# Burroughs B 22

# Desktop Business Micro-Computer System



Burroughs family of desktop business micro-computers is configured around powerful, display-based workstations.

Burroughs distributed intelligence architecture provides a powerful 16-bit processor, a high resolution 15-inch video display unit, keyboard, and up to 640K bytes of Random Access Memory (RAM) at each workstation.

Workstations share peripherals and data bases, but not the processor. The result is unprecedented responsiveness and the ability to support complex and diverse applications operating on the same data base simultaneously.

Designed as building blocks, the B 20 Series hardware and software are totally modular, with multiple upgrade paths available. A stand-alone system can be upgraded to local networking without software modifications.

The real-time, multi-tasking operating system is designed to be built upon and supports four standard programming languages—COBOL, FORTRAN, BASIC, and Pascal. Data management facilities include ISAM, Forms, and Sort/Merge. Word processing is organized specifically for data processing integration. Communications protocols include Burroughs Poll/Select, X. 25, and IBM 3270 and 2780/3780.

Designed with sensitivity to the physiological and psychological needs of the operator, Burroughs B 22 workstation is a slender, elegant package that provides an ideal spatial relationship between eye, screen, keyboard, and the built-in document holder. Heat and noise outputs are negligible, and every aspect of the operator interface is friendly—even in foreign languages.

Distributed intelligence has long been discussed as the ideal solution for applications of the '80s. Now, with Burroughs B 20 Series of desktop microcomputers, distributed intelligence is a low cost reality.

# **Highlights**

- ☐ High performance desktop microcomputer directly addresses up to 640K bytes of memory.
- ☐ Each desktop unit consists of a 16-bit CPU, up to 640 bytes of RAM, keyboard, and video display.
- □ Desktop units can be linked together via a high-speed local network, providing multistation access to shared resources.
- ☐ High resolution 15-inch display with software control over character generation, multiple split screens and a wide range of display attributes.
- □ Easy hardware customization to special applications through IEEE-796 standard Multibus<sup>TM</sup> compatible card slots.
- ☐ Real-time, multi-tasking operating system provides all the functionality needed to implement real-time and interactive applications.
- ☐ Standard programming languages include COBOL, FORTRAN, BASIC, and Pascal.
- ☐ Communications protocols include Burroughs Poll/Select, X .25, and IBM 3270 and 2780/3780.

# System Overview

Burroughs B 22 product line incorporates three major system elements—workstations, mass storage base units, and mass storage expansion units.

- □ A workstation consists of a 16-bit processor, RAM, a keyboard, and a video display unit.
- ☐ A mass storage base unit consists of a disk controller and two disk drives.
- ☐ A mass storage expansion unit consists of add-on disk drives which are controlled by the controller in a mass storage base unit.



These three system elements can be put together to form various system configurations:

- ☐ A workstation plus a mass storage base unit is called a *stand-alone system*.
   Mass storage expansion can be added as required.
- □ A workstation with a mass storage base unit can provide resources such as disk storage to other workstations. Such a workstation is called a master station.
- ☐ A workstation that uses resources provided by a master station is called a cluster station. A high-speed local network connects the cluster stations to the master station.
- ☐ A collection of cluster stations and a master station is called a *cluster system*.

# The Workstation

The B 22 product line is centered around the workstation. The B 22 workstation integrates the processor and memory with a video display into a compact desktop unit. It supports from 256K to 640K bytes of RAM, has a software selectable display of 34 lines by 80 or 132 characters, a keyboard, and contains two Multibus slots.

B 22 workstations have a 15-inch high resoution video display unit mounted horizontally in "landscape" mode. The display is fully articulated and may be tilted from 10 degrees to 30 degrees above the horizontal plane, and rotated ±30 degrees for easy viewing. The display is green phosphor to help reduce eyestrain. A brightness control can be easily accessed by the operator. The front of the electronics enclosure functions as a lectern with clips to hold documents.



The 98-key keyboard has a typewriter style sculptured surface, contoured keycaps, and a palm rest for operator comfort. It is detachable and connected to the display unit with a coiled cable. The keyboard provides a 14-key numeric pad, an 8-key status/control function pad, a 6-key cursor control pad, a 4-key page control pad, and 10 user-definable function keys. The keyboard also provides software controllable LED indicators on 8 keys.

The characteristics of the B 22 workstation are summarized below.

RAM: 256 to 640K bytes Display: 132 x 34 or 80 x 34 (software selectable) Multibus Slots: 2

Placement of Processor: On the desktop Serial Communications Channels: One RS-422 and one RS-232C or two RS-232Cs

Parallel Printer Port: Centronics-like Interface Uses: Stand-alone; Master Station; Cluster Station

#### Mass Storage Units

There are two types of mass storage units: mass storage base unit, and mass storage expansion unit.

A mass storage base unit is housed in a 7 1/2-inch wide floor-standing enclosure. It consists of a disk controller and two disk drives.

The Winchester-based unit contains a Winchester controller, a floppy controller, a non-removable Winchester disk, and a .5M byte floppy disk. The Winchester disk comes in two sizes: 10M bytes and 20M bytes (unformatted).

A mass storage expansion unit is housed in a 7 1/2-inch floor-standing enclosure. It consists of one or two disk drives. There are two kinds of mass storage expansion units:

- ☐ One 20M byte Winchester disk (unformatted)
- ☐ Two 20M byte Winchester disks (unformatted)

The controller in the mass storage base unit handles the drives housed in its enclosure and also the drives housed in one or more mass storage expansion boxes. A controller can handle a maximum of three Winchester disks. Using three 20M byte Winchesters, the controller can support 60.5M bytes. Hence, mass storage directly connected to one workstation can range up to 60.5M bytes (unformatted).

#### Configurations

There are two types of B 22 systems: stand-alone systems, and cluster systems.

A stand-alone system consists of one workstation, one mass storage base unit, and optional mass storage expansion units. All stand-alone systems start with a minimum of 256K bytes of system memory and can be expanded to 640K bytes.

A cluster system consists of one master station, one or more cluster stations, and a high-speed local network connecting them together. The high-speed local network is implemented via one or more multi-drop RS-422 lines, each running at 307K baud.

☐ The master station consists of a workstation, a mass storage base unit, and optional mass storage expansion units.

☐ A cluster station typically consists of just a workstation. A cluster workstation obtains disk storage from the master station and typically has no local mass storage.

A master station serves two functions: (1) running applications, and (2) providing resources to individual cluster stations.

The balance between the two functions depends on the kind of applications being run, the number of connected cluster stations, and the amount of memory in the master station.

At one extreme, the master station runs the same application programs as the cluster stations. At the other extreme, the master station runs server-only programs: ISAM, the Print Spooler, and the IBM 2780/3780 RJE and 3270 servers.

Typically, the master station serves both functions—running a standard application program plus a number of server functions.

Cluster systems range in size from one to 16 cluster stations. When more than three cluster stations are connected to one master station, additional hardware is required to handle the high-speed local network. The hardware support takes the form of Communications I/O Processor(s) (Comm IOP) and memory.

The Comm IOP fits in a Multibus slot of the master station. It consists of an Intel 8085 processor, 32K bytes of local RAM, and a serial I/O controller.

NOTE: The B 22 system is capable of clustering up to 16 workstations. The application and/or the amount of disk and memory at the workstation will dictate overall performance.

#### Software

Burroughs B 20 software is structured for the system builder. It provides the necessary components to speed application development:

- ☐ A real-time multi-task operating system. ☐ Four standard programming languages.
- □ Program development tools.□ Data management facilities.
- ☐ Text management facilities.
- ☐ Standard communications protocols.

The BTOS Operating System provides a reliable, high-performance foundation for real-time, interactive applications. It is efficient, easily extended, and highly configurable. Its modular structure combined with its carefully planned model for extension provides an adaptable environment that is ideal for implementing applications.

The B 20 programming languages are:

- □ COBOL—ANSI '74 (high/intermediate level)□ FORTRAN—ANSI '77
- ☐ Pascal—ISO draft 5
- ☐ BASIC—ANSI '78

Each of these languages implements its relevant standard, augemented by extensions aimed at enhancing its utility in its application area.

Productive program development requires good tools. Burroughs supplies a complete, state-of-the-art environment. The B 20 Editor makes it easy to write and revise source code. The Linker/Librarian is used to maintain object libraries and to link together independently compiled modules. The Debugger is a powerful software debugging tool designed to help debug programs efficiently, including real-time programs.

Data management facilities are optimized for the B 20 system architecture. The multi-key ISAM provides flexible access to records; its B-Tree implementation allows efficient retrieval by exact match, range match, or prefix match. The Forms facility makes it easy to design screen forms, display them on the screen, and accept operator-supplied data. The Sort/Merge facility sorts multiple files of unordered records and merges multiple files of ordered records into one ordered file.

Text management facilities are organized by the system builder. The Font Designer provides an interactive facility for designing fonts to customize the character set displayed on the video screen for specific applications. WRITEone is a state-of-the-art word processing package that includes a document assembly feature to allow merging of data processing and word processing capabilities.

Several industry standard communications packages are supported: Burroughs Poll/Select, IBM 3270 and 2780/7780 RJE Terminal Emulator, X. 25, and Asynchronous Terminal Emulator.

## **B 22 Workstation Electronics**

The B 22 workstation electronics consist of four printed circuit assemblies. These assemblies are mounted vertically in a cardcage capable of supporting four electronics boards, and either one or two Multibus-compatible boards.

The four electronic printed circuit assemblies are the processor board, the memory I/O board, the video display control board, and an optional memory expansion board. These four assemblies are linked *via* a high-speed bus which is separate and distinct from the Multibus.

The Multibus slots provide an IEEE-796 standard interface, allowing the attachment of customized-device Input/Output.

This dual-bus architecture allows the addition of user hardware extensions in the Multibus slots without impaction of the integrity or speed of the electronics.

# **Processor Board**

The processor board contains an Intel 8086 16-bit processor operating at 5 MHz and provides the following system functions:

- $\hfill \square$  Memory control and refresh logic.
- ☐ External interrupt control logic.
- $\hfill\square$  RAM parity check and generate logic.
- ☐ Direct Memory Access (DMA) control.
- ☐ Multibus interface.
- ☐ Bootstrap (ROM) software and logic.

External interrupt control is provided through a programmable interrupt controller. There are eight priority levels of maskable interrupt.

Four high-speed DMA channels are provided with each workstation. These channels are used for high-speed I/O and for a Multibus slave to gain access to the bus signals. These channels operate at 3.3 megabytes/second.

# Memory I/O Board

The Memory I/O Board contains:

- □ RAM
- ☐ Power fail logic.
- ☐ Real-time clock and interval timer.
- ☐ Keyboard interface.
- ☐ Two high-speed serial channels.
- ☐ Centronics-compatible parallel printer interface.

Workstation memory size ranges from 256K to 640K bytes. RAM validation is *via* a single-bit error-detection parity unit.

The real-time clock provides a maskable interrupt at the line frequency. The programmable timer provides a 16-bit timer with a count rate of 19.5 kHz.

The two serial communications channels may be programmed to perform a variety of tasks. One channel is configured for RS 232C-compatible interface operation. The second channel operates in either RS 232C or RS 422-compatible modes. The RS 232C channels have software selectable baud rates ranging from 110K to 19.2 K baud. The RS 422 channel operates up to 615K baud.

Both channels can support a variety of synchronous and asynchronous bit- and byte-oriented protocols, including BiSync, ADCCP, SDLC and HDLC.

#### Memory Expansion Board

The memory expansion board can consist of up to 512K bytes of additional RAM. A RAM expansion board plugs directly into the workstation backplane.

### Video Display Control Board

The video display control board uses a high-speed DMA transfer to display data stored in an area of the user memory called a "character map" on the screen. It provides the following functions:

- ☐ Generates timing signals required by the video monitor and refreshes the video screen.
- ☐ Holds the current character set in on-board RAM.
- ☐ Translates the 8-bit character codes into video signals.
- ☐ Interprets the visual attributes associated with each character.
- ☐ Generates and maintains the cursor position on a line-by-line basis.

#### Comm IOP Board

Up to two optional Comm IOP boards may be used in a master station to off-load the main processor by performing most of the functions required to handle the high-speed local network. The Comm IOP board consists of an 8085, 32K of on-board RAM, and a serial I/O controller. It provides two multi-drop lines; each line runs at 307K baud and supports up to four cluster stations. It fits into a Multibus slot.

The Comm IOP handles all polling of and acknowledgements to the cluster stations. It accepts packets from the master station's CPU, transmits them to the cluster station, receives acknowledgements from the cluster stations, and posts completion notices. In the other direction, it polls the cluster stations, receives packets from them, acknowledges the packets, and presents the packets to the master station's CPU.

# Video Display Subsystem

The B 22 video display system is organized as 34 lines by 80 or 132 characters. Line width is selectable under software control. The screen may be split into multiple parts called "frames." The number of frames, and their layout on the display, is established by the user with calls to the BOTS Operating System. Each frame may have its own cursor, and scrolling may be performed in each frame independent of other frames.

Each character is built in a 10 x 15 pixel cell. The standard character set contains a full 256 characters, including the entire printing ASCII character set, graphics characters, common symbols, and selected foreign alphabetic characters. The character set is stored in a high-speed 4K x 10 RAM array, known as Font RAM, on the video display control board. The character set may be easily changed under software control by loading another character set into Font RAM from a disk file. Thus, the number of character sets that may be used in the same application is virtually unlimited.

Various display attributes may be added to each character individually, to one line of characters, or to the entire display.

#### Standard Attributes

Screen—Reverse Video; Blank Screen; Disable Character Attributes

Line—Cursor Position (one per line)

Character—Half Bright; Underline; Reverse Video; Blinking

#### **System Specifications**

# Memory Capacity

RAM: 256K bytes; 384K bytes; 512K bytes; 640K bytes

ROM: 4K bytes

## Mass Storage

Floppy disk drive
Unformatted: 0.8 megabytes
Formatted: 0.5 megabytes
10MB Winchester disk drive
Unformatted: 10.5 megabytes
Formatted: 8.4 megabytes
20MB Winchester disk drive

20MB Winchester disk drive Unformatted: 21.0 megabytes Formatted: 16.8 megabytes

#### Timina

Processor Clock—5 MHz with no wait states when accessing internal RAM. Apporximately 3 wait states when accessing PROM.

Bus Clock—Full Multibus compatibility with 10 MHz bus clock.

# Mass Storage Timing:

8-inch Winchester Disk Drive Transfer Rate: 271.7K words/second Access Time (Avg.): 70 ms (10MB); 50 ms (20MB)

Access Time (track to track): 19 ms Settling Time: 15 ms

Floppy Disk Drive

Transfer Rate: 31.25K words/second

Access Time (Avg.): 260 ms Access Time (track to track): 8 ms

Settling Time: 8 ms Head Load Time: 35 ms

Serial I/O Rates:

External Clock

RS-232C: 110 baud to 19.2K baud RS-422: 10 Hz to 615K baud maximum

Internal Clock

RS-232C: DC to 19.2K baud RS-422: DC to 730K baud

Parallel I/O Rate (Printer interface): Programmed I/O; 9.6K characters/ second typical.

#### Electrical

AC Power Capacity: 60 Hz ± 0.5 Hz—U.S. & Canada 50 Hz ± 0.5 Hz—International

## Voltage:

85 to 130 Vrms—U.S. & Canada 170 to 260 Vrms—International

AC Power Requirements (maximum at 105 Vrms):

U.S. -3.3 Amps

Without mass storage—2.7 Amps With mass storage—3.3 Amps

International—1.65 Amps Without mass storage—1.35 Amps With mass storage—1.65 Amps

# Temperatures and Humidity

Operating Temperature:

10°C to 40°C 50°F to 104°F

# Non-operating Temperature:

- -22°C to +47°C
- -7°F to +116.6°F

Humidity: 20% to 80%

# **Physical Characteristics**

	Height	
	Inches	Cm's
Workstation	13.75	34.92
Mass Storage Base Unit Keyboard	26.00 2.40	66.00 6.09
	Width	
	Inches	Cm's
Workstation	30.00	76.20
Mass Storage Base Unit Keyboard	8.46 18.00	21.50 45.72
	Depth	
	Inches	Cm's
Workstation	12.00	30.48
Mass Storage Base Unit	20.87	53.00
Keyboard	8.50	21.59
	Weight	
	Lbs.	Kg's
Workstation	Lbs. 50.00	Kg's 22.73
Workstation Mass Storage Base Unit Keyboard		•

## Cable Lengths:

AC: 10 feet (3.05 meters).

Keyboard to workstation: 14 inches coiled;

5 feet extended (1.52 meters).

B 22 Workstation to Mass Storage Subsystem: 10 feet (3.05 meters)

Workstation to workstation in cluster: 50 feet (15.27 meters) Standard 1200 feet (366 meters) Maximum

Mass storage subsystem to mass storage expansion unit: 5 feet (1.52 meters).

# **Environmental and Safety** Safety

- ☐ Meets UL 478 (EDP) and 114 (Office Equipment).
- ☐ Meets CSA 154 (EDP) and 143 (Office Equipment).
- ☐ Designed to meet VDE 0730 Parts I and II.
- ☐ Designed to meet BSI BS 3861 Parts I, II and III.

#### **EMI**

- ☐ Designed to meet U.S. FCC Rules and Regulations, Part 15, Subpart J, Class A.
- ☐ Designed to meet VDE 0871 Level A.

#### Altitude

Operating: 6,000 feet ASL (1,829 meters). Non-Operating: 12,000 feet ASL (3,658 meters).

#### **Acoustic Noise Level**

Without Mass storage: NR 30 With Mass storage: NR 40

# Burroughs Building on strength.