimal combination of raw material based on product specifications and ingredient analysis information.
- Appropriation Accounting — provides appropriation, revenue, and general accounting system for public institutions (cities, counties, states, school districts, hospitals, colleges, universities, etc.). This package helps public institutions conserve public property and plan, direct, and control revenues and dollar costs.

Application Customizer Service

IBM Application Customizer Service was developed for the small computer user. Small businesses are not financially able to invest in personnel to develop integrated programming systems for their applications. The Application Customizer Service allows each user to fill out a questionnaire relating to a particular application; the user specifies the content and layout of records and reports, identifies calculations required, and chooses processing procedures. Related jobs can be linked into an integrated family. The user punches cards from the questionnaire and sends them to an IBM Basic System Center where the cards are read as input to a System/360 Model 20. The Model 20 is programmed to run IBM's Application Customizer Program.

The output of this program produces the following for the user:

- Editing listings — indicate the accuracy and consistency of the specifications.
- Flowcharts — define the processing and clerical steps involved in each application.
- Data dictionary — defines the terms used in the particular application.
- Record listing — shows record formats.
- File cross-reference listing — references each record and the pertinent application.
- Program description — specifies detailed input specifications, calculation logic, and

output printing requirements for the program to be coded in RPG or Assembler language.

- Sample reports — show the format of the final report according to the original specifications.

This output supplies the user with all the necessary materials to prepare the computer program at his installation. The user must code the program, which is the easiest step in the process of generating it.

The Application Customizer Service is available for six major business application areas: order writing and invoicing (prebilling and post billing, automatic backordering, automatic selection of item prices or discounts), accounts receivable (open-item or balance forward method), inventory accounting (stock status reports), sales analysis (reports classified by item, product class, customer, or salesman), payroll (registers, paychecks, earning statements, etc.), and general ledger accounting (internal or client basis).

User Groups, Vendors, IBM Newsletter

User Groups. There are four independent organizations of IBM customers, supplying a wealth of information related to System/3. The user groups are: COMMON, NASU (National Association of System/3 Users), GUIDANCE, and GROUP/3. These organizations enable interchange of information, routines, programs, and programming packages among their members. Information services in the forms of newsletters or publications allow members to keep posted on available System/3 hardware and software (IBM and non-IBM).

Vendors. Many application programs are available from independent software houses. The programs can either be rented or purchased outright from the vendor.

IBM Newsletter. One of IBM's newsletters, the Management Services Update, announces new program products and user applications programs that apply to any of the IBM systems. System/3 applications have been receiving thorough coverage in order to demonstrate the utility of the system.

DESIGN FEATURES

Model 10 has a large selection of central processor units, peripherals, and software support. It is a versatile computer system with appeal to small businesses that adapt it initially or convert

their present data processing methods to System/3. Software and hardware have been designed to embrace the diverse small business environments. The software provides many techniques that were previously accessible only on larger computer systems; the devices, in a number of instances, have been compacted to obtain maximum utilization of hardware.

Because of its optional communications features, Model 10 is especially attractive to those users who want to link several small divisions or branch offices with a centrally located System/360 or System/370, at the same time providing each remote site with a flexible batch computer facility of its own. System/3's exterior design is desk-like in size and appearance, a quality particularly desired by small companies that have limited office space and are novices in data processing.

PERFORMANCE

Model 10 is well-suited to the typical scope of business data processing needs. In fact, the technical specifications of Model 10 equal or surpass those of the more costly IBM 360/20 and IBM 1401-G in all categories except card punching rate. Model 10 card punching rate is one half or one third that of Model 20 and 1401-G. The Model 10 lacks the punched paper tape capability of the 1401-G, but it offers magnetic tape and higher capacity disc storage. I/O transfer rate is higher than that for System/360 Model 20.

System/3 disc organization techniques simplify the programmer's work in dealing with files. While easing the programmer's task, it presents one of the obstacles to compatibility with System/360 or 370. Potential users, who start with System/3 and contemplate moving to the 360 or 370 system when growth requirements necessitate it, should note that System/3 and System/360 and 370 disc files are not compatible. System/360 and 370, however, can be programmed to input data from 2316 Disk Packs that were recorded on a 5445 disc on a Model 10 system.

Because RPG II can be used to process data files and generate summaries of the results, it is ideal for ready-to-read analysis of a broad variety of data. RPG II incorporates many desirable features that extend its capabilities over System/360 RPG. System/3 Model 6 can use Model 10 RPG II files.

MAINTENANCE

System/3 maintenance is available through the more than 50 Basic System Centers that IBM operates across the country. Other IBM services

include comprehensive customer training courses and system engineering assistance; these, unlike maintenance under a rental contract, are separately priced.

The education courses provide sound knowledge of basic System/3 concepts, application design, disc system design, and programming fundamentals. System engineers are ready to operate a turnkey system for the user who doesn't want to acquire a programming staff or who doesn't want to assign System/3 programming tasks to his current programming group. The IBM system engineers furnish support ranging from simple aid to design of entire application systems.

HISTORY

System/3 is IBM's highly successful entry into the market represented by smaller businesses with limited or no computer experience. Since its inception, IBM has continually expanded System/3's capabilities by adding new peripherals as well as more models to the product line. Model 10 was announced June 30, 1969; Model 6 on October 20, 1970.

At IBM's April 1972 stockholder's meeting, it was revealed that, since January 1970, the firm had shipped more than 10,000 System/3s. In the words of the company's president "System/3. . . is rapidly becoming the most popular single system that IBM has ever produced."

IBM

System/3 Model 15 Advance Report

OVERVIEW

IBM's System/3 Model 15 is a small business computer that is capable of servicing the needs of many different kinds of industries and interests, including clothing, law enforcement, hospitals, finance, TV and radio, and manufacturing. Its use in a teleprocessing and remote data entry capacity is being stressed by IBM.

The Model 15 is currently the largest computer in IBM's System/3 series of small business computers; the other 2 computers in order of power are the Model 6 and the Model 10.

The Model 15 can do more work than the Model 10 because it has additional facilities: some new processor instructions, larger memory, more on-line disc storage, and a multiprogramming operating system. It uses the more modern memory technology of IBM's System/370 Models 115 and 125 instead of that used in the System/3 Model 10. The Model 15 has basically the same communication offerings as the Model 10; a special option, however, can provide for up to 8 communications lines instead of the limit of 2 that are currently available as standard with both the Model 10 and the Model 15.

The Model 15 can use more than 15 peripherals, including discs, magnetic tapes, card equipment, printers, a display station, OCR, MICR, and communications equipment.

Programs can be written in RPG II, Cobol, Assembler, and Fortran IV. System support programs for disc or tape sorts and utilities are also available. Conversational Basic (used on System/3 Model 6) is unavailable.

The operating environment is a new one for System/3; it is beginning to look like a miniature System/360/370 Disc Operating System. The System/3 Model 15 SCP (System Control Program) is a disc-based, multiprogramming, operating system that should take advantage of the increased main storage available with the Model 15 to provide significantly greater throughput than has been available on the Model 10. Specific throughput comparisons should be available after the machines are installed next year. The new SCP is not a virtual memory operating system.

Also announced was a conversational-type program, DATA/3, that will be available on both Models 10 and 15. DATA/3 allows a remote terminal and the central system to communicate, plus a few other things.

The Model 15 was announced in July, 1973, and first delivery will be in March, 1974. The largest Model 15 system will be delivered in June, 1974. No availability date has been specified for multiple systems.

Typical monthly rentals will range from \$3,240 to \$7,127, and purchase prices will range from \$136,575 to \$298,480. DATA/3 will be available under a license agreement for \$120 monthly.

EVALUATION AND COMPETITIVE POSITION

System/3 users are perhaps unique in the industry in that they knew when they obtained their 3s they could go nowhere without conversion pairs except to more 3s. The larger System/360 computers were, and the System/370 models are now, incompatible with the 3s.

In spite of this, System/3 users have hoped for a bridge system between the System/3 and the System/370 lines. What they want is a system that does more, costs only a little more, and acts as an entry system into the System/370 migration path.

When IBM announced the System/370 Model 125, System/3 users saw a system several times more expensive than their 3s, and conversion costs as the only route. Faced with that, most System/3 users simply continued to upgrade by buying additional 3s.

When the System/370 Model 115 was announced, System/3 users saw conversion costs, plus a machine with major instruction timings simply not as fast as the System/3 in many cases and, at more than twice the cost. System/3 users simply continued to upgrade by buying additional System/3s.

The July, 1973 announcement of the Model 15 is a different story. It does represent, at least temporarily, the upgrade that Model 10 users have been hoping for; offers more main storage capacity (48K, 96K, and 128K bytes) at prices reasonably proportionate to those of the Model 10; offers twice the on-line direct access capacity (over 80 million bytes, compared to the 40 million bytes of the Model 10); and uses the advanced technology of the System/370 Models 115 and 125 (MOSFET memory) instead of the slower, larger, more expensive magnetic core and also offers features that had been available only from independent vendors for the System/3 Model 10, specifically, multiprogramming and spooling.

Something System/3 Model 15 doesn't offer is the System/360 Model 20 simulation available from independent vendors. System/3 Model 15 users, if they stick with only IBM offerings, will have to convert their RPG II programs, if they're coming from the System/360 Model 20. The new System/3 model still doesn't offer System/370 compatibility or conversion aids. So, in perhaps a year or two, System/3 Model 15 users will be exactly where the Model 10 users were before the new announcement — nowhere to go except to more 3s without conversion pains.

Of course, IBM could continue what seems to be its commitment to the System/3 by announcing another model. The new model could have features such as conversational Basic, currently enjoyed by the System/3 Model 6 user. Or it could have a System/360 Model 20 emulator and attach faster peripherals. It might even have a virtual storage operating system, which would be interesting in a 16-bit addressing machine. But it probably won't have System/370 compatibility.

Conversion from the Model 10

Model 10s cannot be field upgraded to Model 15s, so the first thing a Model 10 user who expects to upgrade should prepare for is a new processor. The next thing he should prepare for is a different minimum configuration requirement (see CONFIGURATION GUIDE). Among other things, he must now have a 3277 Display Station. If he's using the 5203 printer, he will probably need a 1403 printer, since an attachment for the 5203 printer has not yet been announced. Tapes and discs can be transferred, with the appropriate attachments and, happily, the user can now double his on-line disc storage capacity if he chooses.

The Model 10 user must recompile all of his programs, if he chooses to use the new multiprogramming operating system, which takes advantage of the new processor facilities available for multiprogramming; for example, storage protection, I/O operation end interrupt, and program check interrupt. The Model 15 can run object programs from the Model 10 provided the I/O is the same, the Model 10 SCP is used, and the user does not want the advanced Model 15 capabilities (e.g., multiprogramming).

The Model 15 user can expect increased throughput compared to the Model 10.

Competitive Position. The IBM System/3 Model 15 competes with Burroughs B 1728, HIS 2030, and IBM System/370 Model 115, among others. These 3 major competitors will be dis-

cussed because, assuming a main memory capacity near 96K bytes, they can be configured into systems of comparable price, within \$1,000 of each other in monthly rental.

When comparing systems, the first thing to consider is the operating environment and the current specific applications. Then the growth potential should be considered.

Table 1 shows the major characteristics of the Model 15 and its 3 major competitors. They are relatively well-matched for straight batch processing. They vary in the amount of on-line data storage capacity and in their communication facilities.

For a large amount of on-line data in a communications environment, the B 1728 is definitely the best suited. It is currently the top of its line, however, and the migration path can require re-compilation of all programs to go to a medium system, which runs under a different operating system.

The next most suitable system for communications is probably the System/370 Model 115, which supports its lines via an integrated communications adapter that is program compatible with the 2703 transmission control unit. The 115 is also in the attractive position of being an entry system to the System/370 line, but its on-line disc capacity is currently only half that of the B 1728.

The HIS 2030, if it had enough main storage to run OS/2000 effectively, would probably be the best communications contender. OS/2000 would allow DATANET front end processor, which cannot be used with the MSR operating systems now available on the 2030. The MSR systems will support either the 285 communications adapter or the 286 communications adapter. The 285 handles a single line; the 286 handles 4 to 6 lines. The MSR operating systems are naive by comparison with IBM's DOS/VS and Burroughs MCP.

CONFIGURATION GUIDE

The minimum System/3 Model 15 configuration consists of a 5415 processor (Model A17) with 49,152 (48K) bytes of memory. In addition to the 5415, the Model 15 requires a 3277 display station with a 78-key operator console keyboard, a 1403 printer (Models 5, 2, or N1), a 5421 printer control unit, a minimum of one 5444 disk storage drive Model A2, and one of the following: a 5425 multi-function card unit; a 1442 card read punch Model 6 or 7; or a 2560 multi-function card machine.

Table 1. System/3 Model 15: Competitive Statistics

System Characteristic	IBM S/3 Mdl 15	HIS 2030	Burroughs B 1728	IBM S/370 Mdl 115
Max comm line	2 ⁽¹⁾	7	16	5 sync or 4 sync and 8 async
Max on-line disc storage capacity	91.8 mb ⁽²⁾	300 mb	565.6 mb ⁽³⁾	280 mb
Multiprogramming operating system	Yes (SCP)	Dual (MSR)	Yes (MCP)	Yes (DOS/V5)
Languages:				
RPG	Yes	Yes	Yes	Yes
Cobol	Yes	Yes	Yes	Yes
Fortran IV	Yes	Yes	Yes	Yes
Assembler	Yes	Yes	No	Yes
PL/1	No	No	No	Yes
Basic	No	No	Yes	No

Notes:

- (1) Eight communications lines can be attached through an RPQ item only.
- (2) 9.8 mb on fixed disc, 82.0 mb on removable disc.
- (3) 40.5 mb on head-per-track disc, 525.6 mb on removable disc.

This minimum configuration differs from that of the Model 10 in that the 5203 printer cannot be used on the Model 15 (although it can be used on the System/370 Model 115); the 2560 multi-function card machine will satisfy the Model 15's card requirements (not so on the Model 10); and the 3277 display station with the operator console keyboard is required (again, not so on the Model 10).

Devices are connected to the computer via attachments, not by channels (with 2 exceptions). Attachments are fitted to the 5415 processor, and most of them are field installable. All of the devices mentioned in the minimum configuration list are connected by attachments. Other devices that can be attached are: 5445 disk storage drive; 3410/3411 magnetic tape drives; 2501 card reader; a local communications adapter; and 1 or 2 binary synchronous communications adapters.

A maximum of four 5445 discs can be attached to the Model 15, which can support 4 tape drives, the same number as the Model 10. Only 1 printer can be attached; 2 card readers can be attached, if the second is a 2501. A 1255 magnetic character reader or a 3881 optical mark reader can be attached if a serial I/O channel is installed (extra cost). But they are not yet supported by Model 15 programming and must use the Model 10's programming.

Main memory is available to 64K, 96K, and 128K bytes. Memory is field installable. Some expansions, depending on the system configuration, may also require a power supply expansion.

(Additional information on the individual peripherals capacities and configurations appears in the Peripherals and Data Handling segments of your AUERBACH Computer Technology Reports.)

MAINFRAME

The System/3 is a small, single-processor, business-oriented system. The mainframe contains the main storage and facilities for addressing main storage, for processing data arithmetically and logically, and for controlling the I/O units. The Model 15 CPU utilizes monolithic systems technology (MST), the same as that of the Model 10, for circuit logic. The cycle time is 1.5 microseconds, the same in both machines. The main storage is Metal Oxide Semiconductor Field Effect Transistor (MOSFET), the same as that of the System/370 Models 115 and 125. The Model 15 also uses the same error correction and checking (ECC) as that used in System/370. The ECC corrects single bit errors and detects double bit errors with no loss of processor time.

The basic addressable unit is an 8-bit byte. Data is coded in EBCDIC. The card code is a 64-character set using 6 bits; up to 96 columns of information can be contained in a card.

System/3 uses a 16-bit address (System/370 uses a 24-bit address); 16 bits can address up to 64K bytes. The Model 15 Address Translation Table (ATT) consists of 32 registers, which address up to the upper limits of 128K bytes of storage. The Model 15 supervisor loads the appropriate values into the ATT registers, which are then used to convert the 16-bit addresses in a user program into the 17-bit addresses required to address 128K bytes of memory.

Other Model 15 features that differ from the Model 10 are CPU storage protection; program check interrupt; 8 levels of interrupt; a mask interrupt capability; privileged mode operation; operation end interrupt, and cycle-stealing overlap of I/O operation with processing.

A feature to increase I/O transfer rate is the 2-byte wide data path for discs (5444 or 5445). This reduces the number of processor cycles required to satisfy I/O requests, and these cycles can be used for other tasks. Another I/O enhancement is scan/read for discs (5445 only); this permits the system to retrieve the index from the disc in a single rotation instead of two.

PERIPHERALS

Over 15 peripherals — slow-speed, high-speed, and special-purpose — have been announced as available with the new System/3 Model 15. Conspicuous by their absence are the 5203 printer currently available to System/3 Model 10 users (perhaps a connection will be announced later) and paper tape facilities. Paper tape has never been

available on System/3 but is available on competitors' systems.

Slow-Speed Peripherals

Printers, 80-column card units, and 96-column card units are available.

5424 Multi-Function Card Unit Model A1 or A2. For 96-column cards: A1 reads/punches/prints at 250/60/60 cards per minute; A2 reads/punches/prints at 500/120/120 cards per minute.

1442 Card Read Punch Models 6 and 7. For 80-column cards: Model 6 reads at 300 cards per minute, punches at 80 columns per second; Model 7 reads at 400 cards per minute, punches at 160 columns/second.

2560 Multi-Function Card Machine. For 80-column cards: Model A1 reads at 500 cards per minute, punches at 160 columns/second; can also collate, interpret, and print documents.

1403 Printer Model 2, 5, or N1. 132 print positions; printing speed, respectively, is 600, 465, and 1,100 lines per minute.

2501 Card Reader Model A1 or A2. Reads 80-column cards; 600 and 1,000 cards per minute, respectively.

High-Speed Peripherals

Discs and magnetic tape drives are available. The tape drives are also available on the System/370 models, the discs are not.

5444 Disk Storage Drive Model A2. Combination removable and nonremovable discs; 200 cylinders on each; 4.9 million bytes (9.8 million packed) capacity.

5445 Disc Storage Drive Model 1. Removable; 20.48 million bytes capacity; 60-millisecond average access; Model 2 is attached to Model 1, up to 2 Model 1s (and therefore 2 Model 2s) can be attached.

3410/3411 Magnetic Tape Unit and Control, Models 1, 2, or 3. 800 or 1,600 bits per inch; 7- or 9-track; transfer rates of 20, 40, or 80K bytes per second.

Special-Purpose Peripherals

A magnetic character reader and an optical mark reader can be attached to the Model 15 via the optional Serial I/O Channel. (See CONFIGURATION GUIDE.)

1255 Magnetic Character Reader, Models 1, 2, or 3. Reads/sorts 6-inch documents at speeds of 500, 750, and 750 documents per minute. Models have 6, 6, and 12 stackers, respectively.

3881 Optical Mark Reader. Reads documents 3 x 3 inches to 9 x 12 inches with marks made by number 2 pencils or appropriately equipped printers.

Operator's Console

The 3277 Display Station, together with an operator console keyboard, is required for operator/system communications. This station is optional on the Model 10, where it can be used for inquiry, secondary output, limited key entry of data, and operator/program interaction. The same functions are available with the Model 15.

The 3277 is a cathode ray tube which displays up to 480 characters (12 lines of 40 characters each). The 78-key operator console keyboard has 45 alphameric keys, 21 control keys, and 12 program keys.

DATA COMMUNICATIONS

The Model 15 provides the same communications capability as the Model 10; it can function as a processor terminal or a host or sub-host system.

One or two binary synchronous communication adapters (BSCA) are available to provide synchronous transmission rates from 600 to 50,000 bits per second.

The Model 15 BSCA supports the System/3, System/7, Systems/360/370, 2770 data communications system, 2780 data transmission terminal, 2972/2980 general banking terminal system, 3270 display system, 3735 programmable buffered terminal, and 3741-2 data station.

An EIA local feature permits attachment of one 3271 control unit or one 3275 display station without using a data communication line or modem at either device.

A local communications adapter (LCA) allows direct local attachment of a 3741 Data Station with a diskette. A 3271 control unit or a 3275 display station can also be attached locally via the LCA to provide single or clustered CRT display capability. The LCA cannot be installed with the first BSCA.

A feature that will be priced separately and available only on specific request is the Multiple Line Terminal Adapter (MLTA) that provides attachment capability for IBM's low-speed start/stop terminals. Connection of 1 to 8 communication lines with multiple terminals per line is possible.

MLTA supports the 1050 data communication system, the 2740 terminals, the 2741 terminals, the CMCST (Communicating Magnetic Card Selectric Typewriter), and System/7, which is supported as a 2740-1.

SOFTWARE

Specific information on how the Model 15's software varies from that of the Model 10 is not yet available, but a few things are known. The Model 15 will support programming languages, utilities, and data communications, and a new disc-based multiprogramming operating system will be available.

Programming Languages. Cobol, RPG II, Assembler, and Fortran IV will be available. The compilers will be enhanced to reflect the new operating environment and the increased peripheral support.

Utilities. Disc sort, tape sort, and various other utilities already available to System/3 users will be available for the Model 15 and will be enhanced to support the new operating environment and additional peripherals.

Data Communications. The Communications Control Program (CCP) will allow high-level language access to MLTA and BSCA attached terminals. This includes resource management to reduce contention between programs accessing the same files, concurrent program execution to allow multiple application programs within the available storage partition, and terminal monitoring to accept data and terminal commands. The concurrent program execution in a partition creates subpartitions that can handle multijob streams.

The CCP was originally announced for the Model 10, and included support for Cobol, Fortran, and RPG II. As announced for the Model 15, only Cobol and RPH II are available.

CCP requires no additional hardware over the minimum Model 15 configuration except, of course, an MLTA or a BSCA and at least 1 terminal.

Data/3. The newly announced Data/3 will provide conversational displays on a remote 3270, allowing the operator to interact with data files during inquiry and data entry.

Operating System. The new System Control Program (SCP) features multiprogramming and spooling, plus support for the additional peripherals supported by the Model 15 (that is, the discs). Three new commands — LOAD CPU, STORE CPU, and COMMAND CPU — are used to support the multiprogramming environment.

Multiprogramming allows 2 or more programs to execute at the same time, but the maximum number allowed and the method of implementation have not been released.

Spooling allows data in input or output queues to be stored on disc for reading, printing, or punching at a later time. Until now, this signif-

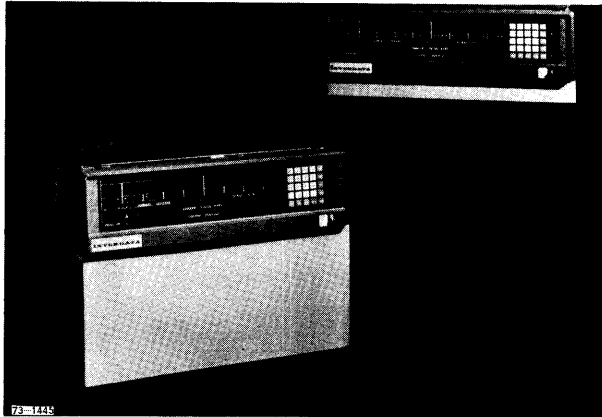
icantly faster way of handling data I/O has been available from independent vendors for System/3, but are not available from IBM.

The Model 10 SCP will run on the Model 15, without, of course, taking advantage of the new processor features, or the new SCP instructions.

Application Programs. Application programs will have to be recompiled to run on the Model 15, but that is the only restriction on programs already written for the Models 6 and 10. No new application programs have been announced so far. Existing programs available from IBM include apparel business control; bill of material processor; business analysis; health, welfare, and pension fund; hospital accounts receivable; hospital patient billing; inventory and requirement planning; law enforcement; a system for TV and radio; and a utility billing system. Many others are available from independent vendors.

IBM

System/370 Model 115



OVERVIEW

System/370 Model 115 is a small general purpose computer marketed primarily for business applications. It supplants the System/370 Model 125 as the smallest, fully upward compatible member of IBM's System/370 family of computers, as well as the smallest entry-level computer into the System/370. It can also be considered an upgrade system for present users of System/360 Models 20, 22, and 25; System/3 Models 6, 10; and the 1130 system. Although the 115 may not be an upgrade system for System/3, Model 15 users, the 115 does offer a migration path into the System/370.

Conversion to the System/370 via the Model 115 allows all but the System/3 Model 15 users to benefit from a more efficient multiprogramming capability; more processor instructions; more modern hardware technology in CPU and main storage; cost-effective facilities of virtual storage; and faster, larger-capacity, lower cost-per-byte discs. Model 115 is directly compatible with the 360/22 and 25 and can emulate the 360/20. It offers no compatibility bridges to the System 1130, although it does offer similar applications programs. The 115 does, however, offer 1401/1440/1460 compatibility.

As for compatibility with System/3, the 115 can handle programs written in RPG II and Cobol, and it is equipped with both 80- and 96-column card equipment. IBM calls this "entry level" compatibility.

In fact, this compatibility with System/3 is no different from that offered by the Model 125; that is, the systems are not compatible. The 115 and System/3 record and handle data differently, and they use different addressing schemes. IBM has not yet announced any conversion aids. In effect, the Model 115 differs little from the Model 125;

it has less total core capacity and costs less. Both systems offer the same improved performance over the 1130, 3/10, 360/20, 360/22, or 360/25.

Whether or not the 115 will offer improved performance over the System/3 Model 15 has yet to be seen. Both use the same memory technology. The 115's virtual storage operating system may be a little too sophisticated for the entry level user. A knowledge of program mixes is all-important to avoid operating system overhead and thrashing, and this knowledge requires training. The Model 15's operating system appears nicely suited for entry-level operation, and it probably can be run with on-hand personnel with minimum training. Neither system has been delivered yet, so it is too early to tell exactly how the 2 systems will compete. The 115, as well as the System/3 Model 15, is slated for first delivery in March, 1974. Figure 1 shows a plot of price versus memory capacity for various models of System/3, System/360 and System/370. According to this Figure, the only systems that can be upgraded to a 370/115 without increasing costs are a 360/30 with 64K-byte memory and a 360/25 with 48K-byte memory. In terms of performance, however, these systems should probably be upgraded to the 370/125.

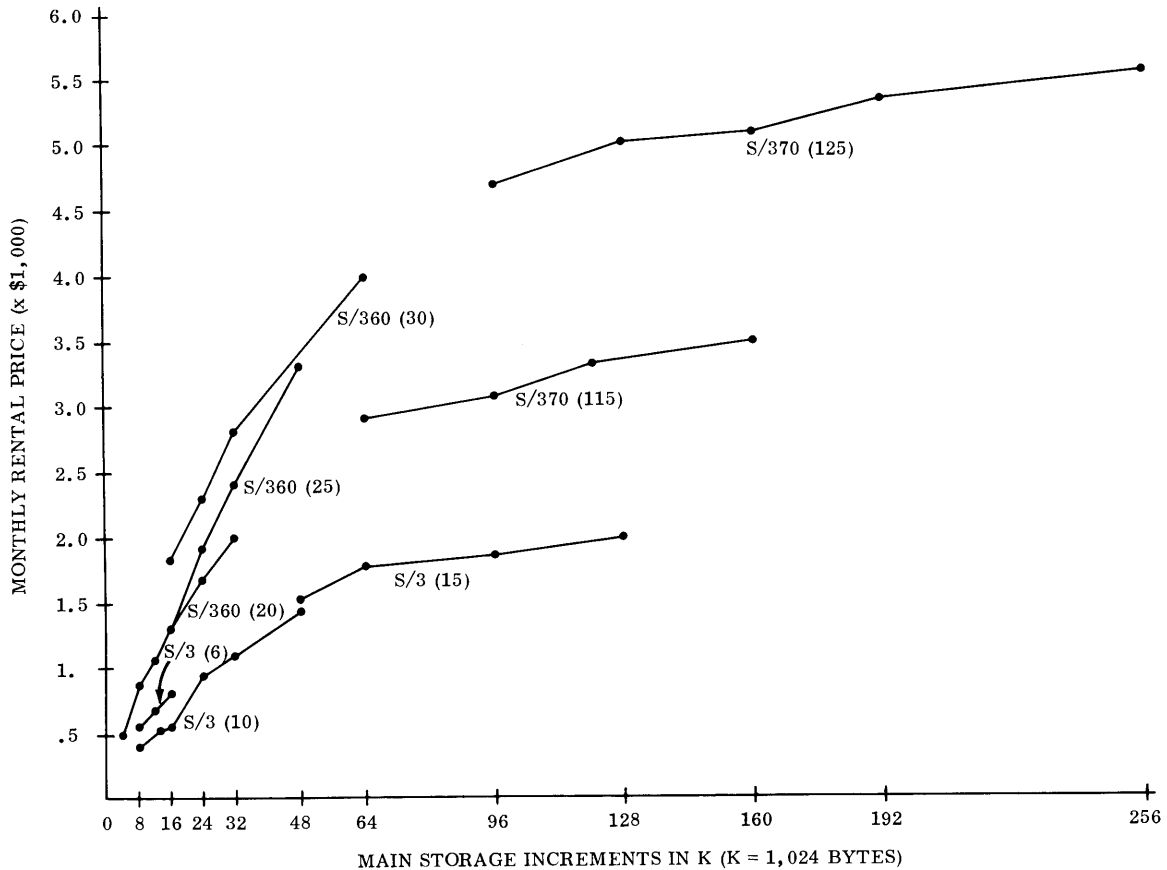
To increase processing power beyond the Model 15, System/3 users must upgrade to the 125, not to the 115; and that upgrade costs more than double that of a System/3.

IBM is increasing its emphasis on the communications market, and the 115 can be used as a front-end processor, a host processor, or a remote job entry (RJE) workstation. A total of 4 synchronous and 8 asynchronous lines or 5 synchronous lines can be attached to integrated communications processors; that is, the lines are directly attached to the CPU.

Programming support for the Model 115 is DOS/VS. Language processors available are RPG II, Cobol, Fortran, PL/1, and Assembler. Conversational Basic, as enjoyed by System/3 Model 6 users, is not supported. Initial applications at which the 115 is targeted are banking, manufacturing, and automobile industries.

Compatibility

The Model 115 is totally upward compatible with other System/370s. Most DOS programs from 360s can run immediately under DOS/VS. Current Model 22 and 25 programs can be run using the optional System/360 I/O compatibility and 2311-1 compatibility features. The changes



73-1450

Figure 1. IBM S/3, S/370, and S/360 Storage: Rental Comparison

are reflected in the control language because disc storage under DOS is allocated by specific volume, track, and extent.

DOS/VS supports an integrated System/360 Model 20 emulator which includes access to pseudo-2311 discs.

DOS/VS allows the definition of 5 memory partitions. One will probably be dedicated to the spooler program (Power), which requires 18K bytes; another could be dedicated to teleprocessing; and perhaps another to background processing. Any memory below 128K bytes appears barely sufficient to use the virtual system fully. Albeit the 115 is a flexible, small general-purpose machine in terms of hardware, its software seems potentially ponderous and susceptible to thrashing.

PERFORMANCE AND COMPETITIVE POSITION

Systems that compete from the standpoint of performance with the S/370, 115 are the Bur-

roughs B 1726, the HIS 2030, and others. Currently, the Burroughs B 1726 is a powerful machine very well suited for small- to medium-scale general-purpose processing with a business orientation. With optional equipment, the 1726 can accommodate over a half-billion bytes of on-line storage; up to 8 communications lines on a multiline controller; and addresses for up to 96K bytes of main storage. The MCP-II operating system utilizes the same paging technique used on the very large multiprogramming, multiprocessing B 6700/7700 machines.

Currently, the 1726 is most suitable for Cobol programs; however, the sophisticated architecture for reconfigurable microprograms is easily adaptable to other languages, to a multiprocessing environment, or to the emulation of other machines. To date, only emulation of the IBM 1400 series, however, has been announced. IBM recently announced the same capability on the 115.

The 115 has a larger main memory addressing capacity, (a current maximum of 160K bytes),

fewer communications lines, and a more complicated operating system than the 1726. DOS/VS requires more processing overhead than does the 1726's MCP-II; that is, DOS/VS requires more main storage addresses, more direct access storage space, and more instructions for paging and address translation than the MCP-II. A specific example is the size of routines resident in main storage: 8K bytes for the MCP-II, and 18K bytes minimum for DOS/VS.

Both DOS/VS and MCP-II perform spooling operations; MCP-II allocates resources in a more sophisticated way than does DOS/VS. For example, MCP-II assigns data sets dynamically while DOS/VS requires specific device information.

The HIS 2030 with a maximum core capacity of 96K bytes does not use modern storage technology, nor does it offer an operating system of the sophistication of DOS/VS or MCP-II. It does offer a large amount of on-line storage, and it is oriented toward communications processing. A dedicated system running under OS/2000 and the DATANET 2000 is a strong contender for communication applications, but the 2030, because of its limitations on main storage addressing, could do little else. Honeywell apparently realizes this because they have announced the MSR/2000 operating system for exclusive use of the 2030. This offers dual-programming capabilities and communication facilities that are slightly better than those of the 115, but they are not equivalent to the powerful DATANET 2000.

Certain characteristics are common to all of the competing systems; all offer Cobol, RPG, and Fortran. The 1726 does not offer an assembler language, but the other systems do. All are upward compatible with larger medium system models of general-purpose computers. All offer more or less industry compatible peripherals.

CONFIGURATION GUIDE

One central processor is available for the 115. The 3115 has a 480-nanosecond, 2-byte, memory cycle time; it provides arithmetic and logic circuits, plus a direct disc attachment, reloadable control storage (20K words of 22 bits, a concept borrowed from the 125), and main storage. The main and control storage use MOSFET (metaloxide semiconductor field-effect transistor) technology. Main storage is available in 4 sizes: 64K, 96K, 128K, and 160K bytes.

The 115 has also borrowed the "floppy disc" concept from the 125. The removable magnetic diskette contains the microcode for the basic system, the optional features ordered for the system, and CE diagnostics. Error logging

therefore is on the diskette instead of in CPU registers, as is done on all larger 370s, except the 125.

Standard Features

Standard Model 115 features include a commercial instruction set, dynamic address translation (required for virtual storage; to address up to 16M bytes), channel indirect data addressing, program event recording, monitor call, interval timer, time-of-day clock, CPU timer and clock comparator, store and fetch protect, byte-oriented alignment, and special reliability, availability, and serviceability features. Also included are the Display Operator Console (DOC), a CRT plus keyboard, and direct attachment of the 3340 Model A2 two-disc drive storage. Additional 3340s, Model B1 or B2, are attached to the 3340, to a maximum of 4 drives.

The reloadable control storage is provided with the optional card I/O attachment, printer attachment, integrated communications adapter, and the byte multiplexor channel.

I/O devices attached via integrated controls or adapters are the 3340 direct access disc drive, the 3411 magnetic tape units, the 2560 and 5425 multifunction card units, the 5203 printer, and the communications adapter.

I/O devices connected via the byte multiplexor channel are the same as those that can be connected to the byte multiplexor channel on System/360 Models 22, 25, 30, and 40. The byte multiplexor channel has 32 subchannels (8 shared; 24 unshared), giving a maximum data rate of 29K bytes per second in burst mode and 19K bytes per second in byte mode. Devices requiring higher sustained data transfer rates cannot be attached. The multiplexor channel and the integrated card I/O attachment require special features to be installed together.

PERIPHERALS

Except for the 3330 disc storage facility and the 3803/3420 magnetic tape substations, the Model 115 supports the same peripheral devices as the Model 125. These devices attach as already described in the Configuration Guide.

Table 1 lists the specific punched card peripherals available and Table 2 the magnetic tape units. Other peripherals available include the 3203 printer, which is a faster and considerably more expensive version of the 1403 printer, and the 3340 disc storage and control. The 3340 can be used only under virtual storage operating systems. It uses the 3348 single cartridge data module to hold the disc recording surface, the

access arms, and the read/write heads. The 3540 Diskette I/O unit can also be used.

Other peripherals available are the 1287 Optical Reader, the 3881 Optical Mark Reader and

Table 1. IBM S/370 Model 115: Card Equipment

Identity	Columns	Channel or Integrated Attachment	Control Unit Implementation
3504-A1, A2 Card Reader	80	I	Internal
3505-B1, B2 Card Reader	80	C	Internal
3525-P1, P2, P3 Card Punch	80	C/3505	Internal
1442-N1 Card Read Punch	80	C	Internal
1442-N2 Card Punch	80	C	Internal
2501 Card Reader	80	C	Internal
2520-B1 Card Read Punch	80	C	Internal
2520-B2, B3 Card Punch	80	C	Internal
2540 Card Read Punch	80	C/2821	In 2821
2560-A1 MFCM (360/20 device)	80	I	Internal
2596 Card Read Punch	96	C	Internal
5425-A1, A2 MFCU	96	I	Internal

Note:

- (1) Channel is optional byte multiplexor.
- (2) The 3525, 2560, and 5425 cannot coexist in integrated attachments, but either of the latter 2 can coexist with an integrated 3504.

Table 2. IBM S/370 Model 115: 3411/3410 Magnetic Tape

Characteristic	Model 1	Model 2	Model 3
Data Rate (kb/sec)			
at 1,600 bpi/PE	20	40	80
at 800 bpi/NRZI	10	20	40
at 556 bpi/NRZI	6.9	13.9	27.8
at 200 bpi/NRZI	2.5	5	10
Tape Speed (ips)	12.5	25	50
Interblock Gap			
Time (msec)			
9-track (0.6 in.)	48	24	12
7-track (0.75 in.)	60	30	15
Avg Read/Write			
Access Time (msec)	15	12	6
Full-Reel Rewind			
Time (min.)	3	3	2
Max Drives/Subsystem*	4	6	6

Note:

* The 3411 is a tape drive with a built-in control unit. It can attach a number of single-drive 3410 tape units having the same model number. Connection to a 115 requires an appropriate attachment.

the 3886 Optical Character Reader. The 7770 Audio Response Unit is also available.

Users considering a migration or a change from their present IBM system will find Table 3 interesting; it lists selected device availability on the probable growth/migration systems.

DATA COMMUNICATIONS

The Model 115 can be used as a stand-alone communications processor or as a front-end processor with other members of the System/360/370 family.

Software support includes BTAM (Basic Telecommunications Access Method) and QTAM (Queued Telecommunications Access Method) but not TCAM (Telecommunications Access Method).

An impressive array of terminals can attach via either the Integrated Communications Adapter (ICA) or a control unit on the multiplexor channel. The ICA is program compatible with the 2703 transmission control unit. It allows direct attachment of up to 5 synchronous or up to 4 asynchronous and 8 asynchronous lines. The ICA is equivalent to 2701s, 2702s, or 2703s or 3704s/3705s in emulation mode attached by a byte multiplexor channel. The data transfer rate is 45.5 bits per second for asynchronous lines and up to 50,000 bits per second for synchronous lines.

The following terminals can be attached: the 3270 Information Display System units, the 3735 Programmable Buffered Terminal, the 3780 Data Communications Terminal, the 2922 Programmable Terminal, the 2740 and 2741 Communications Terminals, the 2760 Optical Image Unit,

Table 3. IBM S/370 Model 115: Comparison of Device Availability on Probable Growth/Migration Systems

S/370 Mdl 115 Characteristic or Device	1130	S/360			S/3			S/370	
		20	22	25	6	10	15	125	135
3340 Direct Access Storage Facility (34.9 or 69.8 mb; 25 msec seek; 885 kb/sec data rate)	—	—	—	—	—	—	—	X	X
3203 Printer Mdl 1 & 2 (600 or 1,200 lpm; 132 PP, 10 cpi; 30- to 240-char sets)	—	—	—	—	—	—	—	X	—
5213-1 Console Printer (85 cps)	—	—	—	—	X	—	—	X	—
3872, 3875 Communications Modem	X	X	—	X	X	X	X	—	X
5425 Multifunction Card Unit (96 col)	—	—	—	—	—	—	X	X	—
2560 Multifunction Card Unit (80 col)	—	X	—	X	—	—	X	X	—
5203 Printer Mdl 3	—	—	—	—	—	X	—	—	—
3410/3411 Magnetic Tape Units (20, 40, 80 Kb; 6 max/controller)	—	—	—	—	—	X	X	X	X
2260 Display Station	—	—	X	X	—	—	—	X	X
3271 Display Station	—	—	—	X	—	X	—	X	X
2501 Mdl A1 or A2 Card Reader	X	X	X	X	—	—	—	X	X
1231 Optical Mark Reader	X	—	X	X	—	—	—	—	—
1627 Plotter	X	—	—	—	—	—	—	—	—
Cobol	X	—	X	X	X	X	X	X	X
RPG	—	X	X	X	X	X	X	X	X
ASM	—	X	X	X	—	X	X	X	X
Fortran	X	—	X	X	X	X	X	X	X
PL/1	—	—	X	X	—	—	X	X	X

the 2770 and 2790 Data Communication Systems, the 2780 Data Transmission System and the 2260 and 2265 Display Stations.

Additional communications control beyond that provided by the ICA can be implemented using the 2701, 2702, or 2703 units or the 3705 communications controller. Line adapters (each of which requires a channel control unit position) are also available: the 2711 line adapter and the 3872, 2875, and 4872 modems.

SOFTWARE

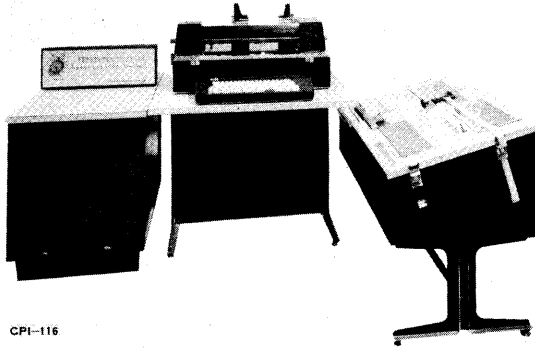
The software available has already been discussed under OVERVIEW and PERFORMANCE AND COMPETITIVE POSITION. A thorough analysis of the DOS/VS operating system can be found in the System Software Segment of your AUERBACH Computer Technology Reports.

HEADQUARTERS

IBM Corporation
White Plains NY 10601

LITTON

ABS 1200 Series



OVERVIEW

Litton Automated Business Systems markets its ABS 1200 Series to small businesses that need the benefits of automated paperwork procedures and a data analysis tool for management control. Members of the ABS 1200 Series operate in the interactive mode. Litton's 1200 Series appeals to users of electronic accounting machines who require an automated system with stored program control.

The ABS 1200 Series comprises five configurations of a basic processor with paper tape and character-printer input/output devices. Somewhat unique among small business computers, the ABS 1200 Series uses magnetic drum storage for its working storage. This type of storage has a longer access time than core or semiconductor memories. However, it's quite suitable for the interactive applications performed with Litton's system.

Litton markets its systems on a turnkey basis with all programming, training, and installation guidance provided by its staff. The firm offers over 40 applications covering a wide range of business requirements. Customized modifications are also available.

CONFIGURATION GUIDE

The ABS 1200 Series includes the following six models: 1210, 1220/1221, 1231, 1241, 1252, and 1281. All models are distinguished by the capacity of their drum memory, the number of input/output channels, and the speeds of their peripheral devices.

A basic ABS system comprises a central processor (storing up to 4,096 40-bit words), a keyboard for entering data manually into the central processor, a character printer, a reader for

paper tape or edge-punched cards, and a punch for paper tape or edge-punched cards.

Printers offer speeds of 10 or 35 characters per second and automatically control forms handling. The paper tape reader reads punched paper tape or edge-punched cards containing operating programs or data at 30 characters per second. Paper tape is punched at 30 characters per second.

On its ABS 1241 and 1252 systems, Litton offers magnetic drums for auxiliary file storage. Each drum has a capacity of 16K words (40 bits). Also available on the 1241 and 1252 is 50 character-per-second reader/punch capability.

The ABS 1281 is essentially the same as the ABS 1241 with the addition of magnetic ledger card chute(s) — ABS 1281-1 has one chute and ABS 1281-2 has a pair of chutes for processing two magnetic ledger cards simultaneously.

SOFTWARE

Litton's 1200 Series is usually offered on a turnkey basis. However, it includes an operating system designed to direct the operator through its interactive procedures. Under an operator's direction, the operating system also controls the error protection and correction procedure. Software for modifying and duplicating programs and records as well as for input/output handling is included in the 1200 Series' repertoire of utility routines.

ABS application programs are written in Litton's assembly language which is a mnemonic interpretive language. The firm offers a wide range of application software covering billing and analysis, financial statements, production orders work loading/scheduling, accounts receivable/payable, invoicing, account aging, sales distribution analysis, inventory, payroll writing, labor analysis, job costing, standard costs, internal expense analysis, general ledger distribution, financial statement preparation, and revenue analysis.

DESIGN FEATURES

Litton designed its 1200 Series to operate in a normal office environment; it requires no special flooring. Each model is housed in compact desk-high modules. All modules house a processor, keyboard, printer, and tape reader and punch. The drum memory used for auxiliary storage with Models 1241, 1252, and 1281 can be located either at the side or in front of the processor.

LITTON ABS 1200 SERIES

An application program, which is entered into magnetic drum memory from paper tape, controls the system. Thus, accounting documents are prepared automatically with manual operator actions normally required only to handle such input media as edge-punched cards containing customer and product data, to enter keyboard data such as item quantity, and to initiate and terminate program execution. All operator-directed procedures are performed via an interactive keyboard.

PERFORMANCE

When compared to other small business computers, Litton's 1200 Series doesn't offer the same processing power or upward growth capabilities as achieved with, for example, the IBM, NCR, or Univac systems. However, ABS 1200 is not designed to compete at that level. Instead, the 1200 Series offers an attractive low-cost alternative to small businesses whose current EAM equipment can't handle their firms' increased data handling requirements.

With the 1200 Series' stored program capabilities, new application demands can be satisfied without any major hardware changes. This flexibility is not encountered in standard electronic accounting machines.

MAINTENANCE

Litton provides maintenance for its 1200 Series equipment via its international staff of field service engineers. The system support staff is located in over 60 cities across the United States and in major cities in Europe. Each service center is staffed and equipped to service and maintain systems in its jurisdiction.

Preventive maintenance is performed on a 90-day schedule. All parts and labor are included

in maintenance plans. Software maintenance for turnkey systems is furnished as required.

HISTORY

Litton Automated Business Systems is a division of Litton Industries. The firm manufactures a diversified line of electronic office equipment. Its small business computer experience comes from specializing in the sale of electronic accounting equipment.

Litton ABS maintains an international marketing force. It markets turnkey systems to end users, including hardware, system and application software, and installation training. Customized programming and a wide variety of pre-packaged software are also available.

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	40
Capacity (words)	2K-4K
Cycle Time (μ sec)	0.5
Working Storage	Drum
AUX STORAGE	Drum (Models 1241, 1252, and 1281 only)
DATA OUTPUT	
Line Printer (lpm)	—
Serial Printer	Yes
Card (cpm)	—
Paper Tape (cps)	30; 50
DATA INPUT	
Keyboard	Standard
Card (cpm)	—
Paper Tape (cps)	30; 50
SOFTWARE	
Assembler	Yes
Operating System	Yes
Compiler	No

NATIONAL CASH REGISTER

NCR Century 50 and Century 100



SUMMARY

National Cash Register's Century Series is a family of general-purpose computers designed for first-time computer users as well as for those users who currently have an installed small computer system. It's particularly suited for upgrading from punched card or electronic accounting machine data processing to the more powerful and flexible facilities available with small business computers.

One major advantage is direct, upward software interchangeability between members of the series. By extending this feature down to the Century 50, NCR eases the transition of Century 50 users who want to upgrade to a Century 100 or even more powerful models of the series.

Other manufacturers of major computer systems do not yet offer software compatibility down to their small business computers. For example, upgrading from an IBM small business computer, the System/3 Model 10, requires switching to the System/360 which does not have compatible software. This results in disruptions and inconvenience for the user.

NCR also offers a translator, which eases transition of IBM System/360 users to the Century Series. The translator, available on both Century 50 and 100, converts IBM 360/20's only compiler language into NCR's NEAT/3. Thus, no reprogramming is necessary when a 360 user switches to a Century 50 or 100.

NEAT/3, a multipurpose compiler language, includes the capabilities of a standard report

program generator language. The Century Series also supports Fortran and Cobol compilers — powerful software for scientific and small business applications, respectively.

The Century 50 and Century 100 are both designed for batch data processing. Three-fourths of the installations have been in batch-oriented operations, namely, in service bureaus and as replacements for punched card systems.

Application packages in more than 24 major categories are available for these computers, including software for applications in manufacturing, distribution, and retailing. Also offered by the Century Series are standard accounting applications, packages for hospital patient-account management, packages for life insurance companies, such law enforcement packages as central information file and traffic-violation fine collection, and utilities billing packages, among others. Despite this library of software, NCR's marketing emphasis is not on turnkey systems, delivered complete with the desired software, but on systems whose software is developed by the users' own EDP staffs. NCR provides a variety of support-service packages to assist these staffs during the system startup phase.

CONFIGURATION GUIDE

The primary difference between the Century 50 and 100 is that the 50 is basically a 100 with a more restricted input/output capability and a lower performance disc. With full upgrade, however, the Century 50 is virtually a 100.

A minimal Century 50 configuration comprises a central processor unit (CPU) with a 16K-byte thin-film rod memory, an 8,400K-byte magnetic disc auxiliary storage unit, a 300 card-per-minute punched card reader, and a 200 line-per-minute, 132-column line printer.

This configuration can be upgraded by any or all of the following steps: doubling main memory to 32K bytes; replacing the card reader with a 1,000 character-per-second punched paper tape reader; replacing the 200 line-per-minute printer with either a 300 line-per-minute or a 450 line-per-minute model (rates are for alphanumeric data — purely numeric data is printed at 600 lines per minute and 900 lines per minute, respectively); replacing the original disc drive, which has an access time of 153 milliseconds, with a model whose access time is only 65 milliseconds.

Further system flexibility is possible through the addition of an input/output typewriter console, a second disc drive, and a line printer

feature that permits the selection of line spacing at either six or eight lines per inch.

All of the preceding peripheral devices are integral to the computer, that is, they derive some of their operating voltages and logic functions from circuitry that resides within the basic computer. Further upgrading of the Century 50 requires the addition of a common trunk feature, which provides eight positions for attaching I/O devices. It also permits the CPU to service various combinations of the following peripherals: a 1,500 character-per-second paper tape reader; a 200 character-per-second paper tape punch; a controller for a slow-speed magnetic tape encoder; a card reader/punch which reads 560 cards per minute and punches 60 to 180 cards per minute; a 750 card-per-minute card reader; 60 to 180 card-per-minute card punch; and a 600 check-per-minute magnetic ink character recognition (MICR) sorter that can sort into 11 pockets.

The final step upgrading a Century 50 is to add a synchronous or asynchronous communications controller or one that combines the two types. This addition permits communication between the Century 50 and either sister computers or those of other manufacturers. The 15 lines of an asynchronous controller can also be used to link the CPU with teletypewriters, thermal printers, or CRT displays. NCR's thermal printer is a single-copy, 30 character-per-second, typewriter-like device that is used for remote inquiry and for interactive communication with the CPU. The CRT display includes a keyboard and performs the same functions as the thermal printer. CRT controllers are available with display capacities up to 1,000 characters.

Although closely related to the Century 50, the Century 100 adds a magnetic tape auxiliary storage capability, available in either seven-channel or nine-channel models of tape drives, the latter at data transfer rates of up to 240K bytes per second. The Century 100 provides the user with more types of peripheral equipment that have faster speeds. For example, the Century 100 includes a 450 line-per-minute printer and a 240 card-per-minute on-line card punch as standard equipment, and it can handle a 1,500 line-per-minute printer, optionally available in a 160-column model.

Other advances include a faster, more flexible MICR sorter that sorts 1,200 checks per minute into 18 pockets; an optical character recognition (OCR) capability, which lets the unit read the OCR-character-printed journal tapes that NCR cash registers commonly generate; and two common trunks, with a total of 16 positions. In addi-

tion to the 15-line communications controller, the Century 100 can add a 256-line communications multiplexer for use in networks that employ NCR's teller terminals and billing terminals of the CRT and Teletype variety.

A Century 100 can also control up to eight of NCR's CRAM random access data storage units. These devices use punched edge-coded, magnetic-oxide-coated mylar cards and provide a formidable data storage capability of up to 145 million bytes. Eight of these units can provide the system with a data bank of well over 1 billion bytes or the equivalent of more than 300,000 pages of printed data. Average access time of CRAM is only 125 milliseconds.

SOFTWARE

Although approximately 100 application packages are available to users of the Century 50 and Century 100, NCR does not emphasize turnkey installations. It prefers to assist the user's own EDP staff in developing the necessary software, typically modified versions of NCR's standard programs. However, many users take advantage of NCR's bundled software because it can be used without modification about 80% of the time.

The three compiler languages formerly available for programming the Century 50 — Cobol, Fortran II, and NEAT/3 — have been augmented by a fourth, Basic. The latter is a simple yet quite powerful general-purpose language that is easy to learn and permits even novice users to start programming quickly. Cobol and Fortran II are standard languages used for business and scientific applications, respectively, and are widely familiar to programmers. NEAT/3 is NCR's own multipurpose compiler language with report program generator capabilities, among many others.

Additionally, the Century Series supports many utility routines and an operating system for simplifying the programmer's job. Utility routines include a variety of sorting operations. Also available are routines for the following functions: copying data from one type of file to another, comparing data files, generating program test data, program checking, debugging, file-to-file conversion, and printout in the form of cross-referenced flowcharts.

The operating system handles all I/O functions, including those involved in simultaneous operation of multiple peripherals. It also performs program loading and program-to-program linkup. The system's dating facility permits date-referenced programs, such as end-of-week or end-of-month reports, to be run. With this

facility the operating system manages a dating scheme with a duration of up to 3 years, maintains a daily log on system operations including systems status, abnormal conditions, and others, and provides for long-term log maintenance.

DESIGN FEATURES

The Century Series uses a far greater number of index registers that are customarily found in such relatively low-cost systems. Because the large number of registers greatly simplifies the software-command structure, the series affords the user exceptional processing flexibility. All members of the Century Series also have what amounts to three-way simultaneity — reading, processing, and printing.

NCR offers a moving-head disc storage system with an unusually large number of read/write heads per recording surface. Each of six recording surfaces can be accessed by a moving arm with 12 read/write heads. As a result, up to 256K bytes of data can be stored and recovered without the delay of repositioning the access arm. Thus, the user who wants to process sequential data of less than a few thousand items, such as product lists or customer lists, can do so efficiently on the Century 50. The organization of the disc files is also unique in that sequential blocks of data are not stored contiguously but are diagonally opposite each other on the disc. This arrangement allows enough time for data in the first sector to be processed and then, half a revolution later, written into the second sector, and so on.

For the user who requires a huge data bank capacity, the Century 100 offers CRAM, a mass storage capability unique among small business computers.

All members of the Century Series make extensive use of integrated circuits. Large numbers of a single basic circuit are variously interconnected and used for all data processing functions. Standardization also extends to the plug-in printed circuit boards which comprise the bulk of the system's circuitry. The Century 100, for example, uses only 81 circuit boards, and 80% of them are of six standard types. This design commonality not only simplifies maintenance but also makes it easy to learn the system.

PERFORMANCE

The Century 50 is well suited to users of punched card or electronic accounting machine

data processing who are upgrading to a more powerful, more flexible system. It is marketed as a competitor to the disc-oriented version of IBM's System/3 Model 10. The NCR machines fare well in a feature-by-feature comparison except in the area of main memory. Century 50 and Century 100 have 32K-byte maximum capacities, compared to 49K bytes for the System/3 Model 10.

Although NCR markets the Century 50 as a direct competitor to System/3 Model 10, there is a basic difference in the orientation of the two series. System/3 is intended for users who are novices in electronic data processing. Thus, while it has a batch processing capability, its design emphasis is on interactive processing through a typewriter keyboard. The Century Series, however, is designed as an upgrade from punched card or electronic accounting machine installations and is strictly intended for batch processing. Its typewriter is an optional feature that serves primarily for communication with the CPU.

NCR emphasizes the programming capabilities of the user's own EDP staff, and has developed training methods designed to build staff skills quickly. This approach results in high installation productivity because the user's staff has shared in software development.

MAINTENANCE

Maintenance for the Century Series is available through the almost 300 NCR service offices in the United States and Canada and the approximately 900 overseas offices. This series is easy to service because its high degree of circuit standardization makes possible the correction of virtually all malfunctions with a handful of plug-in replacement circuit boards. Therefore, system downtime is kept to a minimum. The standard service contract offers maintenance during any selected 8-hour period between 8 a. m. and midnight, and special arrangements can be made for 24-hour service at higher rates.

HISTORY

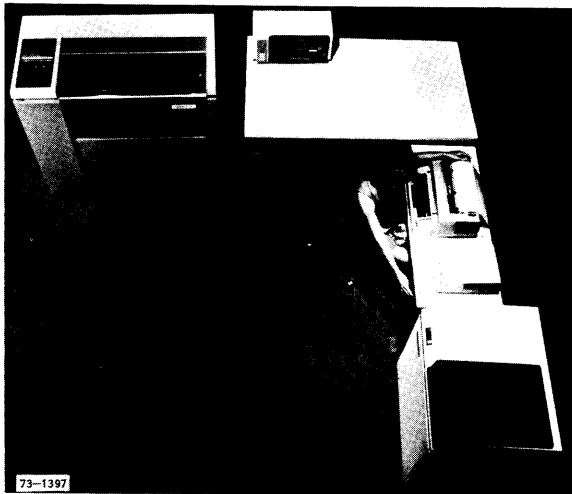
NCR, founded in 1882, is one of the two largest manufacturers of electronic accounting machines and one of the six largest computer manufacturers. The firm manufactures a full line of data processing equipment and offers related products and services. Century 100 was introduced in 1968, and the Century 50 early in 1971.

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	8
Capacity (words)	16K-32K
Cycle Time (μ sec)	0.8
Working Storage	Rod (thin film)
AUX STORAGE	Disc; magnetic tape; magnetic cards (CRAM)
DATA OUTPUT	
Line Printer (lpm)	200; 300; 450
Serial Printer	Yes
Card (cpm)	60-180
Paper Tape (cps)	200
DATA INPUT	
Keyboard	Optional
Card (cpm)	300; 560; 750
Paper Tape (cps)	1,000; 1,500
SOFTWARE	
Assembler	Yes
Operating System	Yes
Compiler	Basic; Cobol; Fortran; NEAT/3

QANTEL

Qantel System



OVERVIEW

The Qantel System is a small business computer actively marketed for banking, distribution and telecommunication applications. It is sold in 5 basic configurations that vary only in amount of main memory. The Qantel System enjoys widest acceptance in banking applications. Nine out of the top 20 banks in the country including 3 branch offices of the Federal Reserve System use the Qantel System as an integral component of their data processing installations. Qantel Systems are used for funds transfer, coupon securities collection, securities custody, broker accounting, and international letter of credit operations.

Qantel units are also functioning as self-contained systems for distributors, providing comprehensive inventory control, pricing, discounting, and complete accounting reports.

Qantel systems also provide complete data processing services for meat packers and processors. MIMS (Meat Information Management System) satisfies the need for tight receivables control, and for immediate adjustment to price fluctuations in the commodity market. It also provides payroll, discounting, and portion control in mixture blending.

Medical clinics constitute still another area of specialization for Qantel. In this market the systems provide faster receivables turnaround, more detailed reports than those available from service bureaus, more sophisticated appointment scheduling and better overall control of data and medical clinic management information.

The Qantel System can transparently communicate with host computers from many manufactur-

ers, such as IBM, Univac, and Burroughs. It can simulate the IBM 2701, 2740, 2770, and 2780 as well as the Univac 1004, Burroughs TC 500, and Control Data UT200. It provides communication at rates up to 9,600 baud synchronously and 2,400 baud asynchronously, as well as at Telpak speeds (40K and 50K baud).

System peripherals include tape and disc, alphanumeric CRTs, line printers, card reader, paper tape reader/punch, and communication line controllers.

Along with business-oriented application software, Qantel supplies an assembler, an RPG compiler, and a number of housekeeping routines.

On-site maintenance is available from a field service organization of approximately 30 people located in 14 nationwide service centers. Maintenance contracts are available for leased systems. Purchased systems carry the typical 90-day warranty, with an optional contract available for maintenance. System engineering is available at offices located in New York and San Francisco.

CONFIGURATION GUIDE

A basic Qantel System includes a processor with 4K, 8K, 16K, 24K, or 32Kbytes of memory, an I/O typewriter (with buffer), and a power supply. The I/O typewriter is an IBM Selectric Model 735. In a source data entry environment, the system uses an alphanumeric video display terminal, a 10-key numeric pad, and the I/O typewriter. Data entered into the processor is edited (or verified) and stored internally, or it is written onto magnetic tape or disc. Data stored on tape or disc can be transmitted for communications applications.

For other applications, output can be the I/O typewriter, line printer, paper tape, disc, or magnetic tape.

Input can be from a card or paper tape reader, disc, or magnetic tape as well as the I/O typewriter. Disc drives that store 7.6 million, 30.7 million, or 60 million bytes and 9-track magnetic tape drives that use 600- or 2,400-foot tape reels are available for storage. Three line printers provide printing speeds of 60, 200, and 245 lines per minute. They print up to 132 characters per line on multi-part paper for an original and up to 5 copies. Paper can be standard, continuous fold edge-punched, and from 4 inches to 19-7/8 inches wide. The card reader reads standard 80-column cards at a speed of 300 cards per minute. The paper tape reader/punch operates at 50 characters per second for reading or punching. It is

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unbuffered, thus it suspends processing while it is operating.

Three CC model controllers use a microprocessor with 2K bytes of memory to control data communications lines, to add 12 I/O channels to a Qantel System and to control up to 8 CRT displays in a data communication network.

Model CCA-1 handles transmission speeds up to 1,800 baud asynchronous, and 9,600 baud synchronous. It can also operate at Telpak speeds of 40K to 50K bits per second. It operates with any serial-by-bit data set or other data sets with an EIA interface and handles automatic calling units. It can also communicate with other computer systems using the IBM bisynchronous communication mode.

Model CCB-1 communication line multiplexer that includes a remote controller can handle up to 12 Qantel I/O controllers. Model CCC-1, a display concentrator can handle up to 8 CRT displays in a data communications network.

Communication controllers that do not use the microprocessor are available for unbuffered synchronous and asynchronous communications and buffered asynchronous communication.

A Qantel System is mounted in an office desk configuration. It comes in various colors to match office decor.

Performance and Competitive Position

The Qantel System has sufficient processing and communications capability plus supporting peripherals to compete on many fronts, as a small business computer, remote batch terminal, intelligent terminal, line controller, and communication processor.

It offers flexible system configurations. The microprocessor controller for data communications can effectively double I/O throughput. Other I/O features include a wide range of peripherals with paper tape, punched card reader, 3 printers, 5 tape drives, and 3 disc drives.

An interesting system asset is the ability to store microprograms in main memory as well as in ROM.

Communication features include modularity and high speed. Modularity is provided by low-cost communication controllers, and the higher-cost but more powerful microprocessor.

On the negative side, the peripheral line does not include a card punch (which could limit its use in a remote batch environment). Also, the Qantel system has no magnetic tape cassette capability.

Probably the most significant minus is software. The system lacks a full-scale operating system though one is currently in preparation and on schedule for November 1973 introduction. Qantel offers an assembler and an RPG compiler for program preparation. The application program library is still limited but growing. Qantel has conserved its resources by specializing and developing complete packages for specific applications.

Users that we contacted were unanimous in feeling that the Qantel system offered very good performance for its price. They also liked the use of an IBM Selectric for input because it requires no operator retraining for the system.

Users also mentioned that the Qantel is simple to install and operate, it is rugged, communication facilities are good, the system is flexible, and uptime is good. One user quoted an uptime of 93 to 94 percent.

The most consistent negative comment users made about Qantel was that maintenance service could be improved. Only 1 user that we contacted said the maintenance was good, another rated it fairly good. Two other users felt the service was improving. Another commented that the limit of 4 typewriters per system could cause some difficulty and that users needed more programming assistance such as turnkey application packages.

Despite the drawbacks mentioned, users were generally expanding their installations by buying more Qantel Systems.

MAINFRAME

Table 1 lists the Qantel mainframe characteristics.

The Qantel processor is a stored program minicomputer constructed almost entirely of integrated circuits. Program and data storage is provided by an integrated circuit, byte-oriented memory. The standard memory unit is 4,096 bytes. Field expansion to 8,192, 16,384, 24,576, or 32,768 bytes of memory is optional. Table 2 lists the data formats used by the system.

Internal processor control is a function of microinstructions executed in a read-only memory (ROM). ROM contains fixed nondestructive memory for the execution of user macroinstructions. The standard ROM is 1,540 bytes. Access time is 50 nanoseconds. If a different or special micro (control) program is needed, the user can simulate ROM in main memory by loading additional microprograms with a special instruction. Typical instruction execution times are listed in Table 3.

Table 1. Qantel System: Mainframe Characteristics

Characteristic	Qantel System
Central Processor	QA-s, QB-2, QC-1, QF-1, QD-1
No. of Internal Registers	0
Addressing	
Direct (no. of words)	32,768
Addressing	
Direct (no. of words)	32,768
Indirect	Multi-level
Indexed	No
Instruction Set	
Number	51
Decimal Arithmetic	Yes
Floating Point	No
Priority Interrupt System	
Lines	1
Levels	Software
Main Storage	
Type	Core
Cycle Time (μ sec)	1.5
Basic Addressable Unit	Byte
Bytes/Access	
Min Capacity (bytes)	4K, 8K, 16K, 24K, 32K
Max Capacity (bytes)	32K
Increment Size (bytes)	4K
Parity	No
Protect	No
ROM	Yes
Use	Control memory
Capacity (bytes)	1,540
I/O Channels	
Programmed I/O	Std
DMA Channels (no.)	12 Std
Max Transfer Rate (bytes/sec)	
Within Memory	6K
Over DMA	668K

Table 2. Qantel System: Data Formats

Name	Representation
Byte	8 bits
Word	1 byte
Operand	
Binary	1 to 16 bytes (unsigned)
Decimal	1 to 16 dec digits
Transfer Code	ASCII
Internal Code	Hexadecimal

Table 3. Qantel System: Typical Instruction Execution Times

Instruction	Execution Time (μ sec)
Load/Store	32
Binary	
Add	40
Decimal	
Add	40
Subtract	40
Multiply	500
Divide	650

The system has 12 standard I/O channels. The CCB-1 multiplexer extends the I/O bus so that it can handle 12 additional device controllers. Up to 3 multiplexers can be added to a system.

Up to 9 of the 12 standard I/O channels can be used as direct access (to main memory) channels. The maximum direct access data transfer rate is 668K bytes per second.

PERIPHERALS

Table 4 lists the peripherals available for the Qantel System.

I/O Typewriter. The I/O typewriter is an IBM 735 heavy-duty Selectric[®], which can be operated (off-line) as a normal typewriter. No separate DC power source is required. The basic system contains a buffered controller to provide proper interface with the Qantel processor.

The typewriter uses 15.5-inch paper. Horizontal spacing is 10 characters per inch, while

[®] Selectric is a registered IBM trademark

Table 4. Qantel System: Peripherals

Peripheral Device	Performance Characteristics	Comments
AA-2 Programmer's Control Console	Indicators and switches to display and modify contents of internal registers and memory	For program debugging and processor troubleshooting
AB-1 10-Key Numeric Input Module	32-char buffer; readout tube for no. of digits entered and 2 indicator flags	Desktop device
AF-1 Video Display Unit	CRT display area 12"; 27 lines; 74 char/line; 64 ASCII char set; A/N keyboard; 10-key numeric keyboard	Includes controller; normally configured with up to 6 system
AC-2 Card Reader	Reads 500 cpm; translates Hollerith to ASCII	Uses 80-col cards; reads col by col
AD-1 Paper Tape Reader/Punch	Read and punch speed 50 char/sec	Unbuffered
PA-1 Extra I/O Typewriter	Typing speed 15 char/sec; fully buffered	IBM Selectric Model 735
PO-1 Serial Printer	Print speed 60-100 lpm; 132-char lines; 63 ASCII char set; uses 5 x 7 dot matrix; 1 original and 4 copies	Has full line buffer; prints 10 char/inch horizontally and 6 lpi vertically; paper width up to 14.75 inches
PB-2 Line Printer	Print speed 200 lpm; 132 char/line; 64 ASCII char set	Has full line buffer; prints 10 char/inch horizontally and 6 lpi vertically; paper width up to 14.75"
PC-1 Line Printer	Print speed 245-1,120 lpm; 24 to 132 char/line; 64 ASCII char set; 1 original and 5 copies	Has full line buffers; 10 char/inch; 6/8 lines/inch; uses std continuous fold-paper 4 to 19.875" wide
PE-1 Line Printer	Print speed 700-1,800 lpm (depending on char printing); 132-col line; 64 ASCII char set; 1 original and 5 copies	Has full line buffer; 10 char/inch; 6/8 lpi; uses std continuous fold paper 4 to 19.875" wide
MF-1 Magnetic Tape Drive	9-track; NRZI-IBM compatible format; 800 bpi; 10K byte/sec transfer rate	1 unit/controller; controller included; 600' reel
MJ-1 Magnetic Tape Drive	Same as MF-1 except 20K byte/sec transfer rate	Requires CJ-1 controller for up to 4 drives; 600' reel
MK-1 Magnetic Tape Drive	Same as MJ-1 drive	Same as MJ-1 except uses 2,400' reel
ML-1 Magnetic Tape Drive	9-track; PE-compatible format; 1,600 bpi; transfer rate 40,000 bytes/sec	Requires CL-1 controller for up to 4 drives; 600' reel
MM-1 Magnetic Tape Drive	Same as ML-1	Same as ML-1 except uses 2,400' reel

Table 4. Qantel System: Peripherals (Contd.)

Peripheral Device	Performance Characteristics	Comments
MD-1 Disc Drive	Capacity 7.6M bytes; 380 bytes/sector; 20K sectors; avg seek/avg seek/write time 55 msec	Integral controller; rotation time 25 msec
ME-1 Disc Drive	Capacity 30.7M bytes; 768 bytes/sector; 40K sectors; avg seek/write time 55 msec	Integral controller; rotation time 25 msec
MP-1 Disc Drive	Capacity 61.4M bytes; 768 bytes/sector; 80K sectors; avg seek/write time 55 msec	Integral controller; rotation time 25 msec

vertical spacing is 6 lines per inch. Typing speed is approximately 15 characters per second. This low speed is partially prevented from degrading the system's normal operating speed through use of a 128-character buffer. In addition, the controller translates the processor ASCII code into typewriter correspondence code.

Serial Printer. One serial printer is available. The model PD-1 uses a 5 x 7 dot matrix, prints 132 characters per line (buffered), at a rate of 60 to 100 lines per minute, and makes an original and up to 4 copies.

Line Printer. Three models — PB-2, a chain printer, prints 140 to 250 lines per minute; PC-1, a drum printer, prints 245 to 1,100 lines per minute; and PE-1, also a drum printer, prints 700 to 1,800 lines per minute. All are impact printers and feature 132 print positions per line. All printer controllers have a 1-line buffer. All 3 printers use an ASCII character set and can produce an original and 5 copies.

Paper Tape. The AD-1 reads or punches 5-, 6-, 7-, or 8-channel paper or mylar tape at a speed of 50 characters per second. Reel capacity is 1,000 feet. It is unbuffered, thus processing is stalled while it is reading or punching.

Card Reader. AC-2 reads 80-column cards, at 500 cards per minute; it translates extended Hollerith (256 characters) code to ASCII.

CRT. AF-1 CRT has a 12-inch screen, a storage capacity of 1,998 characters, 27 lines of 74 characters each, a standard typewriter keyboard with the full 64-character ASCII set, plus a 10-key numeric pad. An integral controller allows the attachment of up to 6 CRTs. The display uses 2-level video intensity for distinction between background and foreground data. The cursor is programmable.

10-Key Numeric Input Module. Model AB-1 uses a standard 10-key adding machine style keyboard, is designed for numeric data entry, has a 31-digit buffer, and has an audible program-controlled signal that warns an operator of an incorrect procedure.

Programmer's Control Console. The model AA-2 console is used to troubleshoot the processor or debug user programs. It allows usual debug functions such as display or modify memory address register, memory locations, and other registers.

Voice Response Controller. The unit allows access to computer files from touch-tone telephones, and prerecorded human voice response. It is well suited for inquiry and verification since any touch-tone telephone can be used as an inquiry station. The effectiveness of voice response units for data entry is limited by the lack of normal input controls. A hard-copy record of entries is not recorded unless it is printed at the central computer site. The inexperience of the people using the units is overcome by verbal instructions preceding each step.

A vocabulary of up to 16,000 words can be stored on Qantel's 30.7 million-byte disc. The customer selected vocabulary can consist of phrases of up to 1,000 words. The phrases can be varied, and used in combinations. The controller is a 2K microprocessor connected to a direct access channel. Each controller can communicate with 2 telephones, and up to 4 controllers can be used with a Qantel.

Disc Drives. Three drive models are available: MD-1 with 10 read/write heads is in the IBM 2311; it has a capacity of 7.6 million bytes stored in 380-character sectors; ME-1 and MP-1 are in the IBM 2314 class; each has 20 read/write heads and stores data in 760-character sectors.

QANTEL SYSTEM

The ME-1 stores 30.7 million bytes and the MP-1 stores 61.4 million bytes. Rotation time is 25 milliseconds; average seek-and-write time is 55 milliseconds. To minimize search time, a randomizing routine rather than an index sequential routine is used to address disc sectors directly.

The drives contain their own controllers, which have full-sector buffers. This allows automatic write/read and check/rewrite operations independent of the program. Overlapped seeking and reading is possible through a seek-and-read instruction. Bad spots on the disc are recorded in the file directory by the disc handler.

Magnetic Tape Drives. The Qantel system has 5 tape drives available. All use 9-track, industry-compatible, 1/2-inch-wide tape and have hardware-buffered controllers.

DATA COMMUNICATIONS

Qantel offers 3 families of communication controllers to interface to its system: the CA Series, the CB Series, and the CC Series. Table 5 summarizes the available communication devices.

The CA Series are unbuffered, and they operate in the half-duplex mode serial-by-bit with any data set using the standard EIA interface. Synchronous transmission speed is up to 4,800 baud, and asynchronous transmission speed is 75 to

2,400 baud. Transmission and reception speeds and modes are switch selectable. The controller can handle an automatic calling unit, and can operate unattended with automatic answering.

The CB Series are buffered asynchronous communication controllers that operates in the half-duplex mode at standard transmission speeds up to 1,800 baud. Transmission speed is switch selectable. The buffer holds 156 bytes. This controller operates with 103 or 202 serial data sets or 402D parallel data sets. It uses a 7- or 8-bit code with 1 start bit, and 1 or 2 stop bits. It can handle an automatic calling unit and can operate unattended, providing automatic answering.

The CC Series controllers use a microprocessor with 2K bytes of integrated circuit memory. The microprocessor transfers data with the Qantel System memory via the direct memory access channel on a cycle stealing basis. A Qantel System can support 3 Model CC controllers.

The Model CCA-1 is a buffered communications controller that can operate in synchronous or asynchronous, full- or half-duplex modes. It can communicate with any bit serial, Bell data set, or any data set with the EIA standard interface. It can also communicate with any computer system in the IBM BSC mode. Transmission speeds are up to 1,800 baud asynchronous and up

Table 5. Qantel/System: Data Communication Devices

Peripheral Device	Performance Characteristics	Comments
CA-2 Unbuffered Synch/ Asynch Communications Controller	Half-duplex; up to 4,800 baud synch and 75 to 2,400 baud asynch; transmission mode and speed switch selectable	Operates with any serial- by-bit data set with std EIA interface; handles auto call, auto answer
CB-2 Buffered Asynch Communications Controller	Buffer 156 bytes long; half- duplex; switch selectable speeds up to 1,800 baud; 7- or 8-bit code; 1 start bit; 1 or 2 stop bits	Operates with 103 or 202 serial data sets or 402D parallel data sets; handles auto call and auto answer
CCA-1 Buffered Synch/ Asynch Controller	Transmission speeds up to 9,600 baud synch or 1,800 baud asynch communicates with other systems in IBM BSC mode	Transfers data with Qantel memory over DMA chan- nel; operates with any serial-by-bit data set with EIA interface; handles auto call and auto answer
CCB-1 Communications Line Multiplexer	Extends I/O bus to handle up to 12 more I/O controllers	Includes remote control and power supply in cabi- net; up to 3/system
CCC-1 Display Concentrator	For up to 8 CRTs in data comm system	Includes display multiplexer

to 9,600 baud synchronous. The controller can handle an automatic calling unit and can provide unattended service with automatic answering.

The Model CCB-1 is a Communications Line Multiplexer to extend the Qantel System's I/O capacity by 12 I/O controllers. It includes a remote control unit and power supply housed in a desk or cabinet. The CCB-1 can handle any Qantel I/O controller except a Model CC Series controller.

The Model CC-1 is a Display Concentrator in a data communications system. It includes a multiplexer for 1 to 8 display units.

SOFTWARE

There are 4 basic types of software available with the Qantel system: (1) an assembler and RPG Compiler, (2) the terminal simulators, (3) application packages, and (4) a program library supervisor and an interactive editor for program modification.

Assembler

Qantel's assembler is very similar to IBM's 1401 Autocoder. The instruction set contains 51 business-oriented instructions, which include decimal arithmetic, bit/byte manipulation, branching, and I/O. All instructions are of the 1- or 2-address type. Indirect addressing is included as a standard feature.

Actual program execution is accomplished by executing any number of the 87 microinstructions

in the ROM. The microinstructions are addressed and initiated by the 51 user program instructions (macroinstructions). A special feature of Qantel's microinstructions is that they can also be loaded from main memory.

RPG

Qantel's RPG is a subset of the RPG language and its associated compiler. The compiler generates absolute object programs to run on any Qantel system. The compiler itself requires a Qantel system with a minimum of 8K, a system with a card reader and at least 1 magnetic tape.

This version of the language is not intended as either a file management tool or a system development tool. It is designed to simplify the writing of reports from existing fixed format files.

Software Simulators

The Qantel terminal simulation packages do not offer 100% plug-compatible replacement operations. Rather, they are about 90% functionally identical; the other 10% must be custom-written for a particular user. This is not necessarily a disadvantage. Customizing often allows the user to take advantage of some additional capability of the Qantel system over the terminal being simulated.

HEADQUARTERS

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SINGER

System Ten

OVERVIEW

WANTED: A small- to medium-scale business computer, flexible in terms of available peripherals, extensive communications capabilities, available on turnkey, competition for IBM System/360, System/3 and must be low cost, must not have operating system.

No operating system? In a third-generation machine that competes with IBM's 360/40?

In a world where the relationship between operating system software and hardware is finally being understood and developed, Singer has produced an operating-system-less computer that not only is selling well but has an impressive array of very satisfied customers.

Singer's System Ten is small- to medium-scale business computer used both by small businesses that do not need or cannot afford larger computers, and by very large organizations with scattered work locations needing a network of on-site terminals to provide input to larger computers.

What characterizes users in almost all cases is that jobs being run on the System Ten are all of equal priority and are, for the most part, continuous (in-house data capture, such as retail sales and inventory monitoring).

What characterizes the system in most cases is its comparatively modest cost and its flexibility and ease of operation.

The simple message is: If you want to run programs of equal priority, or remote processing, or with a remote job entry terminal, there probably is no system better able to give equal weight to all jobs.

System Ten's ease of operation means that little training is required for its standard and special-purpose I/O terminals to be used by clerical personnel, sales persons, factory workers, hospital orderlies, and others. Users report as little as 2 hours are needed before a previously untrained person can comfortably use the system. Part of the ease of use comes from the fact that the System Ten does not have an operating system; therefore, there is no "operator," per se.

The System Ten is flexible. It provides time sharing and on-line information storage and retrieval with up to 20 simultaneous users and 200 I/O devices on one system. It can serve as a remote processor and I/O terminal for a larger

central computer such as an IBM System/360 or 370. The System Ten can combine batch processing with time sharing operations and offers multiprogramming.

The System Ten is available on a turnkey basis, complete with either standard or some customized application packages. A comprehensive set of utility routines facilitates programming. This includes routines for program loading, card and paper tape reading, punching, verifying, and duplicating. In addition, common calculating routines are available, as are sorting and merging programs for both disc and magnetic tape, and computer-to-computer communications programs.

Languages available are RPG and Assembler.

The availability of special-purpose peripheral equipment, which replaces such devices as automated time clocks and semiautomatic merchandise checkout terminals also lends flexibility to System Ten. Special-purpose peripherals include employee badge readers and cash-register-type terminals with merchandise tag readers.

The System Ten's flexibility is due to the modular design of the system architecture. The multiprogramming is provided by a round-robin, time slicing priority system that is monitored by hardware without the use of an operating system. Plug-in 10K increments of core memory expand the system from the smallest configuration up to a total of 110K. Simple 2-wire connections hook up I/O terminals up to 2,000 wire-feet away from the central processor.

System Ten's field expandability means that operator stations or more storage modules can be added at the installation site without interrupting the operation. As a result, users can start out with small systems and expand to larger configurations as needed.

Although Singer itself is only a recent entrant to the ranks of computer suppliers, its Friden division, which originally manufactured and sold System Ten, was founded in 1934 and is currently one of the largest manufacturers of desk calculators and accounting machines. As a result, Singer has an excellent understanding of the data processing needs of the business community, considerable expertise in manufacturing equipment to meet those needs, and detailed knowledge of the specific requirements of its accounting machine customers, many of whom may be considering a change to electronic data processing.

CONFIGURATION GUIDE

Two basic processors, Model 20 and 21, and three basic configurations exist. Each of the configurations, the 101, 104, and 106, has been designed for a specific application and requires certain minimum equipment. In addition, each configuration can add optional equipment or increased quantities of the minimum required items.

The minimum and maximum hardware configurations for the Model 20 processor appear in Table 1.

The Model 21 processor differs from the Model 20 in that its common area can be as large as 65K; it supports indirect addressing, has a new instruction, and does not support the "privileged common" feature of the Model 20. Singer also advises that users convert to Assembler II and DMF II to fully utilize the Model 21.

One result of the new processor is that users can now execute a program up to 75K bytes in length (65K common and 10K in the partition).

Series 20-101. There are 2 versions of the Series 101 Configuration: Model 101-RJ and Model 101-TP. Both versions are oriented toward communications facilities, either synchronous or asynchronous. Both units in this series use the Model 80 CRT Display as an input device, and offer punch card or other processing equipment only in the maximum configurations. Disc storage (8 million characters) is available only in the largest configurations of this series.

Series 20-104. The Series 20-104 configuration handles larger volumes of data that can be handled by the 20-101 configuration, and has more extensive terminal capacity and greater expansion capability than the 20-101, including the use of punched-card equipment.

Because of its greater memory, this configuration can use the more powerful versions of Singer's file management software. Disc capacity can be from 20 million to 100 million characters; and for each additional hardware partition (maximum 20) another 10 I/O devices can be added. This gives a theoretical maximum of 200 terminals with up to 20 simultaneous data entries.

In addition, the 20-104 configuration can be used not only as a local computer, but also as a front-end computer to process and summarize data before transmission to a larger central computer system via wires, tapes, or disc. It does not handle data communications devices.

Table 1. Singer System Ten: Hardware Configurations for Model 20 Processor

SERIES 101	
Model 101-RJ	
Minimum	
1 Model 20-101 processor with 10K core	
2 I/O channels; SCA, ATA, or ACA	
1 Model 53, 54, 55 or 56 Line Printer	
1 Model 80 CRT Display	
Max Additional	
20K additional core	
1 additional I/O channel	
Additional Model 80 CRT, Model 31 Card Readers, Mdl 35 Card Punches or Line Printers, depending on I/O ports	
Model 101-TP	
Minimum	
1 Model 20-101 processor with 20K core,	
1 FAC; 1 disc controller; 2 I/O channels,	
1 SCA, ATA, or ACA	
1 Model 42 Disc Drive	
1 Model 53, 54, 55, or 56 Line Printer	
1 Model 80 CRT Display	
Max Additional	
10K additional core	
1 additional I/O channel	
Additional Model 31 Card Readers, Model 35 Card Punches, Model 80 CRTs, or line printers, depending on I/O ports available	
SERIES 104	
Minimum	
1 Model 20-104 processor, with 20K core,	
1 FAC, 1 disc controller, and 2 I/O channels	
2 Model 70 workstations or 2 Model 80 CRT Display (CRT requires line printer)	
2 Model 40 disc drives	
Max Additional	
Any device except Model 42 split disc and SCA or ATA communications adapter; includes additional core to max 110K, workstation, CRT, regular disc, line printer, mag tape, card reader or punch, paper tape reader or punch, JIS, attendance terminal, digital clock; total disc capacity: 20-100 mc	
SERIES 106	
Minimum	
1 Model 20-106 processor, with 20K core,	
1 FAC, 1 disc controller, 3 I/O channels (for nondisc communications systems, omit FAC and disc controller).	
Max Additional	
Additional core to max 110K; any System Ten peripheral including SCA or ATA communications adapter, workstation, CRT, split or regular disc, line printer, mag, card reader or punch, paper tape reader or punch, communications terminal, JIS, attendance terminal, or digital clock; total disc capacity: 20-100 mc (same as 20-104).	

Series 20-106. Communications-based remote batch processing is the key concept for the 20-106. The 20-106 processor configuration can use a wide variety of terminals and communications devices to process source data off-line before its transmission to the host computer. Of the 3 configurations, the 20-106 is the most flexible in variety of applications, and is the most easily expandable because it can accommodate any Singer peripheral device without restriction. It can serve as an intelligent terminal (for example, 1 or more processors can appear to the host computer as an IBM 2780 remote job entry terminal) and has advantages in cost/performance over the other 2 configurations.

Special Capabilities

Singer System Ten is distinguished by certain hardware features that give it a personality all its own.

Modularity. Memory, additional I/O channels, and additional peripheral devices are simply plugged in. All components are upward compatible.

Hardwiring of Peripherals. Slow-speed devices such as CRT and typewriter (workstation) terminals, line printers, card and paper tape readers and punches, are connected by a simple 2-wire interface and can be located as far as 2,000 feet from the central processor. In most cases special-purpose peripherals, for instance, point-of-sale cash-register-type terminals and badge readers, can be connected by the same 2-wire interface as far as 8 miles from the central processor. Each user partition has one I/O channel (IOC) and each IOC accommodates up to 10 terminals, depending on the terminal mix.

Disc and Magnetic Tape Capabilities. The System Ten magnetic disc and tape drives interface with the processor through a high-speed file access channel (FAC), which can handle up to 4 tape drives and up to 10 disc drives. This allows a generous maximum of 100 million characters of disc storage. Magnetic tape drives can handle either 7- or 9-track format that is compatible with other manufacturers' drives.

Easy-to-Use Terminals. Various I/O terminals, including CRT, keyboard, and special-purpose, have helpful console lights to guide an inexperienced user, so that little training is needed.

Hardware Multiprogramming. The System Ten memory is divided into a partition called Common and from 1 to 20 user partitions, each

of which shares the Common partition. The Common area stores subroutines and data that can be shared, to avoid duplication. Control of the processor by each of the user partitions is hardware monitored through a round-robin, time slicing priority system. Each partition receives 37.5 milliseconds for execution. Partition sizes are specified at installation, with a minimum of 1K increments.

The round-robin, time slicing priority system means that in the System Ten environment there can be no thing such as a rush job, or a priority queue of express jobs; the fact that an I/O interrupt prematurely terminates a partition's time slice means that an I/O-bound program's chances of being executed in a reasonable length of time, comparative to other competitive machines, are relatively slim. The only environment totally suitable for a System Ten is one with approximately equal programs with respect to I/O-processing balance and priority. This makes it an excellent remote processor.

Software. Singer System Ten software consists of 2 levels of assemblers with comprehensive sets of utility routines; the software also includes 2 report program generators, software packages for use when System Ten is employed as remote processor or input device for a large computer, and an extensive group of modules for business data processing. None of these language implementations or software packages is compatible with those of other computer manufacturers. The user has the option of obtaining the System Ten on a turnkey basis, complete with either standard or customized applications packages.

Performance and Competitive Position

Singer's System Ten computer is intended for business data processing such as sales order entry, invoicing, accounts receivable and accounts payable processing, inventory control, sales analysis reporting, general ledger processing, and payroll processing. Some work environments in which it has proved useful include the following: wholesale and retail merchandising for point-of-sale data collection, inventory control, and sales analysis; garment design and manufacturing business for analysis of styles, control of manufacturing and inventory; aerospace manufacturing organization for on-site scheduling of manpower and work priorities; a large hospital that uses it for 24-hour on-line control of supplies inventory and billing of services to patients; a large film-rental library in a state university for statewide film bookings; a large computer installation for locating and

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scheduling the use of thousands of reels of magnetic tape.

Comments from users indicate that System Ten was selected after comparisons with all other makes on the market led them to believe that, for the price, no other system offered the same advantages of on-line interactive processing combined with the modularity that permits easy growth. Users feel that System Ten requires little training, because any clerk typist can operate a terminal after a few hours experience.

In addition, users of larger computers are finding System Ten a useful supplement to or substitute for the larger computer. They are installing System Ten because of the advantages of having 1 or more small flexible computers in-house and dedicated to a specific project, rather than having to share a larger computer located elsewhere.

Some recent applications using System Ten include the following.

Hospital. A large general hospital developed manual procedures over a period of 5 years, to identify where drugs, supplies, and services such as surgical, nursing, and laboratory were used; to control inventory of drugs and supplies; and to bill patients for these items.

This hospital eventually needed a system that could be on-line 24 hours per day, could be run by hospital orderlies or unskilled personnel, and would cost less than time on a large computer. The hospital investigated the capabilities of IBM System/360 Model 40 and DEC's PDP-15 Series before looking at Singer System Ten. Features of the System Ten that held appeal and led the system's installation in the hospital were the combination of lower-cost, hardware-controlled multiprogramming; on-line conversational terminals; simultaneous operation of programs; ease of expanding the system for future growth; and the convenience of having small functional units that are job-oriented. This hospital has installed System Ten, using 2 computers with 8 CRT terminals and 2 typewriter-type workstation terminals, for inventory control and billing of customers. Supplies used, and doctor's and nurse's services, can be billed to each patient. A simple system in which information is typed by hospital orderlies at a terminal, for use in billing as well as automatic inventory control and reordering of supplies, has enabled the hospital to perform more accurate inventory control 24 hours per day; the system has also reduced inventory from a 150-day stock level to a 30-day

level, as well as to decrease losses on inventory items by more than \$500,000 a year.

University. A large state university has installed a System Ten with 30K core for scheduling bookings of rental films that are distributed to schools across the state. The film library has more than 9,000 film titles, with 1 to 35 prints of each film. Schools order a film for as many days as needed. Scheduling must be done as much as 16 months in advance; there are as many as 120,000 bookings per year.

One requirement that the library expected the computer to meet was the on-line retrieval of information. Singer System Ten was the only computer that met the requirements of low cost, on-line processing, and flexibility to perform various functions. IBM System/3 was not on-line but merely card based.

Now with a System Ten and an on-line interactive terminal, the personnel can determine immediately if a request can be honored on the date requested, or if alternate dates are available. The computer prints shipping documents for confirmed bookings and can report on failures to book as requested, thus pinpointing the need for additional prints of some films. Use of its System Ten has enabled this film library to handle requests more efficiently and to reduce the costs of manpower and film rental.

Life Insurance. A large life insurance company uses a large computer, and has more than 65,000 computer reels that it needs in processing insurance transactions that used to be manually card indexed. The facility needed to improve turnaround time on jobs and cut down lost-reel searches; at the same time, the tape library was growing fast. There was an additional need for features that would enable keeping track of maintenance information.

Before deciding on the Singer System Ten, management compared prices of alternatives. The manual system was costing \$98,000 a year; to use in-house telecommunications system (IBM) would cost \$250,000 a year, while a modified version of this would cost \$134,000 a year.

The Singer System Ten was estimated as \$61,000 a year. It is used with on-line terminals to index tape reels, provide on-line reel status information, supply information needed to bill charges to user departments, and furnish maintenance reports needed for cleaning and recycling tapes. System Ten is on-line 24 hours per day, has saved up to \$20,000 a year in employee time

over the manual system, and has allowed the company to provide better service.

Auto Parts. An auto parts dealer with remote branches has installed a System Ten with on-line terminals, for inventory control and shipping of more than 45,000 auto parts.

Aircraft. A large aircraft manufacturer with 8 scattered facilities used to depend on manual clerical procedures to obtain information on the status of all manufacturing operations. Major considerations in the selection of a new system were flexibility to support a number of systems, capacity to handle more information, operating simplicity, and ability to handle transactions quickly with an audit of data entered. Singer System Ten met these requirements and within an economical price range.

Eleven System Tens are installed as remote processors and input terminals for large IBM System/360s. Input to the System Ten computers is from 492 job information stations and 140 attendance terminals (badge readers). Job information stations are programmed to display information pictorially. Data from 16,000 hourly workers forms a massive data base that supports 18 major information systems. The terminals are used to record time, attendance, and work in progress. At 7:00 a.m. each day, action reports are available for shop foremen to use in scheduling, determining priorities, and planning manpower and equipment requirements.

Sales. A company with many sales representatives, selling cosmetics directly to about 50,000 customers, has installed 3 System Tens with 7 on-line CRT terminals and an array of data terminals for point-of-sale data collection that is being enlarged from about 20 terminals to about 70. One System Ten is used for inventory control, another for general ledger and accounts payable; the third System Ten is used for data on sales to the 50,000 customers. This system polls the remote locations. As the company opens more outlying locations, it plans to install more data terminals.

Retail/Mail Order. A very large chain of retail stores and mail-order catalog facilities, with 836 stores and more than 1,200 catalog sales offices, as well as warehouses and business offices, has installed a large network of System Ten computers with Singer Data Terminals for point-of-sale data collection; the systems serve as remote data collectors and processors for 33 IBM System/370s. There are 200 System Tens connected to up to 18,000 Data Terminals.

In addition, the chain of stores is experimenting with reading wands attached to the data terminals, for reading credit cards and sales tags. This technique not only speeds up checkout lines and cuts credit losses, but also it controls inventory, assists in ordering, provides sales data, handles numerous accounting and personnel records, and ties in about 1,000 of the company's largest suppliers to the purchasing offices.

Compatibility

All System Ten configurations are upward compatible with each other. Additionally, the System Ten is compatible with the various Singer special-purpose peripherals such as the MDTS point-of-sale system and the job information system (JIS). The languages supported by System Ten are not compatible with those of any other computer; however, data format is compatible with IBM System/360 and 370 equipment in all categories except disc files.

Internal data format in System Ten uses a 6-bit subset of ASCII. For 9-track magnetic tape output, data is converted to ASCII and written on the tape in a format compatible with that used by most other manufacturers' tape drives.

Evolution and Maintenance

The first customer delivery of System Ten was made in 1970, and by the end of 1972 more than 800 installations had been completed. The capabilities of the central processor, and the variety and nature of peripherals, have been expanded and refined as experience dictated. Singer offers maintenance for System Ten through its worldwide network of over 400 sales and service offices. Users interviewed commented that maintenance is dependable and available on short notice, often within an hour.

MAINFRAME

Product specifications for the System Ten appear in Table 2.

Central Processor

Data Structure. System Ten uses 6-bit characters. Data fields are variable in length and can contain up to 10,000 characters, depending on the instruction being executed.

Instruction Set. System Ten uses 13 machine instructions. Each machine instruction word is 10 characters long. Most instructions specify 2 operand addresses; each operand address is 4 characters long.

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Table 2. Singer System Ten: Specifications

PROCESSOR	
Main Memory (kc)	10-110
Char Size (bits)	6
Addressable Registers	3/partition, except Common
Cycle Time (μ sec)	3.3
No. of I/O Channels	1 slow-speed/ user partition; 1 high-speed (FAC)
Max Devices/Channel	10
AUXILIARY STORAGE	
Storage Medium	Disc
Capacity (mc)	4; 100
Transfer Rate (kc/sec)	229
DATA ENTRY	
Keyboard	Workstation; includes serial printer (15-25 cps)
Card Reader (cpm)	300
Paper Tape Reader (cps)	275
DATA OUTPUT	
Card Punch (cpm)	100
Paper Tape (cps)	150
Line Printer	132 col; 110-450 lpm
CRT Display	80 col by 20 lines
SOFTWARE	
Operating System	Multipartitioning via hardware
Assembler	Yes
Compiler	RPG

The operand fields have an alternate usage in I/O instructions. One operand field becomes the address of the I/O area, and the other the data count. If the addressed device is a disc, the second operand field is treated as an indirect address. All disc transfer must be 100 characters, so it is unnecessary to specify the count for disc operations.

Addressing Facilities. Every location in core can be addressed directly. A program instruction can directly address any location in its partition (10K max) and any location in Common (which is expandible to 65K in the Model 21 processor). Indirect addressing is available on the Model 21 processor. When an address in an instruction is indexed, the contents of the selected

index register are added to the address. Indexing of 1 operand address requires 31.1 microseconds, and indexing of both operand addresses requires 58.9 microseconds. There is no double indexing in System Ten.

Interrupt Control

Interrupts occur as a result of program checks and initiation of I/O instructions. When a single character is ready for I/O transmission, an interrupt is signalled by the IOC. The processor temporarily stops processing in whatever partition it is currently working, transfers the character, then resumes processing where it left off. If the processor should switch to a partition in which an I/O operation is in progress, it immediately switches to the next partition.

There are 6 causes of a program check: an out-of-limit address, a privileged area violation attempt, an attempt to store the protected area of Common, an invalid op code, bit 5 in any character of an instruction not being a 1 (Model 20 processor only), and a binary-coded-decimal value in excess of 9 in the numeric portion of a character fetched by the ACU.

Main Memory

Hardware partitioning divides main memory into partitions, with the size of each partition ranging from a minimum of 1,000 locations to a maximum of 10,000, in multiples of 1,000. In every System Ten computer, there must be 1 section of memory, called Common, of at least 1,000 locations, and from 1 to 20 user partitions. Thus, a minimum configuration of 10K might contain 1 core module divided into a 1,000-location Common area and a 9,000-location user partition. (Memory allocation is done by the Singer customer service representative at the time of installation, and can be changed easily by him when the need arises.)

Storage allocated to a partition is accessible in 1 of 2 ways: (to a program resident in that partition and to a program in Common that has been activated by the same partition. In either case, the storage is accessible only during the time slice allotted to that partition. Common does not have its own time slice; instead, programs in that area are activated by branching from a partition's program, and remain active only for the duration of the calling partition's time segment.

Reserved Storage. The first 300 character locations of Common are protected from program

alteration although they can be examined by any program. In this protected area, each partition has 3 fields used for storage and maintenance of program status and I/O control information. In the remaining Common area, 1,000-character segments, which are contiguous, can be designated as privileged area of Common (Model 20 only).

Input/Output Control. I/O control is established via the IOC for slow-speed devices (card readers and punches, paper tape readers and punches, line printers, and terminals) and the FAC for high-speed devices (magnetic disc and tape). The channel concepts are second generation in origin and result from the lack of an operating system in the System Ten.

IOC. A dedicated IOC is associated with each user partition and can control up to 10 devices. Data transfer via IOC is overlapped with processing on a cycle-stealing basis. Each IOC can support a data transfer rate up to 1.5K characters per second.

FAC. Each user partition shares the single FAC to access the magnetic disc and tape files. This architecture is necessary in order not to duplicate files used simultaneously by several partitions. FAC supports data transfer rates up to 330K characters per second. FAC can handle 1 tape controller with up to 4 tape drives, as well as 1 disc controller with up to 10 disc drives (an additional controller is needed for more than 4 discs). Devices on the FAC are available to all partitions although, through programming, it is possible to allocate these resources selectively by partition. Operations on the FAC must proceed sequentially; they will halt all processing activities but not operations currently proceeding on the IOCs.

Special-Purpose Channels. System Ten supports optional synchronous (SCA) and asynchronous (ACA) communications adapters and an asynchronous terminal adapter (ATA). SCA and ACA each replace 2 regular I/O channels and each attach to 1 user partition. ATA replaces one I/O channel and is attached to 1 user partition. Other partitions communicate with the SCA, ACA, and ATA partitions via the Common partition or disc or magnetic tape.

SCA allows programs to be transmitted between System Ten and remote computers via voice-grade communications lines. Over SCA, transmission can be 2,400 bits per second when over a dedicated line using a Bell Series 201 data set, up to 9,600 bits per second over a dedicated line using non-Bell data set, or 2,000 bits per second over the switched (DDD) telephone network, respectively.

ACA allows data to be transmitted over voice-grade lines between System Ten and asynchronous ASCII terminals, and to receive from Model 800 individual store-and-forward modules. Over ACA, transmission rates up to 1,800 bits per second are selectable under program control.

ATA allows data transmission between System Ten and low-speed operator-oriented terminals over voice-grade lines. Nominal transmission rate is established by hardwired connection and is from 110 to 300 bits per second.

PERIPHERALS

System Ten has a complement of slow-speed, high-speed, and special peripheral devices.

Slow-Speed Devices

Models 50 and 52 Line Printers. Both Models 50 and 52 printers are 132-column devices used for rapid data printout. They differ only in print speeds; the Model 50 prints up to 450 lines per minute, while the Model 52 only prints up to 110 lines per minute. A buffer stores data for 2 lines of print; buffering is necessary so that the output flow remains uninterrupted when the CPU is servicing another channel or peripheral device. Otherwise, an interrupt would occur with every byte transferred. Line printers are attached to the central processor through the I/O channels.

Model 53, 54, 55, 56 Line Printers. All 4 printers use a standard 64-character print set, 6 lines per inch, and 120 print positions. Their respective speeds are 125 lines per minute, 200 lines per minute; 300 lines per minute; and 400 lines per minute. Options include 132 print positions per line, 8 lines per inch, OCR A and B print drums, and 12-channel VFU tape for vertical tabbing.

Model 30 Card Reader and Model 35 Punch. Model 30 Card Reader is an 80-column, 300 card-per-minute reader that attaches to the CPU via an I/O channel. The 100 card-per-minute, on-line Model 35 punch connects to the CPU through a multiterminal I/O channel. Up to 10 readers or 9 punches can be serviced by a single partition.

Model 31 Card Reader. The Model 30 Card Reader reads 20, 51, 80, or 96-column cards at a speed of 300, 600, or 1,000 cards per minute (selectable at time or purchase.)

Model 60 Paper Tape Reader and Model 65 Punch. An on-line paper tape reader, Model 60 can read either continuous reels or strips of

punched paper or polyester tape at a rate of 275 characters per second. A Model 65 paper tape punch (companion unit to the reader) can punch 150 characters per second. Up to 10 readers and punches can be serviced by a single main memory partition.

High-Speed Devices

Model 40 Disc Drive. The disc pack (Model 41) is removable and accommodates 10 million characters. Average data access time is 73 milliseconds, and data transfer rate is 229,000 characters per second. Up to 10 drives can be on-line to the central processor, which provides up to 100 million characters of storage.

The disc drives are linked to the CPU through the disc controller on the FAC. When more than 4 drives are used, the fifth and successive disc drives require an auxiliary disc controller rather than the regular controller. Each disc read or write operation involves a 100-character transfer.

Model 42 Disc Drive. A split-disc drive, Model 42 features 2 separate and removable disc packs — 1 mounted on top of the other in a single unit. The resident pack (Model 41A) is used for active manipulation and filing of data, which then can be duplicated onto the other pack (Model 41B), called the "removable pack," and stored for file backup. Both the resident and the removable packs provide 4 million characters of storage capability. Access rate and data transfer rate are the same as for Model 40 disc drive. Up to 10 disc drives can be connected to a central processor.

Model 44 Disc Drive. The Model 44 Disc Drive uses removable and interchangeable disc packs with a total capacity of 40 million bytes. Two of these disc drives can be attached to the central processor through the disc controller and the FAC. Each Model 44 looks like 4 Model 40 drives (that is, has 4 logical subdivisions) to the central processor; the Model 44 can also be intermixed with Model 40 or 42 Disc Drives as long as the total number of logical devices does not exceed ten. Each disc pack constitutes 4 logical volumes.

Model 45 Magnetic Tape Drive. Model 45 reads and writes in a format compatible with most other manufacturer's tape drives. Magnetic tape, used as auxiliary storage or as backup for disc, is connected to the CPU via a tape controller attached to an FAC. Up to 4 units of the System Ten tape drives can be operated on-line.

Models are available for reading or writing on either 9-track or 7-track industry-compatible tape. Recording density on 7-track tapes can be either 556 or 800 bits per inch, and on the 9-track tapes is always 800 bits per inch. Both 7- and 9-track tape drives have maximum transfer rates of 20,000 characters per second. The 7-track drive normally reads and writes the System Ten 6-bit ASCII subset. The 9-track drive reads and writes in ASCII; it reads or writes unsigned numeric data in packed format or 8-bit codes, such as EBCDIC, by using a double-frame mode.

Special-Purpose Devices

Model 70 Workstation. A desk-type data entry keyboard and serial printer output device, the Model 70 Workstation provides interactive communication with the CPU and prints output at 15 to 25 characters per second. The workstation features a standard alphanumeric keyboard and prints a 170-character line using a pressure-platen forms handler. Optional features include a pin-feed forms handler. An operator panel assists the operator with indicator lights displaying system status. The workstation can serve as a load device when given device address zero.

Model 80 CRT Display. The Model 80 CRT is another interactive device for communicating with the CPU. It adds a 10-key numeric cluster similar to those on adding machines and unavailable on the workstation. Also, instead of the workstation's serial printer, it uses a CRT to generate a 1,600-character display in an 80-column by 20-line format. This display is fully buffered so that the CPU simply reads into the buffer the 1,600 characters of the display and then goes on to service another channel or I/O device.

The CRT display can be programmed to resemble a blank form onto which the operator "types" entries before feeding the entered data to the CPU. This is an advantage to a new operator because it shortens the question and response time between the computer and operator. The unit can be located up to 2,000 feet from the CPU, and 10 can be serviced by a single I/O channel.

MDTS Data Terminals (all models). Part of the Modular Data Transaction System (MDTS) for point-of-sale transactions, these cash-register-type terminals are used for remote data entry to the central processor. The MDTS terminals

also have the capabilities of a freestanding calculator, receipt printer, and totalizer. The compact units are particularly useful in a retail environment. They can be used with automatic tag readers for both detachable and non-detachable merchandise tags, as well as with credit card readers. Every transaction is recorded on an internally stored audit tape that can hold the details of approximately 400 transactions.

The CPU can, at any time, poll each free-standing terminal by telephone line for its magnetic tape contents and use the data to update the files. Tapes from every terminal can be processed at the end of each day or sent out. Further, directly linked terminals can be on-line to magnetic disc and/or magnetic tape files to ascertain customer credit limits, special customer discounts, and so on. Up to 180 such terminals can be connected by a simple 2-wire line to a single System Ten CPU up to 8 miles distant.

When the MDTs with data terminal is employed with System Ten, other equipment provided by Singer for use with MDTs includes the following: Line Switching Unit (LSU), Model 191; Individual Store and Forward (ISF) Module, Model 800; Asynchronous to Synchronous Transmission Adapter (ASTA), Model 850, Asynchronous Communications Adapter (ACA); and Modular Data System (MDS) I/O Channel.

Model 100 Job Information Station. The JIS is an intelligent terminal that guides the operator with a series of preprogrammed indicator lights on a display panel. It is used primarily for numeric data entry from a job station to a remote CPU. This device can read punch-coded employee badges and punched cards. It features a numeric keyboard for nonstandard data entry and a set of function keys.

JIS applications include monitoring work in progress, with regular reports directly from the manufacturing floor. Other manufacturing applications are stockroom, tool-room, and instrument-room inventory control. The JIS can also be used for check-in/check-out stations in libraries and warehouses, and as a nurses' reporting and communications station in hospitals. The badge reader with the JIS can be used separately as an on-line time and attendance recorder.

Model 105 Attendance Station. A special-purpose System Ten terminal, the Model 105 Attendance Station records employee in-and-out attendance. It is computer monitored, and holds in-

formation on up to 13 badges while establishing contact with the computer. Each station clock is synchronized with the processor system clock every 10 minutes.

SOFTWARE

The System Ten has no operating system in the conventional sense. It relies on its hardware interrupt schemes; buffered devices; hardware partitioning; and a round-robin, time slicing priority scheme to achieve its multiprogramming environment.

Even so, the environment achieved actually has no priority setup other than I/O interrupts and the 37.5 millisecond time slice (which in an I/O-bound program, or with an unbuffered device, can never be experienced).

Under normal circumstances, each partition must have dedicated to it whatever devices (except discs) that it will use. However, a multi-partition loader is available that allows a "blind" partition (core allocated, but no devices) to be used to absorb data from devices otherwise dedicated to another partition.

System Ten supports 2 levels of assemblers and of RPG compilers, as well as software for communications, business data processing, and disc file management. Since the system is available turnkey, a user doesn't have to worry about being able to find (or having to write) his own application.

The Disc Management Facility (DMF) software, utilizes a file organization and access method that enables the user to perform a wide variety of disc operations by entering logical commands through an on-line workstation or other input device rather than by executing assembler language instructions. A DMF system can use 1 to 10 disc packs and is divided into segments called pools. Each pool is given a 1- to 6-character alphanumeric name. The user accesses pools and files by using pool and file names with the control statements.

Communications software is designed solely for data communications processing, in which a Singer System Ten is linked to a remote larger computer, and serves as a remote processor or remote job entry input device for the larger computer. A System Ten can also communicate with another System Ten.

Assembler

The System Ten supports 2 levels, Assembler I and II. Assembler I is the less sophisticated

SINGER SYSTEM TEN

card version, while Assembler II is the disc version run under control of DMF. Source input can be a DMF file (accessed randomly by pool name and file name), or it can be input from any input device. Object code and listings can be output in DMF files or routed through any output device. Both assemblers require 9,000 locations in a partition; although Assembler I can use Common, Assembler II never does.

Both assemblers allow the user to process data; control the assembly process; format the assembly listing; and to define I/O areas, work areas, and constants. They also allow the insertion of debug instructions and provide an optional cross-reference listing. In addition, Assembler II provides for macro definition and expansion; conditional assembly; assembly-time variables, statements, and functions; extended mnemonics; literals; relocatable object code; a cross-reference listing that shows "where set" and "where used"; assemble-and-execute capability; additional assembler-control statements; indirect addressing; and disc storage of assembler work files, including a symbol table that allows the assembly of a larger program than can be handled by Assembler I.

Report Generator

RPG accepts input specifications from the user, specifying I/O devices, the format of the data file, and the calculations to be performed. Output of the report can be punched on cards, printed by a line printer, routed to a disc file or to a buffer area in Common. RPG requires 10,000 locations in a partition and can place the object program generated from the specifications either in a disc file or in a punched object deck.

Communications Software

Remote Job Entry Facility (RJE) comes in a basic version and a disc version. It is a set of programs used by System Ten for communicating over voice-grade lines while appearing as an IBM 2780 Remote Job Entry Terminal.

Thus, with RJE, a System Ten computer can serve as a remote I/O satellite for an IBM System/360 OS HASP system. In this manner, the

360 executes batch programs entered at the remote locations and transmits the output via communications lines to the original terminal, where the output can be printed or punched. One System Ten computer can accomplish up to 6 HASP-type remote operations. The disc version allows input to the data transmission system from DMF files resident on disc, without preparation of intermediate card decks or paper tape. Likewise, output received from the HASP system can be spooled to the disc.

Additional communications software includes the synchronous communications access method (SCAM), which is a set of 16 programs that control the synchronous communications adapter (SCA) I/O channel.

Modular Business Management System (MBMS)

The MBMS is a set of programs that provides business processing capabilities, including sales order entry, invoicing, accounts receivable processing, accounts payable processing, inventory control, sales analyses reporting, general ledger processing, and payroll processing. These parts are modular so that the user can purchase or lease only those modules that he needs. Each module can be individually adapted at modest cost. Minimum hardware configuration includes 1 workstation (used for messages from the system and responses with requested data from the operator), 1 disc drive, and a 10,000-location Common partition with one 10,000-location user partition.

Utility Software

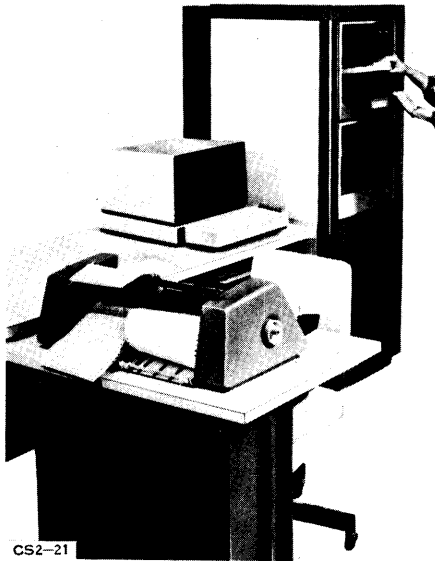
System Ten's complement of utilities includes routines for text editing, code translation, conversational testing, loading object cards, tracing, disc sorts, file copying, providing dumps, retrieving and modifying individual records from a disc file, and editing.

HEADQUARTERS

Singer Business Machines
2350 Washington Avenue
San Leandro, CA 94577

ULTIMACC SYSTEMS

Ultimacc



OVERVIEW

Ultimacc manufactures and markets an interactive data processing system geared to business accounting applications. The system is available in two models — disc and magnetic tape cartridge. Both models are marketed as upgrades for electronic accounting machine installations and are sold primarily as turnkey systems, including a comprehensive set of application programs and an operating system.

The Ultimacc systems are designed for operation by computer novices: all programs interactively direct the operator with step-by-step instructions. Up to 15 input/output devices can be connected to the central processor unit, which services them on a simultaneous basis.

Ultimacc's software concentrates on the rapid, automatic generation of business forms, accounting records, and management reports. Standard programs include the following monthly procedures: customer statements, profit and loss statements, aged trial balance, general ledger, and customer ledger card. Programs that run on a daily basis include: purchase journal, cash disbursements, cash receipts, sales journal, inventory report, reorder list, and month-to-date report.

Accounts payable and payroll-check writing are also included in Ultimacc's standard applications package, as are accounts receivable, invoicing, sales analysis, and job cost accounting where required. Ultimacc offers separately priced specialized management information report software.

Industry-oriented application software includes electronic parts distributors, decorative hardware wholesale distribution, fuel oil dealer delivery scheduling, customer accounting, and service history.

Additional industry-oriented program packages include book publishing; route accounting; wholesale distribution of foreign and domestic goods; and manufacturing of copper tubing, steel, silverware, and other industrial and consumer-oriented goods.

Two programming languages, Basic and Fortran IV, are also available for users who wish to develop their own software, either initially or after installation.

CONFIGURATION GUIDE

A basic Ultimacc configuration consists of a CPU mounted in an L-shaped desk console, with a wide-carriage serial printer and a compact magnetic tape cartridge file unit on the desktop. The CPU has an 8K-byte read/write core memory and 2K bytes of read-only memory, the latter largely reserved for the operating system. The configuration can be upgraded by plugging in additional core memory in 8K-byte increments for a total of 65K bytes.

The serial printer has a split platen and can handle multiple, pin-feed forms at the same time that it prints on a ledger card; the ledger card is held in a special feed on the carriage. The printer adds a numeric keyset to its standard alphanumeric keyboard. It can print a 192-character line at 30 characters per second. The cartridge file unit handles the tape cartridges on which the application programs and the data files are stored. Two cartridges, or a total of four tapes, can run simultaneously, representing a total on-line storage capacity of 3,700K bytes.

The Ultimacc disc system replaces the cartridge file unit with a dual-disc drive that has 5,000K bytes of storage. The CPU of a disc system has a minimum 24K bytes of core memory, expandable to 65K bytes in 8K-byte increments.

The basic Ultimacc disc configuration consists of a CPU, mounted in a desk console with a video keyboard display station; a dual disc drive with 5,000K bytes of storage; and a 135 line-per-minute, 132-column line printer.

The configuration can be upgraded by plugging in additional core memory in increments of 8K bytes, adding dual disc drives in increments of 5,000K bytes, adding up to 10 additional video display terminals, and adding keyboard printers

and/or other variable speed line printers to increase printed output capability.

The disc-oriented configuration can expand by adding up to three disc drives for a total of 20,000K bytes of on-line storage. It can also accommodate up to four IBM-compatible magnetic tape drives, in addition to an assortment of other peripherals. The magnetic tape drives and peripherals can appear in any combination with a limit of 15 devices. Peripherals include: a video display terminal that combines a 12-inch CRT, which can display 1,998 characters in a 74-column by 27-row format and write up to 1,200 characters per second, with an alphanumeric keyboard and numeric keyset; a 135-line-per-minute, 132-column line printer; and a 300 line-per-minute line printer. A telephone coupler or an asynchronous modem can be used to link remotely located I/O devices to the CPU, whose 15-device total can include additional serial printers.

SOFTWARE

A comprehensive package of accounting-type programs modified to the user's needs is supplied with each Ultimacc installation. It comes with an operating system to manage the data files and network operation and to support the system's utility routines. These include data formatting and copying routines, file creation and editing routines, and an automatic restart routine.

Sort/merge, not considered a utility routine, is provided as a separate program with each installation. All programs are normally resident in the disc or tape files. They are called into core, as required, during processing.

Basic and Fortran IV are available to the user's EDP staff for the development of specialized software. Ultimacc offers customized programming services for the development of specialized management-report software when minor modifications to its standard accounting application programs will not meet the user's needs.

DESIGN FEATURES

The chief design features of Ultimacc's disc-oriented system are its main-memory partitioning and operating system, which permit up to 15 I/O devices to run the same or different programs and to be serviced by the CPU on a time-shared basis. Several operators can communicate simultaneously with the system.

Partitioning is normally performed before installation, with portions of the core memory being

software-dedicated to the various I/O devices in accordance with the complexity of the programs they will be using. However, more core can be added with peripherals in a field upgrade because of the system's multiprogramming capabilities. System throughput is increased because of the random access feature. Each partition is able to contain temporarily a desired program from the disc library file of programs.

On both the disc and tape systems, the keyboard serial printer can be included to print onto two continuous forms and a hard-copy ledger card in a single pass.

A typical application requiring a prebilling procedure would include an invoice form on one side of the carriage, a plain roll sales journal on the other side, and in front of the sales journal a front feed ledger card chute for charge and credit posting.

Customer header information and inventory line item pricing and discount policies are read and printed automatically from memory, and all accounting transaction detail is stored for later management report generation.

PERFORMANCE

Ultimacc's comprehensive software package and, in the disc model, good networking capabilities with effortless multiprogramming are well suited to the needs of small businesses upgrading from an electronic accounting machine installation. Although the system is interactive rather than batch oriented, throughput is quite high since the CPU is able to handle several terminals simultaneously. The system's magnetic tape capabilities offer a convenient means of using Ultimacc-developed data as input to larger, batch processing systems.

MAINTENANCE

Ultimacc Systems provides maintenance services under contract according to its published schedule for computer mainframe and peripherals. In addition, a third-party maintenance agreement is available through Ultimacc's arrangements with Honeywell Information Systems. HIS will provide maintenance service in those cities where Ultimacc does not maintain local field engineering staff.

The standard contract provides on-call maintenance during normal business hours. Second- and third-shift service arrangements are available

PRODUCT SPECIFICATIONS

CENT PROCESSOR	
Word Size (bits)	16
Capacity (words)	4-32K
Cycle Time (μ sec)	1.2
Working Storage	Core
AUX STORAGE	
	Disc; magnetic tape drive and cartridge
DATA OUTPUT	
Line Printer (lpm)	135; 300
Serial Printer	Yes
Card (cpm)	—
Paper Tape (cps)	—
DATA INPUT	
Keyboard	Standard
Card (cpm)	—
Paper Tape (cps)	—
SOFTWARE	
Assembler	Yes
Operating System	Yes
Compiler	Basic; Fortran IV

for those installations requiring this level of additional support.

Preventive maintenance can be scheduled for other than business hours to prevent interference with on-going operations.

HISTORY

Ultimacc Systems, formerly known as Automated Information Systems, was founded in October 1968. Its headquarters and sales offices are in Maywood, New Jersey, with marketing efforts focused on the Philadelphia/New York/Boston region.

UNIVAC

9200 System

OVERVIEW

The Univac 9200, 9200 II is the smallest of the 9000 Series systems and is a small-scale, general-purpose, business-oriented system. The 9200 is a logical upgrade from a punched card unit record system, and includes all of the necessary functions of computation, control, card reading and punching, and printing within the basic system.

Functionally the 9200 can be used as the total business data processor for a given installation. It is one of a series of systems used for I/O editing and validation when main processing might be accomplished by a larger system; or the 9200 can be employed as a communications front-end type of processor.

Both low-speed and high-speed I/O channels are available. This makes the system capable of considerable expansion in terms of I/O devices. However, memory size limitations preclude it from becoming more than a small-scale system. The 9200 does offer the user an opportunity of expanding within the series to meet his needs for some future time.

The Univac 9000 Series was introduced in 1966, and currently consists of the 9200, 9200 II, 9300, 9300 II, 9480, and 9700, of which the 9200 is the smallest.

PERFORMANCE AND COMPETITIVE POSITION

The 9200 has met the need as a small business data processing system especially since it offers upward compatibility within the 9000 Series. Hundreds of the Model 9200, 9200 II are now in field operation. Users seem to be quite satisfied with system performance and with Univac's support concerning manpower and software. Probably the most serious system limitation is the restriction to a 32K memory size. While a variety of peripherals is available, the memory limitation makes the inclusion of such peripherals and more sophisticated software somewhat academic.

The 9200 competes with the IBM System/360 Models 20, 22, and 25, the Honeywell 120 Series, and the IBM System/3. With all of these systems, there is a myriad of device mixes. However, the 9200 provides an excellent cost/performance ratio in most competitive situations. The System/360 Model 20, the H120, and the System/3 lack the compatibility with a larger range of systems within the same family that the 9200 has in the 9000 Series.

The use of the 9200/9200 II can be summarized in 2 general categories. First, the system can function as the main processor at an installation to perform any number of application functions for a small business organization, a government installation, or for various nonprofit organizations. The system could use the punched card as the prime unit of storage; but would more likely utilize the small disc files available with the system as master file storage. Second, the system is used as a slave communications front end or an I/O processor for a larger Univac system or one of another manufacturer, IBM, for example. This type of application uses various terminals in the inquiry/response mode or as a data I/O handling system.

To illustrate system usage the following 4 configurations are representative of present methods of system application.

Card Storage Configuration

- Hardware: 9200 Processor, 12K memory. I/O: card reader, card punch, printer (bar type), optional 1001 Card Controller.
- Software: Supervisor, job control, Assembly, RPG on cards; serial operation.

This configuration can process application systems such as payroll, accounts receivable, general ledger, and a small inventory system. File storage is on punched cards and the creation of updated files is accomplished by punching a new card master. A more powerful version of this system includes use of the 1001 Card Controller in an on-line manner. (The 1001 is an off-line, on-line card reading, punching, collating, and sorting device.) The user can eliminate the preprocessing of card collating because of the dual file input capability of the 1001. Not only is the collating operation eliminated, but both files are read at a combined speed of up to 2,000 cards per minute, considerably faster than a conventional card reader. This system is typical for a number of small wholesale organizations and financial firms.

Disc Storage Configuration

- Hardware: 9200 Processor, 16K memory. I/O: card reader, card punch, printer (bar type), multiplexor channel, 8410 disc subsystem — 6.4 million bytes of storage.
- Software: Disc operating system (NCOS), Assembly, RPG, utility routines.

The second configuration substitutes the disc for the punched card as the prime file storage medium. The card column format for data is much expanded since disc formats allow a significant increase in data capacity, and the number of files is reduced through consolidation of data. Operating times are greatly improved with file I/O which is now a function of disc operating times. Additionally, programs are stored on disc and total system operation improves. This is because the Job Control function loads new programs from disc and supplies a somewhat continuous job stream to the whole operation. This configuration is typical for a manufacturer, a distributor, or a municipal government operation.

Disc, Tape, Extended Memory Configuration

- Hardware: 9200 II Processor, 32KB memory. I/O: Card reader, card punch, multiplexor channel, 4-34K-byte magnetic tapes, printer (drum type), selector channel, 8411 Disc subsystem.
- Software: Disc operating system (COS), Assembly, Fortran; Multiprogramming — main program operates with symbionts.

The third configuration significantly increases system capacity in several ways. Memory is doubled, disc capacity is in modules of 29 million bytes, tapes are added, and printing speed is increased. The operating system provides the facility of running the main program while simultaneously performing data transcription programs (card-to-tape, tape-to-print). The user has the Cobol and Fortran languages available; the number and scope of applications processed have expanded. While this configuration serves a wider range of businesses, the limitation on memory size becomes significant.

Communications Front-end Processor Configuration

- Hardware: 9200 Processor, 16K-byte memory. I/O: card reader, card punch, printer (bar type), multiplexor channel, 8410 Disc subsystem, data communications subsystem, line terminal controller, line terminal, terminals, intercomputer control unit.
- Software: Disc operating system (NCOS), Assembly, RPG, OS-500 communications operating system.

The fourth configuration is an example of the 9200 used as a data I/O device and a communica-

tions front end for some larger system. OS 500 provides the software capability for the DCT 500 Terminal, while the normal IOCS routines can be applied to other terminals. In addition, an optical document reader can be attached for specific input documents. This system provides an I/O and terminal capability that serves as an interface for a larger system which is used by a public utility or an insurance company.

MAINFRAME

The 9200 uses the single stream processor concept that operates on an internally stored program. The system basically consists of program control, arithmetic, I/O control, and memory functions. The basic unit of information is an 8-bit byte that carries a ninth parity bit. The hardware provides for 2 states of operation: the processor program state control and the I/O program state control. These two states can operate concurrently, which means that the 9200 can execute 1 machine instruction with 1 of the following:

- Up to 3 slow-speed operations performed by the integrated devices. (The integrated devices, the card reader, punch and printer are connected to the direct I/O channel and are an integral part of the 9200 mainframe.)
- Up to 8 medium-speed data transfer operations taking place on the I/O multiplexor channel (optional on the 9200).
- One concurrent high-speed data transfer using the I/O selector channel (optional on the 9200 II).

Central Processors

Two processors are available in this series: the 9200 and the 9200 II. The basic difference is that the multiplexor is optional on the 9200, while the multiplexor is standard and 1 selector channel is optional on the 9200 II. The 9200 memory storage maximum is 16K, while 9200 II maximum is 32K.

The storage available in these processors ranges from 8,192 bytes to 32,768 bytes in increments of 4K or 8K bytes. Each byte is individually addressable, or can be addressed as a half-word — 2 bytes at a time; or addressed as a full-word — 4 bytes at a time. The processor houses integral controllers for card reading, card punching, and printing. The byte is made up of 8 information bits and 1 parity bit for validity of data.

The first 256 bytes of main memory are reserved for system use and include 2 sets of 2-byte

address registers. Eight of these registers are used for the processor normal state and another 8 for the I/O state. A benefit of this operation is that when the program state changes, which is based on an interrupt, the system simply switches from 1 set of registers to the other without the need to store the contents of each. This reduces the system overhead time consumed in the storing of register conditions, which would be necessary if there were only 1 set of registers.

Instruction Set. The 9200/9200 II processors have an instruction set of 35 instructions, of which 3 are optional: the edit, multiply, and divide. Included are instructions to translate, test under mask, decimal arithmetic and logical functions. Instructions for floating-point arithmetic are not available. Instructions are 4 or 6 bytes in length, and can address direct memory locations or indirectly address memory through the use of registers.

Interrupt Control. On the 9200/9200 II, interrupts are an integral part of all phases of computer operation that use the I/O devices. An interrupt request is generated when an I/O unit is ready for servicing (read cycle completed, punch ready, printer ready, and so forth). It allows a break in the program to attend to the I/O unit until its requirements are satisfied. The point of this program break is automatically recorded, and control is immediately returned to that point after the I/O device has been serviced. Thus, the speed limitation imposed on each unit is the inherent limitation of its normal electromechanical operation.

Main Storage

The 9200 has a plated wire main memory. The memory has a single access port, so that contention for memory access by the central processor and peripherals causes interference. The cycle time is 1.2 microseconds and each memory cycle accesses 1 byte.

Input/Output Control

A multiplexor channel is optional on the 9200 and standard on the 9200 II; a selector channel is also optional on the 9200 II. The multiplexor provides for the simultaneous operation of up to 8 peripheral devices. It can also operate in the burst mode wherein the channel is dedicated to 1 device and allows a higher data transfer rate. The selector channel is faster; however, it is dedicated to 1 device at a time.

Since there is only 1 access path to main memory, delays are introduced when different

peripherals and the CPU attempt to access memory simultaneously. The processor initiates an I/O instruction by sending an execute I/O word to the appropriate I/O control unit; then the processor proceeds to execute the next instruction in sequence. In the I/O control unit, execution of the I/O operation occurs independently of the processor, but time-shares access to the memory with the processor and other I/O control units.

PERIPHERALS

The peripherals available with the 9200/9200 II are described as follows. The controllers for the 0711-00 and 0711-02 card readers, the 0603 card punch, and integrated bar printer are each a part of the processor unit itself.

Model 0611-00 Card Reader. 400 cards per minute; 1,200/1,500-card input hopper/output hopper capacity; 80-column cards standard; optional 51- or 66-column short card feeds. Its controller is standard with the CPU.

Model 0711-02 Card Reader. 600 cards per minute; 1,200/1,500-card input hopper/output hopper capacity; 80-column cards standard; optional 51- or 66-column short card feeds. Its controller is standard with the CPU.

Model 0716-02 Card Reader. 1,000 cards per minute; 2,400/2000-card input hopper/2 output hoppers (2,000 each); 80-column standard; optional 51- or 66-column short card feed. Its controller is part of CR Subsystem, available on a processor with a multiplexor.

Model 0603 Card Punch. 75 to 200 cards per minute; 1,200-card input hopper; 850 output normal stacker; 850 output select stacker; 80-column standard; optional read-before-punch at 200 card-per-minute rate; controller is standard with CPU.

Model 0604 Card Punch. 250 cards per minute; 1,000-card input hopper; 1,000 output normal stacker; 1,000 output select stacker; 80-column standard; optional read-before-punch at 250 card-per-minute rate. Controller is part of CP Subsystem; attaches to multiplexor.

Model 1001 Card Controller. 1,000 cards per minute — 1 feed; 2,000 cards per minute — 2 feeds; performs on-line or off-line collating, proving, editing, sorting; 256-position memory to add, subtract, and compare. Seven output stackers for selection. Input hopper — 1,200 to 3,700 cards, output hopper — 1,500 per stacker.

Model Integrated Bar Printer. 250 lines per minute; 96-print position; 63-character font; removable typebar; 6 lines per inch; other speeds; line widths as special features. Controller is standard with CPU.

Model 0768-00/01 Printer. 900 lines per minute with 63 contiguous characters; 1,100 lines per minute with 49 contiguous characters; 1,200 and 1,600 lines per minute available with special feature; 63-character font; 132 print position; 6 or 8 lines to inch; form width — 4 to 22 inches; length — 1 to 22 inches; 10 characters per inch; controller is part of printer subsystem.

Model 0768-02/03 Printer. 840 lines per minute with 94 contiguous characters; 1,000 lines per minute with 87 contiguous characters; 2,000 lines per minute with repeated subset of 14 characters; 94-character font; 132 print positions; 6 or 8 lines to inch; form width — 4 to 22 inches; length — 1 to 22 inches; 10 characters per inch; controller is part of printer subsystem.

Model 0920 Paper Tape Reader/Punch. Reads 300 cards per minute; punches 110 cards per minute; tape widths 11/16, 7/8, or 1 inch; tape channels — 5, 6, 7, or 8; 10 characters per inch; controller is part of paper tape subsystem.

Model 2703 Optical Document Reader. Reads 300 documents per minute (or 600 documents per minute upgrade); document size: height — 2.75 to 4.25 inches; length — 3.0 to 8.75 inches; 20 to 62-pound paper; reads single line of numeric data and special symbols; 3 stackers under program and hardware control; modulus 10 check digit; mark read; punched card read. Controller part of reader subsystem; attaches to multiplexor.

Uniservo VIC Magnetic Tape. This subsystem consists of a controller and from 2 to 8 magnetic tape drives. A master/slave concept is employed; thus, 1 master unit has the power and control circuitry for 1 master tape unit and 1 slave unit. Two additional slaves can be added. If more than 4 tapes are needed, a second master/slave must be added. Available in 7- or 9-track; 34,160 bytes per second at 800 bits per inch; gap time 14.1 milliseconds; 2,400-foot reel; 3-minute rewind; attaches to multiplexor; 9200 II only.

Uniservo 12 Magnetic Tape. This subsystem consists of a controller and from 1 to 16 Uniservo 12 Tape Drives. A master/slave concept is employed whereby 1 master unit has the power and control circuitry for 1 master tape drive and 3 additional slave tape drives. When more than 4 units are needed, a second master is necessary. Available in 7- or 9-track; 68,320K-bytes per

second for phase-encoded (1,600 bits per inch); 34,160K-bytes per second for 800 bits per inch; 14.1-millisecond gap time; 2,400-foot reel; rewind 3 minutes; attaches to selector channel; 9200 II only.

The 9410 Disc employs, as a recording medium, a nickel-cobalt-coated disc in an interchangeable cartridge. Each single disc cartridge can store up to 3.2 million bytes; but only 1.6 million bytes of each cartridge can be accessed on-line at a given time. By physically removing each disc cartridge, turning it over, and replacing it on the drive, the remaining 1.6 million bytes of data become accessible.

Two independently operated disc drives are housed in a single cabinet; each drive services a single disc cartridge. Up to 4 dual-disc drives are allowed in a maximum 9200 Series system configuration to provide a total on-line data capacity of 12.8 million bytes. The controller attaches to the multiplexor channel.

8411 Disc Subsystem provides a disc system that is compatible with the IBM 2311 Random Access System. The disc pack has the same number of recording surfaces, the same number of tracks, and the same byte capacity as the 2311. The drive accessor mechanism has the same 10 read/write heads for proper track and cylinder selection. The controller is part of the subsystem and attaches to the selector channel.

8414 Disc Subsystem expands to 29.18 million bytes per pack and is compatible with IBM 2314 disc system. The controller is part of the subsystem and attaches to the selector channel.

Besides the standard teletypewriters, Univac offers a wide variety of terminals for use with the 9200/9200 II. The DCT 500 inquiry terminal consists of a keyboard and 30 character-per-second serial printer; while the DCT 1000 is a version of the DCT 500 to which card and paper tape I/O capabilities can be added to provide remote batch operation. Faster and more comprehensive remote batch capabilities are provided by the DCT 2000 terminals.

Univac also provides 2 alphanumeric displays — Uniscope 100 and Uniscope 300. Although Uniscope 100 is a newer, less expensive version of Uniscope 300 with the same comprehensive editing facilities, Uniscope 300 has not been entirely superseded by the Uniscope 100. Uniscope 300 is better suited for high-traffic applications where terminals are connected in large clusters, while

Uniscope 100 is intended for low-traffic situations in which there are small clusters of terminals.

SOFTWARE

As a member of the 9000 Series, the 9200 has upward compatibility with other systems in the series, and the Univac supplied software is written to meet the needs of the entire series. The 9200 benefits from this relationship. The choice of the vendor-supplied software is very dependent upon the selection of hardware that is made by the user.

Operating System

With the minimum system configuration of the 9200, a basic Supervisor program is supplied to provide the control for communications between the operator, the user program, and I/O software; it also provides program restart. The Supervisor handles the I/O interrupts passing control between the IOCS routines (a subset of the assembler) and the main program. Programs, as well as various control cards, are entered via punched cards as the system executes jobs in a serial fashion. Included are an assembler with macro facilities and a report program generator.

The Minimum Operating System is available for use with 8K-byte main storage and larger tape-oriented 9200 systems. The operating system consists of a group of processing programs and control programs which are capable of operating in a semiautomatic environment. The basic supervisory program control functions are performed on-line in conjunction with, and in service to, the problem program. The minimum configuration includes an 8K memory, 3 Uniservo VIC magnetic tapes, the card reader, card punch, and multiplexor channel.

The Non-Concurrent Operating System requires a minimum 16K memory and at least 4 magnetic tapes. The supervisor and the job control program oversee system operation; the user now has a Cobol and a Fortran compiler available. System programs are disc-resident if a minimum 2-disc system is used. At this software level, only 1 program would be operable at a time. Both the MOS and the NCOS require the use of the multiplexor to interface tapes or disc.

The Concurrent Operating System which provides multiprogramming operations is basically oriented toward the larger systems in the 9000 Series. Technically, it can be used on the 9200/9200 II, but usually it would be run on a larger system.

Language Processors

The basic card assembler is a 2-pass program that will operate on the minimum configuration of the 9200. It is a simplified, and a somewhat restricted version of the larger tape assembler although the card assembler does include many of the macro facilities found in the larger version.

During the first pass, the card assembler reads information from the source program deck and produces a symbol table. During the second pass, the assembler generates object code from each source card to produce an object card. The assembler can translate all Model 9200 machine instructions and uses up to 8 assembler control instructions. Assembly-language symbolic labels can reference relocatable or absolute data; self-defined constants can also be included in many instructions.

The tape assembler is constructed at an 11K-byte design level. The assembler will function with any system that has at least 16K bytes of memory, 4 tape units, a card reader, line printer, and the I/O multiplexor. The assembler provides for the following:

- Use of system library and macro routines, and user-prepared macroinstruction definitions.
- Use of separately-prepared program segments that can be linked together as 1 object program. Thus, many cumbersome overlay control manipulations are removed from the concern of the programmer.
- Use of system control facilities of the supervisor program.

The report program generator is available in both card and tape versions; it provides a source language facility which is oriented toward the production of reports. The report program generator is subdivided into 3 parts: input, calculation, and output; each has a corresponding entry form. From the user coding on these forms, RPG produces an object program that will read the described input, do the specified calculations, and produce the printed reports and summary punched cards or object tape.

This RPG closely parallels the report program generator that is used with the IBM System/360. RPG requires an 8K memory, a card reader, punch, and bar printer as a minimum configuration.

The Cobol compiler is available only for the 9200 II due to the requirement of 4 magnetic tape

UNIVAC 9200 SYSTEM

units on a selector channel (none available on the 9200). Also required are a 16K memory, a card reader, and printer. This compiler meets the specifications proposed by the USA Standards Institute for a minimum USA Standard Cobol.

The Fortran compiler requires the same minimum equipment configuration as Cobol. The Fortran language contains features of both ANSI Basic Fortran and ANSI Fortran.

Other System Software

Gangpunch-reproduce program generator — (card only) this permits functions normally associated with tabulating equipment to be described in problem-oriented terms. It generates a program to perform straight reproducing; controlled reproducing; master card, interspersed master card; and offset gangpunching; sequence checking; and consecutive punching.

Debugging aids that are available include a memory dump routine, and the Squeeze program for alteration of object programs. The memory dump routine can be incorporated in a program under test or loaded under operator control. The Squeeze program provides for patching binary programs.

Sort routines, both tape and disc-based, provide the facility to sort either punched card input records or fixed or variable length tape records in ascending or descending sequence.

Application Packages

A broad range of application packages are available; these packages include: general payroll, typesetting, linear programming, medical accounting, mortgage accounting, CPM-PERT, accounts payable, bill of materials, basic inventory control, television scheduling, and others.

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1335 South Claudina Street
Anaheim CA 92805
(714) 553-0200

Burroughs Corporation
World Headquarters
Burroughs Plaza
Detroit MI 48232
(313) 972-7000

Cascade Data, Incorporated
3000 Kraft Avenue SE
Grand Rapids MI 49508
(616) 949-8850

Digital Equipment Corporation
146 Main Street
Maynard MA 01754
(617) 897-5111

Eldorado Electrodata Corporation
601 Chalomar Road
Concord CA 94520
(415) 686-4200

Honeywell Information Systems, Incorporated
60 Walnut Street
Wellesley Hills MA 02181
(617) 237-4100

International Business Machines Corporation
1133 Westchester Avenue
White Plains NY 10604
(914) 696-1900

Litton Industries
Automated Business Systems Division
600 Washington Avenue
Carlstadt NJ 07072
(201) 935-2200

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Main and K Streets
Dayton OH 45409
(513) 449-2000

Qantel Corporation
3474 Investment Boulevard
Hayward CA 94545
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Singer Company
Business Machines Division
2350 Washington Avenue
San Leandro CA 94577
(415) 357-6800

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